

Financial Planning for Transportation Asset Management: *An Overview*



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1. Introduction and Overview

Transportation agencies have the responsibility and the challenging task to maintain, preserve and improve infrastructure assets (assets) for current and future generations. While maintaining existing assets is an overriding concern for transportation agency officials, most agencies are grappling with funding issues. Considering the fact that assets such as pavements and bridges have long useful lives, a sound asset management practice will necessitate the development of long-term asset management plans. Practices and experiences from other countries with mature asset management processes and also from transportation agencies within the U.S. show that implementing and sustaining the performance and condition of assets requires long-term financial plans that support and are linked to long-term asset management strategies. Comprehensive transportation asset management plans (TAMP) could show the expected and desired projections of asset performance and condition for ten or more years in to the future. A pragmatic TAMP would address the amount of investment required each year for the rehabilitation, preservation and maintenance of assets during their useful life. The associated financial plan can be linked to the targeted performance and conditions of the assets identified in the TAMP.

The financial plan can show the expected and desired funding projected for the future, often for ten or more years. To be useful to decision-makers, the financial plan can establish how the agency will address the resources needed to achieve and sustain the long-term asset management objectives. It could clearly illustrate the financial state of the agency and express the financial needs for the plan period, shedding light on the gaps, and the funds needed to bridge the gaps between the current conditions and those established in the asset management plan to sustain and cost effectively

extend the useful life of the assets. The elements of the financial plan can succinctly highlight the actions that need to be taken over the long-term to maintain the health, performance and condition of the assets. The financial plan also can address financial risks. It could enable the agency to monitor and compare the funding available to the expected funding projections throughout the life of the plan, make tradeoffs, and take corrective actions to accomplish the agency's asset management objectives. The financial plan is thus critical to the successful implementation of the agency's TAMP. Finally, well developed financial plans would allow agencies to communicate with the public and the stakeholders the value of transportation assets, the current, projected and desired performance and condition of assets, the funding required to support the projected and desired performance and condition targets, the financial risks and the level of performance and condition that stakeholders can expect. It also can summarize any changes in strategy that may be required to address changing financial realities.

2. Why Develop A Financial Plan?

An asset management plan, whether it projects modest or ambitious goals and condition targets, will not mean much unless the financial plan that is tied to it conveys and validates the agency's financial strength and ability to deliver those goals and targets. The financial plan will broadly enable agencies to do the following:

1. The financial plan will allow agencies to clearly identify how much revenue they need in order to sustain the conditions set out in the plan and how these needs compare to forecasted revenues. Currently for most agencies, the forecasted revenues will not be sufficient to sustain and maintain existing assets. The financial plan will provide a clear picture of the state of funds.

2. The financial plan will enable an agency to make more sophisticated projections to forecast the funding needs and the associated timing for the most cost-effective treatments it will have to implement to provide the level of service projected in the TAMP. These projections, which will be based on an assessment of the historical condition and performance of an agency's assets, will include funding needs for maintenance, preservation, rehabilitation and replacement. A long-term financial plan that helps decision-makers get a summary view of the agency's asset management strategy should present the funds required annually for treatments in each budget category for the projected period of the plan. The plan will thus serve as a powerful tool to illustrate to the public, legislators, commissions, interest groups and other stakeholders, the investment needed in the different budgeted categories to maintain, improve and sustain the system.
3. Highlights the difference between the funds needed to sustain the assets for the long-term and the funding that is projected to be available and will provide an indication of the financial sustainability gap. This financial sustainability gap puts into perspective the funding deficit and the investment needed. It can be used to show clearly the current system conditions as well as where the system will be in the future if the funding gap is not addressed. The financial picture can thus be used effectively to articulate the gap in the funding required to sustain asset conditions.
4. The financial plan can serve as the central theme to communicate realistic levels of service that can be achieved with the expected funding available to the agency. Where insufficient, it can be used to show the additional revenue required to provide those services and help agencies communicate and manage the public's

expectations on the conditions and service levels that they can expect. The funding needs, projected revenues, and gaps in the financial sustainability and funding availability as detailed in the financial plan can be tools for shaping the discussion of future transportation programming, project selection and delivery decisions.

5. A well-developed financial plan will inform the public and stakeholders clearly about the reduced level of services they should expect to receive, the continuing deterioration of conditions, and the increased resources that will be required as a result of delaying or postponing treatments. It will also show the reduction in asset value for future generations and the significantly higher costs that will be required to bring these assets back to a state of good repair. The financial plan is used to present multiple funding scenarios reflecting what can be achieved with different levels of increased investment. It can prepare the public for the consequences of insufficient investments and arm them with the information necessary to make decisions on supporting options for revenue increases.
6. For a given set of assumptions, the financial plan will predict if an agency is likely to accrue looming future infrastructure deficits that will require significant funding outlays.
7. The plan will also serve as an excellent vehicle to describe and communicate the financial risks that an agency faces in its efforts to achieve the new, more sophisticated, and long-term condition targets. Presenting these risks brings to the forefront, the reality and implications of failure to achieve the condition targets. The financial risks that the agencies face include:
 - a. Declining fuel tax revenues

- b. Uncertain federal funding caused by declining Highway Trust Fund revenues and national lack of consensus on new revenue
 - c. Uncertain future economic conditions including inflation rates
 - d. Having the right balance between “over-programing” and “under-programming” and the cost of delaying projects due to lack of funds
 - e. Uncertain future conditions and performance caused by factors such as,
 - i. Rising sea levels, climatic and storm events’
 - ii. Localized impacts such as from fracking, timbering, mining trucks,
 - iii. Uncertain performance of key assets, such as aging bridges, tunnels and pavements
8. The risks detailed in the financial plan will also provide agencies an opportunity for discussing these risks with stakeholders. It can display recognition of these uncertainties and agencies’ strategies for managing them for the public benefit.
9. The plan will provide an excellent opportunity for agencies to demonstrate how responsibly they are managing the transportation system in the public’s interest with the resources available to them. The financial benefits of preservation, preventive maintenance, and other timely treatments can be illustrated to highlight how much greater investment would be needed if only a worst-first strategy were pursued.

10. By incorporating discussions about asset valuation, agencies can illustrate the massive investment already made in their infrastructure and the need to preserve that investment. Asset valuation states in financial terms the value of the infrastructure. For most states, the transportation infrastructure will be far and away the largest state investment in physical assets. By casting the transportation network in economic terms, it accentuates the need to preserve this irreplaceable asset and to preserve its value for future users.

These features are well illustrated in several of the TAMPs and associated financial plans that have already been developed by several states. A good example relates to the Colorado DOT (CDOT) TAMP dated December 9, 2013.

Summarizing the results of a public survey conducted by CDOT regarding the public's perception of CDOT priorities, the CDOT TAMP states the following: "According to the recent survey, there is a high correlation of the need for asset management with the public's priorities. Maintaining the State's highways and bridges is the public's number one priority for CDOT^[1]."

Discussing the agency's program distribution for asset management the CDOT TAMP states that the agency does *revenue forecasting for 20 years* and shares this information along with the realistic baseline, high and low scenarios for planning purposes to the local planning organizations for input into their plans that have to be fiscally constrained by state statute^[1]. The agency notes that to develop a 10-year fiscally constrained funding for asset management, the agency had to make several assumptions and it has listed these assumption in the Financial Plan section of the TAMP.

In summary, the financial plan will illustrate and enable agencies to plan the level of investment required to achieve

and sustain their asset condition objectives. The financial plan can illustrate the extent of shortfall and the implications of tradeoffs between treating existing assets and adding new assets, as well as the impact of tradeoffs across asset categories and related treatments. It will enable an agency to present a fiscally balanced asset management plan that addresses the performance and condition targets that the agency states in the TAMP. It will engage the public and other stakeholders in getting involved and in supporting the need for adequate investment in infrastructure. A fiscally balanced, long-term financial plan will provide transportation officials the tools needed to influence project selection, programming, project delivery, and support of increased funding. It will create a better understanding of the implications of reduced investment and the high cost of postponing action. It will encourage preservation and maintenance activities and create better appreciation of the immense value that exists in the nation's infrastructure assets.

3. The Importance of Financial Sustainability

In Australia, the life of bridges is expected to be about 100 years. In the United States, the lives of pavements and bridges vary from 10 to 50 or more years depending on type, location, and other factors. Nonetheless, they have long life spans. Short-term budget cycles focus on short term perspectives and treatments. Short-term budgets, such as biennial budgets, viewed in isolation fail to capture the accruing long-term needs of such infrastructure assets. They fail to show the long-term consequences of reduced funding of maintenance and preservation activities within the biennium. The financial plan provides a long-term view of the implication of funding such treatments and shows the

decline in asset condition over the long-term that results from reduced funding.

The asset management plan and the related financial plan clearly illustrate the “cause and effect” of short-term reduced maintenance and preservation funding on long-term asset conditions.

A financial plan along with the included financial scenarios will demonstrate that a long term plan that takes a strategic approach to the management of assets represents responsible financial management. It will show that timely preservation and maintenance are cost effective strategies that are also financially responsible actions. With financial constraints that agencies are facing, delaying preservation and maintenance will cost the agency more in the long-term.

Figure 1 shows the Michigan DOT forecast indicating that without the influx of funds, the pavement conditions will rapidly decline. The forecast makes the case for the need for long-term investment in pavements.

Figure 2 shows the WSDOT analysis on the cost of delaying treatments. It shows that the cost per lane mile of treating asphalt pavements in “fair to very good” condition ranges to a maximum of approximately \$250,000, whereas that of treating pavements in “very poor to poor” condition is between \$800,000 to \$1M. It also shows that the cost of chip sealing pavements in “very good to fair” condition ranges to a maximum of approximately \$45,000 and those in “very poor to poor” condition ranges from \$150,000 to \$250,000. The figure demonstrates that the cost of pavement treatment is dependent on its condition. The cost of rehabilitating roads in good to fair condition is the lowest and is significantly lower than rehabilitating roads in poor condition. The chart also conveys that it is cost effective to preserve and

maintain roads in good and fair condition so that they do not fall into a poor condition.

Applying the information from Figure 2, it is clear that treating pavements after their condition has deteriorated

Trunk Line Pavement Condition Forecast

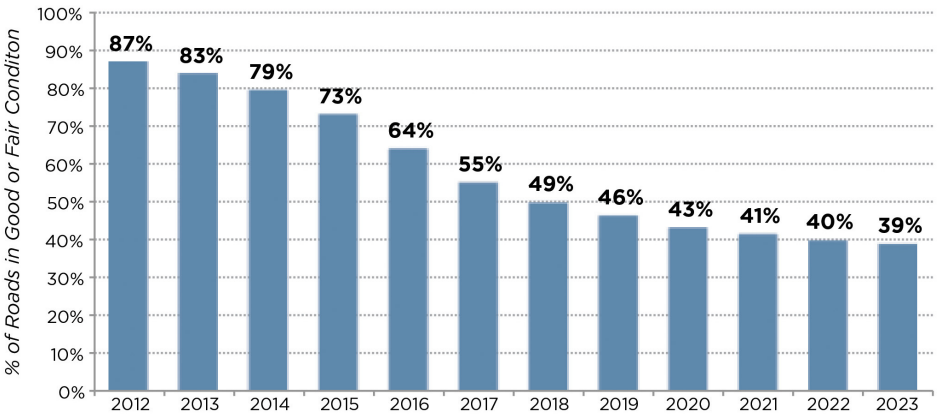


Figure 1. Forecasted Pavement Conditions for Michigan DOT

SOURCE: MICHIGAN DOT

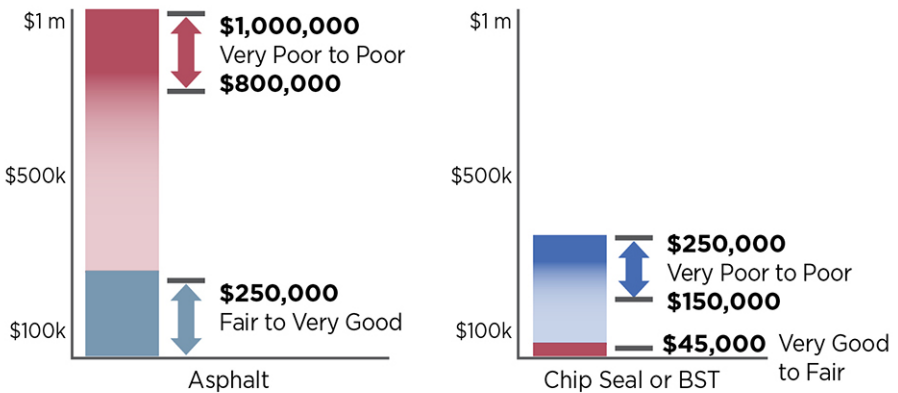


Figure 2. Average Statewide Cost (\$/lane-mile) for Pavement Treatments

SOURCE: WS DOT

will cost the DOT many times more than if they are treated before the decline occurs. This logic can be well reflected in the financial plan. The plan can thus show that strategic asset management is prudent and it is pragmatic to invest monies in timely preservation and maintenance. Such asset management strategies involving timely treatments will result in reduced costs that will in turn reflect in a smaller gap between the funds needed and the funds available over the useful life of assets. The agency will thus be in a better position to financially sustain the condition and performance, and extend the useful life of its assets at a lower cost.

Public Recognition of the Need for Financial Sustainability

The financial failures of companies such as WorldCom and Enron led to their collapse. Barings Bank, a prestigious bank in the United Kingdom failed because of risky investments by a young trader. Similar examples can also be seen in the public sector. In 1998, Orange County in California went bankrupt when a county investment manager invested pension fund proceeds in an investment that lost value when interest rates rose. Similarly, unfunded pension liabilities contributed to Detroit's bankruptcy.

These and other financial issues led to Congress enacting the Sarbanes-Oxley Act (SOX) in 2002. Known as the Internal Control over Financial Reporting Requirements Act, SOX is a broad legislation of hundreds of pages that has been summarized by one author as basically aimed at more thorough and objective auditing of financial statements^[iii]. However, the impact of the more thorough auditing extends to important reforms so that investors or stakeholders have more confidence in the integrity and completeness of the financial liabilities facing a company. SOX brought more disclosure to financial statements and, in part, strengthened

them as documents providing greater insights into the financial viability of a company.

These and other such financial failures have resulted in a gradual increase in the public's recognition of the importance of long-term financial plans discussing the financial needs and financial sustainability of companies. This recognition can be seen in public budgeters and regulators requiring public agencies to formally acknowledge the extent of unmet financial liabilities. Examples of long-term pension liabilities in California, Rhode Island and Detroit represent such acknowledgement.

