ASSET MANAGEMENT FINANCIAL REPORT SERIES

REPORT 6

The Vermont Experience:
A Case Study

U.S. Department of Transportation
Federal Highway Administration

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1. Introduction

Description of the Project

This case study describes the Vermont Agency of Transportation's (VTrans) experience during the development of the first 10-year financial plan associated with its Transportation Asset Management Plan (TAMP). The case study shows the VTrans efforts to meet the state's requirements and agency objectives for management of transportation assets, while also meeting Federal transportation asset management plan requirements.

The effort to meet Federal requirements centers around the Moving Ahead for Progress in the Twenty First Century Act (MAP-21) and the subsequent Fixing America's Surface Transportation (FAST) Act. The FAST Act retains the initial MAP-21 requirements for state transportation agencies to develop and implement a 10-year risk-based transportation asset management plan for the National Highway System (NHS). The objective of this plan is to improve or preserve the condition of the assets and the performance of the system. It encourages states to include other assets in the plan, and reduces the requirement and oversight of such assets. Title 23 U.S.C. 119(e)(2) states,

> ***"a State asset management plan shall include strategies leading to a program of projects that would make progress toward achievement of the State targets for asset condition and performance of the National Highway System [NHS] in accordance with section 150(d) and supporting the progress toward the achievement of the national goals identified in section 150(b)."***

The VTrans financial planning effort is aligned to support the aspects of Federal transportation asset management (TAM) requirements which states, "FHWA considers the best evidence of plan implementation to be State DOT funding allocations that are reasonably consistent with the investment strategies in the State DOT's asset management plan; and this approach takes into account the alignment between the actual and planned levels of investment for various work types (i.e., initial construction, maintenance, preservation, rehabilitation and reconstruction)."

This case study discusses the experience of VTrans, while it was developing its 10-year asset management financial plan. It describes the process followed, the factors guiding the plan, the challenges faced, key provisions of the plan, lessons learned by VTrans, and guidance to peers from the VTrans experience. The components of the VTrans TAM financial plan projections discussed in this report are based on various assumptions that may change over the 10-year TAMP period. It is also noted that the version of the financial plan reviewed for the purpose of this study is currently in a draft form and may undergo further revisions following the completion of this report.

2. Establishing the State's Context

"Meet the required customer service level, in the most cost effective manner through the management of assets for both present and future customers."

Since 2002, VTrans has made asset management a priority. In 2001, the Vermont Legislature passed a bill[i] requiring the state to develop an asset management plan that, "established systematic goal and performance driven management and decision making to operate, maintain and upgrade transportation assets cost effectively." The bill required VTrans to address pavements, structures, facilities, construction and maintenance equipment, vehicles, real estate, materials, corporate data and information, and ground and water transportation facilities and equipment. It also required VTrans to develop deterioration rates, and determine the annual funds required over the long-term to fund infrastructure maintenance at the recommended performance levels. This VTrans plan [ii] was presented to the House and Senate Transportation Committees on January 15, 2002. The requirements of the bill set in motion a focus on asset management within the agency that continues to this day.

Table 1. VTrans Highway Assets, based on 2016 data

Highway System Assets	Description
Interstate System*	640 lane miles
State System	2,327 lane miles
Class 1 TH	139 lane miles
Small Culverts (less than 72" dia.)	Approx. 46,000
Guardrail	1,000+ miles
Traffic Signs	70,000 + signs
Highway Lighting	1016 fixtures
Traffic Signals	159 signals

*not including ramps

In 2006, VTrans began implementing its "Road to Affordability" [iii] initiative which supported asset management principles of preserving and maintaining existing assets. It directed the agency to focus only on project elements that were functionally necessary to carry out the core purpose of a transportation project. It directed VTrans to keep within project scope and not add elements to a project using state and Federal non-earmark funds.

The Road to Affordability initiative was intended to focus on financial planning and instilling a strategic outlook towards day-to-day management activities. It required VTrans to

a. focus on preservation of existing assets and on traveler safety,
b. optimize financial resources by focusing on a practical number of large projects, and
c. set realistic time tables for these projects and for new roadway segments while balancing the funding to reflect a focus on system priorities.

