Local Road Asset Management State of Practice

Project Report

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Peter Torola, Research Engineer
Center for Technology & Training

Michigan
Transportation Asset
Management Council

Michigan Tech
Civil, Environmental, and
Geospatial Engineering

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I would like to thank Joe Wood for his work in developing the web scraper used for this study. Without this tool, the completeness of this report would not have been possible in the time that was available.

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EXECUTIVE SUMMARY

A major challenge with any state of practice study at a national level is reducing down the volumes of discovered data into precise, digestible pieces of information. During the completion of this study over 12,000 items were identified and over 6,000 of these were reviewed by the study author in order to collect useful information on the state of local road transportation asset management in all 50 states. The useful findings from this volume of material are not easily consolidated into a single written resource. As a result, this report is intended to act as a resource for further investigation into the topic.

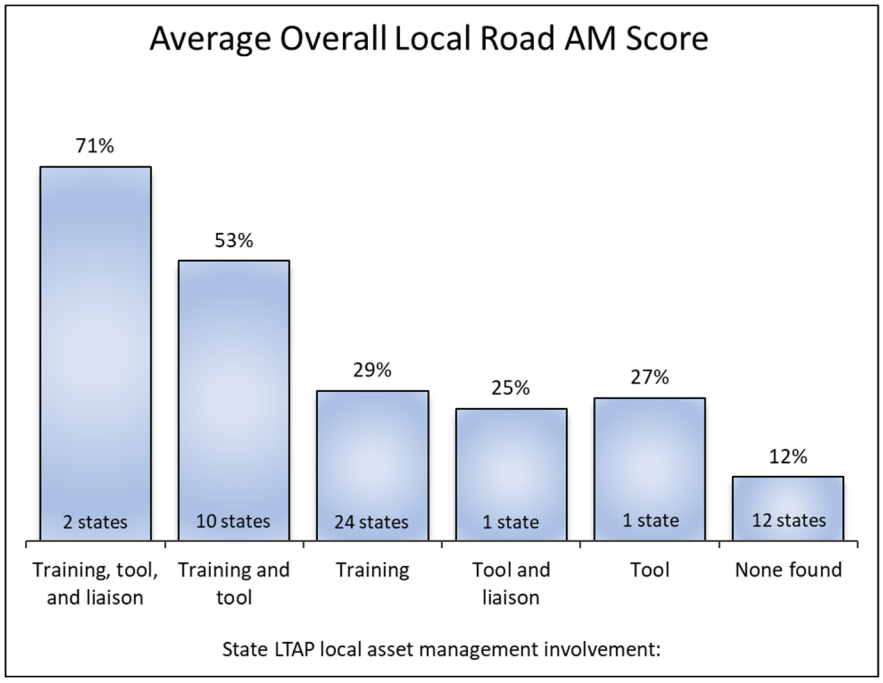
A supplementary resource spreadsheet was created as an easy method for looking up the major source documents used in the study findings. This resource spreadsheet can be found at https://tinyurl.com/ye644hh5. It contains links to 223 of the cited sources for this study which are indexed by state and year of publication. These source items provide a broader description and context to any given topic addressed in this report.

The state of practice on local road transportation asset management has undergone positive changes for Michigan local road-owning agencies since the formation of the Michigan Transportation Asset Management Council (TAMC). The TAMC has been a pioneer in their coordinated approach to transportation asset management across the differing agency types and has been unique in their local agency transportation asset management support. The Center for Technology & Training (CTT) was tasked with identifying the statewide transportation asset management best practices performed on local roads across the United States. This study sought to identify these leaders and extract information from their experiences by looking at the incentives for encouraging adoption of best practices, state perspectives of transportation asset management integration, range of assets considered, tools or practices that may be beneficial and implementable to Michigan, and lessons learned from others states.

This study conducted an extensive search by using three data collection methods to collect data on fourteen data collection measures in all fifty states. The two main data collection methods were web-based: by searching the web manually and by using an automated web scraper. The third data collection method used an online survey as a check to see if any items were missed from the first two data collections. These collection methods were then used to score points on nine different scoring measures, which were used to calculate an average overall statewide local road transportation asset management score for each state. The average overall score for all fifty states was 31%. By contrast the highest scoring states of California, Michigan, Maine, and Idaho scored 90%, 84%, 77%, and 75%, respectfully.

The local road transportation asset management score for each state was used to look for trends based on how different individual collection measures influenced the overall score. A state without any sign of existing transportation asset management training, tool, or regulatory

requirement averaged a score of 24% or below for each scoring measure. The least influential metric on the average overall score was having regulatory requirements. One of the more interesting findings was how average scores increased from 19% to 68% when it was found that states had a unified transportation asset management (TAM) system. In addition, an effort for having data and an effort for using preventive maintenance treatments had a much larger influence on increasing average scores than an effort to have written transportation asset management plans. Another interesting finding was how the average score increased by orders of magnitude as the state's local technical assistance program (LTAP) involvement diversified into additional support areas as shown in the figure below. Having a statewide champion for local road transportation asset management is a key finding because the level of LTAP involvement was not a direct collection measure or a direct scoring measure.



Many of the practices that were recommended are already being administered in Michigan through its TAMC. The main takeaways were to:

- keep TAM practices from becoming stale by continually improving trainings and tools
- ensure that collected data is reliable and shared with other agencies
- ensure that collected data not be overly complex, which would inhibit initial buy-in
- offer standardized tools and practices to aid in TAM implementation
- provide support for unified TAM systems and unified rating systems
- offer education for those who want continuous improvement for their TAM practices
- educate decision-makers on the importance of TAM
- establish a TAM committee to help steer statewide practices
- establish a funding source for agencies to collect their own data.

BACKGROUND

Transportation asset management at its simplest definition is using data to make informed, cost-effective decisions. Data can be used to determine the effectiveness of pavement treatments, provide guidance in selecting between treatments, help determine when a treatment will be needed, act as a framework to set a goal, and show a budgetary need for reaching a goal. Transportation asset management can then take a more advanced stance by incorporating items such as risk management, strategic goal setting, level of service targets, life cycle costing policies, and even benchmarking skill development for transportation asset management staff.

The transportation asset management state of practice was quite variable across the United States. The state departments of transportation (DOTs) were required by the Federal Highway Administration (FHWA) to develop a transportation asset management plan as of June 30, 2019. These plans provide a somewhat consistent gauge between states because they were required to have specific components for routes that are part of the National Highway System (Kuklenski, 2021). There are also standard practices for federal-aid-eligible roads that are higher-level national functional classification (NFC) routes. Projects for these routes are typically required to be included on each state's statewide transportation improvement plan (STIP) to be eligible for federal funding. The non-federal-aid local roads, which comprise 76% of the road miles in the United States as reported in the FHWA's Highway Statistics Table HM-51, have asset management practices that are highly variable for each state and their statewide practices are not documented in one place (FHWA, 2020).

In Michigan, Public Act 499 of 2002 required road- and bridge-owning agencies to report mileage and condition data on their federal-aid eligible road network and entire bridge network to the Michigan Transportation Asset Management Council (TAMC). Agencies are financially reimbursed for the training they are required to attend and for the data collection they are required to perform. For road condition data collection, the TAMC had chosen the Pavement Surface Evaluation and Rating (PASER) system for paved roads and the Inventory-based Rating (IBR) System™ for unpaved roads. These data were collected by each road-owning agency and shared with their Michigan planning organization representative and then with the TAMC. The same data was used at each of these three entities to fulfill their reporting desires and requirements.

Michigan road-owning agencies with 100 or more certified centerline miles of public roads are also required by Public Act 325 of 2018 to submit transportation asset management plans to the TAMC every three years. In order to ease the burden of agencies needing to meet the required plan components established by the Michigan legislature, the TAMC contracted with the Center for Technology & Training (CTT), which also houses Michigan's Local Technical Assistance Program (LTAP) and the Roadsoft software development and support team, to develop plan templates, tools, and trainings. Michigan's local agencies have no-cost access to

Roadsoft, a GIS mapping database for collecting, storing, and analyzing data associated with transportation assets. Roadsoft is the only approved tool used for the TAMC sponsored road condition data collection and reporting in Michigan.

The CTT also performs additional trainings for the TAMC that include introductory transportation asset management and gravel road asset management, PASER, IBR, bridge asset management, and culvert asset management. The TAMC also conducts trainings of their own that cover their reporting process. The TAMC holds an annual conference on transportation asset management and reports on the collected data through a website dashboard and their *Roads & Bridges Annual Report*. The trainings and tools developed for use on federal-aid roads can and are also used on non-federal-aid roads by Michigan's local agencies; the only difference between these two types of roads are the regulatory requirements that pertain to each.

Statewide transportation asset management was possible in Michigan because local road-owners are provided with the tools, trainings, and incentives to use the collected data to make informed cost-effective decisions. The TAMC had been the leader in transportation asset management for several decades by the implementation of their coordinated approach to transportation asset management across ownership silos that had been unique in local agency transportation asset management. Several other states have started to expand their approach to transportation asset management; this study sought to identify these leaders and extract information from their experiences by looking at the following topics:

- State and local perspectives of transportation asset management integration
- Incentives and directives for encouraging adoption of best practices
- Level of adoption of transportation asset management across the state
- Range of assets actively considered
- Tools or practices that may be beneficial and implementable to Michigan
- Lessons learned from states that have not started transportation asset management or that have backslid in their deployment.

This study focused on transportation asset management efforts that are used on non-federal-aid routes because there are common practices already used across the United States for the federal-aid routes. Bridge inspection practices were not reviewed because the National Bridge Inspection Standards (NBIS) are required to be followed across the United States.

The goal of this study was to identify strategies that made the largest impact on statewide transportation asset management usage on local roads. The best practices, lessons learned, and overall local road asset management assessment from each state would help the TAMC with setting future direction and provide reassurance that the current course was appropriate.

METHODS

This study conducted an extensive online search to identify the current condition of statewide local road asset management practice for each state in the United States. An evaluation system was created that provided scoring measure points based on fourteen different collection measures. The scoring measures were used to create an overall local road transportation asset management score for each state. The results were used to look for trends in the overall score based on changes in each individual collected measure. Best practices and lessons learned were documented and were also used to look for trends in the overall score.

Data Collection

Each state DOT-approved transportation asset management plan was briefly reviewed to gain insight into the basic details of each state, such as which type of local agencies own roads and what are the local agency levels named in each state. There were three methods used to collect data—searching the web manually, searching the web using an automated web scraper, and an online survey—on the fourteen data collection measures. The fourteen data collection measures used to assess statewide local road transportation asset management were:

1. Who was the champion?
2. Were there any incentives?
3. What other types of roadway assets are managed using AM principles?
4. What are the useful tools or practices found?
5. Do they have any lessons learned that would be helpful for others?
6. Was there a provided TAM system?
7. Was there a prevalent or recommended rating system?
8. Were there any regulatory requirements?
9. Was there any funding to perform local road transportation asset management?
10. What was the state's local technical assistance program (LTAP) involvement?
11. Were there any tools that were used?
12. Were there any connections to Michigan?
13. Assess the level of adoption across the state
14. Summarize their perspective.

The data was first collected using manual web searches. Additionally, the data was collected using a web scraper created specifically for this study that used a web search engine and indexed the items found. Lastly, data was collected using an online survey that was distributed to all fifty states. The data collection process is summarized in the flow chart in Appendix A – Data Collection Process. The driving data collection method was web searching because it was assumed that, if the statewide details are not on the web, then it would be much more difficult to reach all local road owners in most states.

Manual Web Search Data Collection

Manual web searches were performed by staff from the CTT using the DuckDuckGo search engine, and the first three pages of results were reviewed. The DuckDuckGo search engine was chosen for manual searches to limit the bias that could creep into the results when using the Google search engine. The DuckDuckGo search engine returns the top search results and does not adapt the displayed results to the searching IP address (Brown S. , 2021). This prevents the search results from becoming skewed to a researcher's search history. The state name was combined with the primary keyword search terms along with the excluded keyword search terms to assist in refining the results. The primary keyword search terms were:

borough	pavement condition index	road asset management
city	pavement condition data	road guide
county	pavement guide	road manual
engineer conference	pavement management	road plan
local agency asset management	pavement manual	road report
maintenance program	pavement plan	town
maintenance system	pavement rating	transportation asset management
parish	pavement report	transportation conference
PASER	PCI	transportation plan

The excluded keyword search terms were "water" and "EPA". These terms were excluded due to the large volume of local agencies that have created water and wastewater asset management plans championed by the United States Environmental Protection Agency. Water and wastewater asset management plans are not part of this local road transportation asset management study. If no details were found for an individual state using the primary terms, then a set of secondary terms that are typical for planning assets were used to try to gauge the level of statewide local road transportation asset management. These terms are typically used for budget planning of all assets that an agency maintains and not just transportation assets. This was done as a check to see if states use different terminology for transportation asset management plans. The secondary keyword search terms were:

capital improvement plan	capital transportation program
capital improvement program	comprehensive plan

After the DuckDuckGo search engine results for primary and secondary terms were reviewed, specific websites were searched if there still remained unidentified collection measures. First, each state's LTAP website was browsed. Second, state DOTs and state legislature sites were searched; the primary and secondary terms were used on the DOT search page and on the legislative compiled law (or equivalent) search page. Finally, local agency association sites were browsed to try to satisfy any remaining unanswered collection measures. These included

county engineer, city engineer, county supervisor, county commissioner, and judges association sites.

Web Scraper Data Collection

A web scraper is a tool that crawls (or searches) the web and scrapes (or saves data to a database) web sites that meet set criteria (harkiran78, 2022). The web scraper that was created for this study used the Google search engine to search for specific terms and indexed the items found. This index was manually reviewed by CTT staff who then documented items that pertained to the fourteen collection measures. The Google search engine was used because of its familiarity to the web scraper developer. The web scraper had the ability to search websites, pdf files, and also the names of Microsoft Office files. The web scraper provided rating points and statistics for items found, which was based on how many keywords were located. One point was added for each unique keyword that was found and, if more than one of the same keyword was found, there would need to be twice as many found to add another rating point. For example, if the keyword "asset" was found seven times, it would add one point for the first time, another point for the next two times, and another point for the last four times for a total of three points.

Additional features were added to the database to assist with the manual review such as filters, searching, color coding, and adding keyword search terms to be excluded. The keywords used for the web scraper data collection were modified from the original manual web keyword list based on how useful the original terms were at finding data on the fourteen collection measures. The fifty state names were part of the keyword search terms. The remaining keyword search terms were:

asset management
asset management guide
asset management manual
capital improvement plan
capital improvement program
capital transportation program
comprehensive plan
ltap
pavement asset management
pavement management guide
pavement management manual
pavement management system
rating
rating program
rating system
road asset management
road asset management guide
road management manual
road management system
road plan
t2
t2 center
transportation asset management
transportation asset management guide
transportation asset management manual
transportation plan

Two levels of filters were used to review the indexed items found. The first filter level was by state name, which returned all the items that included that state name. The second filter level

used specific keywords to sort related items into six bins to pinpoint specific desired information. The keywords for the second filter level are shown in Table 1.