Exposure to International Practices

An international scan team of agency experts from the United States was exposed in 2011 to the long term horizons of asset management and financial planning in the United Kingdom, Australia and other countries. The examples evaluated by the scan team had ten-year or more planning horizons. These longer-term plans provide a clear picture of the assets' needs and communicate any funding shortfalls that exist in meeting the projected infrastructure conditions.

Figure 3 (see page 12) is an example from Paradise Council's (a local agency in Southern Australia) Asset Management Plan. It shows the projected expenditure for operations and maintenance activities for the 10-year period from 2011 to 2020 in 2010 dollars.

The Paradise Council's Asset Management Plan has budgets tied to the annual level of service planned for the next ten years. The plan is based on "sustainable service delivery and long term financial planning and reporting".

The chart in Figure 4 (see page 13) shows the Council's projected versus planned (available) funding for renewal

activities for a 10-year period. Renewal expenditure as defined by the Council “is major work which does not increase the asset’s design capacity but restores, rehabilitates, replaces or renews an existing asset to its original service potential.” Figure 4 shows that the Council estimated the available funding to be approximately \$8,000,000 for the 10 year period which is approximately 29% of the estimated renewal cost. The Council’s asset management plan also states that over the 10-year plan period, the total available funding for operations, maintenance, renewal and upgrade is approximately 42% of what it would cost the Council to provide the service. This information in the plan communicates the challenge that the Council faces. It also brings the issue up front for discussion and resolution.

Paradise Council—Projected Operations and Maintenance Expenditure (Transport Areg)

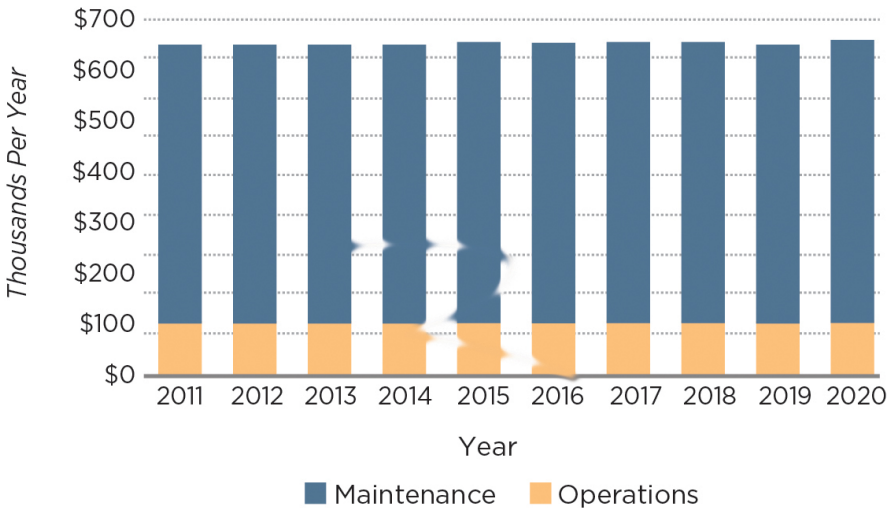


Figure 3. Projected operations and maintenance expenditure for a 10-year period from 2011-2020 for Paradise Council, Australia

SOURCE: PARADISE COUNCIL REPORT [14]

Such charts, showing the long term projections and financial analysis, are extremely valuable to decision-makers and help to communicate with the public and other stakeholders, the financial state and health of the organization.

A long-term financial plan as in the example from Paradise Council's Asset Management Plan clearly shows for the ten year period from 2011 through 2020,

1. the funds needed for operation and maintenance for a ten-year period,
2. the projected funding required versus the planned funding for renewal,

Paradise Council—Projected and Budget Renewal Expenditure (Transport Areg)

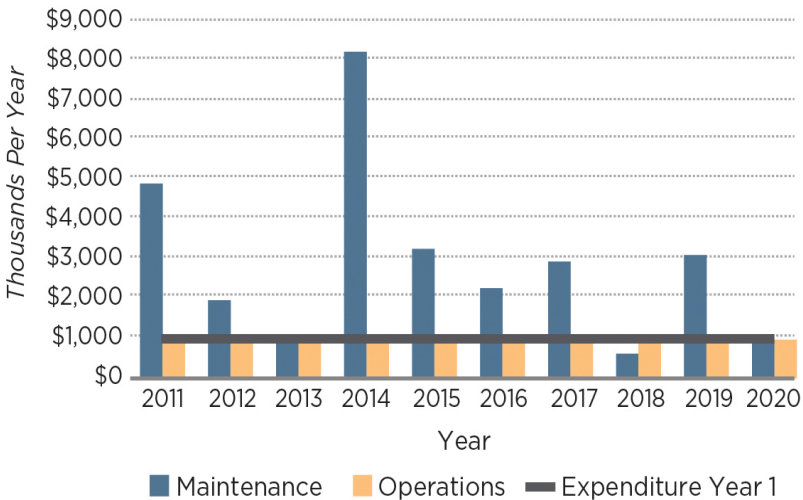


Figure 4. Projected and planned (budgeted) renewal expenditure for the 10-year period from 2011-2020 for Paradise Council, Australia

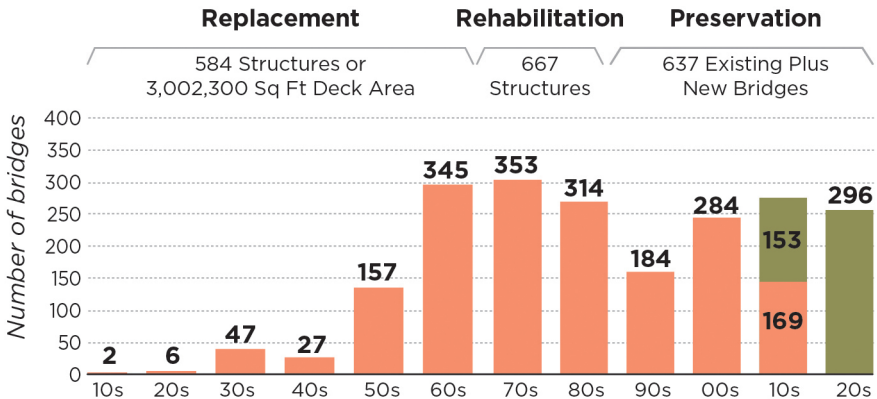
SOURCE: PARADISE COUNCIL REPORT [14]

3. the budgeted expenses and projected shortfall,
4. the yearly and cumulative shortfall in funding investment required, and
5. the level of service that can be expected with the available funding.

U.S. Examples of Long Term Plans

Mature long-term asset management approaches used in countries such as Australia provide detailed financial information for ten to twenty years. Similar examples exist in U.S. transportation agencies presenting the importance of financial sustainability to address the long-term needs of existing infrastructure.

The chart in Figure 5 from Utah DOT^[vi] shows an increase in number of old bridges reaching the end of design life.



20 Yr: Replacement program for older bridges—\$31 Million Yearly

20 Yr: Rehabilitation/Preservation program for newer bridges—\$17 Million Yearly

UDOT is seeing a boom in the number of 30 to 50 year old bridges coming due for replacement.

Figure 5. Age Distribution of UDOT Bridges

SOURCE: UTAH DOT

The chart shows that over the next 20 years, without replacement, over 50 percent of Utah DOTs bridges will exceed their design life.

The agency's asset management plan looks at various factors including asset conditions, age, type and average daily traffic, and makes long-term projections on maintenance, preservation, rehabilitation and replacement needs. The associated financial plan then provides a quick view of the long-term investments needed.

Utah DOT communicates through its 2014 strategic direction document ^[vii] that over the next 20 years, the DOT will have to replace 29 bridges per year to maintain current conditions. In addition, the agency will have to do preservation or rehabilitation of 65 bridges per year with each treatment lasting over 20 years in order to maintain the bridge inventory in current conditions. This information allows the agency to communicate its funding needs for bridges.

The Case for Long-Term Financial Planning

A significant portion of the national transportation infrastructure investment is in longer lasting assets such as bridges, pavements, culverts and other roadside assets. An annual or biennial approach to investing in these long-lasting assets does not provide the necessary planning and funding horizon to address the life cycle cost or the systematic application of treatments necessary over the longer time horizon.

The Moving Ahead for Progress in the 21st Century Act (MAP-21) requirement for risk and performance based asset management plans provides a great opportunity to look at the asset management and financial plans from a longer term perspective versus short term, annual or biennial budgets. This longer view will enable agencies to forecast the conditions and present a realistic impact of treatments and

investments for a duration of ten or more years. It will allow agencies to look at the lowest possible life cycle costs to most effectively apply timely treatment and extend the useful life of assets.

A later section of this report discusses examples of US TAMPs from Colorado, New York and Minnesota that have ten year financial plans. These examples show that the information presented by a fiscally balanced financial plan that supports the long-term asset management strategy of agencies will,

The Government Financial Officers Association (GFOA): Best Practices 2014 document:

Long-term financial planning is the process of aligning financial capacity with long-term service objectives works best as part of an overall strategic plan

Financial sustainability has come to signify practices such as directing one-time revenues away from recurring sources of expenditure and taking into account long-term maintenance and operating costs when planning and evaluating capital projects.

The GFOA recommends that all governments engage in long-term financial planning. It recommends the time frame for the plan to be at least five to ten years into the future.

1. incentivize long-term financial planning so that agencies can forecast needs and plan for future needed investments,
2. incentivize agencies to redirect resources towards timely maintenance and preservation, addressing critical life cycle management of assets, and presenting the resulting long-term cost savings, and
3. direct the political and public discussion to focus on the critical need for infrastructure investments. It will also present the need to maintain and preserve existing assets versus adding new infrastructure assets.

The financial plan provides a clear picture of the long-term financial state of the agency. It provides transparency and lends credibility of the agency's decisions.

A long-term financial plan extends to ten or more years and is based on projections. These projections are based on informed assumptions. Clearly stating all the assumptions improves the confidence in the plan and helps decision makers to better understand the unfilled resource needs and gaps and its impact to the long-term condition of infrastructure assets.

The credibility and transparency of the data presented in the plan also makes it easier to engage and get buy-in from the public in the discussion about the long-term asset needs and the importance of increasing investment in infrastructure.

Excerpts from the 2014 Government Financial Association on Best Practices document summarized above further reinforce this fact.

4. Transparency and Credibility

The examples from Australia and various State DOTs discussed in this report including New York, Utah, and Colorado present a clear quantitative picture of the need for long-term financial planning linked to yearly investment. Presentation of such quantitative information supported by justifiable assumptions provides the transparency needed and establishes credibility of the plan.

The chart from Utah DOT (Figure 6, see page 18) shows the available funds, the required funds and the budget deficit to meet the optimal overall condition index (OCI) through 2030. The chart also shows the projected and target Asset Sustainability Index (ASI). The ASI is the

Asset Sustainability Index and Budgets

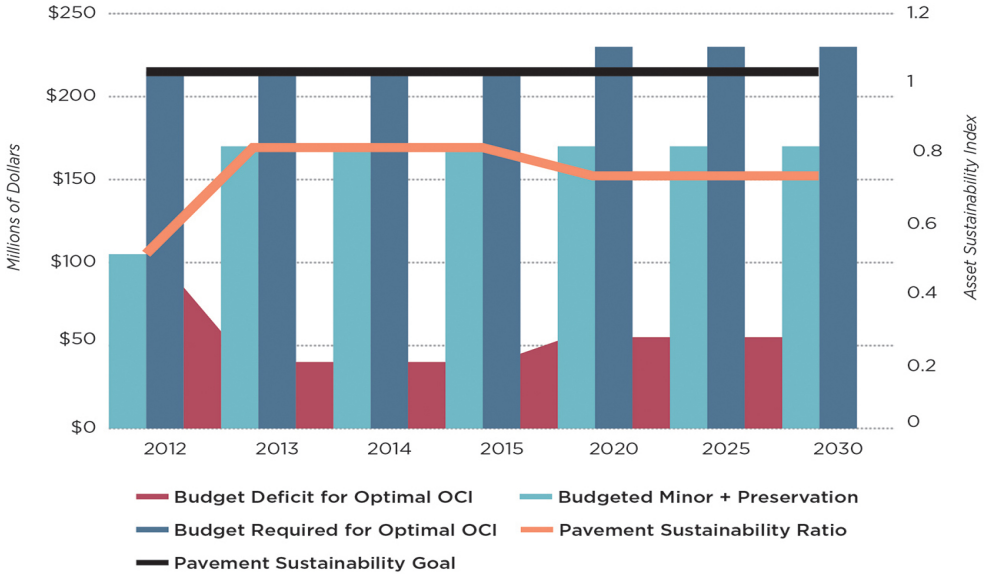


Figure 6. Available, required funds and budget deficit—Utah DOT

SOURCE: FHWA-2012 [VIII]

ratio of the funds available to the funds required to sustain the asset.

These examples are used here to illustrate the importance and value of presenting and providing such detailed information in the financial plan.

Clearly Stating Assumptions

Long term financial plans consist of projections based on various assumptions. The level of detail and reasonableness of the assumptions will serve to establish credibility of the financial plan. For transparency, budget, performance and condition

assumptions made in the development of the long-term asset management and financial plans should be clearly stated in the plans. The assumptions will need to address:

- Expected revenue from taxes and fees
- Future appropriations decisions
- Rate of asset deterioration considered in the long-term projections of asset conditions
- Projected decrease in dollar value due to inflation
- Other assumptions as necessary to address risks associated with timely delivery of the identified treatments

Each state will need to address different performance and asset condition needs that are specific to their situation. For example, some states will consider the impact of natural events such as storms, floods, snow and fires on the projections of asset performance and conditions, and on the funding projections. Some of these situations can be outside the agency's control. For the plan to be credible, it is important to acknowledge these assumptions and uncertainties.

The Rhode Island DOT (RI DOT) asset management plan assumes the receipt of an additional \$551 million over the 10-year period from 2016 through 2025 as shown in Table 1 (see page 20). Based on this assumption, the agency is projecting to invest these additional funds into the bridge, pavement, maintenance and drainage programs. Clearly stating the assumption of expected increase in funding from 2016 will help the DOT to explain any changes that the agency will have to make if such funds do not become available in the future.

Some agencies have adopted a long-term approach by using life-cycle cost management strategies to cost effectively

extend the useful life of assets. However, historically there has not been an overt emphasis on maintenance and preservation of assets.

As agencies develop their TAMPs, they are putting greater emphasis on long-term asset management needs. The emphasis on streamlining and performance-based programs and on achieving and sustaining a desired state of good repair over the lifecycle of assets at minimum practicable costs is becoming the backdrop to financial planning.

