Beyond Transportation Asset Management Planning: Strategies to Start Implementing Today

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Abstract

Beyond Transportation Asset Management Planning: Strategies to Start Implementing Today

Asset management plans are developed to help us take care of existing assets smartly. Agencies have always practiced some form of asset management. When MAP-21 passed in July of 2012, agencies were required to formalize that process. The FAST Act of 2015 continued the focus. Today, the majority of state DOTs have Transportation Asset Management Plans, or TAMPs, that range from high-level outlines to very detailed plans. Still, many DOTs have not begun to implement their plans, possibly because the industry continues to advance transportation asset management with new ideas and tools. This white paper offers practical strategies to begin implementation immediately in five key DOT functional areas where money is already being spent. Any TAMP that can help an agency make better decisions is ready to implement now—regardless of its stage of development.
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The definition of transportation asset management can be long and technical, but the common denominator in all definitions is that asset management is the “practice of taking care of existing assets smartly.”

Imagine the city you live in hires you to take care of all its bridges. That’s a really important job, because the safety of your neighbors and their ability to move around depends on you getting it right. Now, imagine trying to do this job without knowing the following:

- How many bridges are in your town?
- What condition are they in?
- What condition should they be in?
- How will they deteriorate over time?
- What are the biggest risks facing them?
- How much money do you have to spend?
- What’s the optimal use of this money?

In the same way that you don’t just ride around in your car until the engine eventually stops running, you should perform regular maintenance on your transportation assets. Yes, it costs more up front to change the oil, replace the belts before they break, get occasional tune-ups, etc., but you’ll end up saving money in the long run. The same concepts apply to roads and bridges, or any type of physical asset. Through asset management, agencies can make optimal use of their money in a way that maximizes asset conditions, mitigates risks and minimizes long-term costs.

Over the past 15 years, there have been a lot of advances in transportation asset management. The focus has continued to shift away from building new roads toward maintaining existing ones. This trend was strengthened by the Moving Ahead for Progress in the 21st Century Act (MAP-21) in July of 2012, which required all state DOTs to develop a Transportation Asset Management Plan (TAMP). The Fixing America’s Surface Transportation (FAST) Act of 2015 carried forward this requirement, helping to refocus everyone’s efforts on the core elements of asset management. Today, the vast majority of state DOTs have at least started to develop an initial TAMP. Several have completed them with varying degrees of detail. While developing a TAMP is an important step, completing this document does not mean you’re practicing perfect asset management.

“Today, the vast majority of state DOTs have at least started to develop an initial TAMP.”

Mary Peters, a former FHWA Administrator, put it succinctly: “If I have one additional dollar to spend on the transportation system, what is the most effective way to spend it?” Answering this question and then spending that dollar accordingly is the gold standard in asset management. One of the big lessons state DOTs have learned while developing their TAMPs is that we’ve come a long way—but we also have a long way to go.

“Beyond Transportation Asset Management Planning”
Five Areas Where Every Agency Can Begin Implementation Today

If we look at how agencies spend money, there are five key DOT functions that roughly follow the life cycle of an asset:

1. **Planning.** As part of the planning process, DOTs decide where they want to be in the future. They also allocate funds in order to achieve this vision. For example, how much money will they spend maintaining existing assets versus building new ones?

2. **Programming.** This is the process of identifying projects for the capital program. These choices will drive future asset management decisions. A case in point, the bridge work (e.g. reconstruction versus rehabilitation) that is selected will drive bridge-related agency work in the future.

3. **Design.** The details of project design set in place requirements for future maintenance and the associated costs.

4. **Construction.** Quality Control as part of building the project is essential to minimize future asset management costs.

5. **Operations and maintenance.** Once a road is built, the DOT’s work is not done. It is just beginning!

The details of these functions vary from agency to agency. But, regardless of the details, DOTs make important decisions on how to spend their money during these activities. This paper provides ideas that can lead to better informed decisions and result in maximizing limited funds.

A New, Comprehensive Approach to the Asset Management Process

When we think about using asset management to make smarter decisions, we start by asking, “How can agencies use asset management to better inform activities in the five key DOT functional areas?” That brings us to the concept of asset management informed planning, asset management informed programming, asset management informed project design and so on.