Table 1: Second level web scraper filter keywords

Second level Filter	Keywords	
General asset management?	asset management transportation asset management road asset management pavement asset management	!epa !environmental !transit
Do they have a TAM guide?	transportation asset management guide road asset management guide pavement management guide asset management guide	!epa !environmental !transit
Is there a provided system?	rating rating system rating program pavement management system	road management system !epa !environmental !transit
Is LTAP involved?	ltap t2 t2 center !epa	!environmental !transit
Manuals?	transportation asset management manual road management manual pavement management manual asset management manual	!epa !environmental !transit
Plans or programs?	transportation plan comprehensive plan capital improvement program capital improvement plan	capital transportation program !epa !environmental !transit

! = exclude items with this note

Search functionality was added to the database to speed up the manual review of the items found by the web scraper. The searching could be performed on the uniform resource locator (URL) or on the text contained in the found item. The items were then color coded to speed up the manual review and assist with future referencing. Items were colored red if they were not useful, green if they were useful, and yellow if they were interesting but not useful in providing data on the fourteen collection measures. Once the item was color coded it was hidden from view so it was easier to navigate the list. The items in green were then made visible after the review of the list was completed. There was also a download feature created that would download a pdf of the found item. This was done to save a snapshot of what was found because of the shifting nature of online items. The web scraper user interface is shown in Figure 1.

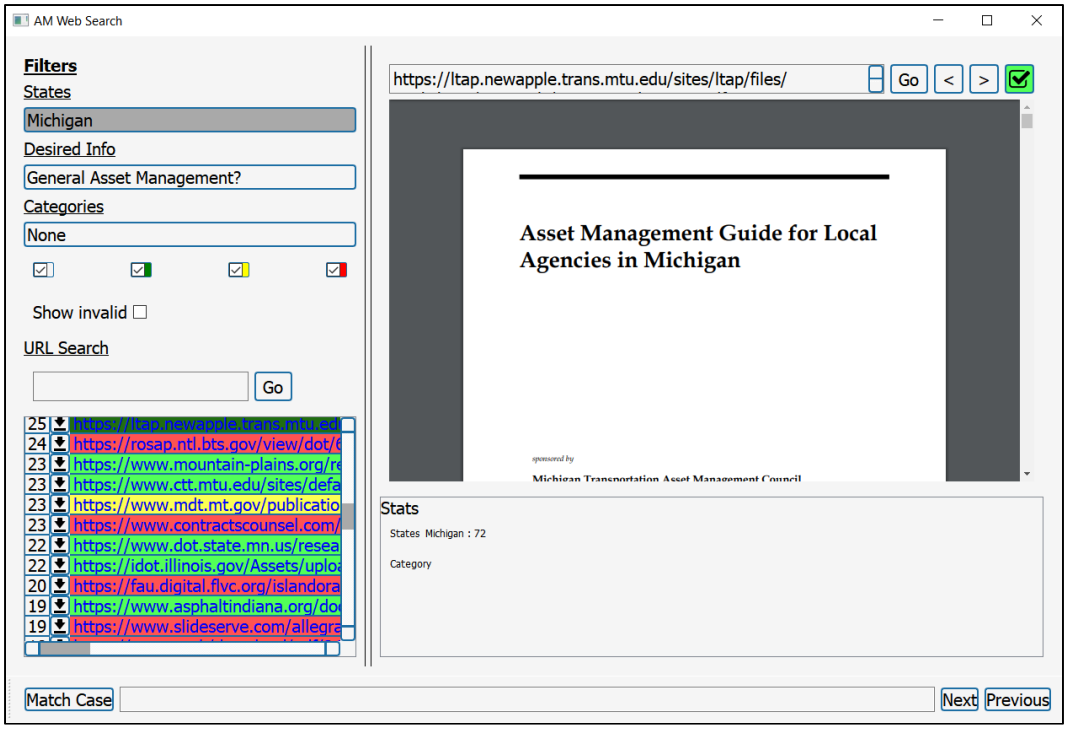


Figure 1: Web scraper user interface

Survey Data Collection

The final data collection method was through an online SurveyMonkey survey that was sent to all fifty state LTAP center directors; this survey is shown in Figure 2. There were five questions and an additional open feedback section for the survey. All questions were short answer except for question three, and all questions required an answer except for the open feedback question. In addition to e-mailing the survey request to all LTAP center directors, a request to fill out the survey was announced at the 2022 National LTAP/TTAP Conference in Seattle, Washington. Flyers were also handed out to attendees of this conference that contained a quick response, or QR, code that linked directly to the survey.

Leaders in Transportation Asset Management Survey

Michigan's Local Technical Assistance Program is in search of leaders in transportation asset management (TAM). We are gauging different states' TAM current and best practices provided to local agencies. Please take a moment to complete this survey. We appreciate your feedback.

For this survey, we are defining TAM as using data to assist with decision making.

Name: *E-mail:* *State:*

1. *Has your state legislature or state department of transportation provided incentives or directives for local agencies to perform TAM? If so, what incentives and directives have they provided?*

2. *Is there a recommended pavement condition rating system used by your state's local agencies? If so, what system is used?*

3. *What percentage of local agencies in your state have pavement condition data that is less than 3 years old on at least one third of their road network? (multiple choice 0%, >0%, >25%, >50%, >75%)?*

4. *What trainings, manuals, or best practices are offered in your state that assist local agencies with TAM (please provide a web link if available)?*

5. *We may wish to follow-up with you by phone with more TAM-related questions. Do you feel that you have a good understanding of the level of TAM implementation being performed by your local agencies? If no, who would you recommend we survey?*

Figure 2: Leaders in transportation asset management survey that was sent to LTAP directors

Search Validation

A common concern with many literature reviews is determining whether the search was in-depth enough to have a deep understanding of the topic and a thorough understanding of the subject matter and related topics. Validation checks were performed for this study in a variety of ways to assess the completeness of the data found in the online searches and if further investigation was warranted.

Manual Web Search Validation

In order to gauge whether the manual web searching using the DuckDuckGo search engine was in-depth enough, a validation review was undertaken for the six states of Georgia, Hawaii, Maine, Mississippi, North Dakota, and South Dakota. For this validation review, the websites of the top three counties and top three cities within each state, by population, were searched. The search consisted of using the primary and secondary keyword search terms on the local agency's search page and browsing their pertinent webpages, meeting minutes, and meeting recordings if they were available. The goal of this in-depth review was to identify any details on the statewide local road asset management practices that were not found earlier.

Web Scraper Validation

The web scraper validation review first looked at the points that were given to each item found that contained the keyword "Michigan". All the items found using the first-level Michigan filter were manually reviewed by a CTT staff member and marked if they were useful in providing data on the fourteen collection measures. This was then compared to how many points the web scraper gave to the item. The intent was to correlate the points given to the likelihood that the item answered one of the collection measure questions. For example, checking how likely that the amount of points above a certain threshold would contain information that would answer one of the collection measure questions.

The second web scraper validation review again tried to investigate ways to optimize applicability of the total dataset. This would result in less time manually reviewing the items and more time determining whether the state met the criteria for a particular scoring measure. All the results from the seven states of Alabama, Alaska, Idaho, Indiana, Michigan, Utah, and Wisconsin were reviewed and marked if they were useful items. The results were then filtered by the second-level filter terms and were compared to the items found for each of the seven states first-level state name filter. This validation assessment checked if it was adequate to just review the first-level state name and second-level desired information filter results instead of all the results found with just the first-level state name filter.

Survey Validation

The primary data collection method was web searching because it was assumed that, if the statewide details are not on the web, then they don't exist. It would be much more difficult to reach all local road owners in a coordinated effort about reporting that was performed, trainings and tools that are available, and any regulations that apply if the internet was not used. The SurveyMonkey survey results were used as a check that was not tied to web searching in order to verify that an adequate understanding of statewide asset management practices on local roads was found.

Data Analysis

Data from the fourteen collection measures were used to evaluate states on nine scoring measures described in Table 2 below, which were then used to create an overall local road transportation asset management score. The nine scoring measures were based on whether there was a statewide effort for local roads to use a unified rating or TAM system, have data, use a mix-of-fixes approach, use preventive maintenance, have a written plan, assess needs, include other road assets, use ratings to determine fix, and evaluate a treatment's extended service life (ESL).

Table 2: Scoring measure point system

	Is there a statewide effort to…	Point given for:
Unified rating or TAM system	…use a unified asset management system or rating system for local roads?	Yes (1.00 point)
Have data	…collect quality data on local roads?	Training (0.25 points), Tool (0.25), Regulatory (0.25), and QC (0.25); *or* Generated report (0.75) and QC (0.25); *or* Self-initiated collection on 75% of non-federal-aid roads at least every 3 years (0.75) and QC (0.25)
Mix of Fixes approach	…use a mix-of-fixes approach on local roads by offering state-specific trainings and tools?	Training (0.50 points) and Tool (0.50)
Preventive maintenance	…use preventive maintenance treatments on local roads?	Training or Guide (0.50 points) and Tool (0.50)
Have a written plan	...have a written pavement asset management plan for local roads?	Training (0.33 points), Tool (0.33), and Regulatory (0.33); *or* Generated report (1.00)
Assess needs	...be able to use data to show elected officials and the public the impact of increases or decreases in budgets on future quality of local roads?	Training (0.33 points), Tool (0.33), and Regulatory (0.33); *or* Generated report (1.00)
Other road assets	…routinely collect data on other roadside assets on local roads?	Training (0.33 points), Tool (0.33), and Regulatory (0.33)
Use ratings to determine fix	…consider distress ratings when deciding on an appropriate fix on local roads?	Training or Guide (0.33 points), Tool (0.33), and Regulatory (0.33)
ESL evaluation	…periodically assess the benefit (years of life gained) of pavement treatments on local roads?	Training (0.50 points) and Tool (0.50)

The evaluation system was based on survey questions on the 10th Annual Michigan Local Agency Transportation Asset Management Implementation Survey Report (Torola & Colling, 2021). This was an annual report that assessed the level of transportation asset management implementation of Michigan's local agencies. The handout from the Center for Technology & Training's February 20, 2018 class entitled Asset Management Maturity Self-Assessment (CTT, 2018) was also reviewed in order to create a more complete evaluation system. Each of the states were given a point or portions of a point for each of the nine scoring measures. The overall score for each state was calculated based on the total points received divided by the total points possible and expressed as a percentage. The overall local road transportation asset management score for each state was used to look for trends based on how different individual collection measures influenced the overall score.

As shown, scoring measures were based on whether systems, trainings, or tools were available; whether regulatory requirements were present; or if a report was generated. Tools for this study were defined as any system, template, decision matrix, or reporting effort that was created to be used by local agencies across the state. Trainings for this study were defined as any in-person training, web-based training, training video, guide, or technical assistance used by local agencies specifically for their state. It has been shown in Michigan that having tools and training helps local agencies meet regulatory requirements for statewide asset management practices. When the evaluation system rating components shown in Table 2 are broken down by the level of influence to the overall score, it was found that offering trainings influence 34% of the overall score, tools influence 34%, regulatory requirements influence 17%, and quality control influences 3%. The unified rating system scoring measure was simply a yes or no metric and not tied to trainings, tools, or regulatory requirements. If a state scored positively on every component with the exception of having regulatory requirements, it still would be able to receive an overall score of 97%.

RESULTS

After the data collection and scoring was completed, the ESL evaluation scoring measure was removed from the analysis. This scoring measure was too inconclusive to provide a definitive assessment for most states. The remaining eight scoring measures were used to produce the overall local road transportation asset management score for each state. The scores ranged from 0% on the low end to 90% on the high end, and the average score of all the states was 31%. There were thirty-six states with a score in the range of 0% to 40% and fourteen states with a score higher than 40% (see Figure 3). The individual state results are shown in Figure 4.

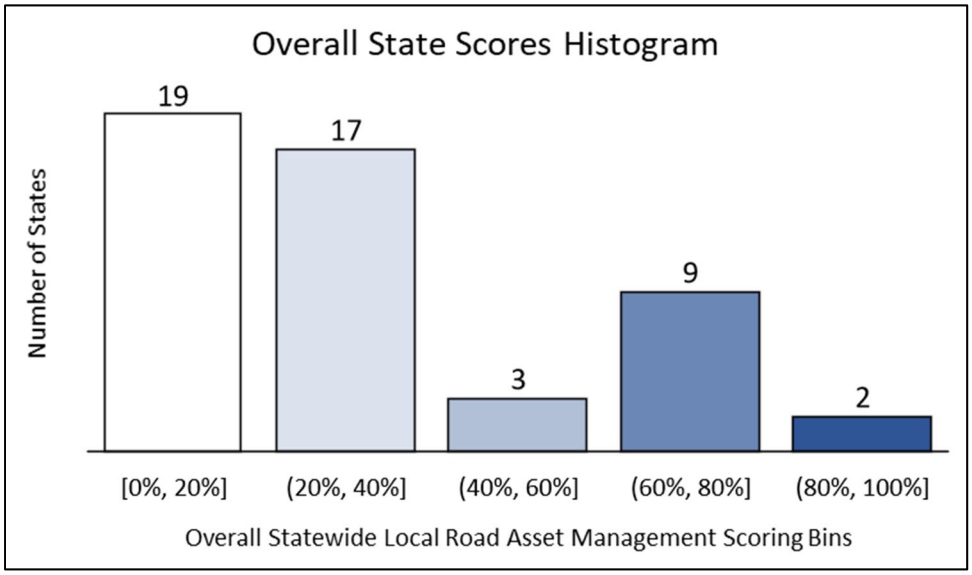


Figure 3: Distribution of overall state scoring

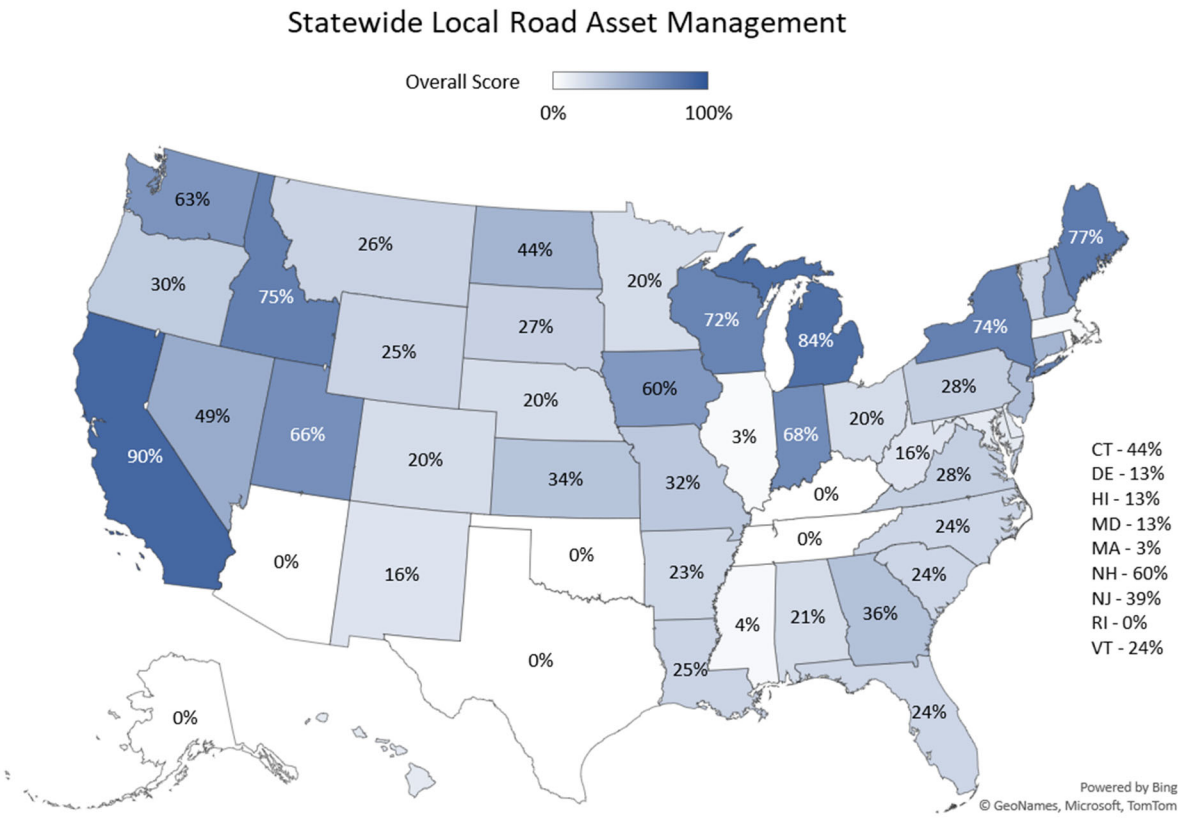


Figure 4: Statewide local road transportation asset management overall score results

Results of Individual Scoring Measures

Unified Rating System or Unified Transportation Asset Management System

The scoring measure on whether there was a statewide effort to use a unified transportation asset management system or unified rating system for local roads was the only scoring measure that was simply a yes or no score. This scoring measure did not score on trainings, tools, or regulatory requirements. Seventeen states had a unified transportation asset management or rating system available to be used on local roads and twenty-nine states did not. The remaining four states had a unified transportation asset management system or unified rating system for county roads only and were given a 50% score to account for this effort (see Figure 5). The rating systems found for each state are shown in Appendix B – Unified Rating Systems.