The Road to Affordability initiative was thus driven by asset management priorities. With these requirements, for several years VTrans has been developing an approach that minimizes the asset lifecycle cost and extends the useful life by *"selecting the right treatment, for the right asset, at the right time."*

With assistance from the Federal Highway Administration (FHWA), VTrans conducted a Transportation Asset Management Gap Analysis in 2014, to identify major gaps within the agency for implementing a 10-year TAMP. The agency formed a TAMP Working Group to develop individual plans for various transportation assets. At the time of preparing this report, the agency had expanded this effort to six task force groups focused on developing a knowledge base in several different topic areas, such as, customer service levels,

data management, customer outreach/education/training, AM processes, life cycle planning, financial planning, etc. Although MAP-21 does not require states to address assets beyond bridges and pavements, VTrans intends to include in its overall TAMP strategic asset management plans for specific assets when they are developed by the respective asset stewards. The inclusion will also depend on the maturity of the data and the associated management processes. The agency's current thinking is that a formal, first generation of the VTrans TAMP that will be submitted to FHWA may only address bridges and pavements.

Considerations Guiding Vermont's TAMP and Investment Strategies

The age and resulting rehabilitation needs of bridges and pavements guide the strategies for investment and asset management planning for VTrans. The Director of the Asset Management & Performance Bureau for VTrans, Mr. Chad Allen, explains that Vermont has bridges rebuilt after the 1927 floods that are over 80 years old and are nearing the end of their life. Other Interstate-era bridges are around 50 years old and in imminent need of major repair or rehabilitation, whereas some bridges rebuilt after the 2011 floods will have several decades of useful life before needing major repairs.

Figure 1 (see next page) shows the number of structures that are in good condition based on VTrans' maintenance, preservation, rehabilitation and reconstruction efforts. Mr. Allen notes that however, on a timeline, a plot of the number of structures that require investment looks like a roller coaster, with large numbers of bridges coming up periodically for major rehabilitation and replacement. These aging bridges will require the agency ***to continue to invest in reconstruction and major rehabilitation.*** The agency will have to balance the new construction needs of these bridges with preservation and maintenance of other bridges to avoid deterioration due to delaying treatments. Additionally,

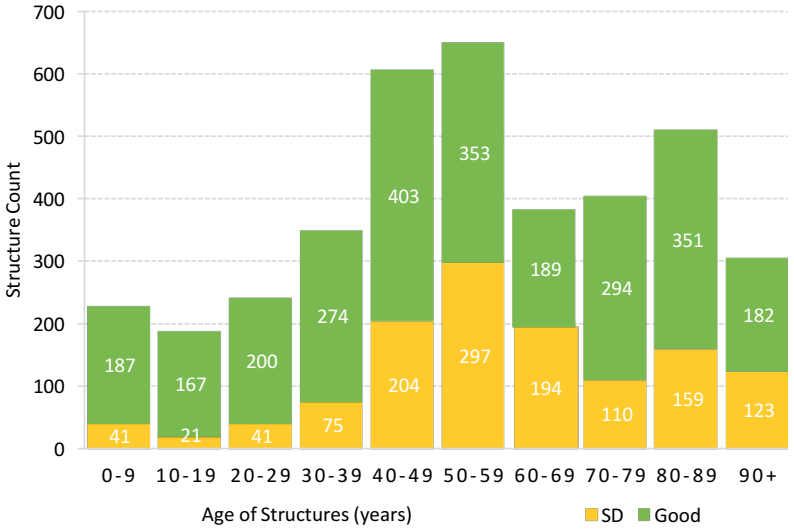

Figure 1. Structure Count by Age

it will have to find ways to distribute and "flatten" the investments required so as to address the needs of all assets.

Vermont's 640 miles of interstate were built to have 20 years of pavement life and 40 years of subbase life. These interstate highways were largely completed in the 1970s and more than ten percent of them are now due for reconstruction. Since about 1995, VTrans has been using its Pavement Condition Index (PCI) to evaluate statewide pavement conditions. The VTrans PCI uses International Roughness Index (IRI), and cracking and rutting measurements to determine overall pavement condition for each 0.1-mile pavement segment. The values in Figure 2 are "unweighted" meaning that there is no adjustment made for traffic volumes. The performance expectation is that VTrans will limit the amount of very poor pavements to 25 percent or less across its entire network. VTrans considers the current trend line for pavement conditions, as shown in Figure 2, to be good. The trend shows that though there

