

The following Executive Summary is supplemental to *NCHRP Research Report 1076: A Guide to Incorporating Maintenance Costs into a Transportation Asset Management Plan* (NCHRP Project 23-08 of the same title). The full report can be found by searching on *NCHRP Research Report 1076* on the National Academies Press website ([nap.nationalacademies.org](http://nap.nationalacademies.org)).

The National Cooperative Highway Research Program (NCHRP) is sponsored by the individual state departments of transportation of the American Association of State Highway and Transportation Officials. NCHRP is administered by the Transportation Research Board (TRB), part of the National Academies of Sciences, Engineering, and Medicine, under a cooperative agreement with the Federal Highway Administration (FHWA). Any opinions and conclusions expressed or implied in resulting research products are those of the individuals and organizations who performed the research and are not necessarily those of TRB; the National Academies of Sciences, Engineering, and Medicine; the FHWA; or NCHRP sponsors.

# Incorporating Maintenance Costs into a TAMP



*NCHRP Research Report 1076: A Guide for Incorporating Maintenance Costs into a Transportation Asset Management Plan*, developed under NCHRP Project 23-08, has been developed to aid state DOTs and transportation agencies identify and overcome challenges to incorporating maintenance costs into risk-based transportation asset management plans (TAMP)

The image above has been used with permission from the New York State Department of Transportation (NYSDOT)

## Background

The American Association of State Highway and Transportation Officials (AASHTO) defines transportation asset management (TAM) as a “strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life cycle.” Under current legislation, state departments of transportation (DOTs) must develop a transportation asset management plan (TAMP) for pavements and bridges located on the National Highway System (NHS) that, at a minimum, includes:

- \* A summary of the assets and their condition.
- \* Objectives and performance measures.
- \* A performance gaps analysis.
- \* A life-cycle planning analysis.
- \* A risk management analysis.
- \* A 10-year financial plan.
- \* Expected investment strategies (23 USC 119(e)).

The federal regulations require state TAMPs to include a financial plan that addresses “the estimated cost of expected future work to implement investment strategies contained in the [TAMP], by State fiscal year and work type” (23 CFR 515.7(d)(1)). The regulation goes on to define work types as “initial construction, **maintenance**, preservation, rehabilitation, and reconstruction” (23 CFR 515.5).

While these requirements emphasize the importance of incorporating maintenance costs into TAM processes and TAMPs, there are many practical barriers that keep agencies

from doing so. Typical highway agency organizational approaches, practices, and information technology architectures have been established to separate maintenance data, budgets, and plans from capital programming. A review of the 52 state TAMPs submitted to FHWA in 2019 indicated only 11 included forecasts of maintenance costs for both pavements and bridges.

## Purpose of the NCHRP Research

A 2020 peer exchange, conducted through the National Cooperative Highway Research Program (NCHRP) Project 23-08, identified that many DOTs were unable to define clear connections between maintenance investments and asset condition, and many had difficulty reporting planned maintenance expenditures by the system, asset type, and year. In response, this project developed guidelines that state DOTs and other transportation agencies can use to better incorporate maintenance costs into their TAMPs.

The peer exchange also identified several challenges currently preventing agencies from fully integrating maintenance costs within asset management practices and plans. The following six challenges were identified as the most common and difficult to overcome.

- \* A lack of common definition for maintenance.
- \* A lack of quality data relating to maintenance costs and accomplishments.
- \* Limited understanding of how maintenance impacts the asset life cycle.
- \* Immature risk management practices that do not incorporate maintenance contributions.
- \* Disparate accounting or budgeting systems for maintenance and capital expenditures.
- \* Planning periods varied for capital expenditures and maintenance programs.

The Guide developed as the key deliverable for NCHRP Project 23-08 provides agencies with the

necessary steps to address these challenges and more effectively include asset maintenance costs in their TAMP.

