

# Transportation Research Synthesis

TRS 2002

April 20, 2020

## LIFE CYCLE COST OF LOCAL ROADS

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The Study expands on the Local Road Research Board’s (LRRB) video, [Roads and Loads: Finding the Balance](#), produced in 2006. The video provides general information on roadway design and load limits; however, it did not provide any hard costs or economic data. Minnesota local agencies seek guidance on how to calculate life cycle cost (LCC) and communicate the cost of maintaining roads/streets to the general public and elected officials. As taxpayers, it would be beneficial if residents understood the life cycle of a roadway, what maintenance is required maintenance that is needed over the road’s lifetime, how much each treatment costs and how their taxes are being used.

The scope of this TRS addressed the following:

1. Identify how agencies are communicating the cost of maintaining their roadway infrastructure to their elected officials and the public.
2. Identify what LCCA methods and tools are currently being used by local and state agencies.
3. Identify what data elements are needed to conduct a LCCA on roadways and determine which of the data elements are annually submitted to State Aid.

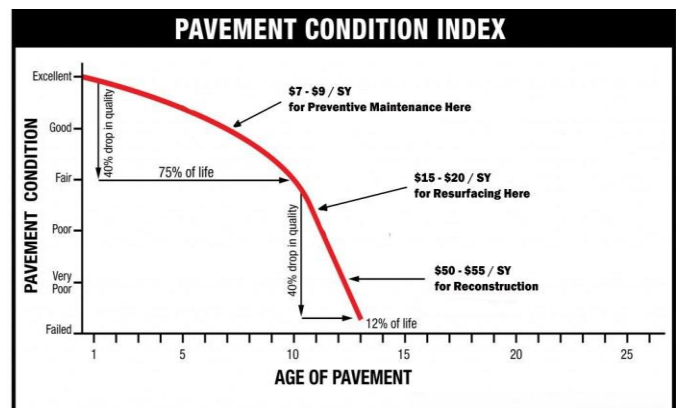


Figure 1. Pavement Condition Index

SRF Consulting Group conducted a literature review and survey representatives from local cities and counties, State Departments of Transportation, and LTAP centers across the County that may be familiar with the concepts of life cycle cost and experienced in tracking and communicating life cycle cost.

## Technical Advisory Panel

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MnDOT Office of Research

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City of Albertville

**Chris Kufner**, Deputy Director,  
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*The purpose of this TRS is to serve as a synthesis of pertinent completed research to be used for further study and evaluation by MnDOT and the Local Road Research Board. This TRS does not represent the conclusions of the authors, MnDOT or LRRB.*

## **Definitions**

Early on, the Technical Advisory Panel (TAP) defined several terms to ensure consistency in the surveying process.

- ***Life Cycle Cost (LCC):*** LCC is the total cost of ownership of an asset during the entire life cycle. It includes design and construction costs, maintenance costs (routine and preventative, but not operational (mowing, striping, snowplowing, etc.), and disposal costs.
- ***Preventative Maintenance (PM):*** PM is a planned strategy of cost-effective treatments to an existing roadway system and its appurtenances that preserves the system, delays future deterioration, and maintains or improves the functional condition of the system without significantly increasing the structural capacity. Examples of preventative treatments include asphalt crack sealing, chip sealing, slurry or micro-surfacing, thin and ultra-thin hot-mix asphalt overlay, concrete joint sealing, diamond grinding, dowel-bar retrofit, and isolated, partial and/or full-depth concrete repairs to restore functionality of the slab.
- ***Routine Maintenance (RM):*** RM consists of work that is planned and performed on a routine basis to maintain and preserve the condition of the roadway system or to respond to specific conditions and events that restore the roadway system to an adequate level of service." Examples of pavement-related routine maintenance activities include cleaning of ditches and drainage structures, pothole patching, isolated overlays, and brush clearing.

## **Data Collection**

Information for this Transportation Research Synthesis was gathered in two forms:

<b>Method</b>	<b>Process</b>	<b>Participants</b>
General Survey	Email survey was distributed in early December 2019	<ul style="list-style-type: none"><li>• All state DOTs</li><li>• 87 Minnesota county engineers,</li><li>• 128 Minnesota city engineers</li><li>• LTAP Centers across the country</li></ul>
Follow-up Detailed Phone Interviews	TAP identified ten Minnesota local agencies to conduct follow up phone interviews; six agencies agreed to participate.	<ul style="list-style-type: none"><li>• Pope County</li><li>• Otter Tail County</li><li>• McLeod County</li><li>• Goodhue County</li><li>• City of Edina</li><li>• City of Marshall</li></ul>

The survey results and interviews are summarized at the end of this TRS.