1. **Asset Management Informed Planning**

State DOTs maintain thousands of bridges and tens of thousands of miles of pavement. Most of these assets were originally built in the mid 1900s. They’re getting old, and they require work. In most cases, agencies don’t have enough funding to do everything they need to do to their existing assets. Things get even worse when you start considering other needs. Agencies must also address safety issues, congestion, freight concerns, economic development opportunities, etc. There’s a lot to be done and not enough to pay for everything. Agencies need to make tough decisions. What are your priorities? Where should you spend your money?

This is where a life-cycle asset management approach can help agencies maximize their investments. During the planning process, life-cycle asset management enables agencies to understand the relationship between funding levels and future performance. Figure 2 on the next page provides an example. It shows the pavement conditions that an agency could achieve for different funding levels.
Using graphs like Figure 2, agencies can answer the following types of questions:

- How much money do we need to maintain current conditions?
- What condition can we achieve with current funding levels?
- What are the impacts if we increase funding by 10 percent?
- What are the impacts if we decrease funding by 10 percent?
- Where do we start to see a point of diminishing returns—the point at which it no longer makes sense to spend more to maintain a given asset?

So far, we’ve just talked about pavements. But imagine you had a similar graph for bridges and one for congestion. You could then start to combine the information and make tradeoffs between the programs. You could help answer questions like:

- How much should we spend on preservation vs. expansion?
- What congestion levels could we achieve if we fully fund the preservation needs first?
- What conditions could we achieve if we address our congestion needs first?

There are no right answers to these questions. They should reflect an agency’s relative priorities; its vision for the future. But the benefit of asset management is that it gives decision makers the information they need to make informed decisions. Funding choices have consequences. Asset management can help agencies understand these consequences. This type of analysis will be invaluable as agencies start to establish performance targets. This is another federal requirement that is coming soon. Agencies will want to make sure that their targets are achievable given available funding.

With this type of analysis, agencies can evaluate tradeoffs during the planning process and make informed decisions about how best to allocate transportation funding. Historically, the planning process has focused on improving the function of the highway system by addressing congestion, supporting economic development, etc. Asset management provides context for these considerations. It’s important to know the cost of maintaining your existing assets as you think about making other types of improvements. Furthermore, all agencies can do some type of this analysis today, with the data and tools they have in hand. Their data and models can always improve over time, and their projections also will improve. But they can get started now and make better informed decisions today.
**Three Ways to Immediately Improve Your Planning Process**

1. Model the relationship between funding and future condition levels.
   
2. Provide this information to decision makers to support their discussions on how to allocate funding.
   
3. Evaluate preservation needs during the long-range planning process. This will provide context for how much funding is available for system expansion and capacity improvements.

**2. Asset Management Informed Programming**

In the generic approach we’ve outlined, the outcome of the planning process is a set of funding levels and performance targets. Agencies must then decide which projects to build. For example, a DOT may decide during the planning process that it wants to spend $100 million each year on its bridges. It then must decide which bridges to work on and what work to do on each. Asset management has tremendous potential to improve these decisions.

Imagine the cost of a new roadway as an iceberg as illustrated in Figure 3. The portion that we can most readily see is the initial construction cost. But this is a small portion of the overall costs. Once it is built, someone needs to maintain it for the entire life of the asset. This is where the real costs start to add up.

![Figure 3: Illustration of the Life-Cycle Cost “Iceberg”](image_url)

In asset management, we think about the iceberg as the whole cost of an asset. When managing an asset, we want to constantly be aware of the entire iceberg, and we want to minimize the size of the iceberg, i.e., the asset’s whole life costs.

The bridge asset is a great example of this concept. Asset management enables agencies to look at the whole life costs of a bridge. In the same way it is cheaper to maintain your car than to wait for the engine to stop working, it is less expensive to stop a bridge from deteriorating than to wait until you have to replace it. But things get a lot more complicated, because agencies typically have bridges that already require replacement. These are expensive projects. So there’s a decision to be made. How much work should be done replacing bad bridges versus stopping good bridges from becoming bad? When is it best to work on a bridge? You wouldn’t replace your car’s oil every 1,000 miles for example. There is an optimal time for this. The same holds true for all transportation assets.

Data and asset management tools are vital for analyzing long-term costs. However, experience has shown us that every agency can improve its programming process without collecting additional data or buying new tools. Most agencies have asset management systems, and others are available for free from the FHWA. Customizing the models used in these tools will increase confidence in their recommendations. Asset management software is designed to recommend projects based on existing conditions, expected deterioration rates and available budgets. Confidence in these recommendations is a common challenge that hinders their use. A cost-effective way to update asset management models is to conduct a statistical analysis of historic data—data that you already have available. You can then use the results to improve future projections.
Another implementation option is to identify the types of maintenance, preservation and rehabilitation activities that you typically perform (what work and when). You can then compare the impact of these strategies on the overall cost iceberg, and develop standards for when to apply specific treatments. This approach lets you improve the process without a formal software tool.