## Anticipated Benefits and Implementation Steps

Routine maintenance costs represent a substantial portion of an agency's total budget. However, determining the impact of routine maintenance on overall asset performance requires quality data, systems, and processes. The Guide has been developed to help agencies identify the barriers that prevent them from quantifying and incorporating maintenance costs into their TAMPs. It also serves as a resource for developing processes and tools to integrate maintenance costs into each of the primary TAMP components. Recognizing the continual-

improvement component of asset management, the framework presented in the Guide includes a step for agencies to assess their current ability to deliver needed maintenance actions and incorporate those costs into a TAMP.

### A REVIEW OF THE 52 STATE TAMPs SUBMITTED TO FHWA IN 2019 INDICATED ONLY 11 INCLUDED FORECASTS OF MAINTENANCE COSTS FOR BOTH PAVEMENTS AND BRIDGES.

Once the maintenance actions are defined, the Guide provides specific direction for incorporating the related costs into each TAMP component based on their impact of the maintenance actions on the asset's life cycle. To address this, the Guide discusses the full spectrum of activities that might be considered maintenance by highway agencies. Using this framework, agencies can choose to apply the information to any activities they decide to define as maintenance.

An overview of the steps to achieve this is provided in figure 1.

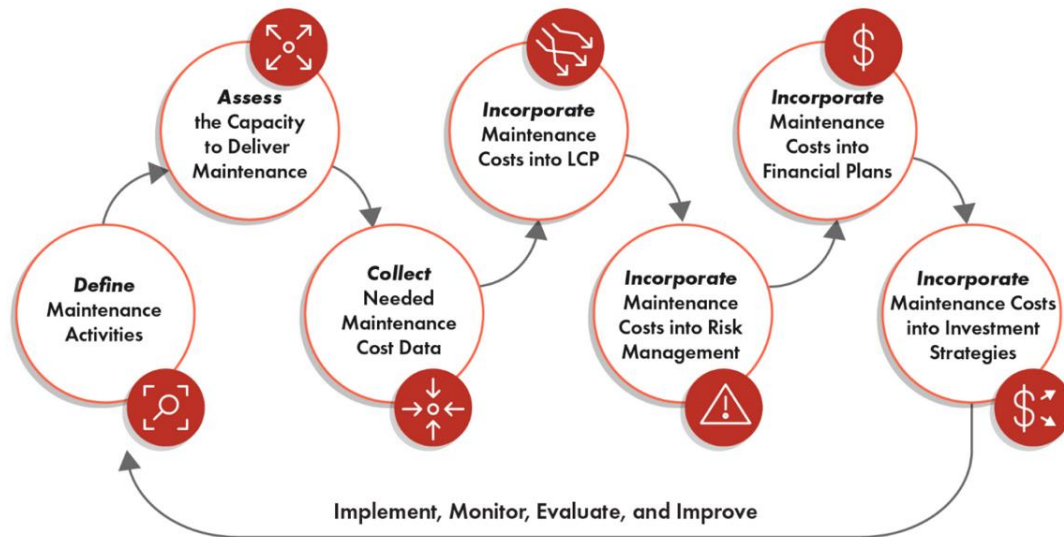


Figure 1. Framework for incorporating maintenance costs into a TAMP.

As a result, the agency will be able to more effectively manage maintenance budgets based on the costs necessary to deliver a targeted level of performance for each asset class. Additionally, the agency may also:

- \* More accurately calculate asset life-cycle costs.
- \* Demonstrate the value of investing in maintenance via asset performance projections.
- \* Demonstrate the impact of not doing maintenance on asset performance.
- \* Avoid routine maintenance on assets that are scheduled for preservation or rehabilitation.
- \* Identify areas of the system that are most in need of maintenance.
- \* Leverage maintenance unit costs to evaluate whether internal or contracted resources provide the most value.

## Continual Improvement

Continual improvement is a critical aspect of performance-based management practices.