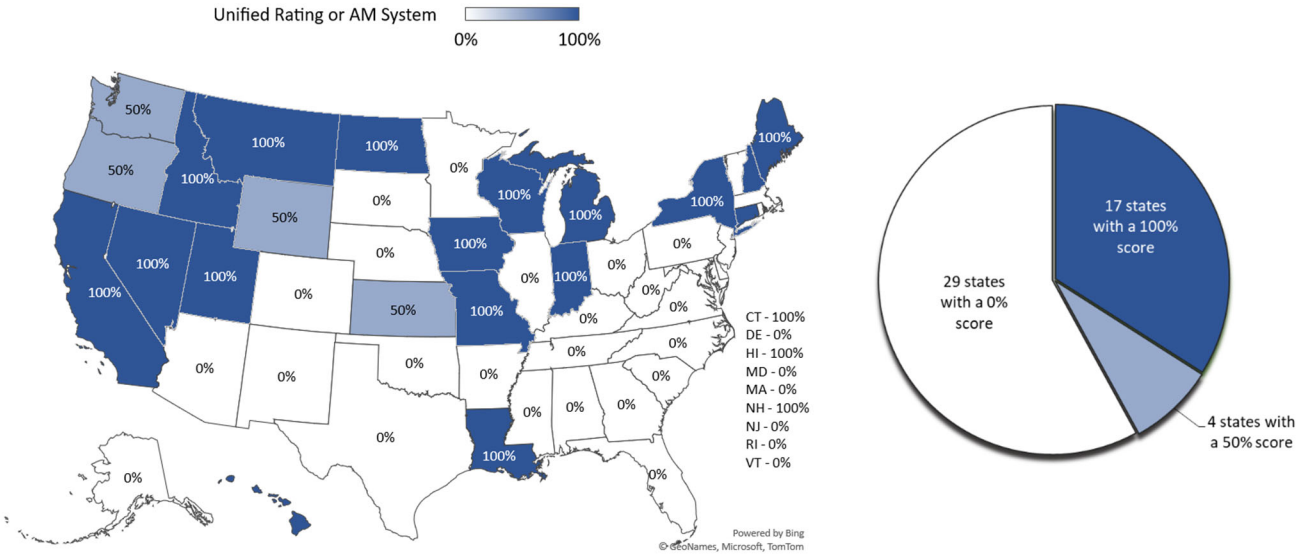


Figure 5: Statewide local road asset management assessment on unified rating or TAM systems results

Have Data on Local Roads

There were three paths to receive scores on the statewide effort to collect quality data on local roads, which was the most complex scoring measure. The first scoring path looked for the presence of trainings, tools, regulatory requirements, and quality control measures. The second path looked for the existence of a statewide local road condition report and if quality control measures were present. The last path looked for local road agency self-initiated data collection on 75% of non-federal-aid roads at least every 3 years and if quality control measures were present. There were statewide efforts that automatically collected and reported local road data by agencies that were not local agencies, and there were local road owner surveys that showed self-initiated collection on at least 75% of the state's local roads. Since these states already have data on their local roads it was decided to score this scoring measure on separate paths instead of giving them a lower score due to not having trainings, tools, or regulatory requirements. There were nine states (California, Connecticut, Idaho, Iowa, Maine, Michigan, Montana, Utah, and Wyoming) that received credit for having quality control procedures in place. The most common reason for receiving credit for quality control was because data was collected by a single entity and distributed to all local agencies or a statewide champion collected the data on behalf of local agencies at their request. If a single entity collects all the data, then data at one agency should be comparable to data at another agency.

The majority of the states received points on this scoring measure through the scoring path of the presence of trainings, tools, regulatory requirements, or quality control procedures on the collected data. Twenty-seven states received points for having trainings and twelve states

received points for having tools; these were the two most common reasons for receiving points for this scoring measure. There were fifteen states that did not receive any points for having data (see Figure 6).

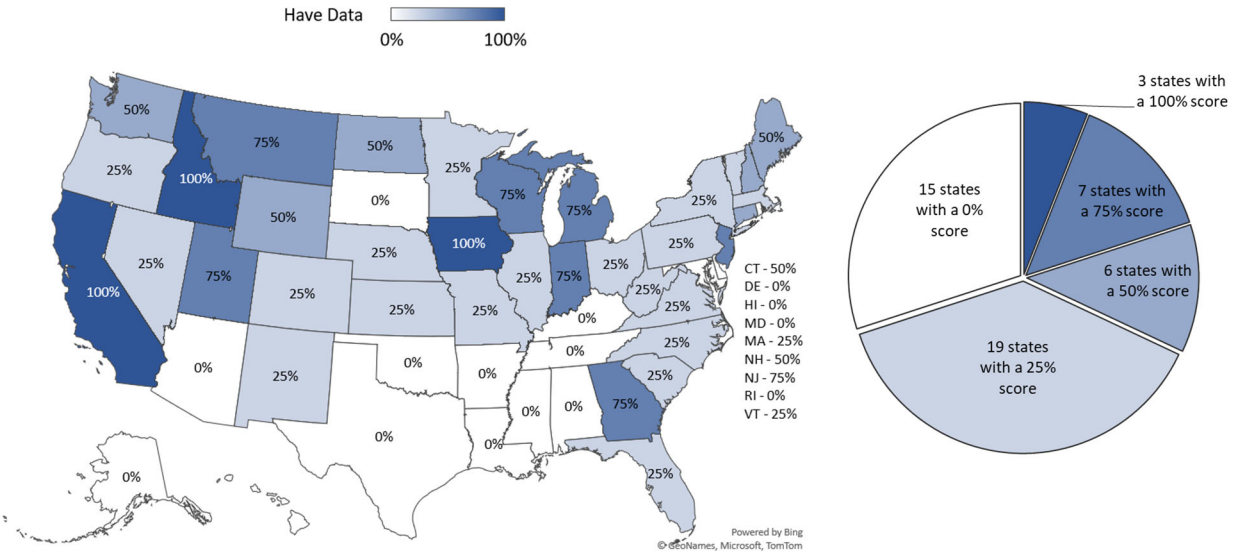


Figure 6: Statewide local road asset management assessment on having data results

Mix-of-Fixes Approach

Points were given to states for having a statewide effort to use a mix-of-fixes approach on local roads by offering state-specific trainings and tools. A mix-of-fixes approach looks at applying different types of treatments at different times during the life of a roadway with the main goal of targeting the most cost-effective window of opportunity. There were six states that offered both trainings and tools, twenty-five states that offered trainings only, three states that offered tools only, and sixteen states that offered neither. The scoring results are shown in Figure 7.

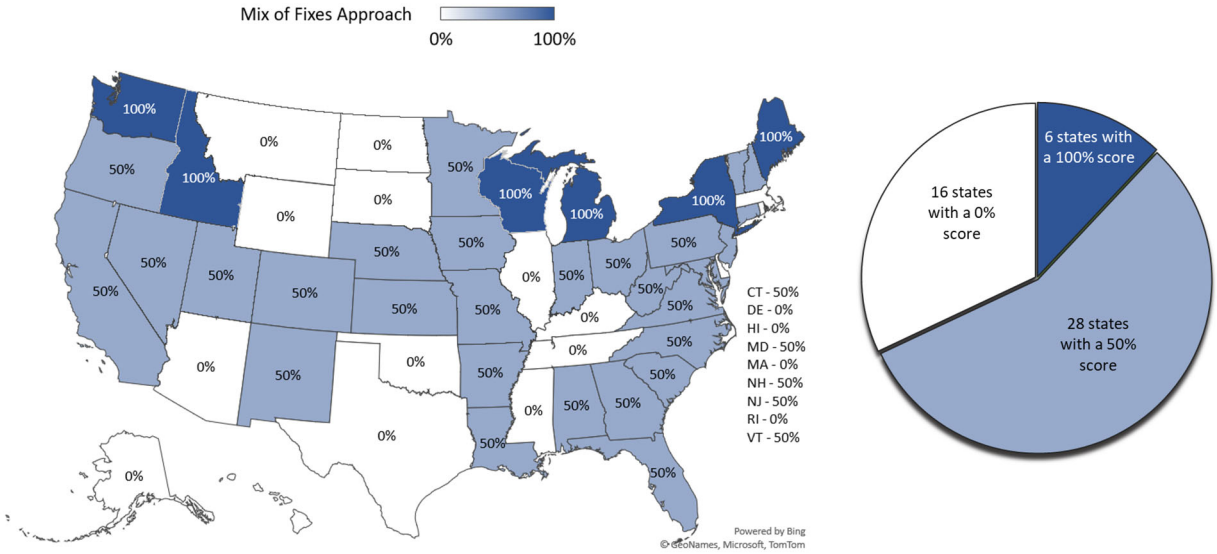


Figure 7: Statewide local road asset management assessment on mix-of-fixes approach results

Preventive Maintenance

Figure 8 shows the results for the scoring measure of having a statewide effort to use preventive maintenance treatments on local roads through offering trainings (or guides) and tools. Preventive maintenance is a cornerstone of effective transportation asset management and has the goal of delaying higher-cost treatments from needing to be performed. There were twelve states that offered both trainings (or guides) and tools, twenty-two states that offered trainings or guides only, two states that offered tools only, and fourteen states that offered neither.

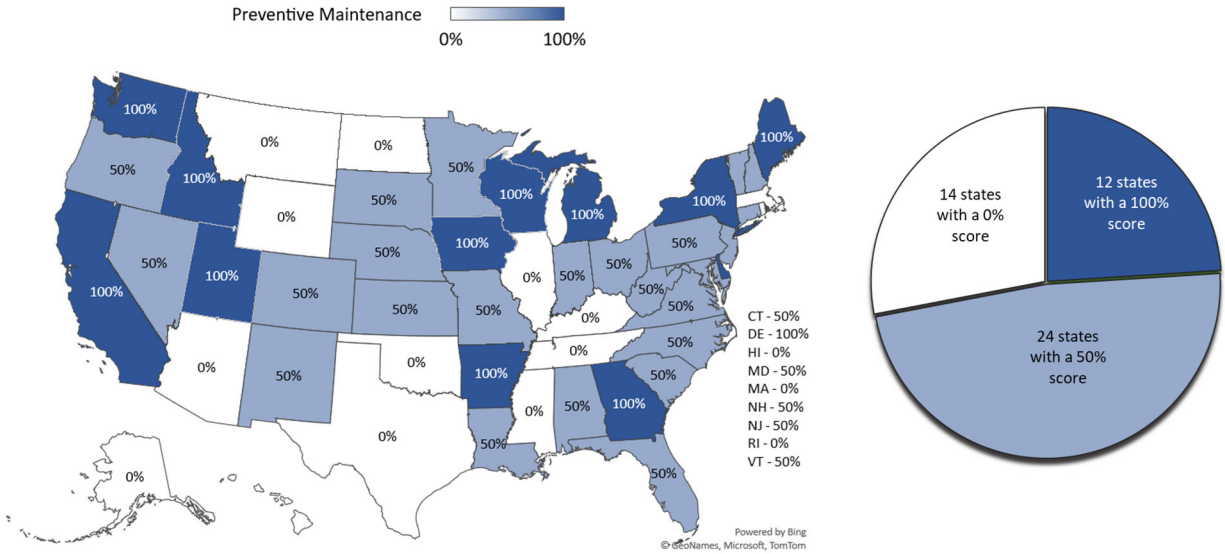


Figure 8: Statewide local road asset management assessment on preventive maintenance results

Have a Written Pavement Asset Management Plan

There were two scoring paths for the scoring measure of having a statewide effort to have a written transportation asset management plan for local roads: having trainings, tools, and regulatory requirements was one path and generating a pavement asset management plan automatically statewide was the second path. California was the only state that followed the second path due to their statewide local needs assessment report (NCE, 2021). For the rest of the states, the regulatory requirements ranged from having to submit full transportation asset management plans to being required to submit a portion of a typical plan such as a list of planned projects on their local roads. There were seven states that offered trainings, six states that offered tools, nine states that had some sort of regulatory reporting requirement, and thirty-six states that offered nothing. Many states had a combination of scoring metrics, which is reflected in the scoring results shown in Figure 9.

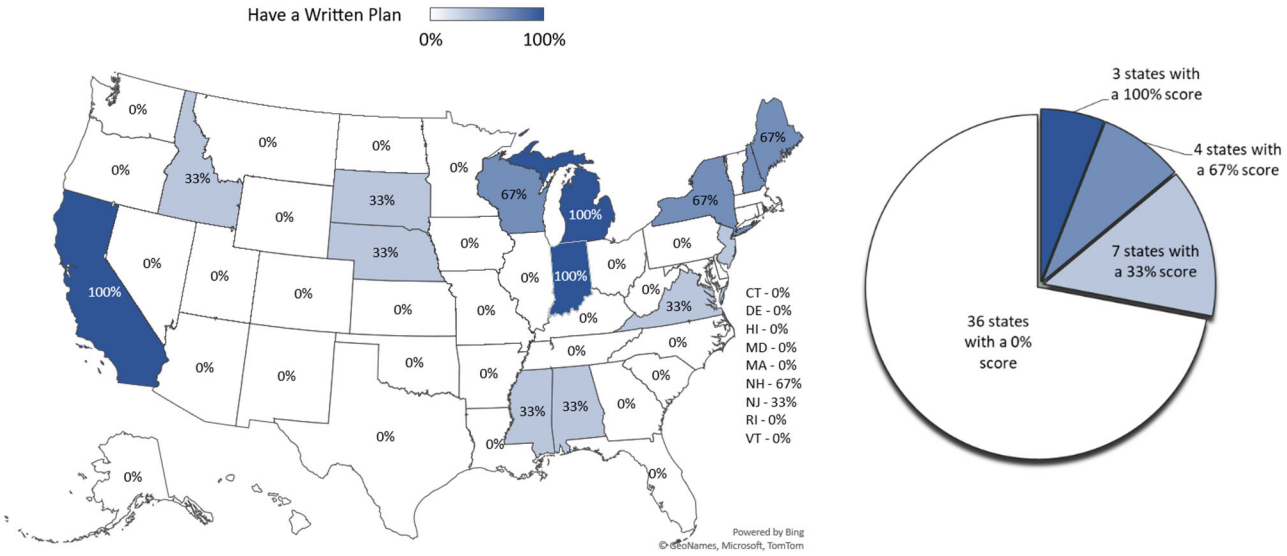


Figure 9: Statewide local road asset management assessment on having a written plan results

Use Data to Assess Needs

There were two scoring paths for the scoring measure of having a statewide effort to use data to show elected officials and the public the impact of increases or decreases in budgets on future quality of local roads: having trainings, tools, and regulatory requirements was one path and reporting to the state legislature was the second path. California, Indiana, North Dakota, and Wyoming were the only states that followed the second path due the statewide local needs assessment report in California (NCE, 2021), needs assessment of roads in North Dakota (UGPTI, 2012), Indiana local road dashboard website (Indiana LTAP, 2022), and statewide conditions of county paved roads report in Wyoming (Wyoming Technology Transfer Center, 2015). Michigan does have a statewide report that includes the conditions of local roads but it

is not reported for all local roads across the state (Michigan TAMC, 2022). There were twenty-three states that offered trainings, sixteen states that offered tools, one state that had a regulatory reporting requirement, and twenty-two states that offered nothing. Many states had a combination of metrics, which was reflected in the scoring results shown in Figure 10.