## **Summary of Findings**

### **Finding #1: Identify how agencies are communicating the cost of maintaining their infrastructure to their elected officials and the public.**

The manner and form in which LCC information is communicated to elected officials and the public varied from agency to agency. In general:

- State DOTs have a larger and broader audience reporting information to FHWA, state leaders and legislators, the media, and public using social media, print media, and presentation and engagement materials handouts with clear, simple messaging.
- Agencies with active asset management plans tended to report more roadway condition and cost information to elected officials and public.
- A higher percentage of responders communicated the cost of maintaining agency infrastructure to elected officials (65%) as compared to the public (43%). A majority of responders (54%) prepared budget requests that communicate the cost of projected pavement maintenance projects.
- An agency's Capital Improvement Program (CIP) was the most common form of communication used by 63% of the respondents while a summary report for the agency's annual budget was used by 50% of the respondents. The amount and type of information provided by each agency varied significantly.

### **Finding #2: Identify what LCC tools are currently being used by local and state agencies.**

- The majority (80%) of survey respondents and none of interviewees have or used a "LCC tool".
- Most agencies that are conducting LCC have developed a methodology and approach using an excel spreadsheet, GPS, and GIS databases containing relevant asset information and maintenance costs.
- Those using LCC tools used: FHWA Realcost, dTIMS BA, TR-608 database, Cartegraph software, ICON software, BrM for Bridges, Deighton system.

### **Finding #3: Identify what data elements are needed to conduct a LCC on roadways and determine which of the data elements are annually submitted to State Aid.**

The survey identified several varying LCC calculation process which incorporated different data elements. The following are some examples:

1. Determine agency's desired life cycle for the road; 30, 50, 60, or 75 years.
2. Based on the desired life cycle, select pavement preservation strategies to be used to achieve the desired life cycle.
3. Determine desired life cycle for each preservation strategy.
4. Use agency data, if available, for developing a cost / mile or some other unit of measure for each preservation strategy.
5. Select an inflation rate.
6. Formula:  $LCC = \text{Capital Cost} + \text{Present Worth of Maintenance Costs} - \text{Present Worth of Salvage Value}$ .

The MnDOT State Aid Office's report *2020 CSAH Distribution Data January 2020* can be reference via this link: [http://www.dot.state.mn.us/stateaid/cсах/cсах-januarybooks/cсах\\_winter\\_2020.pdf](http://www.dot.state.mn.us/stateaid/cсах/cсах-januarybooks/cсах_winter_2020.pdf) The Report includes, beginning on page 58, a document titled *Needs Calculation System Summary Document October 2015* which reflects eight component areas of the new Needs Calculation System.

1. Construction Component
2. Right-of-Way Component
3. Preservation Component
4. Structures Component
5. Railroad Crossing Component
6. Traffic Signal Component
7. Additional Interchange Component
8. Additional TH Bridge/RR Bridge/Municipal Bridge Component

Every county within the State Aid system reports their data for these components to MnDOT State Aid Office on an annual basis. The Needs Calculation System utilizes the components to calculate the total “money needs” for each mile of County State Aid Highway.

The cities are required to follow a similar format (see [Memo](#)) but utilize different components.

Interviewees reported this data/information is not well suited for their LCC needs.

### **Concluding Summary from Interview Participants**

In communicating the benefits and results of LCC, the messaging needs to be clear and simple; including explaining what LCC means, how it can be applied, and why LCC is a better approach to making sound investment decisions.

### **Detailed Findings**

#### **Finding #1: Identify how agencies are communicating the cost of maintaining their infrastructure to their elected officials and the public.**

The manner and form in which LCC information is communicated to elected officials and the public varied from agency to agency.

State DOTs have a larger and broader audience than local county and city agencies. FHWA Transportation System Preservation Initiatives and associated reporting requirements for state DOT roads and bridges are very extensive and specific. State DOTs are required to develop and implement system preservation strategies. In most cases the effectiveness of these strategies is measured using a variety of tools including life cycle cost. State DOT's report information to FHWA, state leaders and legislators, the media, and public using social media, print media, and presentation and engagement materials handouts with clear, simple messaging.

FHWA reporting requirements for DOTs necessitates more state agency staff dedicated to the development, monitoring, and reporting of asset conditions and funding effectiveness and gaps. Local agencies have struggled to find adequate, dedicated staff time to collect, monitor, maintain, analyze, and report on the condition, cost, and effectiveness of pavement maintenance strategies and investments.

Agencies with active asset management plans tended to report more roadway condition and cost information to elected officials and public. Variations of LCC methodology are used by some of these agencies to make project programming recommendations and decisions. Several agencies have used an LCC approach to provide the

information necessary to calculate that agency's transportation asset funding gap. Respondents indicated that the information was of great value to elected officials as they contemplated and attempted to justify various revenue sources for gap funding.

A higher percentage of responders communicated the cost of maintaining agency infrastructure to elected officials (65%) as compared to the public (43%). A majority of responders (54%) prepared budget requests that communicate the cost of projected pavement maintenance projects.