States such as Vermont, Colorado and others are putting the emphasis on strategically managing and sustaining assets by managing life-cycle costs with a focus on timely maintenance and preservation. This requires agencies to develop a financial plan that will clearly show the gaps in funding required to achieve the desired performance targets and enable them to develop mechanisms to mitigate these gaps.

The clear communication of these assumptions and the implications thereof in a financial plan establishes transpar-

Revenue Sources	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
Increase in Funding	\$5	\$30	\$53	\$52	\$64	\$57	\$65	\$66	\$78	\$81
Inflation and Gas Tax Yield Loss		-\$2	-\$4	-\$5	-\$7	-\$9	-\$11	-\$13	-\$15	-\$17
Drainage	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5
Better Bridge		\$9	\$18	\$17	\$21	\$17	\$20	\$19	\$23	\$24
Reliable Roads		\$9	\$18	\$17	\$21	\$17	\$20	\$19	\$23	\$24
Enhanced Maintenance		\$5	\$8	\$8	\$10	\$9	\$9	\$10	\$11	\$12

Table 1. RI DOT projections for increase in revenue from 2016 through 2025 and utilization

SOURCE: RIDOT

ency in communication for a transportation agency and lends credibility to its program of responsibly managing its assets.

5. Elements of a Financial Plan

Fundamentally, a financial plan must look at sources of revenue, both current and projected, and expenditure needs, both operational (operation and maintenance) and capital (additions, improvements, rehabilitation, etc.), to satisfy the state's asset sustainability needs and to meet projected demand. The narrative in the financial plan will need to describe the assumptions relating to demand growth, the need for capital for new investments to meet the projected demand, operational and maintenance needs to sustain the existing assets and have them performing adequately, capital improvement and renovation/rehabilitation needs, where applicable, to sustain the state's critical transportation assets and enable these assets to meet the state's level-of-service needs, all with a long-term view. Necessary assumptions relating to inflation, long-term economic and demographic trends, and other such related factors will also need to be considered and described.

Revenue Sources

An agency's financial plan will need to identify and discuss all the sources of revenue available to an agency. For most state transportation departments, the sources tend to include:

- State motor fuel tax receipts
- Federal-aid highway and transit funds
- Various state fees, such as drivers' license and vehicle-registration fees

- Bond income
- Special fees such as development-impact fees
- General revenue transfers, although these usually are rare
- Other sources such as on-time appropriations or income sources unique to the state

Income Sources	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
State Motor Fuel Tax	\$477	\$482	\$487	\$477	\$472	\$467	\$465	\$459	\$464	\$466
License, Vehicle Fees	\$40	\$41	\$42	\$39	\$39	\$38	\$38	\$39	\$40	\$40
Other	\$22	\$21	\$23	\$21	\$22	\$22	\$21	\$22	\$22	\$22
State Bonds	\$150	\$150	\$150	\$100	\$50	\$50	\$0	\$0	\$0	\$0
Federal-Aid	\$650	\$657	\$663	\$656	\$643	\$650	\$630	\$618	\$624	\$605
Annual Redistribution	\$11	\$12	\$14	\$12	\$8	\$9	\$11	\$12	\$13	\$12
ARRA						\$45	\$37	\$42	\$11	\$0
Federal Bonds		\$100	\$120	\$80	\$80					
Total Revenue	\$1,350	\$1,462	\$1,498	\$1,385	\$1,314	\$1,281	\$1,202	\$1,191	\$1,173	\$1,145

Table 2. Theoretical agency's trend of income for the past decade by source

Information such as that presented in Table 2—for a theoretical agency—would be advisable to illustrate the types, magnitudes and trend lines of income for the past decade. In keeping with the intent to illustrate long-term trends for long-lived infrastructure, it is recommended that past streams of income be illustrated for at least the past decade to capture significant trends. Some typical trends that are affecting states include:

- State fuel tax revenue that increased up to about 2008 and has declined since then because of a weakened economy, increasing fuel economy standards, and increasing use of transit or personal transportation;
- The impact of the addition or removal of critical sources, such as fee increases or repeals;
- The magnitude of income dependent upon bonding, which may or may not be sustainable. Many states relied on bonding for a few years to increase revenue, only to have to reduce their bond indebtedness over time with the result of a significant decline in income;
- The one-time impact of the American Recovery and Reinvestment Act (ARRA) funds which are unlikely to be repeated;
- Changes in the availability of Federal-aid funds which are very important to the agency's overall budget.

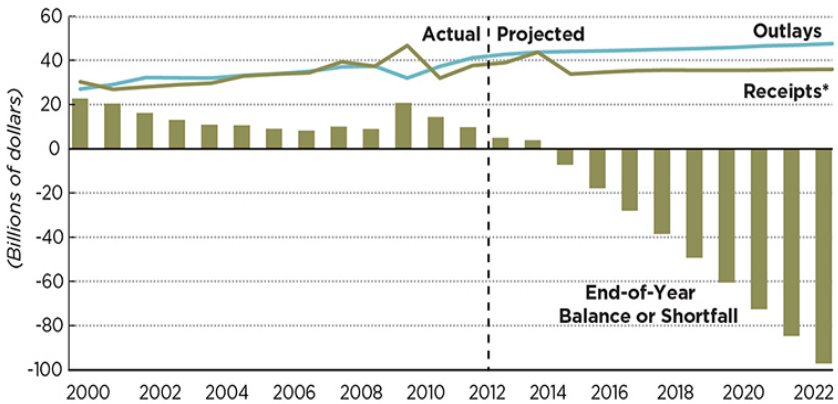
The trends shown in Table 2 are illustrative of trends in a theoretical transportation agency. The trend of the past decade is for an overall decrease in revenue attributable to declining state fuel receipts, the end of unsustainable bonding, and the end of the infusion of ARRA funds. Estimates for future revenues will need to build from this declining baseline.

As agencies estimate future revenues, they will need to articulate their perspectives and interpretation of issues affecting revenues, such as, why motor fuel tax receipts have been declining, or what the ARRA and Annual Redistribution funds are. A key point is the variability of revenue the agency faced over a decade as State and Federal revenues evolved.

A discussion of the Federal Highway Trust Fund would be appropriate in this section of the financial plan. As can be seen from the illustrative example in Table 2, Federal-Aid funds are critical to the overall size of the theoretical State’s program. Yet in recent years, the Federal Highway Trust Fund balances have been in decline and Congress has made several last-minute transfers into the fund from general fund receipts to sustain apportionments to the states.

Figure 7^[ix] provides an illustrative depiction of the amount of “deficit” that theoretically could develop in the Highway Trust Fund if outlays and income trends continue as they are now. Because the Trust Fund cannot deficit spend, appropriations would need to be curtailed or additional revenues provided before the deficit seen in Figure 7 would occur.

Receipts, Outlays, and Balances of the Highway Account



NOTE: Estimates are based on CBO’s May 2013 baseline projections.

*The receipts line includes revenues credited to the highway account of the Highway Trust Fund and intragovernmental transfers to the account. Those transfers have totaled about \$36 billion since 2008. Under a provision of the Moving Ahead for Progress in the 21st Century Act, a transfer of \$10.4 billion from the general fund of the Treasury is scheduled for 2014.

Figure 7. Highway Trust Fund balances and projected shortfalls

SOURCE: CONGRESSIONAL BUDGET OFFICE

The point of Figure 7 is to illustrate the serious structural deficit in the Federal-aid program. An illustration similar to Figure 7 combined with a description of the history of multiple short-term extensions and lack of predictability in Federal-aid funds serves to emphasize the significant uncertainty that an agency would face as it forecast its revenues for the next 10 years.

A point the agency could emphasize is the importance of monitoring the risks of future Federal appropriations during the life of the financial plan. The accuracy of the financial plan will depend in large part upon the accuracy of assumptions regarding federal revenues. In early asset management plans, several states assumed a best-case of stable or continuing Federal appropriations at the level prevalent in recent years. Obviously, increases or decreases above recent levels will impact the overall financial plan. The size of future Federal appropriations is likely to be a major risk and this uncertainty will need to be documented in the risk registers of the overall asset management plan.

Forecasting Future Revenue

A discussion of the agency's best estimates of future revenue, by income source, for the next decade provides the future plan and helps to set the challenges and address expectations. An important observation to be made at this point could be to emphasize the critical assumptions that the agency is forced to make. Each assumption illustrates a major risk that will have to be monitored during the life of the asset management plan. Some of the risks, such as the amounts to be borrowed, may be within the control of the agency. Many others will not. The agency can use this section of the financial plan to explain its assumptions and discuss how much uncertainty it faces as it tries to prepare its long-term revenue forecast, say 10 years into the future. The 10-year period would represent five biennial state

budget cycles and probably two reauthorizations of Federal highway programs. As such, the forecast is dependent upon many assumptions and will probably need to be revisited frequently.

To provide perspective, it is important to discuss the agency's assumptions for future state revenues. The agency can provide its best-case estimate of the rate at which state motor fuel taxes are likely to increase or decrease. A rapidly growing Sunbelt or western state with a strong economy and dispersed population may expect to see its state motor fuel tax receipts increase, particularly if the fuel tax rate has been increased recently. More urbanized states with slowly growing economies and a population with more available transit options may forecast a continuing decline in motor fuel tax receipts. Any additional expertise such as consultation with economists and state treasury officials to develop a consensus forecast of state motor fuel tax forecasts would add to the plan.

Future State and Federal bonding level forecasts will be unique to each State. States with high levels of indebtedness and stagnating revenues may not be able to borrow to a great extent. States with a stronger revenue outlook and lower levels of indebtedness may decide to increase borrowing, particularly for large capital items such as major bridges or extensive pavement rehabilitation programs. The long-lived benefits of those programs may well justify the interest costs from 10-year or even 20-year bonds. The amount of bonding, however, will vary from state to state.

The same variation by state will be seen for the income sources of fees and other unique sources. Depending upon the income sources, past trends, and expected future legislative action, each agency will need to make its own unique forecast for fees and other sources.

Future Federal funding levels represent one of the largest assumptions and greatest risks facing the financial plan. In the early years of the plans, states may want to consider different scenarios. They could develop financial plans under at least three scenarios including:

- Federal appropriations at approximately the same level as the average of the past five years,
- An assumed marginal decrease of 10 or 20 percent, and
- An assumed marginal increase of 10 or 20 percent.

These scenarios would complement other sections of the asset management plan where the sensitivity to system condition levels are illustrated based upon different expenditure levels. Many asset management plans are likely to include scenarios in which bridge and pavement budgets are shown at different levels with commensurate forecasts showing the increase or decrease in asset conditions based upon those expenditure levels. Owing to the significant uncertainty regarding the Highway Trust Fund and the size of future Federal appropriations, scenarios could be used to illustrate the uncertainty faced in the financial plan and the significant impact that different budget levels could have.

Forecasting Expenditures

The forecasting of expenses is as important as forecasting the revenues. The expenditure part of a financial plan draws from the investment analysis section of the asset management plan. It reports upon desired and forecasted levels of expenditures by program areas. Importantly, it shows the gaps, if any, between the desired and forecasted levels of expenditures.

The investment analysis chapters are likely to include forecasts from models showing how much expenditure would be needed to achieve condition and performance targets. Forecasts from pavement and bridge management systems are likely to be produced for those major asset classes. State agencies will use a variety of means to forecast needs for other assets such as traffic control devices, guard-rails, pavement markings, sidewalks and bike paths, lighting, and so forth. In some cases, they will not report on these assets and only report upon the required pavements and bridges. In other cases, states with mature maintenance management systems may use those to forecast needed investment levels. In yet other cases, states could extrapolate from past expenditures to produce forecasts of expenditures needed to sustain condition levels for non-pavement-and-bridge assets.

Agencies face competing demands upon the available state and federal funds. Showing the forecasted expenditure for all categories and not just pavements and bridges will help to better illustrate these competing demands.

It is also important to discuss the State's inflation assumptions. The rate of construction inflation can have a major effect upon purchasing power when compounded over 10 years. Figure 8 illustrates the significant volatility in national construction prices reported by FHWA between 2003 and 2014. Although prices have stabilized in recent years, the inflation growth rate assumed by the state could have a significant bearing upon the purchasing power of the plan. Showing the impact of inflation on the states buying power and the impact on project costs will have a bearing on the funds available to meet the asset needs and the ability to implement timely treatment on assets. These in turn will have long-term implication on the performance and condition of assets.

It is possible for many states that only a minority of their total funds will be available to sustain asset conditions. Other funds may “come off the top” for bond debt, salaries, operating costs, passes through funds to local government or dedicated programs such as safety. Although state transportation budgets can be large compared to the budgets of other state agencies, transportation agencies face many expenses that shrink the residual funds they can dedicate to preserving their asset conditions. Illustrating these factors can be illuminating for legislators and others when they are faced with forecasted shortfalls in funding to sustain asset conditions.

The program categories reported by states are likely to vary significantly. Some states have budget categories for bridges, pavement, safety, roadside maintenance items, as well as new-capacity programs and local programs. Some use the term “maintenance program” to refer to such activities as snow and ice control, mowing and basic roadway repairs.

National Construction Price Trends

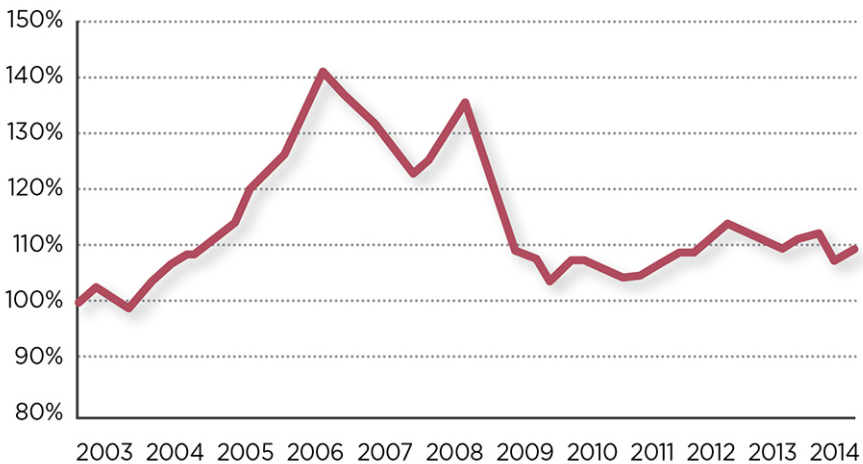


Figure 8. Construction inflation 2003 to 2014

SOURCE: FHWA

Others consider “maintenance” broadly and they include large expenditure programs for significant repairs to existing pavements and bridges. These differences can clearly be illustrated in the financial plan.