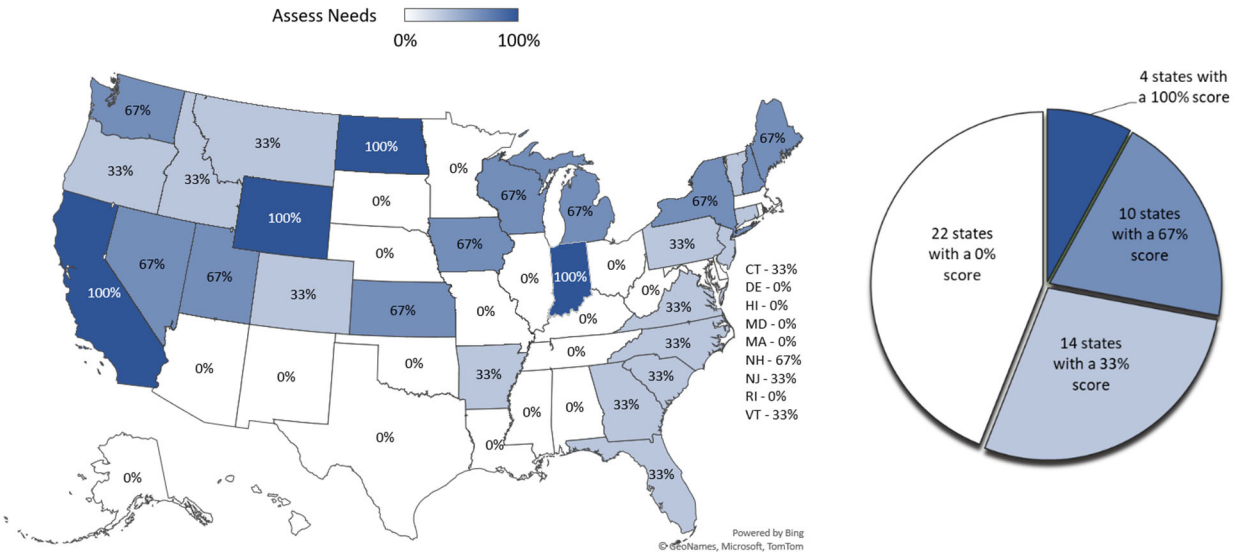


Figure 10: Statewide local road asset management assessment on assessing needs results

Collect Data on Other Road Assets

Figure 11 shows results of the scoring measure of having a statewide effort to routinely collect data on other roadside assets on local roads by offering trainings, offering tools, and imposing regulatory requirements. Most agencies begin their transportation asset management data collection programs by collecting only pavement condition data. The existence of data for other roadway assets indicates that they are expanding their asset management practices to incorporate more data to assist in their decision making. There were fourteen states that offered trainings, fourteen states that offered tools, two states that had regulatory requirements, and thirty-three states that had nothing. This summary totals more than fifty because many states use a combination of these metrics as shown in the scoring.

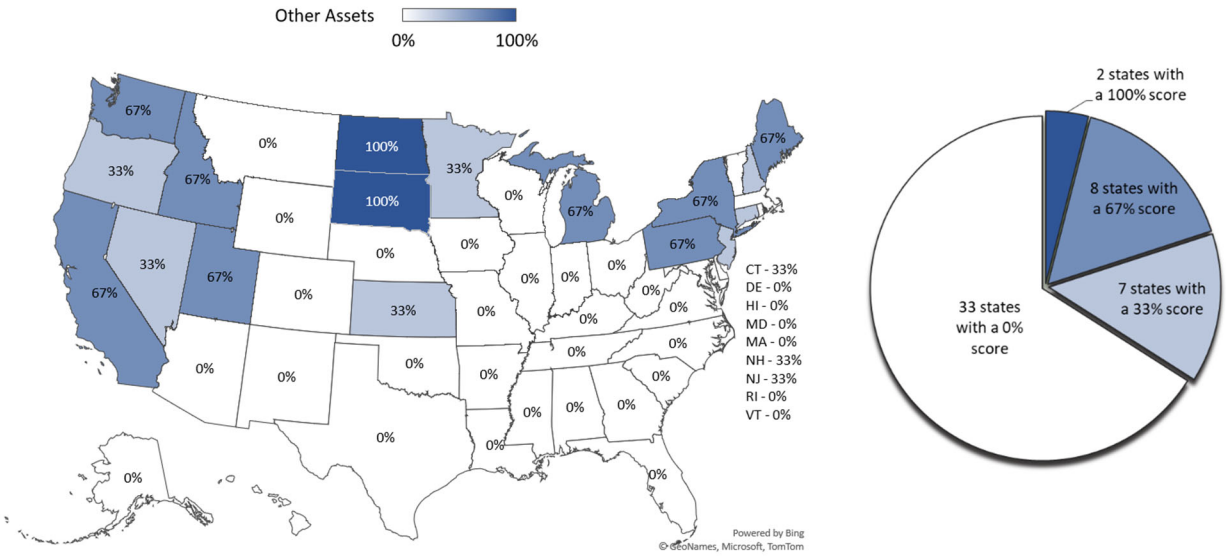


Figure 11: Statewide local road asset management assessment on other assets results

Use Ratings to Determine Fix

Figure 12 shows the results of the scoring measure of having a statewide effort to consider distress ratings when deciding on an appropriate fix on local roads by offering trainings (or guides), offering tools, and imposing regulatory requirements results. There were twenty-one states that offered trainings, fifteen states that offered tools, one state that had a regulatory requirement, and twenty-six states that had nothing.

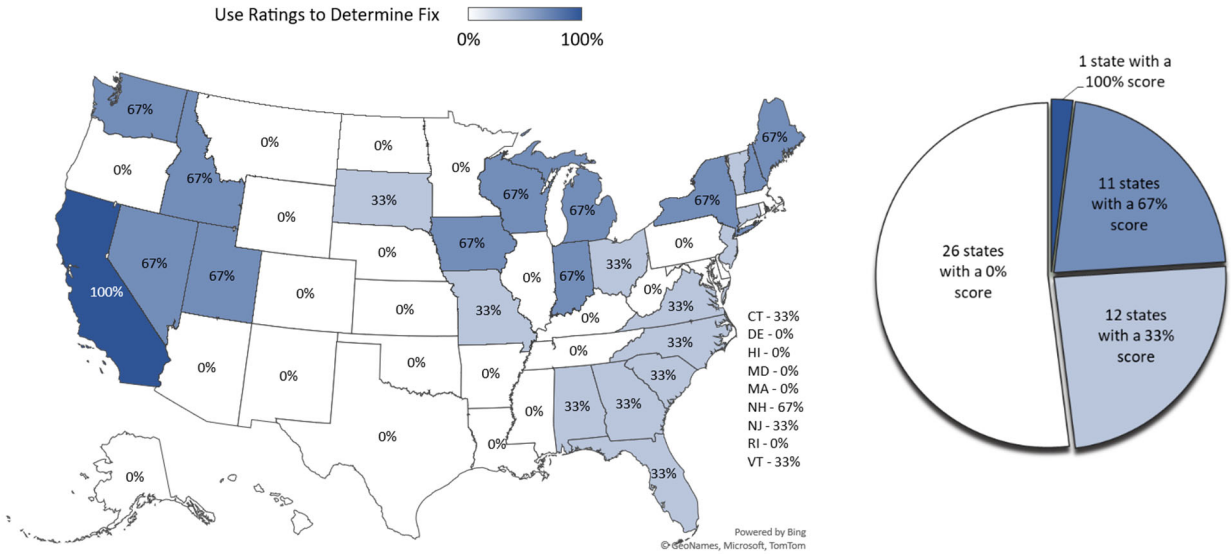


Figure 12: Statewide local road asset management assessment on using ratings to determine fixes results

Collection Measure Findings

Incentives to Perform Transportation Asset Management

There were twenty-three states found that had a way of incentivizing transportation asset management (TAM) practices on local roads. This collection measure had a trend of tying funding eligibility to asset management practices and providing tools or assistance at a low to no purchase price as a way to incentivize TAM. For example, the Connecticut Conference of Municipalities promoted a system that they had vetted for their municipalities as a way to speed up the acquisition process (CCM, 2021). Georgia had a Local Maintenance Improvement Grant that was eligible for roads that are rated a set minimum level (DeKalb County Georgia, 2016). California metropolitan planning organizations (MPOs) required that their local agencies follow asset management practices as they are in control of pavement management and funding at the local level (OCTA, 2021). California also allowed cities and counties flexibility in how they spend their road maintenance funding if their average pavement ratings exceed eighty out of one hundred on the Pavement Condition Index (PCI) scale (California Legislature, 2017). Wyoming had an automatic funding source for collection of county paved road data (Ksaibati, 2014). The remaining TAM incentives found are shown in Appendix C – TAM Incentives Found.

Level of Adoption

The level of adoption was evaluated based on whether the threshold of at least half of the local agencies in the state are managing local roads with asset management principles. This was based on found survey data, reports, and regulatory requirements. Fourteen states had at least half the local agencies in the state managing local roads with asset management principles through a statewide effort. Eight states had a statewide effort to manage local roads with asset management principles with some measurable participation up to a maximum of half the local agencies participating. Twenty-eight states had no level of adoption through a statewide effort.

Other Assets

Twelve states had a statewide effort that offered trainings, offered tools, or imposed regulatory requirements to collect data on other roadside assets for local roads. The more common assets were signs and culverts. Michigan was the only state with regulatory requirements that specifically called out the other roadway assets that must be included in transportation asset management (Michigan Legislature, 2020). South Dakota requires cities and counties to have a four- or five-year road and bridge project plan and a local wheel tax in place in order to submit grants for small structures (South Dakota Legislature, 2015). The remaining findings are shown in Appendix D – Other Types of Roadway Assets Found.

Tools or Practices

There were twenty-one states with tools or practices identified that aided in the statewide effort for managing local roads with AM principles. Arkansas had created a tool that provides white papers on recommended pavement repair treatments based on distress type, severity

level, and distress density (University of Arkansas CTTP, 2017). New Hampshire hosted a regional pavement preservation conference covering thirteen states and provinces (UNH T2, 2022). Indiana conducted a conference to allow communities to network with each other on their use of the PASER system (Domonkos, 2016). Indiana also provided a "Local Level of Effort" statistic on their reporting dashboard. This statistic provided a ratio of money received from the state in comparison to the total money that was spent; this statistic provided context to legislature and the general public on how local road department projects are funded (Indiana LTAP, 2022). In Iowa, the state DOT collected data on all the federal-aid routes, and it was shared with the local agencies. Iowa local agencies could pay to have the same data collected on their non-federal-aid routes though the same DOT data collection program (Iowa DOT, 2011). Michigan had created transportation asset management plan templates and tools that automatically fill in fields with previously collected data (CTT, 2021). The remaining findings are shown in Appendix E – Transportation Asset Management Tools or Practices Found.

Lessons Learned

Three states (Alabama, North Carolina, and South Carolina) developed a statewide tool or system for local road transportation asset management and it was not clear what became of them. It appeared that these systems are no longer supported. There were eight other states with lessons learned identified. In Colorado, the 2002 Local Roadway Needs Assessment identified four major problems with their statewide assessment. This was the fourth time Colorado had tried to assess local roads across the state with problems with the process still not corrected. The major problems identified were:

- "Need was not clearly defined."
- "Needs were not well categorized."
- "Sampling techniques lacked validation, especially for decision-makers."
- "Collected data was inconsistent and unreliable." (Dye Management Group, Inc., 2002)

In Georgia in 2018, a statewide survey was conducted to determine local agency TAM practices. This statewide survey developed the following recommendations:

- Share resources between agencies
- Attend the already developed LTAP trainings
- Transition to computer-based systems and technologies
- "Nominate or elect a TAM Champion" for larger agencies
- "Establish TAM Steering Committee"
- "Organize regular meetings and reporting requirements" (Mildner, 2018).

Idaho local agencies have had access to a transportation asset management system for many years through their Local Highway Technical Assistance Council (LHTAC) and they have seen issues when local agency staff were not directly involved with performing the work of collecting, analyzing, and reporting on the data used by their transportation asset management

system. Their program guidelines stated, “Many years ago, LHTAC [Idaho LTAP] helped setup accounts and data without anyone from the agency designated to learn and maintain it. Unfortunately, it resulted in some agency accounts going dormant and data going stale. Agencies only benefit if they update and use their own data” (LHTAC, 2017).

Minnesota conducted a State of the Infrastructure 2015/2016 Survey that states there are over 100 different types of transportation asset management systems and tools being used to manage Minnesota local roads. This makes it very difficult to assess local roads uniformly across the state. The report offered these recommendations:

- “Make resources available, especially for smaller cities and smaller counties, to implement an asset management system.”
- “Host conferences, training sessions, webinars, or other forms of education to help those who want to begin or strengthen asset management practices in their jurisdictions.”
- “Consider advocating for the use of a few select, easy-to-use asset management systems, rather than many different systems, to promote consistency, collaboration, and capacity across jurisdictions.”
- “Facilitate the building of relationships with neighboring jurisdictions and consortiums to build regional capacity for using asset management practices and systems.”
- “Explore public policy solutions that could make asset management a standard practice for every jurisdiction.”
- “More research was needed to understand how to best support Minnesota’s cities, counties, and state agencies in their use of asset management practices and systems” (Bartholomay & MartinRogers, 2016).

New Hampshire provided a review of their new SADES program in 2014. It contained some buy-in hurdles that needed to be corrected in order to effectively roll out their new program. The hurdles were:

- "Identification of a data acquisition labor force"
- "Sustainability of the data"
- "Appropriate data acquisition hardware"
- "It was difficult to persuade people who have an established system that this new one was 'better'…"
- "…some agencies across the state are still not equipped with modern technology…" (Cottrell, 2014).

Mississippi had strong opposition from a county supervisor with publishing a list of roads that were planned to be repaired (Rankin County BOS, 2019). Uncertain funding levels and construction costs can be an impediment for local agencies committing to complete future projects.