The cost of maintaining an agency's infrastructure is communicated to elected officials in a variety of ways. The most common method, regardless of the level of government, is in the form of annual or biannual budget requests for funding the maintenance of the agency's transportation assets. An agency's Capital Improvement Program (CIP) was the most common form of communication used by 63% of the respondents while a summary report for the agency's annual budget was used by 50% of the respondents. The amount and type of information provided by each agency varied significantly.

The presentation form for providing project information also varied from agency to agency. The trend is that more supporting data and information was needed to justify one expenditure over another. However, simplicity in the form of using charts, graphs, storyboards and dashboards to tell the story is proving to be an effective way to communicate with elected officials. Counties in Minnesota can adopt a Wheelage Tax and a local option sales tax to generate new revenue for funding transportation program. Public meetings and presentations have been held to engage and educate elected officials and the public on the need for additional transportation revenue and the tools available to raise that revenue. LCC has been used by some counties to identify the funding gap for their agency.

Respondents indicated that elected officials have been educated on the benefits of having a funding strategy based on good data and proven pavement maintenance strategies. However, elected officials struggled to reach a consensus on how to secure the revenue necessary to fund the shortfall in transportation.

When communicating with the public, an agency's CIP was the most common form of communication used by 65% of the respondents while a summary report for the agency's annual budget was used by 53% of the respondents. Other effective communications / engagement strategies cited included; county board and city council workshops, town meetings, presentations available on agency website, media articles, agency newsletters, roadshow with presentations to private groups such as the Chamber of Commerce, Lions Club, Rotary Club, Builder's Association, etc.

The consensus from respondents was to create a clear and simple message regarding LCC use and benefits and repeat it repeatedly. As stated previously, simplicity in the form of more charts, graphs and dashboards to tell the story has proven to be an effective way to communicate with the public.

Most all agencies have an inventory of their pavement condition. Most Minnesota counties collect digital images, pavement roughness, and pavement distress via MnDOT's Pavement Management Divisions via State Aid. City and County engineers use their pavement management data to identify and prioritize projects. Some use LCC to justify cost-effective pavement preservation strategies. Interview respondents felt it was important in their role as agency engineers to identify the funding needs of the agency regardless of the fiscal constraints of that agency. This same group of respondents supported the use of LCC as a necessary step in developing priorities and sound funding recommendations for their agency's infrastructure.

**Finding #2: Identify what LCC tools are currently being used by local and state agencies.**

The majority (80%) of survey respondents and none of interviewees have or used a “LCC tool”. Most agencies that are conducting LCC have developed a methodology and approach using an excel spreadsheet, GPS, and GIS databases containing relevant asset information and maintenance costs.

Those using LCC tools used: FHWA Realcost, dTIMS BA, TR-608 database, Cartegraph software, ICON software, BrM for Bridges, Deighton system. PPRA (Pavement Preservation & Recycling Alliance) has a free LCCA tool (Network Optimization).

**Finding #3: Identify what data elements are needed to conduct a LCC on roadways and determine which of the data elements are annually submitted to State Aid.**

The survey identified several varying LCC calculation process which incorporated different data elements. The following are some examples:

1. Determine agency’s desired life cycle for the road; 30, 50, 60, or 75 years.
2. Based on the desired life cycle, select pavement preservation strategies to be used to achieve the desired life cycle.
  - a. Crack filling
  - b. Crack sealing
  - c. Micro-surfacing
  - d. Chip seal
  - e. Thin HMA Overlay
  - f. Reconstruction
3. Determine desired life cycle for each preservation strategy.
4. Use agency data, if available, for developing a cost / mile or some other unit of measure for each preservation strategy.
5. Select an inflation rate.
6. Use the formula:  $LCC = \text{Capital Cost} + \text{Present Worth of Maintenance Costs} - \text{Present Worth of Salvage Value}$ .

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Every county within the State Aid system reports their data for these components to MnDOT State Aid Office on an annual basis. The Needs Calculation System utilizes the components to calculate the total “money needs” for each mile of County State Aid Highway.

The cities are required to follow a similar format (see [Memo](#)) but utilize different components.

A Minnesota county engineer wrote that State Aid's "Needs Calculation System" provided "standard" guidance in submitting and documenting actual project cost data. It is also a "life cycle based" calculation system. However, it is a distribution system and includes several adjustments that need to be considered before one would use the "output" of the system as a life cycle cost tool.

A Minnesota city engineer indicated that the Needs Study unit prices are "way off" for his city and he would not want to be required to use them in any LCC for his city streets.