Additional explanation can be provided to explain the program categories to provide clarity on the specific approach made by the state. Some examples of program categories include pavement preservation, bridge preservation, bridge maintenance, pavement maintenance, local bridges, roadway asset maintenance, new construction, safety and other local programs. Report 2 in this series will discuss in more details program categories.

The portrayal of expenditures is not intended to be as detailed as a state budget. State budgets exist for many reasons including the control of expenditures within narrow categories to comply with statutory or legislative controls. The financial plan is not intended to be a budgeting document as much as a strategic programming document that illustrates the long-term trends and program amounts affecting infrastructure condition. This more general function of the financial plan allows the State to consolidate expenditure categories and avoid a large number of detailed expenditure categories not relevant to the overall trends related to asset investment.

An illustrative example of expenditure levels for the various budget categories are summarized in Table 3. It is assumed that detailed explanations for how those “need” levels were determined are not necessary in the financial plan chapter because they have been developed in the Investment chapters of the TAMP. To the extent needed for clarity in this chapter, the analyses that led to the “need” levels can be summarized here with the reader referenced to the other chapters for more detail.

Category	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
State Bond Payments	\$100	\$100	\$80	\$60	\$60	\$60	\$40	\$40	\$40	\$40	\$40	\$40
Federal Bond Payments	\$50	\$50	\$50	\$50	\$50	\$50	\$40	\$30	\$30	\$30	\$30	\$30
Operating	\$108	\$111	\$114	\$118	\$121	\$125	\$129	\$132	\$136	\$140	\$145	\$149
Salaries	\$152	\$155	\$158	\$162	\$165	\$168	\$172	\$175	\$178	\$182	\$186	\$189
Equipment	\$41	\$42	\$43	\$44	\$44	\$45	\$46	\$47	\$48	\$49	\$50	\$51
Pavement	\$228	\$228	\$249	\$259	\$250	\$240	\$259	\$257	\$245	\$240	\$240	\$240
Pavement Need	\$235	\$247	\$259	\$272	\$285	\$300	\$315	\$330	\$347	\$364	\$383	\$402
Pavement Gap	-\$7	-\$19	-\$10	-\$13	-\$35	-\$60	-\$56	-\$73	-\$102	-\$124	-\$143	-\$162
Pavement Preservation	\$25	\$26	\$26	\$27	\$28	\$28	\$29	\$29	\$30	\$30	\$31	\$32
Pavement Preservation Need	\$30	\$32	\$33	\$35	\$37	\$38	\$40	\$42	\$44	\$47	49	\$51
Pavement Preservation Gap	-\$5	-\$6	-\$7	-\$8	-\$9	-\$10	-\$12	-\$13	-\$15	-\$16	-\$18	-\$20
Bridge	\$110	\$110	\$110	\$110	\$110	\$110	\$110	\$112	\$113	\$107	\$96	\$85
Bridge Need	\$103	\$106	\$109	\$113	\$116	\$119	\$123	\$127	\$130	\$134	\$138	\$143
Bridge Gap	\$7	\$4	\$1	-\$2	-\$6	-\$9	-\$13	-\$15	-\$17	-\$27	-\$42	-\$58
Bridge Preservation	\$20	\$20	\$20	\$20	\$20	\$20	\$20	\$20	\$20	\$20	\$20	\$20
Bridge Preservation Need	\$22	\$23	\$23	\$24	\$25	\$25	\$26	\$27	\$28	\$29	\$29	\$30
Bridge Preservation Gap	-\$2	-\$3	-\$3	-\$4	-\$5	-\$5	-\$6	-\$7	-\$8	-\$9	-\$9	-\$10
Maintenance	\$44	\$44	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
Maintenance Need	\$44	\$46	\$47	\$48	\$50	\$51	\$53	\$55	\$56	\$58	\$60	\$61
Maintenance Gap	0	-\$2	-\$7	-\$8	-\$10	-\$11	-\$13	-\$15	-\$16	-\$18	-\$20	-\$21
Local Projects	\$45	\$42	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35	\$35
Safety	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
New Construction	\$14		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL	\$978	\$968	\$966	\$965	\$963	\$961	\$959	\$958	\$956	\$954	\$952	\$951

Table 3. Example of forecasted expenditure needs and gaps

Table 3 shows expenditure by example program categories. Juxtaposing the needs and the projected available funding by various program categories for the period of the plan enables an agency to highlight the gap or shortfalls clearly.

Irrespective of the specific format chosen, providing an “at-a-glance” view of the financial picture including a summary view of needs and gaps helps to communicate a lot of information about the long-term financial health of an organization that can be valuable to decision-makers. It helps focus the discussion on the big picture needs and the need for long-term investment.

6. Examples of Recent Financial Plans

States vary in the approach to addressing the financial planning component of the TAMP. The following summaries examine several of the financial analyses included in the first-generation asset management plans produced in the U.S.

New York State DOT Financial Plan

The New York State Department of Transportation (NYS-DOT) May, 2014, Draft Transportation Asset Management Plan does not include a separate financial plan but integrates throughout several TAMP sections, a clear depiction of the agency’s severe financial constraints. The plan does not rely on tables of sources and uses of funds, but it clearly emphasizes in a more general narrative, the serious gap in funding for the preservation of the State’s bridge and pavement assets. Those two assets are the focus of the NYSDOT asset management plan.

On the first page of its executive summary the plan says that the agency's "preservation first" approach will produce higher conditions than if the agency relied on a "worst-first" approach. However, even with a preservation first approach, the resources will fall well short of what is needed to prevent asset conditions from deteriorating further. The current investment strategy will not result in a state of good repair for pavements or bridges and the preservation first approach only slows, and does not prevent, the continuing decline. The plan says that the agency would need to spend \$1.7 billion annually for each of the next 10 years to achieve and sustain a state of good repair. However, current forecasts indicate the agency only will have \$750 million annually for pavements and bridges.

The plan spends considerable effort effectively communicating through the document to enable stakeholders to understand the financial context of the State's efforts to preserve its pavements and bridges. It notes that although the state five-year capital plan allocates \$17.93 billion to NYSDOT, the large majority of those funds are allocated for purposes other than preserving the core highway network. It includes a large table showing what allocations "come off the top". Those include nearly \$8 billion over five years for engineering, maintenance and rights-of-way. Another \$2.9 billion goes to "off system" for local routes. Another \$3.3 billion goes to safety, congestion-relief and other assets. Remaining for pavements and bridges for five years out of the \$17.93 billion is \$3.75 billion.

NYSDOT officials said the asset management numbers were very useful in communicating with local and MPO officials about the reality of the agency's resources. Many officials see the larger \$17.9 billion figure and believe the DOT should be able to devote more resources to other needs, such as additional funding for local assets or more funding for capacity relief. The fiscal analysis in the TAMP helps to

educate stakeholders of the many demands upon DOT resources and illustrates that the agency is left unable to meet one of its core missions, which is to sustain its critical infrastructure. A common reaction was that \$3.75 billion “doesn’t go as far as we thought”.

Agency officials said the Asset Sustainability computations were very useful in communicating to MPOs and to State budget officials. The officials said the projected budget only meets 19 percent of the State’s bridge needs and 36 percent of the state’s pavements needs. The plan notes that with such a low percentages, no matter how sophisticated the treatment strategy, the overall asset conditions will continue to deteriorate. Sustainability gap is the gap between the projected funds needed and the projected funds available to address asset needs.

The agency officials said the long-term planning horizon for the financial analysis and the composite nature of the forecast and the 10-year sustainability gap computations were very valuable. These they said provided a long-term context for where the State’s assets are heading, and provided a general estimate of the amount of additional investment that is needed in future years. They said the sustainability gap computations have already proven catalytic in discussions with local stakeholders and with State budgeters. As state officials consider the next biennial budget update, they already are mindful of the long-term investment needs illustrated by the financial plan and the funds needed to bridge the sustainability gap.

The financial planning exercise and the sustainability gaps calculation caused NYSDOT to crystalize the articulation of some strategies that they had not fully expressed before. In the computation of the funding “need” they included the assets which they expect to be preserved, repaired, rehabilitated or replaced at the appropriate points in their lifecycles.

Agency officials said that some assets are so large and so expensive that they are treated with a “super maintenance” philosophy. That means they may never be completed rehabilitated or replaced because of their cost and the extraordinary maintenance of traffic impacts it would create. The Cross Bronx Expressway is one example. It is repeatedly resurfaced but the agency has no plans to ever reconstruct its pavements. As such, the “need” for a complete reconstruction is removed from the computation of the asset funds “needs” calculation. They said it would have represented an unrealistic result to include such a cost in the “need” calculation. The sustainability computation and the long term financial planning exercise caused the agency to more fully articulate the “super maintenance” strategy that it is pursuing.

Closely related to the financial planning in the NYSDOT asset management plan was the risk analysis. It noted that the greatest risk to achieving the objectives of the plan was the uncertain forecast of Federal-aid. Federal-aid provides 40 percent of the DOT’s capital program and approximately 70 percent of the off-system construction. The 10-year plan will need to be updated if Federal-aid forecasts change. Currently, the plan assumes no growth in Federal-aid amounts. With the Highway Trust Fund depleted, even level funding may not occur.

The asset management plan’s financial analysis served to clarify many financial and policy issues surrounding the DOT’s approach to managing its assets. The acute financial shortfall combined with the state’s commitment to preservation helped to clarify why the state is de-emphasizing capacity additions and is unable to provide more resources to needed local projects. The plan also provided a vehicle for the agency to explain to local stakeholders, the MAP-21 emphasis upon the NHS and why so much of the Federal-aid the State receives will be devoted to preserving the NHS, and

is not available for other local needs. The new Federal-aid categories de-emphasized some of the funding categories that used to be available to locals and rolled them into larger programs that emphasize preservation of the NHS.

The significant underfunding that is expressed as a result of the 10-year financial needs analysis led to the plan noting that there are “profound and practical challenges ahead for New York State.” It notes that left unabated, the amount of “poor” pavements in New York State will triple in the next ten years with the backlog of needed work nearly doubling from \$4.7 billion to \$7.6 billion. Bridge conditions will become approximately 10 percent worse. The cost to restore those assets once they deteriorate will be substantially greater than the cost of maintaining them today.

Minnesota DOT Financial Plan

The Minnesota Department of Transportation (MnDOT) abbreviated the financial analysis in its July, 2014 draft asset management plan because the agency had recently completed an extensive 20-Year State Highway Investment Plan (MnSHIP). The MnDOT expanded the assets in its TAMP beyond bridges and pavements to include Highway Culverts, Deep Storm Tunnels, Overhead Signs, High-mast Lights.

The most noticeable enhancements are the 20-year financial planning horizon and the illustration of how the DOT’s preferred preservation treatment strategies would save billions of dollars over the decades compared to a worst-first approach.

MnDOT estimates in its investment plan that it will have about \$18 billion in Federal and State revenues for capital highway improvements for the 20 years between 2014 and 2033. However, the investment plan also notes a \$12 billion funding gap over the 20-year period. For the first decade, the DOT is

forecasting the ability to sustain most of its asset condition targets and still invest in key safety and capacity projects. By the second decade, stagnant revenues and rising construction costs will cause asset conditions to decline and capacity projects to be halted, if revenue forecasts come to pass. The DOT forecasts 2 percent average increases in revenue but a 5 percent annual construction inflation rate. That will reduce buying power of the forecasted revenue by 60 percent by 2033. An additional \$4 billion would be needed just to maintain today's buying power (see Figure 9).

The 20-year plan indicates that \$30.19 billion is needed over 18 years to meet the need of 10 program categories including pavements, bridges, roadside assets, safety, mobility, local projects, engineering and small program categories. This compares to the \$18 billion expected to be available.

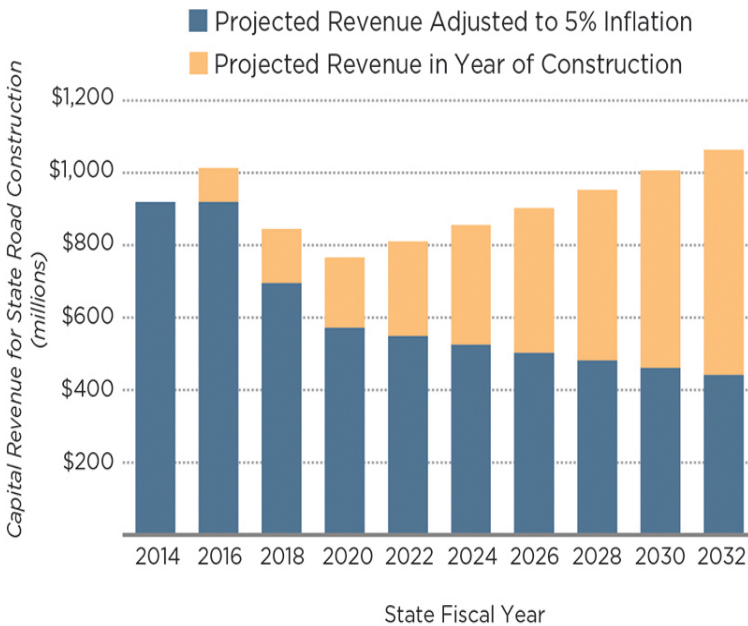


Figure 9. MnDOT’s Anticipated Inflation-adjusted Annual Construction Revenues for the 20-year Plan Period

The DOT notes that the constrained resources prompted a change in strategy compared to past 20-year capital plans. It applies two different strategies to the two decades of the plan. In the first decade, capacity and other mobility projects are included but they are dropped in the second decade. That is because all available funds will be needed for asset preservation. Even with the dropping of the capacity program, asset conditions are expected to deteriorate.

For pavements for the first decade, the department projects to spend \$2.89 billion. With that investment, only 2 percent of interstate highways and 4 percent of other NHS routes will be in poor condition. However, poor pavements associated with non-NHS roads will increase from 7-8 percent today to 11-12 percent. For the following decade, pavement expenditures are projected to rise to \$5.41 billion, yet conditions will continue to worsen. While Interstates will stay at only 2 percent poor, the other NHS and non-NHS routes with poor pavement conditions are projected to increase by two to three times. For the two decades, the DOT projects to spend \$8.3 Billion for pavements compared to a need of \$10.76 billion. The \$10.76 billion would be needed to achieve the aspirational goals of:

- Interstate pavement at only 2 percent poor condition and 70 percent good,
- Other NHS at 2 percent poor and 70 percent good, and
- Non-NHS 3 percent poor and 65 percent good.