In Wyoming, having a unified automatic collection was thought to be a benefit because "Counties with limited resources would not need to develop their own methods for monitoring or analyzing their paved roads" (Ksaibati & Huntington, 2014).

In a New Jersey local pavement management system (PMS) survey, it was found that time and expense "are the biggest impediments to adoption" of a PMS (DeFlorio & Louch, 2014).

Provided Transportation Asset Management Systems

Twelve states had a unified statewide transportation asset management system for use on local roads. The remaining thirty-eight did not have a unified statewide system. The systems used ranged from commercially-produced software that was specifically created for agencies in that state to systems that were created by LTAP center staff.

Prevalent Rating System

The unified rating systems used statewide are summarized in Figure 13. There were some states that collected data on multiple rating systems and some states that recommended a specific rating system be used that was dependent on the size of the local agency. The full list of rating systems used is found in Appendix B – Unified Rating Systems.

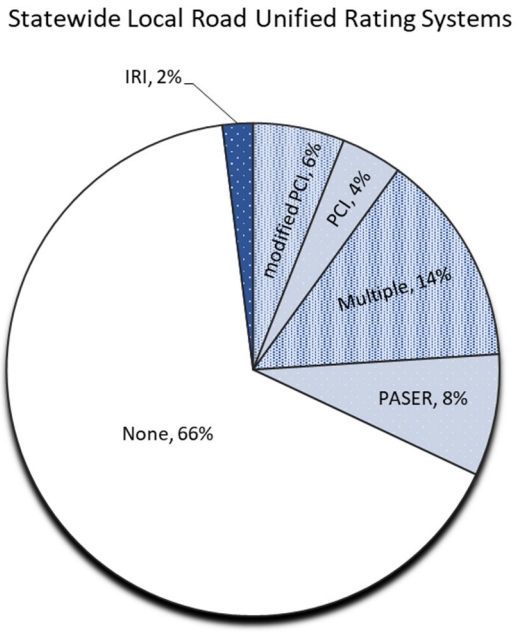


Figure 13: Statewide unified rating systems used

Local Road Regulations for Asset Management Practices

Eleven states had some type of regulatory requirement for transportation asset management to be performed on local roads and thirty-nine did not. The regulatory requirements consisted of reporting a list of planned projects, having metropolitan planning organization's that

required asset management practices be performed, requiring data collection and submission, requiring completion of transportation asset management plans, and requiring a needs study be performed. The requirements found are summarized in Figure 14.

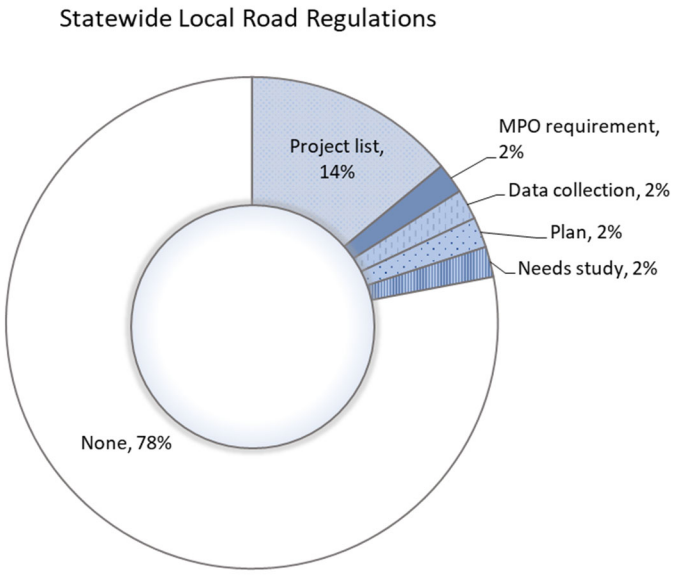


Figure 14: Statewide local road regulations

Funding of Asset Management Practices

Ten states had dedicated means of funding asset management practices on local roads. Five states—California (OCTA, 2021), Connecticut (Connecticut Legislature, 1992), Indiana (Floyd County, n.d.), and South Dakota (South Dakota Legislature, 2015)—required a plan in order to be eligible for grant funding. Georgia had a Local Maintenance Improvement Grant for streets that met a minimum rating (DeKalb County Georgia, 2016). In Idaho, small agencies paid less for their pavement management system (LHTAC, 2017). Michigan reimbursed agencies for collecting local data (Center for Technology & Training, 2022). Wyoming had dedicated funding for collecting paved road data by an outside contractor (Ksaibati & Huntington, 2014). Kansas allowed funds to be transferred from one fund to another when a city (Kansas Legislature, 2021) or a county (Kansas Legislature, 2012) had a capital improvement plan. North Dakota used their periodic local road and county road needs study to guide state legislators on road funding level needs (North Dakota Legislature, 2015).

Statewide Champion

Forty-one states had a statewide champion involved with local road transportation asset management. This was through offering trainings, tools, and liaison support. Thirty-eight states (the majority) had a statewide champion through the LTAP and twelve did not; three states—Georgia, Oregon, and Washington—which had statewide champions through the Georgia-

Carolina Pavement Preservation Council, the Association of Oregon Counties, and the Washington State County Road Administration Board. The LTAP statewide local road transportation asset management involvement is summarized in Figure 15.

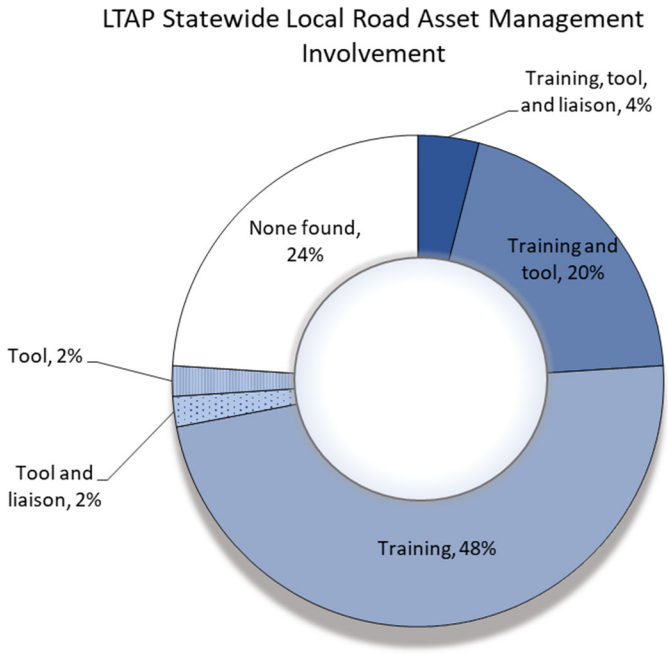


Figure 15: LTAP statewide local road transportation asset management involvement

Validation Results

Manual Web Search Validation Results

The in-depth manual review of the six states of Georgia, Hawaii, Maine, Mississippi, North Dakota, and South Dakota provided insight into *individual* agency asset management practices. It did not produce any additional information on *statewide* asset management practices on local roads.

Web Scraper Validation Results

All the items that were found with the word Michigan were marked as useful or not useful in providing data on the fourteen collection measures. The usefulness was then compared to the points that were given by the web scraper. The intention was to find a correlation between the points given and the usefulness in hopes of being able to eliminate items based on the points given. The point range of the 55 useful Michigan items was between 4 and 58 and the point range of the 745 useful *and* not useful items had points between 1 and 203. This first web scraper validation review did not find any beneficial correlation from the points given by the web scraper to the usefulness of the item found. The higher web scraper rated items were not useful in this study. The results are shown in Figure 16. There were 190 items outside of the useful range for Michigan items found, however performing the review of all the Michigan

items took a considerable amount of time, so it was determined not to do this for another state.

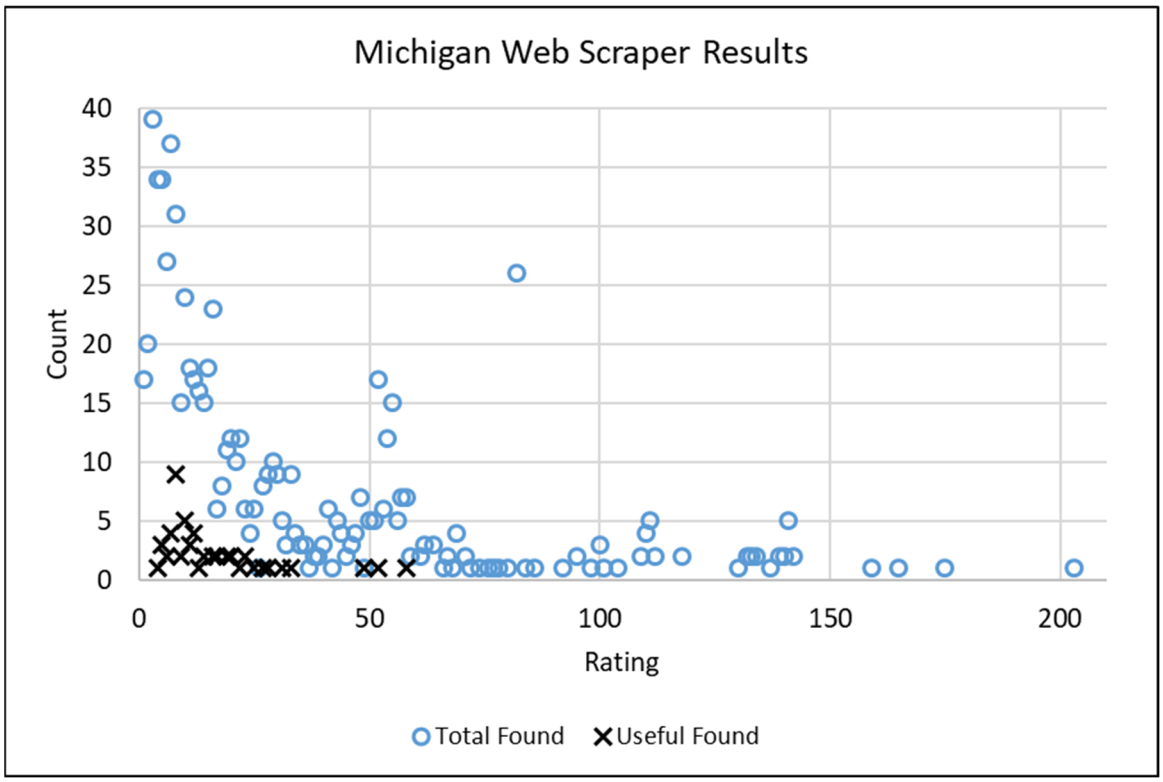


Figure 16: Usefulness of Michigan items found versus web scraper rating given

The second web scraper validation review tried to investigate ways to shrink down the total data set as well. There were 129 total useful items found for the seven states of Alabama, Alaska, Idaho, Indiana, Michigan, Utah, and Wisconsin of the 4,259 total items that were found and reviewed with these state names. The second-level web scraper filtered the found items by the keywords listed in Table 1 and was unable to categorize 27 of the 129 total unfiltered useful items found. These 27 missed useful items were reviewed and determined to not add any additional information to the useful items that were already found in the second level results. A summary of all fifty states is shown in Table 3 and shows that the asset management guide search terms and manuals search terms were too restrictive and did not produce very many results. The useful item totals between the unfiltered and second-level filters do not match because of duplicates between the second-level bins. An additional reason is because the previous validation procedures also included items that were not included in the second-level filters.

Table 3: Overall web scraper results

Web Scraper Results	Useful	Not Useful	Not Reviewed	Total
Total unfiltered items	309	5,724	6,055	12,088
Second-level Web Scraper Filter	**Useful**	**Not Useful**	**Not Reviewed**	**Total**
General Asset Management?	107	739	0	846
Do they have a TAM guide?	0	0	0	0
Is there a provided system?	180	1,901	0	2,081
Is LTAP involved?	1	35	0	36
Manuals?	0	1	0	1
Plans or programs?	19	924	0	943
Second level filter totals	**307**	**3,600**	**0**	**3,907**

SurveyMonkey Validation Results

Six states responded to the online SurveyMonkey survey that was sent to all fifty state LTAP center directors. The information received did not add any missing components to the information that was already found. A follow-up phone call to the Delaware T^2/LTAP Center did provide some additional context to an item found through web searching about their involvement with pavement plan development.

The works cited contains all the useful web results that were found for the manual search, web scraper search, and online survey. A supplementary resource spreadsheet was created as an easy method for looking up the study findings. This resource spreadsheet can be found at https://tinyurl.com/ye644hh5.

DISCUSSION

Compare Overall Score to Results of Individual Metrics

Of the eight scoring measures, there were seven scoring measures with trainings and tools as a metric and five scoring measures with regulatory requirements as a metric. Looking at each individual scoring measure, if no positive scoring metric was found, then the average overall score was found to be at most 24%. Looking at all the scoring measures together, there were twelve states that did not receive points for having a training metric and these states had an average overall score of 10%, there were twenty-six states that did not receive points for having a tool metric and these states had an average overall score of 14%, and there were thirty-nine states that did not receive any points for having a regulatory requirement metric and these states had an average overall score of 26%. Figure 17 and Figure 18 show there was a positive trend in the average scores as more training metrics were found and as more tool metrics were found. It was clear that states are performing statewide local road asset management practices despite not having regulatory requirements (see Figure 19). The regulatory metric was the least reliable in showing an impact on the overall score because the scores for the percentage levels of implementation as shown in Figure 19 had an average standard deviation of 26.6%. The training metric and the tool metric both had percentage levels of implementation with average standard deviations of 13.1% and 13.0%, respectively. Addition details such as maximum score, minimum score, and standard deviation can be found in Appendix F – Scoring by Scoring Metric.