## Survey Results

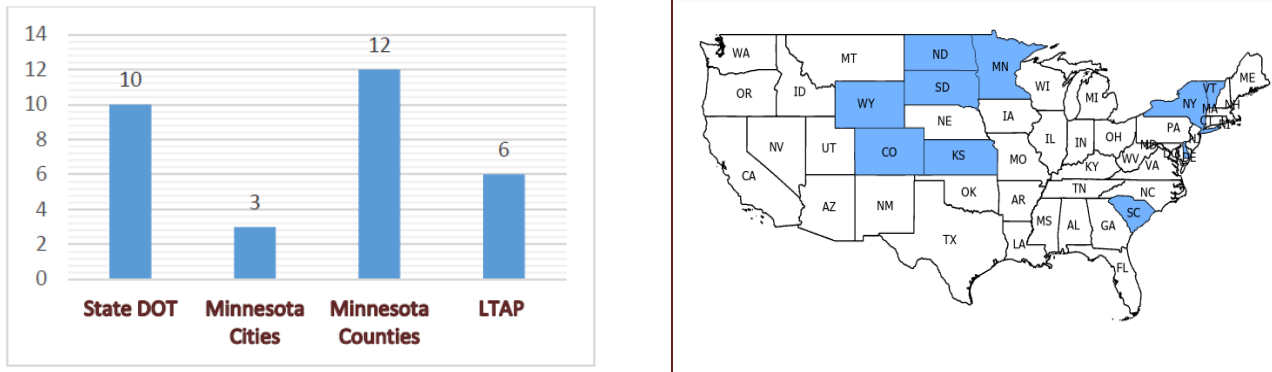
### Survey Approach

A survey, (open from December 12-31, 2019) was distributed to multiple levels of government (US Cities, Counties, and State DOTs) via MnDOT and the MN LTAP. The purpose of the survey was to identify agencies with LCC experience, LCC tools currently being used, and how agencies track and communicate the LCC of maintaining their roadways. More specifically, the survey gathered information on the following:

- Agency user familiarity with the concept of life cycle cost.
- Do agencies communicate the cost of maintaining infrastructure assets to elected officials and how do they communicate that information.
- Do agencies communicate the cost of maintaining infrastructure assets to the public and how do they communicate that information.
- What roadway cost information do agencies communicated to elected officials and the public.
- What “tool” is used to determine an asset’s life cycle cost.
- What effective and/or creative ways are used to help the public understand the cost of maintaining roads.

84 responses were received; 30 responders provided their contact information, which showed the following breakdown:

**Figure 2. Distribution of Responses by Agency Type and Location of DOT Responses**



### Survey Findings (see [Appendix A](#) for full Survey Results).

The following is a high-level summary of the three areas of LCC:

- 90% of responders were familiar with life cycle cost.
- A higher number of responders communicated the cost of maintaining their agency’s infrastructure to public agencies (65%) vs. the public (43%).
  - Responders communicated the cost to their elected officials/public agencies by:
    - The agency’s Capital Improvement Program (63%).
    - Prepare a summary report for the annual budget (50%).
  - Responders communicated the cost to the public by:
    - The agency’s Capital Improvement Program (65%).
    - Prepare a summary report for the annual budget (53%).

- 80% of responders did not have a tool. For those that did have a tool, they use various software, GPS and GIS tools, and spreadsheets. Some form of spreadsheet was the most common response.

## **Local Agency Interviews**

### **Interview Approach**

The Technical Advisory Panel (TAP) met in early February and finalized a list of 10 phone interview questions (see [Appendix B](#)) to be asked of 10 individuals that either responded to the Survey or are knowledgeable of LCC.

An invitation was sent to the 10 Minnesota local agencies (they could participate in a phone interview or complete and e-mail back the questionnaire. Out of the ten people, four responded with written answers; two participated in phone interviews, and four persons did not respond to repeated invitations. Participants included: Pope, Ottertail, McLeod, and Goodhue counties and the cities of Edina and Marshall.

### **Interview Findings**

All respondents have realized the benefits of LCC on a personal, organization, elected official, and public level.

In communicating the benefits and results of LCC, the messaging needs to be clear and simple. You need to explain how and why public asset investment recommendations should now be made differently from past decisions. You need to explain what LCC means, how it can be applied, and why LCC is a better approach to making sound investment decisions. You will need data and facts to back up your recommendations.

Respondents suggested getting buy-in/acceptance of the basic principles of LCC early in the education process. Gaining consensus on early wins; like agreement that the life cycle of a road is 50, or 60, or 75 years is important and provides an opportunity for early engagement. Ask the question: Do you want your road to last 25 years or 50 years? Prepare, share, and explain simple charts and graphs such as the pavement degradation curve, etc.

Respondents supported the use of LCC as a necessary and effective step in pavement investment decisions.

The funding “gap” that results for public agencies when using LCC can be overwhelming and difficult for elected officials to “get their hands around”. Many elected officials and most of the public are focused on the short-term and reluctant to make decisions today based on long-term investment benefits.

Respondents felt it important in their role to identify the funding needs regardless of the fiscal constraints of available funding.

Respondents use a similar, but non-standardized step-by-step approach when conducting a LCC.

No respondents or their agencies have or used a “LCC tool.” Most used spreadsheets and reports for calculating LCC and justifying their recommendations.

Since these agencies did not use an “LCC tool” they don’t see limitations to it, but they did identify knowledge limitations on the correct factors to use in their LCC calculations, such as the “right” inflation rate.