To meet aspirational bridge condition targets over 20 years would require \$5.11 billion compared to the \$3.42 billion available over 20 years. Roadside infrastructure such as overhead signs, culverts and rest areas would need \$1.71 billion to meet targets compared to \$1.49 billion available. The percentage of the department's capital program that

will be devoted to asset management rises from 67 percent in the first decade to 89 percent in the second.

The department also forecasts significantly increased risks in the second decade. It indicates that as risks increase, it will not meet its pavement and bridge targets set for its Government Accounting Standards Board 34 reports. That could reduce its credit worthiness and increase its borrowing costs. It also may fail to meet the MAP-21 performance targets, face higher maintenance costs and the conditions will not meet public expectations.

The department emphasizes the large size of the State’s investment in its transportation system. It notes that 74 percent of the State’s entire infrastructure by value (Replacement Cost) is contained in its 14,000 mile state highway system. Table 4 shows the value based on the replacement cost of MnDOT’s assets.

The department used its pavement and bridge management systems to forecast costs and performance for three scenarios: a current scenario with a mix of timely preservation treatments, an optimized treatment timing scenario and a worst-first scenario. The analyses showed a dramatic savings

Asset Class	Replacement Cost
Pavements	\$29.5 billion
Bridges	\$6.6 billion
Hydraulic infrastructure: Highway culverts	\$1.7 billion
Deep storm water tunnels	\$300 million
Overhead signs	\$200 million
High Mast Light Towers	\$19 million

Table 4. MnDOT Asset Replacement Costs

SOURCE: MNDOT

with the current treatment mix compared to adopting only a worst-first scenario. Over a 70-year analysis period for pavements, the department saves \$17 billion or \$570,000 per lane mile. For bridges, the department's preservation strategy extends bridge life from about 50 years to 80 years with a 37 percent lifecycle cost savings. That equates to an average savings of \$415,000 per bridge or \$581 million for the entire NHS over a 200 year analysis period.

The department also calculated the lifecycle costs of assets as a percentage of their initial investment. This analysis illustrates the long-term costs of assets, in addition to their initial construction costs. It estimates that the lifecycle costs compared to initial construction costs for the following assets are:

- **Pavements:** 142 percent of initial investment,
- **Bridges:** 142 percent,
- **Large culverts:** 139 percent,
- **Culverts:** 443 percent,
- **Deep storm water tunnels:** 252 percent, and,
- **Overhead signs:** 129 percent.

The Department used this data to illustrate the average annualized cost per asset per year. That resulted in the following conclusions:

- Pavements cost on an annual, average basis \$12,000 per lane mile to build and maintain,
- Large bridges cost \$16,000 per bridge,
- Large culverts over 10 feet cost \$1,300 per year,

- Small culverts \$150 per year,
- Deep storm water tunnels cost \$30,000 per mile of tunnel,
- Overhead sign structures cost \$900 per year, and;
- High mast light structures cost \$400 per year.

Officials at MnDOT said the investment plan and the asset management plan are having an important impact on their agency's planning and programming decisions. Driven both by the investment plan and the MAP-21 focus upon NHS performance, the agency has its funding categories changed significantly to direct more resources and to put a higher priority upon the NHS conditions. Some district autonomy for investment decisions needed to be reduced and more centralized project-selection processes were needed to ensure the focus on the NHS conditions.

Agency officials said that they are also seeing significant references to the investment plan and the asset management plan in MPO decisions. From those references they believe that the plan and the related financial information and analysis are increasing the understanding of asset management needs.

They recommend that the asset management and financial plan not be viewed in isolation but be considered as part of the existing, overall planning process. While asset conditions are important to the public, for many stakeholders, asset conditions are just one of many key decisions that need to be balanced. Needs for capacity, safety, community development and environmental conditions need to be considered along with the condition of assets.

The agency advises other states to consider the need for public and stakeholder involvement in the asset

management and financial plan. They said that without buy-in from the public and from key stakeholders, the value of the plan could be reduced. Because assets consume such a large percentage of the total capital program, it is important to have credibility in the plan. Their investment plan included substantial public engagement including public comment upon three different investment scenarios. That inclusion led to greater understanding of the plan and why the department reached the conclusions that it did.

Colorado DOT Approach

Colorado DOT is responsible for the maintenance and upkeep of over 9,100 miles of highways, 3,400 bridges and a large fleet of over 3,300 vehicles. Policy Directive 14 (PD14) defines the framework for transportation planning in the state including the agency's goals and objectives which guide the allocation of resources within the agency.

The CDOT TAMP finalized in December 2013 is a **fiscally balanced plan** for maintaining, preserving and improving the asset conditions over a ten-year planning horizon (July 2014-2024.)

With increasing public demand for services and diminishing funds, CDOT has approached the transportation asset management effort as one that would provide a framework incorporating risk-based and data-driven approaches to making funding decisions based on asset performance. It also looks at transportation asset management as a way to develop more efficient strategies that can be applied state-wide to direct funds to critical needs, develop trade-off tools, and focus on the use of engineering treatments at the lowest life cycle cost.

As part of the process used to establish its first TAMP, CDOT conducted a survey of its citizens to identify priorities for the agency. Survey results indicated a clear mandate for the agency to prioritize the preservation and maintenance of its assets.

The asset management framework for CDOT incorporates addressing risks in decisions. The CDOT assets considered in the TAMP include structures, pavements, bridges, maintenance and traffic assets, buildings, Intelligent Transportation System equipment, fleet, tunnels, culverts, and rock fall mitigation sites.

CDOT is in the process of developing a 20-year performance versus funding curve for each asset class. CDOT has a very strategic approach to long-term funding of assets to achieve the expected level of service (LOS). This information will be a vital part of projecting the funding needs for long-term maintenance and preservation of assets and to provide the LOS expected by the public.

The CDOT TAMP prioritized and identified forecasts of its

Areas of emphasis in the CDOT TAMP include:

- *Long-term 10-year planning horizon*
- *Integrating risk analysis into the planning and programming processes*
- *Incorporating Financial Planning into the TAM process*
- *Analyzing budget trade-offs across asset programs*
- *Incorporating specific investment strategies to preserve and maintain the transportation system at the lowest life-cycle cost*
- *Establishing Asset Management Performance Measures and Targets*
- *Providing value to the State's citizens*
- *Conducting an Asset Management Gap Assessment*
- *Establishing a process for future improvements*

long-term asset condition and performance requirements. The plan accounted for both fiscally constrained and aspirational goals.

The agency generated multiple scenarios to understand the impact of different levels of funding on the performance of bridges and pavements. Figure 10 shows five such scenarios of funding and the impact of these different levels on bridge performance. The \$168 million shown in black in Figure 10 is the performance projection based on the DOT’s FY2015 budget. It shows the percentage of structurally deficient deck area on bridges increasing from about 6% to nearly 10% over a 20-year period. Because there is not enough funding to address the Bridges that are in “poor” condition, or moving towards “poor” condition, the DOT uses a bridge prioritization system to address highest priority bridges first. A combination of quantitative and qualitative factors is used in this ranking process.

Bridge Performance Versus Funding

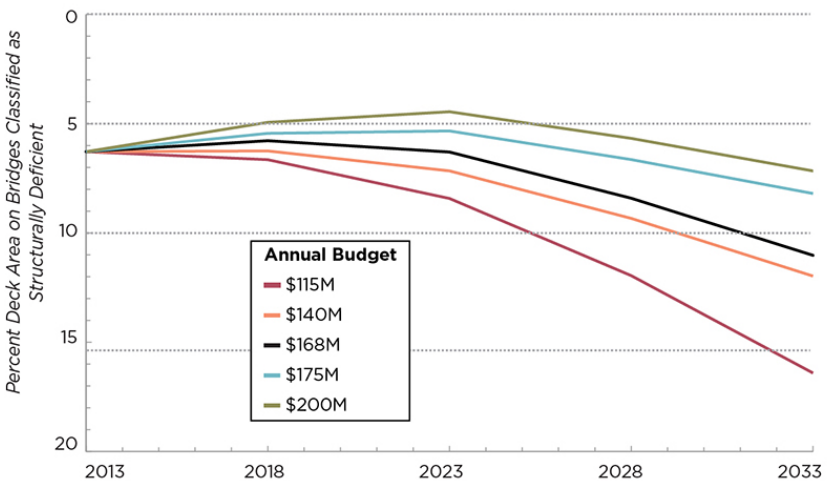


Figure 10. Impact of funding on bridge performance

SOURCE: CDOT

Figure 11 shows impact of similar analysis of different levels of funding on the long term performance of pavements. The agency said that because over 50% of the pavements are in “Moderate” category, without additional funding, these segments would fall into the “low” category. The TAMP notes that the extent of reduction in performance in the early years is directly proportional to the level of funding available.

CDOT uses annual Delphi workshops as a formalized process to obtain recommendations from its staff consisting of asset managers, budget staff, senior management and region staff. Final budget recommendations from the Delphi workshops are provided to the Colorado Transportation Commission, which makes the fiduciary decisions and establishes the annual budget for that year. CDOT staff and asset managers evaluated the agency’s needs and developed scenarios to make funding trade-offs across asset classes at a FY 2015 Delphi Workshop.

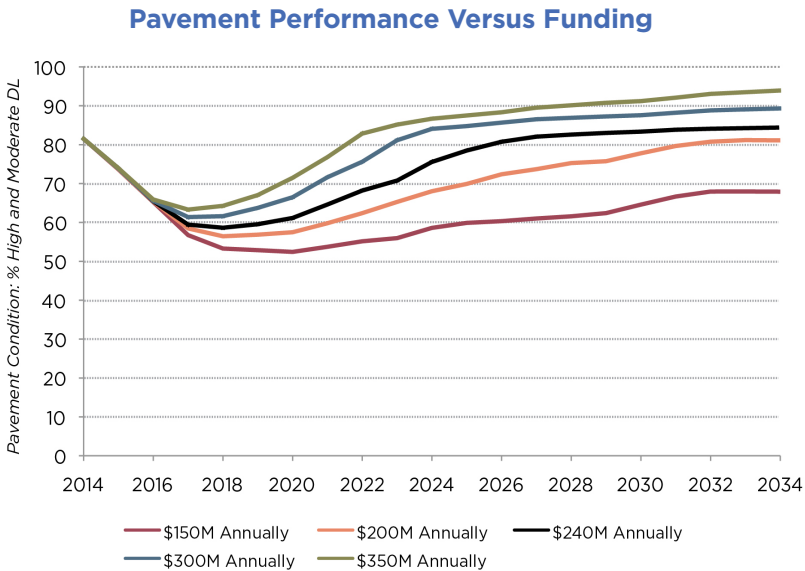


Figure 11. CDOT Pavement Performance versus Funding

SOURCE: CDOT

CDOT has adopted financially and strategically prudent long-term strategies and these are reflected in the agency's TAMP. The agency has adopted the strategy that timely preventive maintenance and rehabilitation can slow the deterioration and cost effectively extends the useful life of an asset. Extending the useful life and delaying the need for replacement drives down the overall cost of ownership. The information and analysis about suggested treatments from the pavement management software and Life-Cycle Cost analysis (LCC) plays a big role in the agency's project and treatment selections. In its project selection process for bridges, the agency takes into account structure type, lowest first cost, corridor requirements or National Environmental Policy Act requirements. The agency's activities relating to extending the service life of bridges inherently takes LCC into consideration. Analyzing the needs across all asset categories, the agency has provided the highest priority to preventive maintenance and asset preservation.

Other initiatives such as the Responsible Acceleration of Maintenance and Partnership (RAMP) program and the Funding Advancement for Surface Transportation and Economic Recovery (FASTER) have significantly influenced the financial planning and budgeting processes associated with CDOT's TAM process.

Developing projections of the long-term asset performance and condition and projecting the funds required to achieve these goals for the ten-year period has enabled the DOT to present a realistic picture to the legislature and to the public. This also resulted in the dialog of stakeholders that led to the FASTER and the RAMP initiatives.

Focus on Bridges, Pavements and Maintenance

CDOT's focus on maintenance and preservation of assets is reflected in the way it has allocated funds. The allocation of

funds in the agency’s annual budget reflects this philosophy. The DOT’s annual budget varied from \$800 million to \$1.6 billion from 2008 to 2014 of which \$450 to \$600 million has gone towards asset management activities. The amount assigned to maintenance activities has been between \$200 and \$230 million. For the seven-year period approximately 80% of the funds have gone to pavements, bridges and maintenance activities. The remaining funds have been utilized on other asset categories.