Incorporating maintenance costs into a TAMP is not an effort with a clear end point. Rather, it is the establishment of ongoing practices that support annual and multiyear planning and programming efforts. Each time an agency performs any steps in the related processes of maintenance or asset management, it presents an opportunity to improve its practices with the goal of making better decisions and making better use of available resources.

By incorporating maintenance costs into a TAMP, agencies establish a coordinated strategy for achieving asset management goals and managing risks using comprehensive investment strategies. Successful implementation of those strategies involves putting the plan into practice while responding to changes or unexpected events. This requires coordination between the capital and maintenance programs, along with establishment of a continual-improvement process to keep both maintenance management and asset management up to date.

Following the maintenance management life cycle, shown in figure 2, provides an agency with opportunities to implement, monitor, and

continually improve its maintenance program and support TAMP implementation.

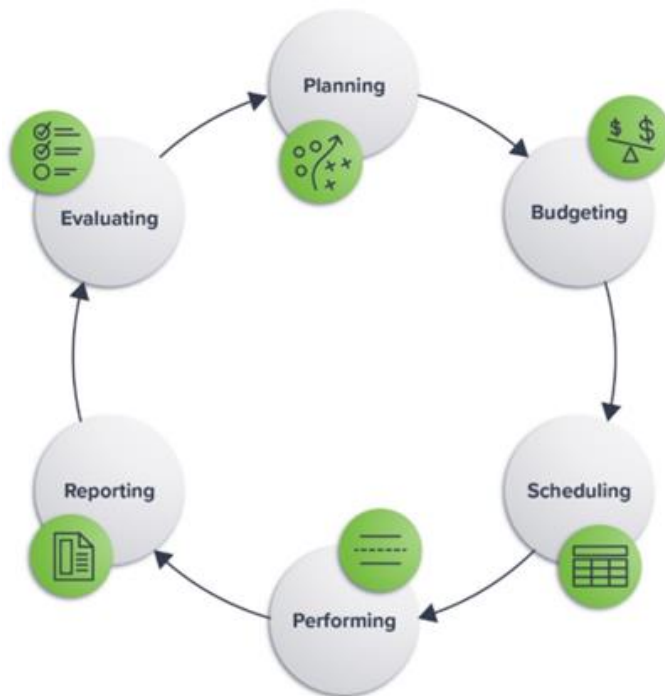


Figure 2. Maintenance management life cycle.

As an agency progresses in its TAM maturity and ability to incorporate routine maintenance costs into its TAMP, improved effectiveness and efficiency in the areas below can be realized:

- \* Planned maintenance expenditures will deliver the types of maintenance assumed in pavement and bridge life-cycle plans and investment strategies.
- \* Trade-off analysis will include the costs of all work types and assets included in the TAMP.
- \* Future funding is properly allocated, or programmed, for maintenance projects.
- \* Maintenance work is delivered by the most cost-effective means.
- \* Delivery of maintenance work is timed appropriately with other work at a given location.
- \* Planned costs will more closely match actual expenditures.

Maintenance work is commonly delivered through both contract and field crews. Contracts may be funded and managed through a capital construction program or from a separate maintenance and operations budget. In many cases, all three of these delivery mechanisms are used. To be effective, these different delivery mechanisms need to be coordinated so the work is being delivered through the most efficient means.

Additionally, coordination of maintenance expenditures and activities across each delivery process will help ensure routine pavement maintenance projects are not completed shortly before a major rehabilitation project.

## Conclusion

This Guide provides specific direction on how to incorporate each category of maintenance activity into each component of the TAMP. It is designed to be part of the AASHTO TAM framework, augment the AASHTO TAM Guide, and provide a series of steps agencies can follow to better integrate maintenance processes and costs into asset management planning and documentation. This project also includes several products, including the *NCHRP Research Report 1076*, this Executive Summary, a Technical Memorandum on Implementation, and an overview presentation. A workshop with agency representatives was held during the 2023 TRB Annual Meeting. By providing information in multiple formats and in varying levels of detail, these materials enable a diverse set of agency representatives to better understand how to incorporate maintenance costs into TAM.