Regarding the use of a “standardized tool” by all Minnesota county and city agencies, there was a mixed response. The pro side of the debate was the unified messaging benefit that could be derived from having a statewide picture of the funding gap and being able to say to elected officials and the public that every agency is making cost-effective long-term investment decisions. The cons side of the debate was that not every city council, county board, or city/county engineer makes decisions the same way and standardization would come as an unnecessary mandate dictating how local government agencies should make their infrastructure investment decisions.

## Appendix A – Survey Results Summary

**Date:** January 8, 2020

**Project:** TRS - Life Cycle Cost for Local Roads

### Survey Results Overview

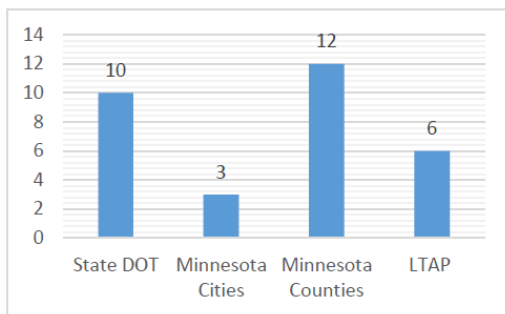
The survey, which was open from the week of December 12th thru December 31st, 2019, was distributed through the following listservs:

- CEAM/MCEA
- State DOTs
- LTAP Centers across the Country

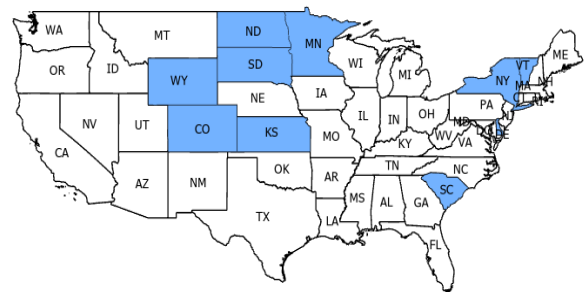
Total Responses Received: 84

Of the 84, 30 responders provided their contact information, which showed:

**Distribution of Responses by Listserv**

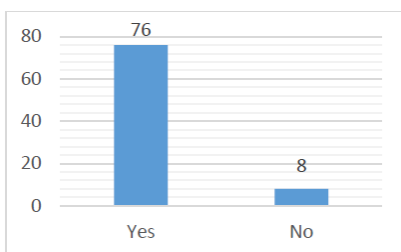


**Location of DOT Response**

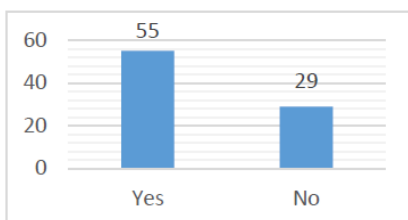


### Survey Results

**Question 1: Are you familiar with the concepts of life cycle cost?**



**Question 2: Do you communicate the cost of maintaining your agency's infrastructure assets to elected officials?**

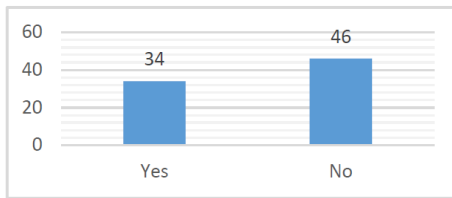


**Question 2A: If you answered ‘yes’ to Question 2 (55 responses), please select how you communicate the cost of maintain your agency’s infrastructure to elected officials? (Select all that apply)**

Answer Choices	Responses
Our administrator or finance director handles it	15
Prepare a summary report for the annual budget	26
Prepare an annual State of the Infrastructure Report	7
Rely on the GASB 34 Reporting requirements	9
The agency’s Capital Improvement Program reflects our short and long-term improvements	33
Hold a workshop periodically to share the information with elected officials	17
Maintain a detailed data-driven asset management plan	16
Maintain a Website	8
Other (Please specify)	8
Total	52

- We include life cycle cost estimates with the feasibility studies for street reconstruction projects in an attempt to educate the policy makers concerning the benefit of selecting the PM treatment that would result in the lowest life cycle cost. So far, we have not been successful.
- Annual capital and operating budget presentations, periodic transportation board briefings
- I Give the board updates from time to time and have gone over items in the highway departments annual report that we give to the board it informs them what was spent on various roads in the county. We have also addressed various cost per mile for the various types of construction or maintenance projects. This included regrading county gravel roads, complete regrade on paved CSAH routes, shoulder widening and slope improvements or the mill and overlay cost per mile. Presentation to the board when asked too.
- Monthly updates on maintenance items at a normal Board meeting.
- Typically done through a legislatively required annual performance report.
- The ICEA Service Bureau completed IHRB TR-608 in 2012, an Iowa Highway Research Project that identifies system needs and costs to maintain the county transportation infrastructure in Iowa. The information is broken down by county and statewide need and cost assessments.
- We provide this information in testimony and presentations we give to the Senate and House Transportation Committees annually and other committees as asked. Once this information is determined and presented to the legislature, we provide this information to our stakeholders via presentations.
- A summary report may be prepared on a project-specific basis when considering different alternatives which may have significantly different maintenance costs or impacts.