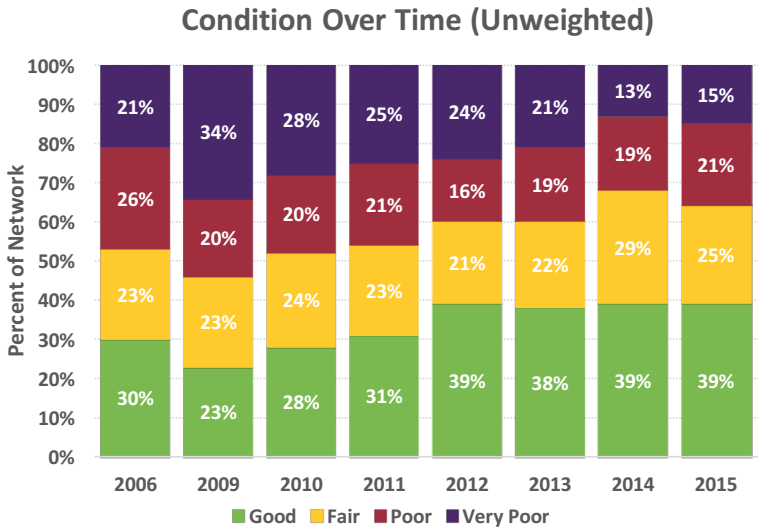

Figure 2. Pavement Condition Over Time (unweighted)

are slight increases in the proportions of poor and very poor pavements from 2014 to 2015, the system has overall been steadily improving since 2009. The agency has maintained the percentage of all pavements in good condition at a steady 39 percent since 2012.

Table 2. NHS Condition Data (Based on VTrans' PCI)

Mileage %	Good	Fair	Poor	Very Poor
NHS Total	44.0%	32.2%	17.7%	4.6%
NHS-IS	47.4%	33.1%	14.9%	3.5%
NHS Non-IS	39.2%	30.9%	21.4%	6.2%

Table 2 containing NHS condition data from VTrans shows that approximately 3.5 percent of the Interstate is in very poor condition compared with 6.2 percent of the non-Interstate NHS. Overall, approximately, 4.6 percent of the NHS pavements are in a very poor condition. It is noted that

the percentages computed in Table 2 also account for a small proportion of invalid data. The VTrans approach for managing pavements takes into consideration their whole-life. VTrans has targeted for the purposes of its TAMP that the pavements on the interstate and NHS-non-interstate in poor condition will be less than 5 percent. The projected investments and funding strategies for pavements are therefore based on achieving this target. Details of VTrans' asset management planning effort are further enumerated below.

VTrans reviewed its NHS pavement condition against the Federal performance measures. As shown in Figure 3, when measuring the NHS conditions using the Federal performance measures, the total NHS in "Poor" condition is approximately 4.8 percent, and the NHS-IS in "Poor" condition is 3.2 percent. In general, VTrans notes that its internal metrics are more conservative than the Federal metrics resulting in VTrans reporting a higher percentage of poor and very poor pavements in comparison to the Federal target of no more than 5 % poor on the interstate.

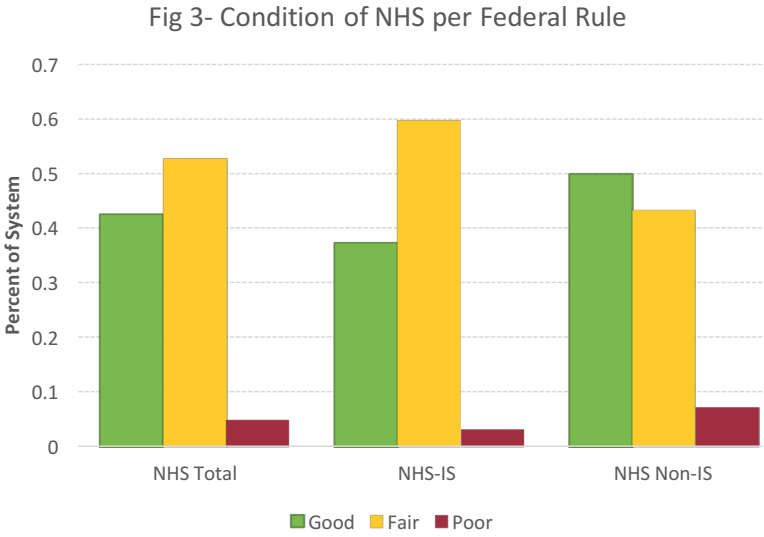

Figure 3. Condition of NHS per Federal Rule (SOURCE VTRANS)