Figures 12 and 13 (see page 48) summarize the historical and projected budget levels by asset class for CDOT’s asset management activities. These figures show that the budget

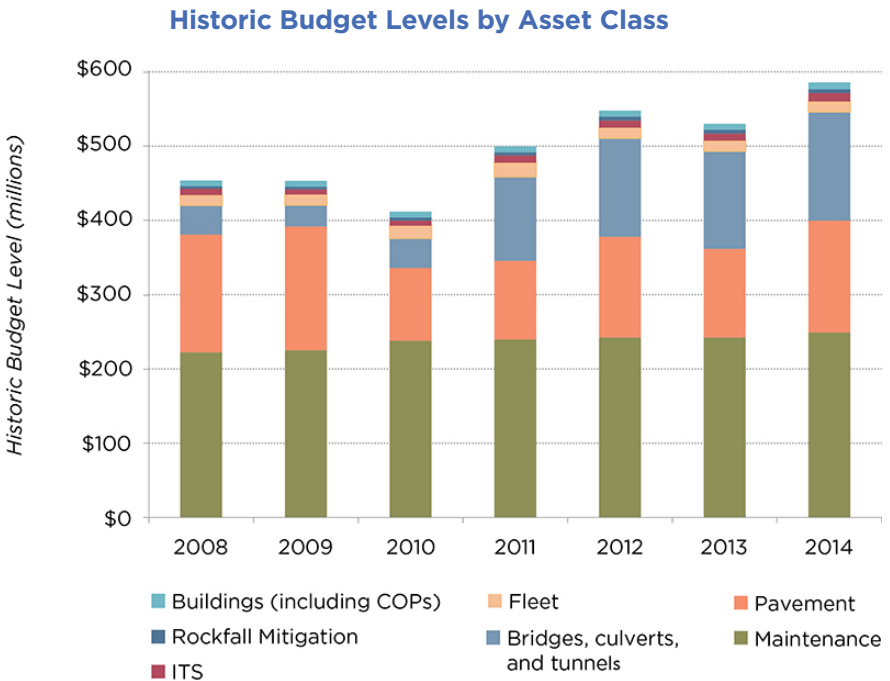


Figure 12. CDOT’s Historical Budget levels for Asset Management by Asset Class

SOURCE: CDOT

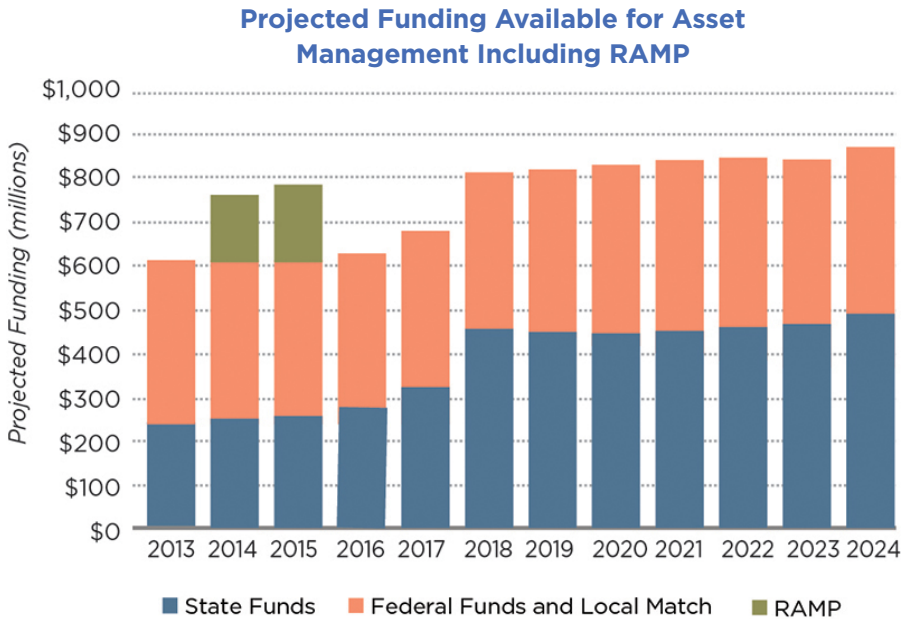


Figure 13. CDOT Projected Funding for Asset Management

SOURCE: CDOT

levels decreased in 2010 and showed a slow but steady increase thereafter through 2012. The projected figures show a relatively flat budget for the 5-year period thereafter (through 2017) before seeing a step jump in 2018 and remaining flat once again thereafter. This step jump is a result of the retirement of CDOT’s Transportation Revenue Anticipation Notes (TRANS) bond debt service, thereby freeing up \$167 million for use elsewhere, which have been allocated for asset management programs. However, as a result of CDOT’s RAMP program, additional funding availability is projected for 2014 and 2015.

This kind of detailed long-term funding analysis helps the DOT and state decision makers take actions that will help sustain the asset performance and condition into the future.

7. Asset Valuation

The value of an asset is a very important factor in the planning of strategies for its long-term preservation, maintenance, rehabilitation and replacement. An organization may consider it more cost effective to replace an asset that has a very low value if replacing the asset is more cost effective and if disposal costs do not make such a strategy expensive. However for high value assets such as bridges and pavements, timely maintenance and preservation are critical to cost effectively extending the useful life.

Asset valuation is the process of assigning monetary value to an asset. For private assets and publicly traded assets, asset valuation is the factor that determines how much an investor is willing to pay to buy an asset. It is also the information that helps investors decide if they should invest in a given portfolio. Valuation is at the heart of decision making when investments and acquisitions are evaluated in the corporate world. It is a guide to the worth of an investment portfolio or of an asset.

The Australian infrastructure financial management guidelines ^[x] explains asset valuation as being an important tool in assisting asset managers assign monetary value to assets in order to plan for their long-term financial management. It also discusses the importance of asset valuation in effectively communicating the value of assets to the public and other stakeholders. Australian accounting standards (AAS 27 and AAS 29) require annual valuation of infrastructure assets. This approach enables the understanding of the value of the infrastructure assets managed or owned by a state, local agency or nation as a whole. Without such an appreciation for the value of infrastructure assets, the public will be unable to appreciate their importance and the need for their long-term management and related funding.

The Concept of Asset Valuation

In the simplest terms, the value of an asset determines the cost of selling or purchasing it. With the exception of toll roads, infrastructure assets are not likely to be bought or sold but the same concept can be applied to it.

Asset valuation shows the cost of building or procuring the asset in an as-is condition. It enables public officials responsible for the management and maintenance of these very important and critical assets to communicate their worth. This aspect is often forgotten when valuation is not part of the discussion. Asset valuation provides the quantitative framework and highlights the investment in monetary terms.

The monetary value casts the light on the importance of this portfolio of public investment and the need to preserve its value. Doing so makes it easier to communicate the need to manage it and minimize its deterioration. The need for preserving, maintaining, and ensuring that these important assets do not deteriorate and become expensive to replace, becomes sound and responsible public policy decisions. It logically emphasizes and encourages the need for sustainable long-term asset management practices.

By computing the value and effectively communicating it, asset managers enhance the ability for decision makers to convey the importance of maintenance, preservation and rehabilitation of existing infrastructure assets. When resource balancing is required, valuation also helps prioritize the funding needs amongst the various categories of assets.

An example can be seen in the Utah DOT's valuation of assets and in the priority ranking indicated by the DOT. Table 5 shows the valuation of assets by Utah DOT and displays the assets in descending order of value. The valuation shows that the agency's pavements are valued at \$24 billion and bridges are valued at \$5 billion. Together, these two assets constitute about 84% of the total value of the agency's assets. This valuation of assets was used by the agency as input to conduct a risk analysis.

The agency created 3 tiers of assets based on the value of the asset, risks of nega-

Priority	Feature	Value
1	Pavement (yd ²)	\$24,000,000,000
2	Bridge (ft ²)	\$5,000,000,000
3	Walls (ft ²)	\$3,400,000,000
4	Culverts (ea)	\$1,000,000,000
5	Barrier (ft)	\$438,000,000
6	Signs (ea)	\$264,000,000
7	Fences (miles)	\$70,000,000
8	Signal Cab (ea)	\$353,000,000
9	Pavement Marking Paint (miles)	\$33,000,000
10	Cattle Guards (each)	\$20,000,000
11	Paint Messages (ea)	\$8,800,000
12	Rumble Strips (miles)	\$6,000,000
13	Power Ped (ea)	\$3,000,000

Table 5. Utah DOT Valuation of Assets

SOURCE: UTAH DOT

tive financial impact for poor management, importance to the agency's performance, operational risks, whether or not the asset had a separate and stable funding source to preserve condition, and other data and informational risks. Strategies for managing assets in each tier were then developed with asset valuation and risk considerations being major factors in the management strategies. Such valuation highlights the importance of the assets and allows the agency to assign resources appropriately to address assets and mitigate risks based on the value of assets.

Asset Valuation is Routine in the Private Sector

Asset valuation is routine in the private sector. The value of assets is one of five main elements of financial statements

(income, expenses, assets, liabilities and equity). Global stock markets track these five elements to gauge the health of publicly traded companies. Investors study and monitor these factors, including the value of the assets, while making their investment decisions. The value of assets for manufacturing,

Preservation and Maintenance are critical to cost effectively extending the useful life of assets. It seems irresponsible to have to pay high cost for reconstruction and rehabilitation when significantly smaller amounts on maintenance and preservation can reap more benefits, cost less and leave our assets in good if not better condition for the use of future generations.

construction, services, and financial investment companies differ. They also differ based on the products of the company. Accounting for depreciation of assets such as equipment, and appreciation of assets such as real estate and goodwill, make a big difference on the worth of a company.

The strategies to manage assets also depend on the products and services of a company. It would be irresponsible

for a railroad to not invest in routine maintenance and preservation of its tracks and trains, and to allow its assets to deteriorate. Similarly, a financial investment company would have to routinely manage the value of its investments, study the long-term management strategies of its portfolio companies and proactively move out of investments that show significant downward valuation trends.

Reporting on asset valuation is part of routine market updates provided by the private sector. Providing market updates and clearly indicating all assumptions in the financial disclosures submittals, is mandatory for publicly traded companies.

Asset Valuation Helps Communicate the Prudence of Long Term Asset Management

Presenting the value of the assets owned and/or maintained by a public agency such as a transportation agency makes it easier to provide context to the funding needs of the agency. It makes it easier to communicate the financial requirements and budgets needed to preserve and maintain the assets. As assets deteriorate, the asset value falls and the cost of fixing and rehabilitation or replacing the asset increase. Asset valuation thus also provides the framework to communicate to the public and explain the additional cost of rehabilitation and loss of asset value that will result without long-term preservation and maintenance of these assets.

This concept is illustrated for a pavement structure in Figure 14 (see page 54), which shows that early maintenance will be less costly than a rehabilitation that is performed after the structure has deteriorated (O'Brien ^[XII], 1989). Washington DOT adopts this model to time maintenance activities to extend the useful life of assets at the lowest life cycle cost.

An agency can use the cost of applying different treatments to rehabilitate pavements along with various scenarios to explain cost effective strategies it plans to use to retain the value of the assets, and also to explain the loss of value of important assets.

In Australia, the practice of assigning monetary value to highway assets is a key component of the asset management and financial plans. Assigning monetary value to assets and tracking the change in that value over time has led to recognition that highway infrastructure is an important community asset that needs to be preserved and enhanced for future users. The emphasis upon preserving asset values further supports a sustainable approach to preserving assets so they are available to serve current and future users.

There are many ways to show the value of assets. The approach used to compute it impacts the final asset value presented. Asset valuation is also a good tool to realistically capture and present how assets depreciate. In the case of infrastructure assets, applying timely maintenance and preservation treatments slows the rate of deterioration and extends the remaining useful life. Preservation and maintenance thus improves the value of the asset. On the flip side, delayed preservation and maintenance accelerates the deterioration and reduces the value of the asset.

Asset valuation can help an organization highlight the importance of its assets. It can help communicate their value and the need for preservation and maintenance, and for not allowing the value of these important assets

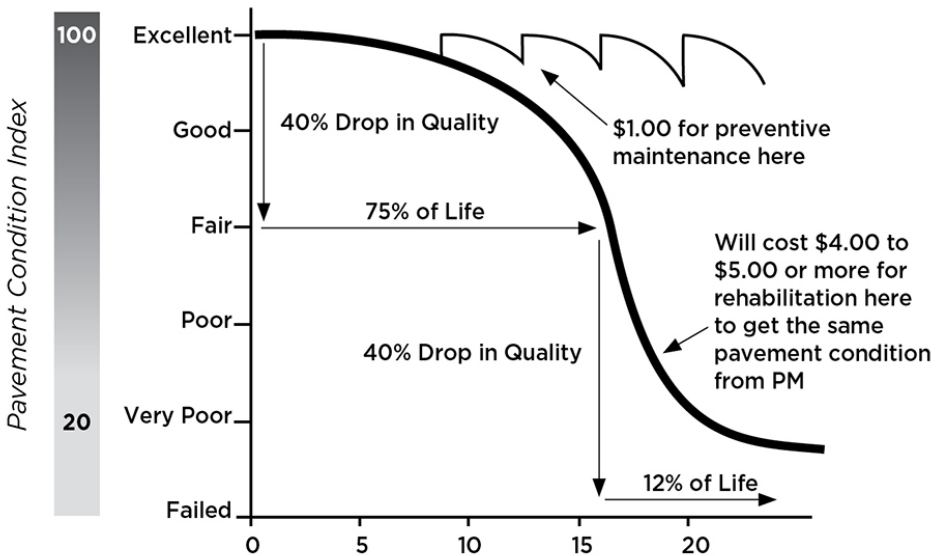


Figure 14. Benefit of preventive maintenance on pavement condition

SOURCE: O'BRIEN^[X], 1989

to depreciate rapidly. It can also help to communicate the responsibility of transportation agency officials in the long term management of these assets.

End of Useful Life

The financial valuation of assets can also help to convey the need to replace an asset when the end of its physical or useful life is reached.

Infrastructure assets have tremendous value not just because of the asset valuation but also because of the impact they have on commerce, the daily life of users, and the life of the

The useful life of an asset is the period over the life of the asset when it is expected to be available for use.

community. Most consumers take these impacts for granted. Transportation infrastructure directly enables movements to and from communities and commerce centers within the state, to and from other states, and nationally. The

importance of this factor alone is sufficient to emphasize the need to preserve and maintain these assets, maximize and extend their useful life cost effectively, and replace them when they reach their end of life. Proactively managing the end of useful life of assets enables the planned replacement that is required for continuation of services to the community.

MAP-21 and Implications of Asset Valuation

MAP-21 has refocused the attention of legislatures and the public on the state of the nation's critical and most valuable assets. It has also drawn attention to the age and condition of the assets by requiring agencies to identify their system condition and develop a plan to improve it to specified

standards. This translates to identifying, (a) the critical funding needed to improve, preserve and maintain the good assets, and (b) the funding needed to rehabilitate and replace those that are aging and in poor condition. By necessitating such funding needs, the emphasis on preservation and maintenance is highlighted. MAP-21 has thus brought to the forefront, the discussion on the state of the system.

Asset valuation and financial plans incorporating these aspects will show that it is sensible and responsible to focus on long-term asset management involving preservation and maintenance of existing assets and help agencies reap long-term benefits more cost effectively. It will also show the negative implications of taking short-term management measures such as worst first treatment approaches. A long-term strategic approach to managing assets by doing routine maintenance and timely preservation treatments costs less and extends the remaining useful life of assets that have not progressed too far in the deterioration curve.

Asset valuation provides the information to explain where preservation and maintenance will work and where rehabilitation and reconstruction is necessary.

Some transportation structures are critical and cannot be easily valued. An asset valuation exercise can illustrate the very high cost of replacing such assets and help communicate the importance of preserving and maintaining them. In such cases, DOTs may adopt a special strategy to keep the asset in good condition. To illustrate, the Brooklyn Bridge is an asset where the DOT spends about \$20 million a year in accelerated maintenance to keep the bridge in good condition. Valuation results for examples such as this will help agencies communicate the tiered approach of addressing preservation and maintenance. This may involve maintaining the condition of the “fair” and “good” assets, improving the condition of the “fair” assets, or in some case letting the

“poor” assets drop till they can be replaced—thus making the most effective use of the taxpayer monies.

How to Value Assets

There are many methods used to value an asset. Private companies and public agencies differ in how assets are valued. The intent of valuation is different for these organizations.

At the simplest level the value of an asset is based on its fair value. The computation of current value or book value of an asset takes into consideration the value of the asset at the time of purchase or construction, and applies depreciation to it, where depreciation is that part of the cost of the asset that has already been consumed. This method of valuing assets is more common for public transportation agencies.