**Question 3A: Do you communicate the cost of maintaining your agency's infrastructure assets to the general public?**



**Question 3B: If you answered 'yes' to Question 3A (34 responses), please select how you communicate the cost of maintain your agency's infrastructure to the public? (Select all that apply)**

Answer Choices	Responses
Our administrator or finance director handles it	8
Prepare a summary report for the annual budget	18
Prepare an annual State of the Infrastructure Report	1
Rely on the GASB 34 Reporting requirements	4
The agency's Capital Improvement Program reflects our short and long-term improvements	22
Hold a workshop periodically to share the information with elected officials	7
Maintain a detailed data-driven asset management plan	11
Maintain a Website	8
Other (Please specify)	5
Total	34

**Other Examples:**

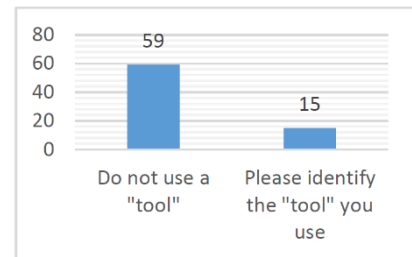
- Short articles printed five times a year in our town wide newsletter
- The TR-608 information is updated each year with historical actual costs data and inventories from each county's annual reports. TR-608 information is available to county engineers and staff who are users of the ICEA Service Bureau website. Their county's projected needs and costs are accessible to them for presentation to their boards and/or members of the public.
- General information related to pavement management and maintenance is part of public informational meetings conducted by the City Engineer during projects.
- We provide the cost of maintaining our infrastructure in presentations we give to legislative transportation committees, and the public.
- Annual STIP public meetings communicate these costs to the general public that wish to participate.

**Question 4: What information regarding the cost of maintaining your agency's infrastructure do you provide elected officials and the public? (select all that apply)**

Answer Choices	Responses
Provide an annual Asset Management Report	15
Provide a multi-year unconstrained budget forecast based on actual needs	12
Provide a multi-year constrained budget forecast based on available budget	28
Provide an annual condition summary	26
Provide a Life Cycle Costing Report for particular asset types	5
Provide a Life Cycle Cost Analysis for comparing particular asset types	3
Provide annual budget requests for covering the cost of projected maintenance	39
Don't provide specific information regarding the cost of maintenance	18
Total	72

**Question 5: What "tool" do you use for conduction LCC or LCCA?**

- The two major parts of the report is current maintenance work performed per mile broken out into categories such as surface, shoulders, signs, etc. The second tool is the pavement and bridge management tools which we run multiple scenarios until we find the optimized mix of treatment types, resulting in the lowest LCC
- dTIMS BA.
- FHWA "Realcost", spreadsheets, Markov chain spreadsheet.
- LCCA spreadsheet I use to figure first cost/life cycle cost of pavement surfaces for construction projects. (a couple responses stated the agency used an internal spreadsheet)
- Counties may use various rating systems to evaluate system condition. TR-608 produces a \$/mile or \$/year for specified surface type roadway and bridge infrastructure.
- Different assets use different databases that generate reports to assist in LCC/A as well as including initial construction, maintenance, rehab, and user costs.
- Cartegraph.
- Precise GPS tracking of snowplows to ascertain amount of material used, etc. Five-year highway improvement plan showing projected costs of resurfacing/reconstruction and one year of maintenance.
- "BrM for Bridges.
- Custom Software for "Pavement."
- "Network" level pavements we use the Deighton system.
- For project level we use a homegrown "tool"



**Question 6: Please describe your effective (and/or creative) way of helping the general public understand the cost of maintaining roads/streets?**

- Seems not to be effective due to people still do not grasp the idea of long-term deterioration and the ramifications of the need for effective LCC.
- Meetings/Workshops and Public Outreach.