Once you have confidence in your asset management tools or agency standards on when to apply specific work activities, you can use these recommendations to better inform the programming process. They don’t have to completely drive the process, but they should inform it. The ideal process should provide flexibility to consider local knowledge and engineer judgment, which is valuable insight that can’t always be automated or standardized.

**Three Ways to Immediately Improve Your Programming Process**

1. Customize your asset management software models using historic condition data.
2. Develop policies for the timing and extent of common treatments.
3. Incorporate asset management system recommendations into your programming process.

**3. Asset Management Informed Design**

Refer back to the iceberg in Figure 3 for a minute. Asset management informed design is the process of designing a project to minimize the entire iceberg. It can help you answer the following types of questions:

- How much will it cost to operate and maintain the new asset for the next 30 years?
- Can we do anything to decrease these costs?
- To decrease costs, should we use different materials? Different design standards? Different geometrics? A different alignment? Etc.

Agencies are already required by federal law to consider long-term costs during the design of large projects. Some agencies have found that their formal life-cycle cost analysis procedures can be simplified so that they can be used on smaller projects as well. Another approach to minimizing long-term costs during design is to apply risk management techniques. For example, what are the project risks that could significantly increase the size of the iceberg? How can you mitigate these risks during project development?

Another approach is to include operations and maintenance staff in the design process. You can ask them to review the design from the perspective of performing their work later on. Incorporating maintenance and operations considerations into the design process can:

- Reduce long-term maintenance, operations and rehabilitation costs.
- Reduce maintenance frequencies to minimize traffic disruptions.
- Improve access to highway features during maintenance operations.

**Three Ways to Immediately Improve Your Project Design Process**

1. Refine your existing large project life-cycle cost analysis process to accommodate smaller projects as well.
2. Incorporate risk management into the design process.
3. Involve operations and maintenance staff in the design process.
4. Asset Management Informed Construction

This part of the process is often the least impacted by asset management. Ideally, the results of the previous asset management analysis are already integrated into the construction documents. Now the goal is to build the thing. One area that has received a lot of attention recently is the construction QA/QC process. This is the process of ensuring that design standards are met during construction. Going back to our car example, it’s widely accepted that the initial quality of our car has a significant impact on our future maintenance costs. The same holds true for highways. Is your agency confident that construction quality is not increasing your long-term costs?

Another area that is gaining attention recently is comparing expected results to planned results. In terms of improving agency accountability, there are a couple of important questions:

- Did we build what we said we would build?
- Did it have the impact we said it would have?

For example, a lot of agencies have developed rules of thumb for how long a pavement should last, often between 10 and 15 years. If an agency finds that its pavements are lasting significantly less than this, the root cause may be construction quality. It may also reflect issues with the design process. Regardless, an agency could save a lot of money over time if it can identify and address these types of issues.

A final area of focus during construction is management of the change order process. Significant changes in a project’s budget or schedule can have a ripple effect throughout the rest of the capital program, potentially impeding the ability to achieve an agency’s overall asset management objectives. Proposed changes in project scope should be evaluated against the project’s original purpose statement and against the asset management informed decisions made during the design process. Agencies can use change order information to identify opportunities to enhance their planning and design processes.

Three Ways to Immediately Improve Your Construction Process

1. Enhance your construction QA/QC process.
2. Monitor asset life and compare it against the original design life. Use the results to update the deterioration models embedded in your asset management systems.
3. Develop a process to use change order trend information to enhance design activities.

5. Asset Management Informed Operations and Maintenance

Operations and maintenance costs, or O&M costs, are a significant part of the asset iceberg. There is tremendous potential to drive down these costs by applying asset management principles. For example, consider a traditional maintenance contract for street lights. When a light goes out, the owner or a contractor is sent to fix it. If the light goes out again a few months later, or a year later, the owner or contractor is again called to fix it. In this approach, the owner is spending valuable maintenance resources or the contractor gets paid for how much work they do (they get paid every time they fix the light). There is no incentive for the contractor to figure out why the light keeps going out, and there is no incentive to minimize the long-term costs of the light.