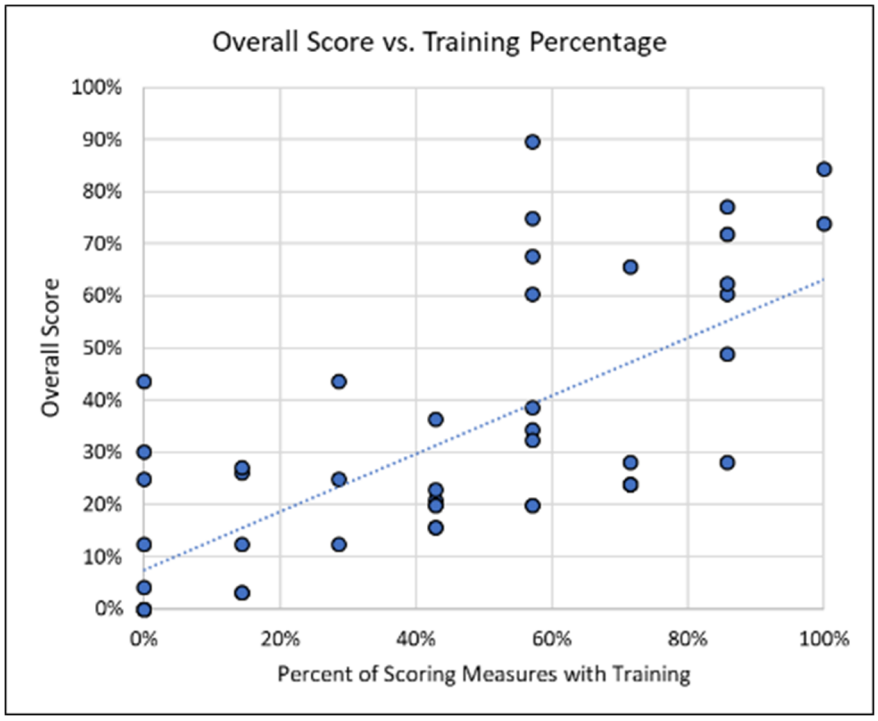


Figure 17: Overall score versus training percentage

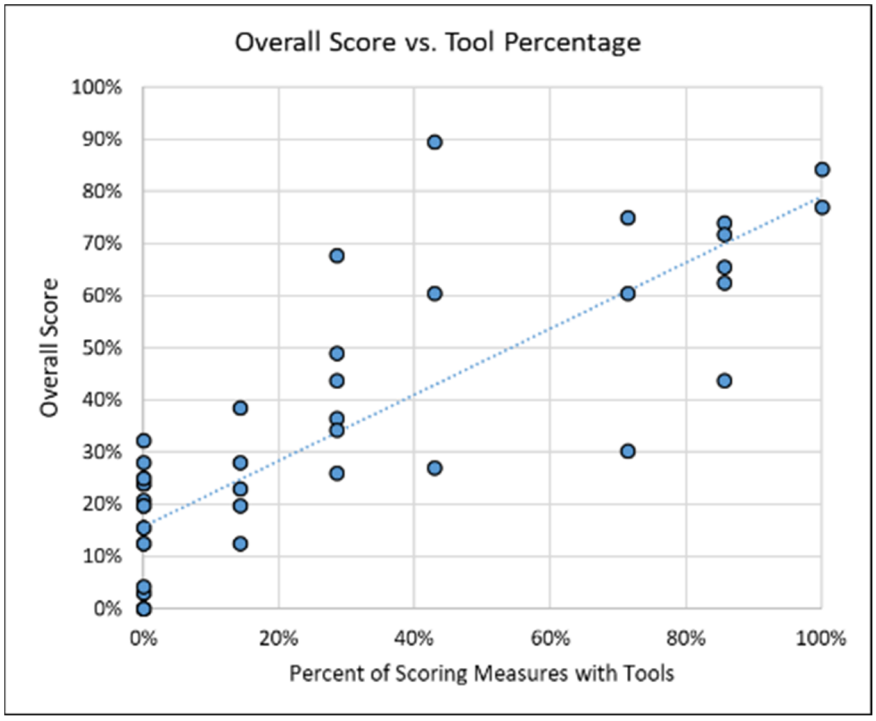


Figure 18: Overall score versus tool percentage

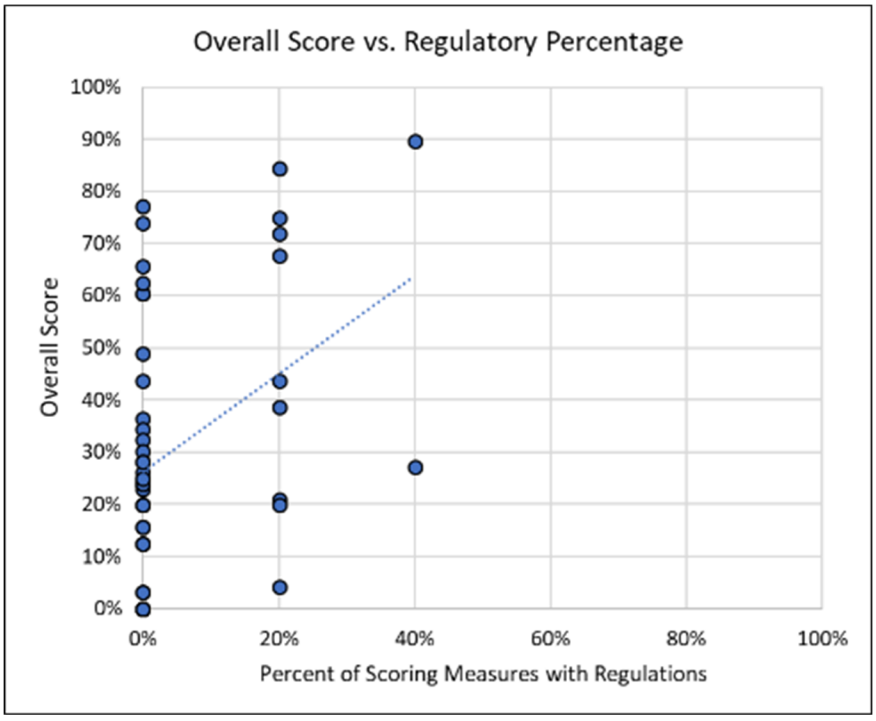


Figure 19: Overall score versus regulatory requirement percentage

Scoring Measure Trends in Overall Asset Management on Local Roads

The eight scoring measures were evaluated to try to identify any trends that lead to higher scores. The states that did not have data received an average overall score of 9% and the states that did not have preventive maintenance efforts had an average overall score of 8%. These two scoring measures were more influential than the scoring measure of having a written plan. The states that did not have a written plan received an average overall score of 23%. An effort for having data and an effort for using preventive maintenance treatments had a much larger influence on increasing average scores than having an effort to have written transportation asset management plans.

The scoring measure of checking for a statewide effort to use a mix-of-fixes approach on local roads by offering state-specific trainings and tools found sixteen states that had neither trainings nor tools and had a 10% average overall score. The twenty-five states that had only trainings had a 33% average overall score and the three states that had only tools had a 47% average overall score. The six states with a combination of trainings and tools on a mix-of-fixes approach had an average overall score of 74%.

For the scoring measure of a statewide effort to use a unified transportation asset management system or rating system for local roads, the twenty-nine states that had neither a unified transportation asset management system nor a unified rating system had a 15% average overall score. There were four states that had a unified system for county roads only and received an average overall score of 38%, and there were seventeen states that had unified systems with an average overall score of 56%. Addition details such as maximum score, minimum score, and standard deviation can be found in Appendix G – Scoring by Scoring Measure.

Collection Measure Trends in Overall Asset Management on Local Roads

The collection measures were also evaluated to try to identify any trends that lead to higher scores. Some collection measures had fairly large scoring differentials when comparing the average scores of the states with positive findings to the average scores of the states with negative findings.

The level of involvement of the state's LTAP center had a positive impact on the average overall local transportation asset management scores. LTAP involvement was not a scoring measure so it can be considered a key finding in this study for implementing local road transportation asset management. This was because the level of LTAP involvement was not a direct collection measure or a direct scoring measure. The more involved the state LTAP was in providing trainings, providing tools, and acting as a liaison for local agencies on behalf of a legislative directive, the more the state displayed a measurable increase in its average scores. The average score increased by orders of magnitude as the LTAP involvement diversified into additional support areas as shown in Figure 20.

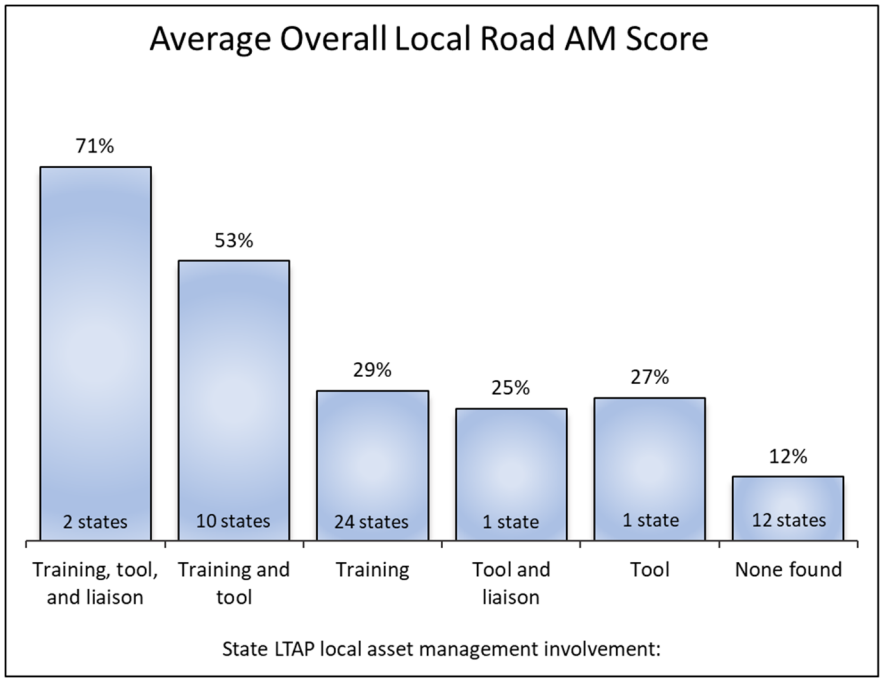


Figure 20: LTAP involvement by average overall score

The local road unified transportation asset management system collection measure findings are shown in Figure 21. There was an increase of an average score of 49% from the states with negative findings to the states with positive findings. Providing TAM incentives and managing other roadway assets also have a large positive influence in the average overall score. Addition details such as maximum score, minimum score, and standard deviation can be found for the remaining collection measures in Appendix H – Scoring by Collection Measure.

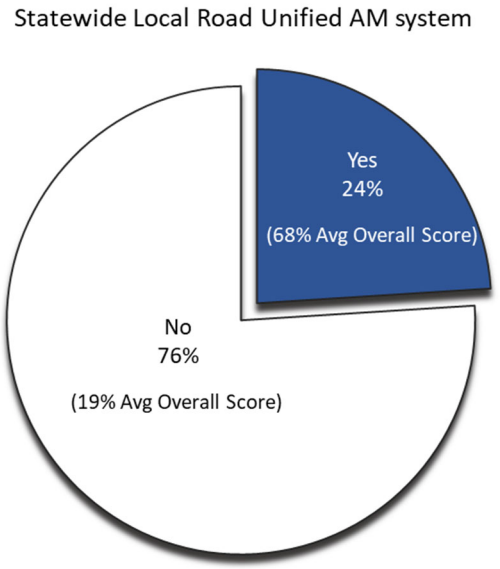


Figure 21: Unified TAM system findings

Paved and Unpaved Local Roads

There was no consistent trend identified in comparing the percentage of paved local roads to how their overall local road transportation asset management score was influenced (see Figure 22). There are requirements for the federal-aid-eligible roads because there is federal money available for these routes. This study focused on all roads that are not eligible for federal funds including gravel roads. Omitting gravel road asset management practices would have downgraded the score of some states, such as the state of Montana. Montana received an overall score of 26% mostly because of the statewide asset management practices performed on gravel roads. Around 14% of the non-federal-aid roads in Montana are paved (FHWA, 2020); this low percentage of non-federal-aid roads amounts to a fairly small portion of their "local" network. Overall, twenty states have less than 50% of their non-federal-aid network paved, and only looking at paved road practices would ignore the asset management efforts that are needed for all roads.

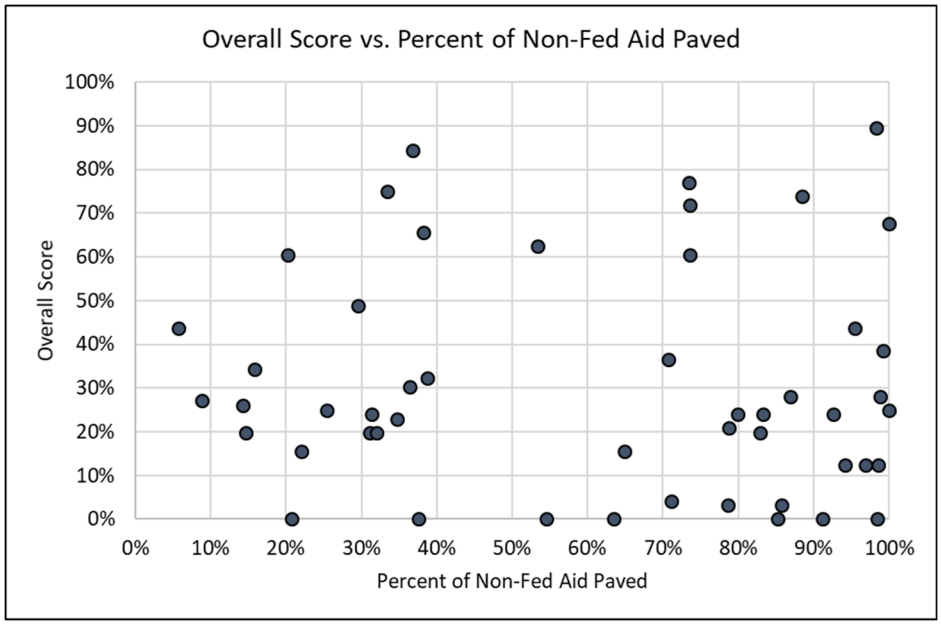


Figure 22: Overall state score compared to the percent of non-federal-aid paved roads

Adjustments During Data Collection and Analysis

The scoring measure on whether there was a statewide effort for periodically assessing the benefit (years of life gained) of pavement treatments on local roads was removed after the completion of data collection. This scoring measure produced results that were too inconclusive to properly assess most state practices. Two states had trainings on evaluating ESL with one of those states also offering a tool. There were nine other states with trainings that probably had an element on evaluating ESL, but it was not definitive that the trainings contained ESL evaluation. It was decided to drop this scoring measure from the analysis; however, this may be worth investigating further in the future. The evaluation of the extension of a pavement's service life from an applied treatment is a slightly more advanced technique for road-owning agencies, and conducting this practice can show advancement into higher-level asset management practices.

Another adjustment that was made during the data collection process was the incorporation of multiple paths to determine the points received for some of the scoring measures (see Table 2). The scoring measure for having a written plan, being able to assess needs, and having data provided a path that provided points for having trainings, tools, and regulatory requirements and a second path that provided points for having a generated report. The states of California and Wyoming both generated reports as mentioned previously on local roads at a statewide level.

It was decided not to penalize states for not having trainings and tools available if the scoring measure objective was already fulfilled. If data was already being collected, then there was no need to provide trainings, tools, and impose regulatory requirements.

For this reason, a third path was created to provide points for the scoring measure that assessed if there was a statewide effort for having data on local roads. This third path gave points if at least 75% of local roads had data though a self-initiated collection effort.

Web Scraper Limitations

There were a few limitations identified that a more experienced web scraper user would most likely know but the lead researcher learned through this study. The first thing learned was the web scraper was able to find and index file names with the appropriate keywords but was not able to search inside Microsoft Office files. There were some useful items found inside these files through manually searching using the DuckDuckGo search engine that were not found using the web scraper with its use of the Google search engine.

Second, the web scraper points that were given were not helpful in prioritizing the items found by what was useful or not in provided data for the fourteen collection measures. The nature and large scope of this study most likely was a contributing factor. Having a more targeted search would have possibly made the web scraper point system usable.

The third factor that limited the usefulness of the web scraper was not identifying all listed keywords, which should have eliminated an item from being indexed. There were many indexed items, such as financial asset management items, found that were not useful. The items that should have been eliminated were only identified after the web scraper was done compiling the index, which takes many hours to run, and the results were manually reviewed. A full manual review of all the indexed items for a single state can take many hours as well. A better solution would be to have the ability to multi-edit indexed items, in other words to mark multiple items at a time that have a common keyword. Multi-editing would be a quick way to post-process indexed items without having to update the excluded keyword search terms, re-run the web scraper, and manually re-review the results.

Limitations of This Study

The driving method of data collection for this study was web searching and the obvious limitation that comes with that was not being able to find asset management practices that are not on the internet. Using trainings, tools, and regulatory requirements as the main metrics made it easier to find items to assess most scoring measures. There was still the possibility that the statewide asset management practices are not on the internet or the appropriate keyword was not used to find the item. It can also be difficult to determine *why* a practice seems to disappear from the web. The practice may not be performed any longer or it may just have become a standard operating procedure. It was assumed that, even if a practice had become a statewide standard operating procedure, there would be some presence of the practice online.