- We address this in our monthly town meeting.
- workshops open to the public.
- Use public meetings to describe challenges of "smooth roads" policy versus "full depth reclaim" - no resolution yet however, just identified the challenge.
- Communicate to those who attend budget discussions with council, project meetings and open houses for specific projects.
- PowerPoint presentations in a public forum.
- We put it on our website.
- short articles written for the town newsletter.
- Share information in newsletters and at town meeting.
- Annual "Fact Book"; public workshops, updated (project and department) websites.
- Quarterly articles in local paper to outline general maintenance items and effects on cost.
- Weekly newsletter of what is going on and where. General cost is provided in the article.
- Annual Reports, SCDOT Website/Public Portal, Presentations (Road Shows before MPOs and COGs), Facebook.
- Communication with Council and Elected Officials.
  - Provide detailed data to city counsel of what we do.
  - We do it through our discussions with the City Council. We haven't performed a detailed public information campaign around this topic.
- Targeted Response to Complainant.
  - Let them know that the complaint is being looked at. We place on a list to order, to work on, and/or to look at.
  - Right now, the goal is just to remind them that is an ongoing cost.
  - "Generally," responding to individual e-mails...the following thought processes are incorporated into our TAMP.
- Specific Document or Plan
  - Beginning to use a 10-year STIP to illustrate needs as opposed to abstract cumulative dollars or performance targets.
  - I provide a 5-year plan based on current funding levels. Also, I convey the current costs for different road fixes periodically. i.e.: material cost for a sealcoat is \$10,000 per road mile. Total cost for a 1.5" mill/overlay is about \$80,000 per mile, bit reclaim/concrete overlay is \$500,000 per mile, total reconstruction is about \$1 million per mile.
  - Additional line item budget categories that show the cost of specific tasks - crack sealing, salt, patching, resurfacing/reconstruction, snowplow reports for each event, etc. Our five-year improvement plan is published and put on the website. It is specifically sent to all townships and cities. The LCC approach isn't specifically utilized each year, but we do a deep dive when a policy, such as adopting the local option sales tax, is being brought forward to show how we were falling behind on ride quality or treading water at the best.
- Description of Information that is Presented:
  - Images of current conditions with virtual images of the goal of the project.
  - "That depends on what they want to know usually they one or two topics of concern. Snow Plowing why don't you run two shifts because of cost. I want more gravel on my road and why

doesn't the dust control work all the time. Mowing the ditches why did you mow mine I wanted to bale it or how come it took so long to get it mowed I hit a deer. The reasons that we need to explain maintenance cost to the public vary public hearings, budgets and one on one discussions need to happen".

- "We are just starting to have the data to do this. We'll figure out messaging in the next couple years as the data matures and we have the resources to do reliable analyses.
- I say they were built in the 50's and typical life cycle of a road is 50-60 years and there is more ADT now days, etc. roads are deteriorating and need upkeep, just like painting the house or shingling.
- TR-608 uses a rolling 8-years of actual expenditures adjusted for inflation and, to produce infrastructure costs and projected needs. It categorizes expenditures into "Carrying Costs" or the actual amount needed to be spent, per year, to operate, maintain, extend and renew the roads and bridges, keeping them in the exact same extent, configuration and condition as they are today. And "upgrade needs" including expenditures that are warranted when the volume of traffic using a road exceeds the safe conveyance capacity of the road's design level.
- We generally explain the cost benefits of preventative maintenance versus reconstruction (i.e. spending budget dollars on aggressive maintenance/preservation strategies at \$1-\$2/SF versus reconstruction at \$6-\$9/SF is a good policy). We sometimes relate simple examples such as painting a house versus re-siding a house.
- We have discussed cost of pothole patching and community members adopted them.
- Would you wait until there is a hole in your house roof before fixing it? Early maintenance saves and prolongs the underlying structure, whether that be a house or a road.
- "Assessing the average cost per mile of differing treatment options, when the road was constructed and/or last treated and illustrating based on those two variables when and how much those assets will need to be invested in to maintain ""status quo"". E.g. - if 1 mile of road was constructed in 1970 with a life expectancy of 50 years, then 1 mile of reconstructed road will need to be budgeted for in 2020. If the cost of the road in 2020, per mile, is \$350,000, then the Council and the public should approve \$350,000 to maintain the asset.
- I present the average cost for various projects and the frequency that the work is needed. I extend the costs by the number of miles of roadway. I then explain how often the work is actually done with the funding provided.
- We showed the trajectory of the system pavement health given several scenarios of funding. These conditions were generated by our PMS.
- "Understandable graphic that show our historical trends (where we have been) and our future trends (where we are going). All this is tied to budgets and to show how effective current budget levels were/are or (in some cases) how ineffective current budget levels were/are. GIS mapping to show current projects give information on the cost of individual projects
- Typical lifecycle cost line graphs comparing different approach scenarios.

## **Key Takeaways**

- 90% of responders are familiar with life cycle cost.
- A higher number of responders communicate the cost of maintaining their agency's infrastructure to public agencies (65%) vs. the public (43%).
  - Responders communicate the cost to their public agencies by:
    - The agency's Capital Improvement Program reflects our short and long-term improvements. (63%).



- Prepare a summary report for the annual budget (50%).
- Responders communicate the cost to the public by:
  - The agency's Capital Improvement Program reflects our short and long-term improvements (65%).
  - Prepare a summary report for the annual budget (53%)
- In regard to the cost of maintaining agency infrastructure, the majority of responders (54%) provide annual budget requests for covering the cost of projected maintenance to their elected officials and the public.
- 80% of responders do not have a tool. For those that do have a tool, they use various software, GPS and GIS tools, and spreadsheets. Some form of spreadsheet was the most common response.