A few of methods to value assets are as follows, with the differences being attributable to how the “consumption” or “depreciation” is applied:

- 1. Straight line depreciation**—This method assumes the consumption of the asset to be constant over the useful life of the asset.
- 2. Declining balance method**—This method assumes the consumption to be higher in the early stages and to be less towards the later years of the asset’s life.
- 3. Increasing Consumption**—This method assumes the consumption to be less in the early stages and increase towards the later years as the asset reaches the end of its useful life.
- 4. Unit of Production**—This method assumes that the consumption is based on the output, on units of product output or service provided.

Note that these methodologies do not account for the value of the intangible benefits of the asset or the effects of cost increases due to inflation. A roadway asset may provide numerous intangible benefits to a community, other than simply providing a means of access, and the community may be willing to pay a price for such intangible benefits. A fair value computation of a public asset would thus need to account for the monetary value of such intangible benefits.

This concept is very well accounted for when a private company values its assets. Consider for example, a company that has constructed and operates a toll road which receives revenues from toll collection. Such a company may use

Fair value is what a knowledgeable buyer would be willing to pay for the asset and is routinely followed in the private sector.

several methods to compute the fair value of its toll road asset. An objective approach to valuation would typically involve the use of a discounted cash flow methodology. This methodology will take into account the net annual cash flows projected to be available to the company for

the useful life of the asset, after accounting for expenses related to operations, routine maintenance, major maintenance, debt service (if applicable), capital improvements, etc., discounted appropriately to compute the net present value. The rate at which the cash flows are discounted may typically account for a long-term bond rate which would be representative of a risk-free rate plus some premium to account for perceived or assessed risks to achieving these projected cash flows. The asset value so computed principally represents the net present value of the net monetary benefits from the asset, and for a profitable toll road, would be higher than the book value of the asset (construction cost less accumulated depreciation). This value would represent what a buyer might be willing to pay to acquire such an asset (fair value).

The two commonly used methodologies for depreciating transportation assets in the U.S. are the straight line depreciation and the declining balance methods.

When one considers the replacement value of an asset at any given stage of its useful life, it would be pertinent to also consider the effects of inflation in the construction costs.

Assets may be revalued from time to time. In Australia, it is mandatory for companies to revalue their assets from time to time and arrive at the fair value. Impairment of assets, major market shifts, inflation, and significant increases or decreases in cost of components and construction materials are factors that would logically indicate the need for revaluing an asset.

DOT Approach to Depreciation

As seen from the description above, application of depreciation is key to how a public agency would value its assets. The concerns over financial sustainability and transparency in reporting on long-term government obligations that arose internationally also were embodied in the U.S. Governmental Accounting Standards Board statement 34 (GASB 34) that was enacted in 1999^[xiii]. GASB 34 was intended to demonstrate the extent to which governments were accruing long-term, unmet financial liabilities that eventually would reduce the government's ability to meet its service obligations.

One of the two major changes to government financial reporting required by GASB 34 involved the accruing of depreciation of assets to be reported on the agency's financial statements. This requirement was intended to be much more than a technical accounting change.

GASB 34 generated many comments from agencies who took issue with only capturing depreciation and using

depreciation as a means to estimate needed investment. GASB 34 rules were expanded to allow agencies to use a “modified” accounting approach.

The modified approach allows agencies with sufficient asset management systems to rely on those systems to document that the agency was adequately maintaining its assets and not accruing significant future financial liabilities to reduce backlogs of unmet maintenance needs.

The criteria to be able to use the modified approach are to have an up-to-date asset inventory, perform condition assessments of those assets, and estimate each year the annual amount needed to maintain and preserve the assets at a determined condition level. Agencies using the modified approach are to document that asset conditions are updated at least every three years and show that for three updates the assessments documented that assets are being preserved approximately at the desired condition level.

An NCHRP 2008^[xiv] report stated that most of the agency officials who participated in a workshop reported that the GASB 34 reports had become “just one more administrative task.” The agencies reported receiving very little interest in the

GASB 34 reports from outside entities, legislative bodies or the investment community. The report’s conclusions say that for GASB 34 to play a substantial role in supporting sound asset management, substantial changes in its rules would be needed. Weaknesses with capitalizing replacement assets also divorced GASB 34 valuations from the on-the-road realities of what agencies were

NCHRP 2008 Report on GASB 34—Issues identified

An asset replaced, is to be listed with the same value as the old asset if the new asset provided a comparable level of service. This results in a new bridge having the book value that is the same as an old depreciated bridge that it replaced.

actually investing in assets. Therefore GASB 34 in its current implementation does not accurately reflect the value of a state's transportation assets. The values of these assets per GASB 34 are significantly lower than the actual value of these assets. If the valuation from GASB 34 would be used to compute the value of replacing the infrastructure assets, nationally they would reflect the value of assets as only a fraction of the actual value and the cost to replace aging assets would incorrectly reflect the need for a very small investment.

DOTs such as Utah DOT are moving towards doing asset valuations that will be a closer reflection of the asset value and also reflect the cost of timely preservation and maintenance versus delaying such action.

Irrespective of the method used for valuation it should reasonably reflect the consumption and the cost of replacing the asset.

Australia: Approach to Valuation

The Australian Infrastructure Financial Management Guidelines Quick Guide Version 1.3 considers the value of an asset as the cost of an acquisition or construction of a physical asset. This can include the cost and other directly attributable costs such as the cost of bringing the asset to the location and setting it up ready for operations. Other costs that are directly attributable to the construction or acquisition of assets can be included. All delivery and testing costs are also considered direct costs and are included in the valuation of the asset. These costs add up to be the fair value of the asset at the time of purchase or installation.

As the asset is consumed, the future economic value of the asset is considered to decline. The rate of this decline is computed using one of the methods of depreciation addressed earlier. An asset can be impaired and decline to

a value below what is indicated by depreciation. Factors such as floods and fires are examples of what can cause impairment beyond the normal depreciation and cause the asset to lose value.

Future Economic Value

The future economic value of an asset is the benefit from the ability to provide to the public, the service required from the investment. The intent in managing transportation assets is that the benefits from the investment should exceed the cost

Risk is the positive or negative effects of uncertainty or variability upon agency objectives.

of the investment. Though not a requirement, agencies such as Colorado DOT have successfully used the future economic value of transportation assets to convey the need for investment in infrastructure assets. The DOT's TAMP

states that "Colorado households and businesses indicate the value of transportation in Colorado through the \$54.8 billion they are willing to pay for the transport of people and goods each year."

Preservation and maintenance activities support the future economic benefits and help to convey the importance of leaving the assets in better, if not as good condition as they are today. More important is the objective of not burdening future generations with the costs needed to fix critically failing infrastructure.

Financial planning provides an excellent way to capture the future economic value of an agency's assets. It is an effective tool to illustrate the magnitude of investment and show the enormous public value of the infrastructure assets. It therefore emphasizes the need for preservation and routine maintenance, so as to enable the handing over of the assets

to future generations in good condition. By providing the tools to communicate the depreciation of the assets, it is possible to further emphasize the need to preserve them and improve asset conditions systematically to extend their useful life.

In conclusion, if the consumption of the asset is such that the future cost of investment exceeds the benefit of an asset, it is a bad investment. Preservation and maintenance activities reduce the rate of consumption of the asset, reduce the impact of use (wear and tear) and increase the future economic benefit.

8. Financial Risks

All organizations, private and public have to make assumptions in developing their financial plans. Corporations use them to plan growth and maintain existing assets. It would be irresponsible for a corporation to ignore the care and maintenance of existing assets and let them deteriorate while investing in new assets, unless the intent was to write-off the existing assets.

Strategic asset management plans should first establish how the long-term needs of preserving and maintaining existing assets will be addressed. A financial plan that focuses on adding capacity without addressing the preservation and maintenance needs of existing infrastructure is an indicator of risks to existing assets.

The majority of transportation agency assets are expensive to build, replace and rehabilitate. Additionally, activities such as replacing or rehabilitating a bridge or a road can cause considerable inconvenience to road users. Extending the useful life of infrastructure assets in a fiscally balanced way is an important responsibility that transportation agency

leaders take very seriously. The financial plan distills the agency's funding responsibilities and establishes the way it intends to implement and fund its activities.

The financial plan is a forecast of the funding for the long-term. Agencies vary in the number of years they address in the financial plans. The Colorado DOT and New York DOT have a ten year analysis in their financial plans. These are projections for future years and are based on many assumptions and scenarios. The uncertainties associated with these assumptions are risks that have to be monitored and managed. In situations where these risks cannot be properly managed, the asset management plan will need to be refined to incorporate the related financial implications.

The asset management plan communicates the long term strategy of an agency to responsibly maintain and preserve infrastructure assets within its charge. The financial plan conveys the agency's intent and how it plans to achieve the asset management objectives. The inflows of funds are often limited and are based on many external factors. Each of these factors pose risks that need to be identified and clearly documented in the plan, along with details of how they will be mitigated.

Funding Uncertainty

A transportation agency's asset management plan and activities for each year are dependent on its revenue inflows. One of the big risks to revenue inflows relates to the uncertainty associated with appropriations of federal and state funds. If an agency cannot be certain about the amount of funds they will receive each year, they cannot reliably plan their program of projects for the short term, let alone the long-term. The reliable delivery of the asset management

plan is therefore closely tied to the funding required to deliver the necessary program of projects.

When short term extensions in budget appropriations occur and the related uncertainty in funding availability clouds an agency’s ability to deliver projects in the program for the short-term, its long term asset management plan also gets jeopardized. These uncertainties from year to year can result in funds getting redirected to short-term actions (“worst-first” approach) that may be necessary, but may not be the most prudent action.

A simplified example illustrating the implications of taking such a short-term approach due to funding uncertainties can be seen from the Minnesota DOT’s example shown in Figure 15. The DOT’s asset management plan emphasizes the risks of reverting to a worst-first strategy by comparing the costs of a worst-first approach to a more lifecycle-cost-based approach. It illustrates the difference in costs for

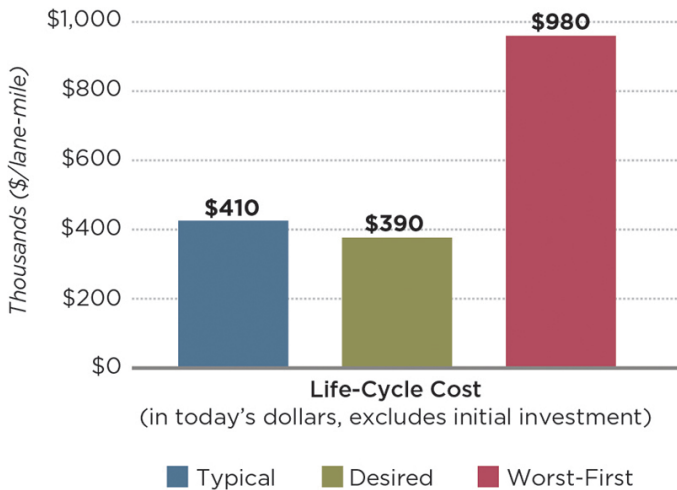


Figure 15. Pavement Life-Cycle Cost

SOURCE: MNDOT

many of its major assets including pavements, bridges, large culverts, small culverts and deep storm water tunnels. Its asset management plan includes extensive discussion of how its proposed lifecycle-based approach will save the State's taxpayers hundreds of millions of dollars over the next 20 years. The analysis emphasizes the financial risk the State will face if it does not pursue the asset-management-based approach to treating assets appropriately during their lifecycle.

In its discussion of a lifecycle approach for pavements, the department notes that the typical preservation and rehabilitation treatments it uses for asphalt pavements includes crack sealing, thin surface treatments, full-depth reclamation and overlays. For concrete pavements the agency has various preservation and rehabilitation strategies. Its treatments and their timing seek to use the lowest cost appropriate treatment to avoid further, more expensive deterioration.

MnDOT strategy compared to its future desired strategy and a worst-first approach. This chart illustrates that over a 70 year period it would cost the State \$980,000 per lane mile of pavement if the department used only a worst-first approach. The department's current lifecycle approach shown in blue costs \$410,000 per lane mile over the 70 year period, or less than half as much. The green cost of \$390,000 over the 70 years reflects the department's estimate that it could lower the lifecycle cost further by adopting even more optimized treatment strategies.

MnDOT illustrates similar savings through an asset management approach for its bridges. It reports that its lifecycle-based bridge maintenance and preservation approach extends the life of its bridges from 50 years under a worst-first approach to about 80 years. MnDOT's current policy saves about 37 percent of the future lifecycle costs, a savings of

\$415,000 per bridge or \$581 million for the entire NHS inventory over the 200 year analysis period. It uses a very long 200-year analysis period to capture the full lifecycle costs of having to more frequently replace bridges that are not adequately maintained. Among the largest cost savings is the need to less frequently replace bridges when they are adequately maintained.

These examples illustrate the need for certainty on longer-term revenues and funding that prepares an agency to plan strategically for the right mix of treatments. With long term funding certainty, transportation agencies can plan investment needs to (a) retain the assets that are in “good” condition, (b) invest funds to improve assets in “fair” condition to “good”, (c) invest funds to improve assets in “poor” condition to “good”, and (d) invest the needed funds to continue to maintain all assets in “good” condition. If a worst-first approach is used then available funds are utilized first to improve the “worst” or “poor” assets, with the spillover funds used next to improve the “fair” assets and finally to preserve and maintain the “good” assets in “good” condition.

A planned approach, on the other hand, will utilize funds to maintain the “good” assets in “good” condition, with spillover funds used to improve the next worse categories. The idea is when an agency has certainty in funding they can have a strategy where the “poor” will be held together so that funds can be used to ensure that there is no downward slide of the other categories.

Assets that are not improved will continue to deteriorate, with some additional assets being re-classified every year into the next worse category with an additional cost implication for improvement over what was previously estimated. The MnDOT example clearly demonstrates that it costs less to retain assets in the “good” condition as compared to a “worst-first” approach.

Recognizing such risks and planning for them through alternative scenarios can help an agency manage the implementation of its financing plan and still continue to take prudent actions that optimize the utilization of funds.

Changes in Economic Conditions

Changes in economic conditions, both at a macro-level and at a local level, can have an impact on financial planning within a transportation agency. If there is a significant downward trend in economic activity in the nation, such as a slowing of the GDP growth, or in more extreme cases, a recession, it can have an impact on the revenues available to a transportation agency. Uncertainties associated with economic conditions in the future are hard to predict and can impose significant constraints. Periods of downward economic trends are typically followed by periods of recovery. An agency can evaluate historical trends and can plan for eventualities should they occur. However, as was seen in the aftermath of the 2008 recession, economic recovery has been slow and long-drawn. This has imposed severe funding constraints on most state transportation agencies in the country. Recognition of such risks can allow an agency to establish a strategy to deal with such occurrences in its financial planning.