Another factor that increases manual searching difficulty was when trainings were not performed annually; when trainings were only performed periodically, they could be missed if the assessment was performed during a time when the trainings were not able to be located in a web search. This study should be viewed as a snapshot in time as practices can change. With changing practices, the score assigned to each state will change as well.

CONCLUSIONS

The goal of this study was to identify the best practices that made the largest impact on statewide asset management practice on local roads. The best practices, lessons learned, and overall local road transportation asset management assessment from each state found can be helpful for the TAMC with setting future direction and can provide reassurance that the current course is appropriate.

All scoring measures were consistent in finding that, if there were no positive training, tool, or regulatory requirement metric found in the scoring measure, the states' average overall score was found to be below 24%. The least influential metric on the average overall score was having regulatory requirements. Having a statewide unified TAM system had a very large average scoring differential from 68% average overall score for those with a unified TAM system to 19% average overall score for those without (see Figure 21). An effort for having data and an effort for using preventive maintenance treatments had a much larger influence on increasing average scores than having an effort to have written transportation asset management plans.

Another revealing finding was the impact to the overall score when a statewide TAM champion was involved such as a state LTAP program, TAM council, or association. A state that had a more-involved LTAP in providing trainings, providing tools, and acting as a liaison for local agencies on behalf of legislative directives displayed a measurable increase in average scores (see Figure 20).

Trends Among Michigan's Transportation Asset Management Peers

The closest Michigan transportation asset management peers determined from this study were California, Idaho, Indiana, Maine, New York, Utah, and Wisconsin. These peers had an overall score that was within 20% of Michigan's score of 84%. These seven states along with Michigan received the highest scores in the study. Nearly all of these top eight states offered a unified transportation asset management system for local roads. The only exception was Indiana which offered a spreadsheet template for capturing the data that was reported on their statewide internet dashboard. All of the top eight states offered trainings and tools on how to consider distress ratings when deciding an appropriate fix on local roads.

California

California received an overall score of 90% which was the highest among all the states. The efforts performed by the metropolitan planning organizations were a large influence on the score California received. The Metropolitan Transportation Commission located in the San Francisco Bay area funded the early development of the state's commonly used transportation asset management system starting in 1983 (StreetSaver, 2017). California had a statewide base map and the Pavement Condition Index is the rating system used by most local agencies. Save

California Streets is a study that is overseen by a multi-agency oversight committee (Leamon, 2021). This committee champions for asset management best practices and educates the public and legislature through their website and their California Statewide Local Streets and Roads Needs Assessment report (Leamon, 2021). California metropolitan planning organizations set eligibility requirements that contained asset management practices for grants that are used on local roads in their area. An example of this is the Orange County Transportation Authority which required biennial pavement management plans be submitted by local agencies (Bucknam, 2018). The California legislature allowed some flexibility in how local agencies spend their funding under the road maintenance and rehabilitation program if their "average Pavement Condition Index meets or exceeds 80" (California Legislature, 2017). California had a long history of using asset management principles on local roads which was driven by their metropolitan planning organizations. This is underscored by the Save California Streets study which says that "approximately 98 percent of the total miles owned by cities and counties are included in a pavement management system" (NCE, 2021).

Idaho

Idaho received an overall score of 75% which was largely driven by the Local Highway Technical Assistance Council (LHTAC) which is affiliated with the Idaho LTAP center (Idaho Local Highway Technical Assistance Council, 2021). The LHTAC is a council established by Idaho law and has council members represented by cities, counties, and highway districts (Local Highway Technical Assistance Council, 1994). The LHTAC champions asset management principles and contracts with the asset management software company iWorQ to provide a coordinated system to their local agencies (LHTAC, 2017). The iWorQ software can be used with remaining service life and the PASER system. The LHTAC agreement with iWorQ states that "LHTAC will encourage the use of PASER method of rating" (Miles, 2015).

Idaho has seen issues when local agency staff were not directly involved with performing the work of collecting, analyzing, and reporting on the data used by their transportation asset management system. Their program guidelines stated, "Many years ago, LHTAC helped setup accounts and data without anyone from the agency designated to learn and maintain it. Unfortunately, it resulted in some agency accounts going dormant and data going stale. Agencies only benefit if they update and use their own data" (LHTAC, 2017). Local agency data is submitted to the LHTAC and data is shared with the public through interactive maps (Idaho Local Highway Technical Assistance Council, 2022). The only requirement is to report a list of future projects and where local agencies have spent their money (Idaho Local Highway Technical Assistance Council, 2021).

Indiana

Indiana received an overall score of 68% which was driven by regulatory requirements. In order to be eligible for their Community Crossings Matching Grant Program, Indiana local agencies must have an approved transportation asset management plan (Indianapolis Metropolitan Planning Organization, 2021). These plans must have a rated pavement inventory, a five year

improvement plan, and “objectives and measures” (Indianapolis Metropolitan Planning Organization, 2021). The PASER system is most prevalent, however large cities use the Pavement Condition Index rating system. The Indiana LTAP center facilitates the transportation asset management plan approval process, data submissions, data management portal, and the statewide condition dashboard (Indiana LTAP, 2022). An interesting component of their dashboard is the “Local Level of Effort” statistic (Indiana LTAP, 2022). This statistic provided a ratio of money received from the state in comparison to the total money that was spent; this statistic provided context to legislature and the general public on how local road department projects are funded (Indiana LTAP, 2022). The Indiana LTAP was forced to develop their training program fairly quickly and received helped in developing it through the lessons learned in Michigan and were shared by the Michigan LTAP.

Maine

Maine received an overall score of 77% due in large part to the Maine Local Roads Center (Maine LTAP) and their support and development of their road system management software RSMS16. The RSMS16 system uses a modified Pavement Condition Index rating system and is only offered to Maine users but its use is not required on local roads (Maine Local Road Center, 2022). The Maine Local Roads Center staff had assisted local agencies with their initial data collection by riding along with them in the vehicle during collection (Town of Chebeague Island, 2010). Maine started providing the RSMS software for their local agencies after the original private developer stopped supporting it (Road System Management Software, 2012).

New York

New York received an overall score of 74%. The Cornell Local Roads Program (New York LTAP) is similar to Maine in that they started their own software system called Cornell Asset Management Program – Roads & Streets (CAMP-RS) because of the loss of RSMS software support from the original developer (Cornell Local Roads Program, 2014). The system they use is a modified PCI system with eight rated distresses for unpaved surfaces and eight rated distresses for asphalt treated surfaces (Cornell Local Roads Program, 2014). The Cornell Local Roads Program coordinates the data collection through an intern data collection program (Cornell Local Roads Program, 2022). The intern is hired by the local agency and both of them are trained by the Cornell Local Roads Program (Cornell Local Roads Program, 2022). There were no requirements on having to collect or report data on local road condition.

Utah

Utah received an overall score of 66% which is driven by the work of the Utah LTAP and their development of their Traffic Asset Management Software (TAMS). TAMS is offered for free to Utah local agencies and the Utah LTAP coordinates an intern data collection program similar to New York (Utah LTAP Center, 2019). They offer multiple rating systems for use in TAMS but remaining service life is the recommended method (Utah LTAP, 2014). They have the ability to inventory signs and sidewalks, collect retro-reflectivity readings, traffic counts, and turn counts

(Utah LTAP Center, 2019). There were no requirements on having to collect or report data on local road condition.

Wisconsin

Wisconsin received an overall score of 72%. PASER road condition reporting is mandatory in Wisconsin and is facilitated through the Wisconsin Information System for Local Roads (WISLR) (Wisconsin DOT, 2022). The Wisconsin Transportation Information Center (LTAP center) offers trainings on managing roads and the PASER rating system, which was developed by the Wisconsin Transportation Information Center (Walker, Entine, & Kummer, 2002).

Other interesting findings

The LTAP center in Nevada is a champion for asset management practices on local roads and is in the process of building a comprehensive training program. One of their recommendations is to use PASER at small agencies and use the Pavement Conditon Index rating system at large agencies (Laffey, 2022). Nevada also offers a spreadsheet template tool for local agencies to create and update spending plans (Nevada LTAP, 2022).

Wyoming created a program to collect road condition data on local paved roads every two years as a way to monitor the damage caused by truck traffic from the petroleum and natural gas industry (Ksaibati & Huntington, 2014). This program was funded initially through a State Transportation Innovation Council (STIC) grant and the Wyoming Department of Transportation (Ksaibati & Huntington, 2014). The funding is now taken out of the funding allocation for each county and the amount is prorated by how many miles of paved roads each county maintains (Ksaibati, 2014). Wyoming contracted with a data collection company to initially inventory the paved county road network at a cost of $125 per mile to collect International Roughness Index data, rutting data, video logs, Pavement Condition Index data, and pavement thickness data with ground penetrating radar (Ksaibati & Huntington, 2014). Wyoming's non-federal-aid network is 25% paved which amounts to just over 5,600 miles (FHWA, 2020). Michigan has just over 31,400 miles of non-federal-aid roads that are paved (FHWA, 2020).

North Dakota has a long history of performing needs studies on their local and county roads. The Upper Great Plaines Transportation Institute, which houses the North Dakota LTAP center, performs these periodic needs studies and they are used to guide state legislators on road funding level needs (North Dakota Legislature, 2015). There had been seven needs studies performed in North Dakota between 2007 and 2017 (Tolliver, 2015).

Best Practices

The best practices that were found had a fairly common theme of finding ways to support local road-owning agencies to perform transportation asset management practices instead of mandating that they be followed. Many of the practices that were recommended are already

being administered in Michigan through its Transportation Asset Management Council. The main takeaways were to:

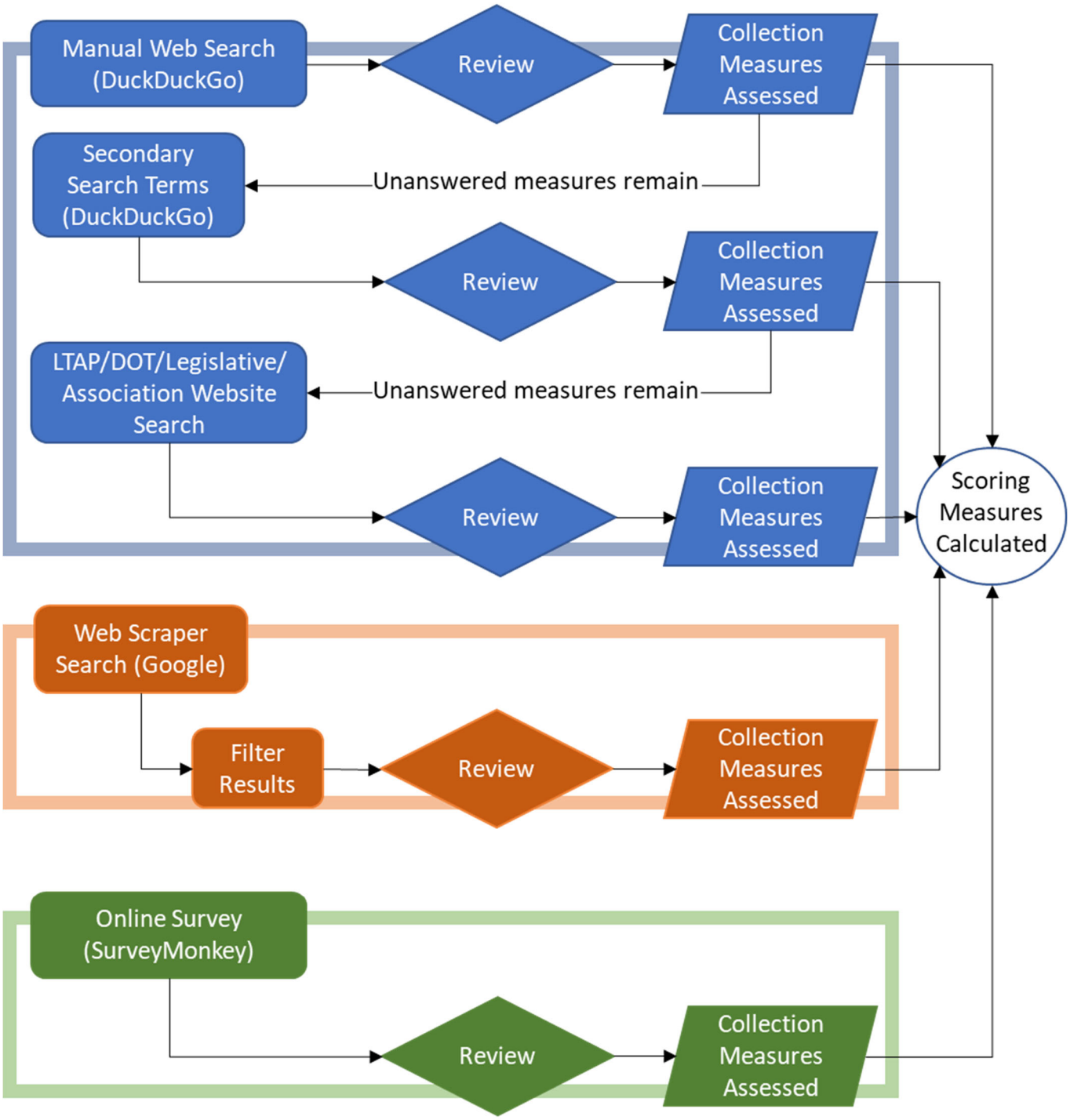
- keep TAM practices from becoming stale by continually improving trainings and tools
- ensure that collected data is reliable and shared with other agencies
- ensure that collected data not be overly complex, which would inhibit initial buy-in
- offer standardized tools and practices to aid in TAM implementation
- provide support for unified TAM systems and unified rating systems
- offer education for those who want continuous improvement for their TAM practices
- educate decision-makers on the need for TAM
- establish a TAM committee to help steer statewide practices
- establish a funding source for agencies to collect their own data.

The percentage of paved non-federal-aid roads in a state did not exhibit any consistent trend in the state's overall score, so it was decided to include statewide asset management practices that were performed on gravel roads. An adjustment was made in three of the scoring measures by incorporating multiple paths to determine the points received (see Table 2). Another adjustment made to the evaluation system was to eliminate the scoring measure on whether there was a statewide effort for periodically assessing the benefit (years of life gained) of pavement treatments on local roads; this scoring measure proved to be too inconclusive to assess most state practices.

The main limitation of this study was that web searching was the driving method of data collection. A survey was sent out as part of this study to verify the understanding of statewide asset management practices on local roads and found that the assessment of state practices was adequate from the states that responded.

Statewide surveys are being conducted in Massachusetts and Ohio to assess the asset management practices of their local agencies. The results of these surveys could provide additional best practices and lessons learned for Michigan.