Now imagine a different approach in which you set aside a certain amount of money for your lights. You tell a contractor you’ll pay them this amount every year, but only if they keep the lights on. You’ve just completely changed the...
contractor’s motivation and improved performance for your constituents. The contractor is now focused on keeping the lights on and minimizing their costs as they do so. Furthermore, the benefits of this approach increase as the length of the contract increases. For example, if a contractor is responsible for keeping the lights on for the next 20 years, they can make more expensive improvements early on in order to decrease their costs (the asset life-cycle costs) later.

**Benefits of a Long-Term, Performance-Based Maintenance Contract**

- Free up maintenance staff to work on other assets.
- Know exactly how much money you will spend on your assets every year.
- Improve the performance of the assets because the contractor only gets paid if they meet performance standards.
- Shrink the O&M portion of the cost iceberg.

In some cases, agencies choose to carve out specific activities such as lighting for these contracts. In other cases, contractors are responsible for performing all O&M work along a stretch of highway. Often, we see DOTs that are interested in this approach carve out some portion of their O&M program, or some portion of their network, and conduct a pilot. Pilots are a good way to work through the logistics of the new contracting approach and to assess the potential cost savings.

Another area that many agencies struggle with is improving the coordination between their capital and maintenance programs. Approaching maintenance from an asset management perspective can enable agencies to identify low-cost maintenance activities that extend the life of an asset. Effective maintenance is an important tool in managing an asset’s long-term costs. Improved maintenance decisions can save you money in your capital program by prolonging more expensive capital projects. In many cases, providing maintenance departments with better information on the location and timing of planned capital projects can lead to better decision making. For example, by enabling them to delay work on an area that will be addressed through a larger capital program in the near future, or by identifying the need for short-term maintenance strategies that address condition concerns while a larger project works its way through the project development pipeline.

**Three Ways to Immediately Improve Your O&M Process**

1. Monitor the performance of your O&M program in terms of asset condition.
2. Identify portions of the maintenance program that could benefit from long-term, performance-based contracts.
3. Provide your maintenance department additional information regarding the scope and schedule of planned capital projects.

**Applying the Same Approach to Other Physical Assets**

Agencies will benefit from a formal asset management program for all of their assets—beyond just pavements and bridges. These efforts typically fall under an agency’s maintenance program. An important first step is to prioritize which types of assets to address first. A common approach is to consider risk. For example, one tactic would be to focus initially on assets that could fall down, such as overhead sign structures and retaining walls.
Regardless of which assets you choose, it’s important to remember that the asset management approach will vary by asset type. For some assets, such as small culverts, DOTs could achieve significant benefits simply by having a complete inventory and condition assessment. Realizing these benefits would be possible even without addressing more advanced elements of asset management planning.

In addition, the frequency of data collection can vary by asset. For some assets, such as pavements, annual inspections are necessary. For others, such as culverts, annual data is not needed. Data collection often is the main focus of starting a new asset management program. Therefore, it’s important to consider the costs and benefits of data collection when designing asset management programs.

The principles we’ve addressed here hold true for any type of physical asset (roadways, transit assets, port facilities, railways, etc.). Implementation will look different, but the core elements are the same.

Take the Asset Management Challenge!

HDR has created an Asset Management Scorecard to help you identify opportunities to improve your agency’s asset management practices. It follows the five DOT functions (planning, programming, design, construction and O&M) discussed in this white paper.

Once you identify opportunities for improvement, an important next step is to conduct a more thorough assessment in those areas to better understand the issues. This assessment can help in answering the following types of questions

• What are we doing now in this area?
• How does it compare to best practices?
• How do we want the process to work going forward?
• What steps can we take to improve in this area?

We encourage you to fill out this scorecard today as the next step in your asset management journey.

Conclusion

The broad topic of asset management has far-reaching implications and potential benefits. Agencies can enjoy early benefits by beginning to implement their TAMPs today using existing resources. This is done by looking at the key DOT functions where they are already spending money. The use of current data and asset management tools can immediately help agencies make better informed decisions at every stage of the asset management process. This approach is not limited to pavement and bridges, and can be applied to all transportation assets.

To avoid getting paralyzed with all of the options available, the Asset Management Scorecard can help agencies quickly identify opportunities for asset management improvement.
For More Information

**Joe Guerre**, PE  
Transportation Planning Program Manager  
HDR, Inc.  
317.485.4245 | joe.guerre@hdrinc.com

**Butch Eley**  
President  
HDR | ICA  
615.515.3658 | butch.eley@hdrinc.com