Similarly, inflationary trends involving increases in construction prices that affect the inputs to construction, preservation and maintenance activities can have a significant impact on the agency's ability to deliver the planned program of projects. For example, the increase in construction prices in 2005 (Figure 8) had a major impact on the number of projects that agencies could deliver.

Inflation or reduction in revenue receipts can materially impact the number and type of projects that an agency may be planning to deliver. A well thought out long-term asset management plan will need to make assumptions in its

projected budgets relating to such possibilities and plan the projects that will be delivered within the projected budget. Not doing so can pose many additional risks to an agency including political risks and the risk of losing credibility with the public. With the nation’s aging infrastructure and dire funding situations, the long-term support of the legislature and the public is vital to any agency for raising critically needed revenue for infrastructure needs. Agencies would be well-served to avoid such consequential risks, by having strategies to address the risk of inflation in their financial plans component of the TAMP.

The example described below illustrates the Washington DOT experience in dealing with economic changes. Washington DOT, received a substantial funding increase in the early 2000s for a major program of new projects. Then, beginning in 2005, construction prices rose sharply as seen in Figure 16 and seriously eroded the number of promised projects they could deliver. This resulted in public questioning and concerns.

FHWA CCI 1965-2006

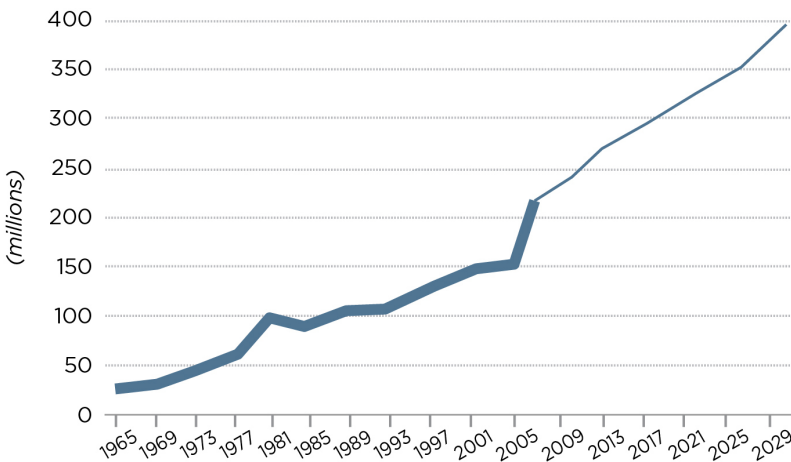


Figure 16. Historical changes in Construction Cost Index reported by FHWA

SOURCE: WSDOT

The agency had to explain that they had not anticipated the risk of future price increases. Learning from this experience, the agency now makes sure to indicate its assumptions on price increases in its plans and closely monitors such risks.

Figure 17 shows how Washington State DOT illustrates the impact of inflation on purchasing power. The DOT tracked the variation of the 8 cent fuel tax revenue it received between 2001 and 2014. The figure clearly shows that the nominal revenue stayed nearly constant during this 14-year period, whereas the real revenue (after adjusting for inflation) declined by 46% during this period.

Political Influences

When political priorities influence project selection, they can create risks for the delivery of the program of projects required for the long-term management of infrastructure assets. Unplanned capital projects resulting in the redirecting

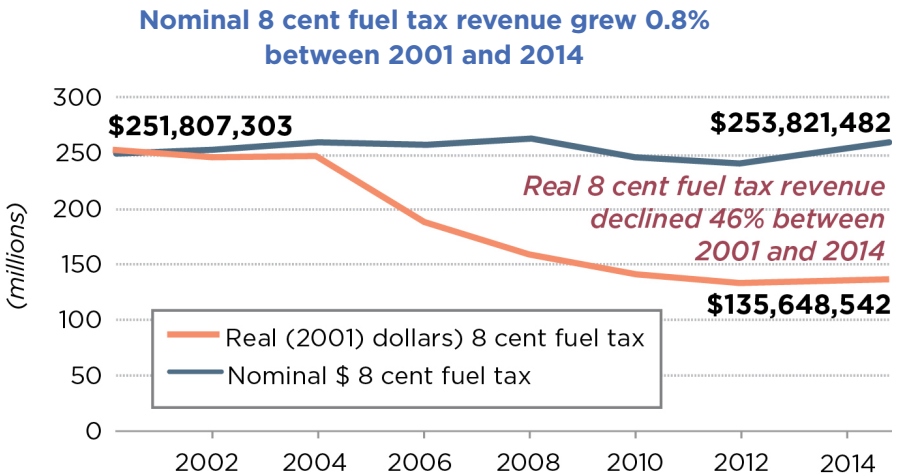


Figure 17. The impact of inflation (shown in orange) eroding purchasing power

SOURCE: WSDOT

of agency funds to new projects can impact the ability of an agency to deliver its planned program. Besides reducing the availability of funds for programmed projects, they also add new responsibilities and risks associated with the addition of new assets that also need to be preserved and maintained. Since most budgets do not address the long-term maintenance of new and unplanned assets, addition of such new assets can result in the diversion of funds from maintenance and preservation of existing assets, thus incorporating new unfunded requirements and liabilities.

In Australia, when a new and unplanned asset is added to an agency's program or budget, the organization (county, city) has to plan for funding for the long-term preservation and maintenance needs to such assets.

Risks from Natural Events

Another risk that can impose a significant financial burden on transportation agencies is the risk of occurrence of natural calamities or events that can materially impact an agency's ability to implement its planned program of projects. Earthquakes, floods, hurricanes, tornadoes and other similar events, including those resulting from climate change can have a significant effect on a state's infrastructure assets. Due to the high degree of unpredictability of natural disasters, transportation agencies have historically not been setting aside amounts necessary to address such events. Occurrences of such events can result in agencies having to redirect funds that have been set aside for strategic needs. Redirecting large amounts of monies can take a toll on even well-planned long-term asset management strategies. By stating the assumptions in the financial and asset management plans and by updating the plans to reflect such risks based on periodically available data, agencies can communicate better with the public, legislature and other stakeholders on the need for additional

funding, or alternatively, on the need to make revisions to the program of projects they can deliver.

For example, the New York DOT has identified climate change issues as one of the risks to its ability to preserve and maintain its assets. The agency lists the consequences of storm events and future climate change events as a risk that will mean further redirecting funds from asset management activities.

New York DOT expects there to be more frequent storms and severe flooding events occurring in the future as a result of climate change. They fear that storm-damaged assets will not fulfill useful life and the asset deterioration will be at an accelerated pace. They also have concerns that such events in the future will draw down funds from core programs and affect the agency's ability to do preservation and maintenance of those assets. These climate change events also complicate planning for asset renewals.

A similar need to redirect funds to address earthquakes and fires for agencies in the west-coast region draw away from funds planned for other core assets and put their long-term management at risk.

Addressing these risks and identifying these as potential causes for redirecting future funds in the financial plan will help to convey a realistic view of the financial health of the agency. This also proactively conveys to the stakeholders the possibilities and prepares them for situations when such redirection of funds occurs.

Long-Term Policy

Long-term policies help align agency objectives and reduces redirection of funds from planned actions that detailed in the TAMP. If an agency has policies that are linked to a long-term

strategic plan it can ensure that agency activities are better aligned to delivering the plan. Agency projects and operations can ensure that the right treatments are applied to the assets at the right time. The policy can provide the clarity and the commitment to strategic preservation and maintenance activities.

Without clarity, there is a higher chance of occurrence of short-term actions that redirect funds from strategic initiatives and may not be the most cost effective treatment for the agency. For example, if any agency decides to switch from a long-term plan to a “worst-first” approach, the objective of strategic asset management will get derailed.

With a long-term policy in place there is clarity that some “poor” assets will be held together for a period of time while other assets are being effectively managed. These “poor” performing assets would have been addressed in the strategic plan and there will be a timeline for what action will be taken and when treatments will be applied to them. Without such a plan and no long-term strategy, there is higher likelihood of moving towards an approach that addresses “worst-first”. This can jeopardize the ability to cost effectively sustain the agency assets over the long-period and extend the useful life of assets.

Vermont DOT has an asset management policy document that states that the agency will focus on a “preservation first” and not a “worst-first” approach and will implement this practice through regular maintenance activities, and planned rehabilitation and replacement projects.

All of these factors that create risks and uncertainty should be explained in the financial plan for it to be credible. Any of these risks can affect the viability of the plan. The agency’s assumptions relating to each risk and how the agency plans to address them, including the necessary monitoring and

mitigating actions will have a substantial influence on the achievement of the plan.

Addressing these risks in its asset management and related financial plan, can enable the agency to effectively communicate both internally to agency personnel and externally to the public, about how it plans to manage the available funds and responsibly manage the states infrastructure assets that are under its charge.

9. Metrics

Metrics are extremely important to understanding the financial health and ability of an organization to deliver its strategic plans.

For infrastructure assets, measuring and monitoring the risks and financial sustainability is critical to an organization's ability to maintain, preserve and enhance its assets and asset portfolio.

Financial metrics create a shorthand summary of the large amount of information included in the financial plan and boil it down to a few ratios that show the bottom line of the consequences of the plan. A few examples include, asset sustainability ratio, asset consumption ratio, and asset renewal funding ratio. These ratios have been used extensively in asset management plans in Australia.

The asset sustainability ratio is an indicator of whether assets are being replaced or renewed at the same rate as they are depreciating. The asset consumption ratio is defined as the ratio of the depreciated replacement cost to current replacement cost for the same assets and indicates the aged condition of the physical assets. The asset renewal funding ratio indicates an agency's ability to fund its asset renewal needs.

As can be seen, each of these ratios digests summary information from an agency's asset and financial plans.

Asset Sustainability Gap

The gap in asset sustainability is another simple measure that can be used to illustrate long-term financial health. It is a way to show the gap between the needs and the available funding.

The example shown in Table 6 (see page 76) uses data from a typical DOT for illustrative purposes and presents a computation of this sustainability gap at a glance. It shows the need for funds and the available funds. It also shows the gap in funds needed to meet the different pavement and bridge

Australian Financial Sustainability Indicators

Operating Surplus Ratio: *This is the operating results expressed as a percentage of total operating income.*

Net Financial Liability Ratio: *This is the net amount owed by an organization compared to its operating income for that period.*

Asset Sustainability Ratio: *This is the ratio of asset replacement expenditures to depreciation for a given period.*

Asset Renewal Funding Ratio: *This is the net present value of asset renewal value and replacement funding accommodated over 10 year period in a long-term financial plan relative to the net present value of projected capital renewal and replacement expenditures identified in an asset management plan for the same period. It assesses the entity's financial capacity to fund asset renewal and replacement in an optimal way.*

U.S. FHWA Asset Sustainability Index

Asset Sustainability Index (FHWA): *An Asset Sustainability Index is a composite metric computed by dividing the amount budgeted on infrastructure maintenance and preservation over time by the amount needed to achieve a specific infrastructure condition target.*

Budget Versus Need	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Maintenance Need	\$74	\$75	\$76	\$78	\$79	\$79	\$79	\$79	\$79	\$79
Safety Need	\$15	\$15	\$15	\$15	\$15	\$15	\$15	\$15	\$15	\$15
Town Aid	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55	\$55
Pavement Need	\$237	\$237	\$237	\$237	\$237	\$249	\$261	\$274	\$288	\$302
Bridge Need	\$152	\$152	\$152	\$152	\$152	\$160	\$168	\$176	\$185	\$194
Signals, ITS Need	\$20	\$20	\$21	\$21	\$22	\$22	\$23	\$23	\$23	\$24
Total Need	\$553	\$554	\$556	\$558	\$560	\$580	\$600	\$622	\$645	\$669
Pavement Budget	\$190	\$190	\$190	\$190	\$180	\$171	\$163	\$154	\$147	\$139
Bridge Budget	\$122	\$122	\$122	\$122	\$122	\$116	\$110	\$104	\$99	\$94
Unmet Pavement Need	\$47	\$47	\$47	\$47	\$57	\$78	\$99	\$120	\$141	\$163
Unmet Bridge Need	\$30	\$30	\$30	\$30	\$30	\$44	\$58	\$72	\$86	\$100
Asset Sustainability Gap for Bridges and Pavements	\$78	\$78	\$78	\$78	\$87	\$122	\$157	\$192	\$227	\$263

Table 6. Illustration of Asset Sustainability Gap

needs. The “bottom-line” is captured in the “Asset Sustainability Gap for Bridges and Pavements”.

By presenting the gap in asset sustainability for each major category of assets and also cumulatively for all assets, an agency can summarize at glance, the extent of the difference between funding availability and needs.

10. Conclusions

Sustaining and responsibly managing the nation’s most valuable and critical assets requires long-term planning for maintenance, preservation, rehabilitation and replacement. The activities detailed in the long-term asset management plan need to be funded each year at the least for a ten years period. Ideally, a long-term asset management plan should have a long-term financial plan that addresses the funding needs of the asset from the time it is constructed to the end of life when it is retired from services. Such an approach has been effectively implemented in Australia.

In the U.S., funding of new infrastructure assets has historically not included the cost to maintain it until end of its useful life and subsequent disposal. However, MAP-21 has set in motion the focus on a fiscally balanced, long-term asset management plan.

As state DOTs are developing their plans, the focus has moved away from “worst-first” approach to implementing timely treatments to preserve, maintain and extend the useful life of infrastructure assets.

The long-term asset management plan provides a strategic view of the investment that is required to manage infrastructure assets. Without a financial plan that is aligned to the asset management plan, an agency will be unable to ensure that the projects and activities detailed in the asset management plan can actually be implemented. The financial plan will highlight the funding gaps that may exist in the implementation of the asset management plan. It will show the long-term investment required to meet the projected asset conditions. The gaps in funding will trigger the discussions necessary to either increase the funds or show the reduction in condition and/or service that will result from the reduced investment.

It also makes it possible to communicate the cost of delaying timely preservation and maintenance actions as well as the cost of delayed action to stakeholders.

The plan also helps communicate the long term state of infrastructure asset health to legislators, stakeholders and the public along with the implications of adding new assets at the cost of preserving and maintaining existing assets. It can set the background for creating better understanding about the need to sustain these important assets and should get the public engaged in the long-term

sustainability of assets and the support of the funding needed for such action.

The plan also creates transparency by clearly summarizing the adequacy of investments and activities to sustain the assets for future users.

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