APPENDIX A – DATA COLLECTION PROCESS



APPENDIX B – UNIFIED RATING SYSTEMS

Name	Unified rating system
California	PCI
Connecticut	PCI
Hawaii	IRI
Idaho	PASER, RSL
Indiana	PASER, PCI (for larger agencies)
Iowa	Federal Metrics, Modified PCI
Kansas	PASER (promoted to Counties only)
Louisiana	PASER (promoted)
Maine	modified PCI
Michigan	PASER
Missouri	PASER, PCI
Montana	PASER (gravel)
Nevada	PASER for small agencies, PCI for larger agencies
New Hampshire	Modified PCI
New York	Modified PCI
North Dakota	IRI, PCI
Oregon	PCI (Counties only)
Utah	Multiple (RSL is recommended)
Washington	PSC (Counties only)
Wisconsin	PASER
Wyoming	Multiple for Paved (Counties Only), WY Gravel Road Rating Standards

APPENDIX C – TAM INCENTIVES FOUND

State	TAM incentives
California	MPOs facilitate funding (DeFlorio & Louch, 2014) and require asset management participation (Bucknam, 2018), Local agencies were allowed flexibility in spending if PCI was at or above 80 (California Legislature, 2017)
Connecticut	Connecticut Conference of Municipalities (CCM) promoted StreetScan (CCM, 2021)
Delaware	LTAP offered technical assistance on road assessments on a limited basis (Kercher, 2016)
Florida	the bond rating of some counties was tied to PCI ratings but not a statewide effort (CTC & Associates LLC, 2016)
Georgia	Local Maintenance Improvement Grant eligibility for roads rated 30 or higher using Georgia DOT's system (DeKalb County Georgia, 2016)
Idaho	iWorQ system was available at little or no cost (LHTAC, 2017)

Illinois	Chicago Metropolitan Agency for Planning (MPO) provided pavement management plans to 44 agencies (2018-2021) at little or no cost as a regional effort (Glover, 2021)
Indiana	matching grant eligibility for having an asset management plan (Floyd County, n.d.)
Iowa	state DOT collects Fed-Aid for free and local agencies can pay to have their non-Fed-Aid collected so they can use the same system for all their roads (Iowa DOT, 2011)
Kansas	Excel database system was provided and promoted to counties by the Kansas County Highway Association (Kansas County Highway Association, 2021)
Maine	RSMS16 system available at little or no cost (Maine Local Road Center, 2022)
Michigan	Training, data collection (Center for Technology & Training, 2022), and system (Roadsoft, 2021) available at little or no cost
New Hampshire	unified system shares data across agencies and free use of LTAP iPads to collect data (Cottrell, 2014). SADES System was available at little or no cost (Vayo & al., 2022)
New Jersey	funding from Local County Aid Program was available if local agencies have a list of projects and spending report (NJDOT Local Aid Resource Center, 2019)
New York	Cornell Local Roads Program provides training and interns to collect data and create a 5-year plan with their CAMP-RS system available at little or no cost (Cornell Local Roads Program, 2022)
N. Dakota	Prairie Dog Funding was guided by local needs study (North Dakota Legislature, 2015). GRIT system available at little or no cost (North Dakota State University, 2021)
Oregon	Transportation and Growth Management Program Grants had been used for asset management plan development (Springer & Chewuk, 2017)
S. Dakota	Bridge Improvement Grant (BIG) program requires 4 or 5-year highway and bridge project plan and a local wheel tax (South Dakota Legislature, 2015)
Utah	System (TAMS) available at little or no cost (Brown, Sun, Fitzpatrick, & Abdaljabbar, 2017)
Vermont	one time data collection grant offered by MPO as a regional effort (Seto, 2016)
Washington	GIS-Mo pavement management system was required for County Arterial Preservation Program (CAPP) funds eligibility (Washington State Legislature, 2019)
Wisconsin	condition reporting was mandatory and WISLR system was available at little or no cost (Delmore Consulting, 2021)
Wyoming	there was an automatic funding source for collecting county data (Ksaibati, 2014)

APPENDIX D – OTHER TYPES OF ROADWAY ASSETS FOUND

Name	Other types of roadway assets
California	signs, medians, lighting, bicycle and pedestrian facilities, curb ramps, and transit items (none required) (NCE, 2021)
Idaho	signs (not required) (Miles, 2015)
Maine	signs (not required) (Maine Local Road Center, 2022)
Michigan	signals and culverts (Michigan Legislature, 2020)
New Hampshire	pedestrian items, guardrail, and drainage items (none required) (Cottrell, 2014)
New York	culverts and signs (none required) (Scott & Orr, 2019)
N. Dakota	minor structures and roadway imagery (none required) (North Dakota State University, 2021)
Oregon	signs, culverts, bridges and vegetation management (none required) (Association of Oregon Counties, 2021)
Pennsylvania	signs (not required) (PennDOT LTAP, n.d.)
S. Dakota	small structures (South Dakota Legislature, 2015)
Utah	signs, crashes, ramps, culverts, sidewalks, and railroad crossings (none required) (Utah LTAP Center, 2019)
Washington	signs (not required) (Washington State CRAB, 2020)

APPENDIX E – TRANSPORTATION ASSET MANAGEMENT TOOLS OR PRACTICES FOUND

Name	Tool or Practice
Arkansas	Asphalt Treatment Selection Tool - Provides recommended treatment white papers based on the distress type, severity level, and distress density entered. (University of Arkansas CTTP, 2017)
California	Statewide Local Needs Assessment (NCE, 2021)
Georgia	DOT Treatment Selection Tool (Internal DOT only) (Georgia DOT, 2021)
Illinois	Bureau of Local Roads and Streets Manual, Chapter 45 - Local Agency Pavement Preservation: Treatment selection guide table (Figure 45-5B) (IDOT BLRS, 2018)
Indiana	PASER Conference (Domonkos, 2016), Local Level of Effort statistic on dashboard (Indiana LTAP, 2022)
Iowa	Annual Rock Requirement Tool (Alabama Legislature, 2019), Treatment Selection Tool (Abdelaty, Jeong, Smadi, & Gransberg, 2015), Locals pay for non-fed aid data collection on the state data collection contract (Same data that was collected for the Fed-aid routes) (Iowa DOT, 2011)

Kansas	Kansas County Highway Association promotes TAM, Pavement Management Guide, and spreadsheet template (Kansas County Highway Association, 2020)
Maine	LTAP provides budget planning, spreadsheets, an initial data collection ride-along for small agencies (Maine Local Road Center, 2022)
Michigan	asset management plan templates (CTT, 2021)
Montana	simplified needs assessment for gravel roads using PASER (Montana LTAP, 2014)
Nevada	LTAP Pavement management spreadsheet tool (Nevada LTAP, 2022)
New Hampshire	hosted a regional (13 states/province) 2022 Northeast PP Partnership Annual Meeting and organized by NCPP (UNH T2, 2022)
New Jersey	Infrastructure Asset Management Academy for Engineers and Planners (Rutgers CAIT, 2022)
New York	Cornell Local Roads Program manages the Cornell Asset Management Program - Roads & Streets (CAMP-RS) where an agency hires their interns and training was provided to the agency and interns to complete data collection over the summer (Cornell Local Roads Program, 2022)
N. Dakota	the statewide needs study guides legislation on road funding amounts (UGPTI, 2012)
Ohio	MPO had a treatment decision tree for the Ohio DOT Pavement Condition Rating (PCR) data and was used in one of their county plans (NOACA, 2020)
Oregon	Oregon's Integrated Road Information System (IRIS) had an accounting element (Association of Oregon Counties, 2021)
S. Dakota	Bridge Improvement Grant (BIG) program requires: 4 or 5-year highway and bridge project plan and a local wheel tax and tools (South Dakota Legislature, 2015), MicroPAVER decision matrix (He, Qin, Wang, & Comes, 2017)
Utah	Interns collect data for LTAP (Utah LTAP Center, 2019)
Washington	Users set their own action levels in the GIS-Mo system (Washington State CRAB, 2020), VisRate road condition collection app was used to collect data (Washington State CRAB, 2020), LA Pavement Managers Guide (Washington State DOT, 1994)
Wyoming	Incorporated gravel roads in asset management by creating their own rating system standards (Wyoming T2 Center, 2014)

APPENDIX F – SCORING BY SCORING METRIC

Training Metric Summary

Number of Positive Scoring Measures	State Count	Avg Score	Max Score	Min Score	Std Dev
7	2	79%	84%	74%	5.2%
6	6	58%	77%	28%	16.1%
5	6	32%	66%	24%	15.3%
4	9	49%	90%	20%	23.8%
3	7	22%	36%	16%	6.6%
2	3	27%	44%	13%	12.8%
1	5	14%	27%	3%	10.5%
0	12	10%	44%	0%	14.5%
	Average	31%		Average	13.1%

Tool Metric Summary

Number of Positive Scoring Measures	State Count	Avg Score	Max Score	Min Score	Std Dev
7	2	81%	84%	77%	3.6%
6	5	64%	74%	44%	10.7%
5	3	55%	75%	30%	18.7%
4	0	N/A	0%	0%	N/A
3	3	59%	90%	27%	25.5%
2	6	43%	68%	26%	13.2%
1	5	24%	39%	13%	8.7%
0	26	14%	32%	0%	10.8%
	Average	31%		Average	13.0%

Regulatory Metric Summary

Number of Positive Scoring Measures	State Count	Avg Score	Max Score	Min Score	Std Dev
5	0	N/A	0%	0%	N/A
4	0	N/A	0%	0%	N/A
3	0	N/A	0%	0%	N/A
2	2	58%	90%	27%	31.3%
1	9	47%	84%	4%	27.0%
0	39	26%	77%	0%	21.5%
	Average	31%		Average	26.6%

APPENDIX G – SCORING BY SCORING MEASURE

Have a Written Plan

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
MPO regulatory and report	1	90%	90%	90%	N/A
Training, tool, regulatory	2	76%	84%	68%	11.8%
Training and tool	4	71%	77%	60%	7.3%
Project list	4	36%	75%	20%	26.4%
Training	1	28%	28%	28%	N/A
No	36	23%	66%	0%	18.3%
Project list, Counties only	2	21%	39%	4%	24.3%

Assess Needs

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Training and report	1	90%	90%	90%	N/A
Training and tool	10	64%	84%	34%	14.5%
Training, tool, report	2	56%	68%	44%	16.9%
Tool	3	50%	75%	30%	23.0%
Training	10	27%	39%	20%	6.1%
Tool for gravel	1	26%	26%	26%	N/A
Report, regulatory	1	25%	25%	25%	N/A
No	22	11%	32%	0%	10.5%

Mix of Fixes Approach

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Training and tool	6	74%	84%	63%	7.1%
Tool	3	47%	66%	30%	17.9%
Training	25	33%	90%	13%	18.9%
No	16	10%	44%	0%	13.5%

Unified Rating or TAM System

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Yes	17	56%	90%	13%	22.7%
Yes, Counties only	4	38%	63%	25%	16.8%
No	29	15%	39%	0%	12.0%

Preventive Maintenance

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Training and tool	12	61%	90%	13%	24.4%
Tool	2	37%	44%	30%	9.6%
Training	21	29%	68%	13%	14.4%
Guide	1	27%	27%	27%	N/A
No	14	8%	44%	0%	13.6%

Other Roadside Assets

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Training and tool	8	70%	90%	28%	18.9%
Tool	4	43%	60%	30%	12.7%
Training, tool, regulatory	2	35%	44%	27%	11.8%
Training	3	34%	49%	20%	14.6%
No	33	20%	72%	0%	18.6%

Use Ratings to Determine Fix

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Training, tool, regulatory	1	90%	90%	90%	N/A
Training and tool	11	68%	84%	49%	9.8%
Tool	3	33%	44%	20%	12.3%
Guide	1	27%	27%	27%	N/A
Training	8	27%	39%	21%	5.8%
No	26	14%	44%	0%	12.7%

Have Data

Scoring Finding	State Count	Avg Score	Max Score	Min Score	Std Dev
Yes, QC	3	75%	90%	60%	14.6%
Training, tool, regulatory	1	72%	72%	72%	N/A
Tool, QC	2	60%	77%	44%	23.6%
Training, tool, QC	3	59%	84%	26%	29.8%
Training and tool	3	56%	63%	44%	10.3%
Yes	3	48%	68%	36%	17.5%
Tool	2	32%	34%	30%	2.9%
Yes, QC (Counties only)	1	25%	25%	25%	N/A
Training	17	25%	74%	3%	16.4%
No	15	9%	27%	0%	10.5%

APPENDIX H – SCORING BY COLLECTION MEASURE

TAM incentives found for local roads

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	23	49%	90%	3%	24.0%
No	27	16%	49%	0%	12.5%

Level of adoption of some level of TAM

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
High (>50%)	14	45%	90%	13%	24.5%
Low (<50%)	8	51%	84%	13%	23.0%
None	28	18%	77%	0%	17.2%

Other roadside assets

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	12	60%	90%	27%	21.3%
No	38	22%	72%	0%	18.4%

States with useful tools found

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	21	48%	90%	3%	23.3%
None	29	19%	75%	0%	18.7%

States with lessons learned found

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	13	37%	75%	4%	25.0%
No	37	29%	90%	0%	26.0%

Statewide Local Road Unified Rating Systems

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
modified PCI	3	70%	77%	60%	7.2%
PCI	2	67%	90%	44%	22.9%
Multiple	7	56%	75%	32%	14.0%
PASER	4	52%	84%	25%	26.7%
None	33	18%	63%	0%	14.2%
IRI	1	13%	13%	13%	N/A

Statewide Local Road Unified TAM system

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	12	68%	90%	44%	13.6%
No	38	19%	63%	0%	14.4%

Statewide Local Road Regulatory Requirement

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	11	49%	90%	4%	28.2%
No	39	26%	77%	0%	21.5%

Statewide Local Road Regulatory Type

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Project list	7	39%	84%	4%	27.8%
MPO requirement	1	90%	90%	90%	N/A
Data collection	1	72%	72%	72%	N/A
Plan	1	68%	68%	68%	N/A
Needs study	1	44%	44%	44%	N/A
None	39	26%	77%	0%	21.5%

Funding for TAM Available?

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Yes	10	53%	90%	25%	23.0%
No	40	26%	77%	0%	22.5%

LTAP Statewide Local Road Transportation Asset Management Involvement

Finding	Count	Avg Score	Max Score	Min Score	Std Dev
Training, tool, and liaison	2	71%	74%	68%	3.1%
Training and tool	10	53%	84%	13%	23.6%
Training	24	29%	90%	3%	19.1%
Tool and liaison	1	25%	25%	25%	N/A
Tool	1	27%	27%	27%	N/A
None found	12	12%	63%	0%	19.5%

GLOSSARY

Data collection measure: The fourteen inquiries used in this study to assess statewide local road transportation asset management and answer the scoring measures.

Data collection method: The way in which information was collected for the data collection measures of this study. There were three data collection methods for this study.

Extended service life (ESL): The time added to a pavement's life by delaying the point when distresses become structural in nature. This varies by the type of treatment used and does not represent the longevity of the treatment.

Mix-of-fixes: An asset management approach focused on performing preventive maintenance treatments in order to keep more roads in good condition for a longer period of time.

Overall local road asset management score: A 0% to 100% assessment of the local road asset management practice with a higher score meaning more trainings, tools, and regulatory requirements were found. This overall score was used in this study to determine the states that were similar to Michigan.

Preventive maintenance: Preventive maintenance typically addresses age-related pavement distresses prior to the presence of structural distresses. These treatments retard or offset age-related distresses.

Scoring measure: The nine assessment questions used in this study to grade the statewide local road asset management state of practice. The scoring measures were used to determine the overall local road transportation asset management score. These scoring measures were mostly based on the trainings, tools, and regulatory requirements present for local roads at a statewide level.

Tools: Tools for this study were defined as any system, template, decision matrix, or reporting effort that was created to be used by local agencies across their state.

Training: Trainings for this study were defined as any in-person training, web-based training, training video, guide, or technical assistance used by local agencies specifically for their state.

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