## Appendix B – Interview Summary

### Interview Summary:

1. **What value has been realized from using LCC by:**
  - a. **you personally?** Most respondents have used the concepts of Life Cycle Costs in making decisions in their personal lives particularly related to major investments in consumer goods like cars, trucks, appliances, etc. Things considered included initial purchase price, cost to maintain, and trade-in or residual value.
  - b. **your organization?** Administrators and finance directors like the strategic nature of the approach. Front-line staff struggle with the paradigm shift away from fixing the worst first.
  - c. **elected officials?** Many agency's felt that elected officials like the business case approach that LCC provides them for making decisions on infrastructure investments.
  - d. **the public?** As the public begins to understand LCC, the more they generally support the concept and use, but they don't want to have to personally pay for it in the form of higher special assessments or taxes.
2. **What lessons have you learned about communicating and messaging the benefits and results of LCC that you are willing to share with other practitioners?** No matter if you present the information, benefits, and outcomes in detail or keep it simple, the message needs to be clear. Explain what you are doing now with the money currently available and what additional maintenance and funding is needed based on a defined life-cycle periods. Then present and explain several scenarios of how to close the funding gap.
3. **What would you do differently if you were in charge of LCC policy development, implementation, and the dissemination of LCC findings in your organization?** The overwhelming consensus from respondents was to gain early acceptance from elected officials on the basic LCC assumptions (i.e. life cycle period, maintenance strategies, cost / mile, etc.) and benefits. Keep the messaging simple and explain the LCC concepts often. Make LCC a required step in capital project selection decision-making.
4. **What advice would you give to city and county engineers considering the use of LCC to support their infrastructure investment recommendations and decisions?** Keep the messaging simple but have the data to back up your assumptions and statements. You're a professional and using LCC is a professional approach to demonstrate to elected officials and the public how to optimize the investment of public funds on infrastructure projects. It's an effective way for you to demonstrate that you are making the right investment at the right time on the right road.
5. **What was the biggest obstacle your organization experienced in communicating that LCC was going to be an integral part of your decision-making culture?** Getting over the size of the funding "gap" hurdle that reflected that past infrastructure investment policies and project selection strategies and decisions had not provide the optimum investment of public funds. LCC requires a greater investment of public funds that are not currently available for use by agencies. There needs to be a political will to acknowledge the benefits of LCC and develop funding strategies to move in that direction.
6. **Please describe the process and methodology you or your agency use for preparing LCC. What steps do you follow and what data do you use?** The amount of detailed analysis used by the respective respondents for preparing LCC varied, but the approach was rather consistent. The approach for any given project consisted of defining the life cycle, defining the various maintenance strategies to be utilized over the life cycle, then defining the unit costs per mile (either from agency data or best practices examples) for the recommended maintenance strategy. This will produce a system need which then must be sized and prioritized to fit available funding. Respondents did not share how that

7. prioritization happens within their agency, but it likely involves some level of professional judgment by the local agency administrators.
8. **What are the benefits of the “LCC tool” that you or your agency use)?** One agency used a proprietary pavement management software to establish pavement condition indices (PCI) and ranked priorities but did not use a formal LCC to determine which projects should move forward. Several agencies indicated that they no longer relied on just the PCI, but looked at other factors such as ADT, roadway function, and the type of maintenance strategy scheduled for the specific road in their prioritization. None of the other respondents utilized a “LCC tool”. Most used spreadsheets and reports to document their process and recommendations. Regardless of the “LCC tool” used by agencies, benefits were realized. County boards and city councils were shown how LCC works and how it can provide the justification for the right fix strategy if done at the right time. In several cases LCC was an integral part of a county board’s and county resident’s decision to support and adopt a wheelage tax and local option sales tax to pay for pavement maintenance.
9. **What are the limitations of the “LCC tool” that you or your agency uses?** Since most agency respondents do not use an LCC tool, only one response was received. That respondent’s response focused more on the limitation of his agencies use of LCC. He indicated that there is a need for a life cycle definition and approach that decision-makers and the public can understand. He also indicated agreement on cost inflation factors is necessary. He also pointed out that updating the various data bases used in LCC requires a commitment of staff time.
10. **In your opinion, would there be a benefit if all cities in your state or all counties were to use a “standardized” tool in performing LCC? What would be those benefits?** Many respondents indicated that getting ALL city and county engineers to agree on a “standardized” tool would be a significant challenge. They realized the benefit that could be achieved in reporting results calculated in a standardized manner to state legislature, the media and the public. One respondent indicated that this was done about 15 years ago and a couple years later, the last gas tax increase in Minnesota was approved by the legislature. Respondents felt the “tool” methodology (do this first, then this, and then this, etc.) could possibly be standardized, but that the local agency’s specific cost experience would need to be used. Concerns were expressed that the MnDOT Needs Study unit prices are averages and not reflective of every local agency’s costs.
11. **Would you be willing to provide links to relevant LCC examples completed by your agency?** Respondents were willing to share relevant LCC decisions, reports, and projects.