Asset Management Portfolio: Performance Metrics and Customer Service Levels Driving Future Budget Allocations

VTrans believes that it is important to incorporate customer expectations on service and sustainability of assets while developing the TAMP. It has segmented its highway network into tiers based on service levels that are aligned with its winter snow and ice control levels of service. The outcome of the tiered service level approach is that customer service level tiers are the same for capital improvements as they are for maintenance activities. VTrans is developing performance measures and service levels in four customer service areas. These service levels will be considered in the agency's target setting and will influence future budget allocations. VTrans' asset management efforts are guided by the objective of maintaining targeted performance levels for its assets in these four service areas. The agency is developing an Asset Management Portfolio that lists its assets and performance targets for those assets, and indicates the spending levels necessary to achieve and maintain those performance levels over the next 10-year period. The portfolio is anticipated to include bridges, pavements, culverts, signals, signs, dump trucks, and rock cuts.

VTrans Customer Service Level Areas

1. Safety
2. Asset Condition
3. Mobility
4. Resiliency

In 2015, addressing important aspects of sustainability and asset resiliency, VTrans worked with Vermont's Agency of Natural Resources on the Act 64 water quality cleanup requirements. This resulted in VTrans increasing Federal and State funds in the 2017 budget. Approximately $1.4 million of funds were directed to municipalities to address water quality issues and to make local roads more resilient to

> **"One of the Agency's strategies is to develop an understanding of the desired performance levels and costs to attain affordable and achievable performance for its transportation assets."**
>
> **—CHAD ALLEN**

floods.[iv] Activities funded will include culvert replacements, and stream bank and ditch stabilization.

Considering Vermont's geological conditions and mountainous terrain, the state has to also address the risks relating to rock falls. A 2015 inspection by VTrans categorized 221 rock slopes as high hazard slopes. These high hazard slopes have to be stabilized. The desired performance target established by VTrans in 2012 was to minimize the risk of rock falls within 25 years, which required a 4 percent reduction per year at an annual cost of nearly $2.7 million. During past budgetary cycles, rock slope remediation projects were often the first projects cut from a proposed budget. The Agency is attempting a more financially sustainable approach, wherein the overall network rock fall hazard rating score is reduced by 1 percent per year at an annual cost of $1.25 million, for the next 10 years.

Basic Funding Needs

VTrans projected the funding needs for 20 years based on analyzing historic expenditures, system and asset conditions, asset deterioration based on projections from management systems, and life cycle planning of assets. VTrans has a high level of confidence in the first 10 years of the 20 year projections that are included in the TAMP.

The average annual funding requirements to address the asset management needs governed by all of VTrans' strategic considerations as projected by the agency are detailed below. The estimates include minor lane additions to address

truck climbing lanes on rural roadways, and where appropriate, adding sidewalks and shoulders in village and urban areas. The annual funding amounts shown do not include any major capacity increases. The costs reported in this section are based on an annualized cost calculated by summing the anticipated expenditures over a 20-year analysis period and dividing by 20. In later charts addressing annual projections, the numbers vary. These annual numbers closely reflect VTrans' asset sustainability index for each year of the 10-year TAMP period. These annual numbers over the TAMP period are subject to change depending on factors such as premature asset failures, flooding, fire and other impacts of climatic events, and loss of buying power over time. Annual costs projections for some of the categories are:

Asset Sustainability Index is the ratio of the funds needed to deliver the plan to the revenue forecasted to be available for the plan period.

1. **Highway Safety: $19.0 million.** Vermont has over 13,000 crashes annually. This investment is for safety initiatives designed to reduce the number of major crashes, serious injuries, and fatalities. The investments encompass Highway Safety Improvement Program(HSIP) and National Highway Traffic Safety Administration(NHTSA) allocations, the operating budget for the Office of Highway Safety, and a $17 million annual budget for traffic and safety design.

2. **Pavement Surface Condition: $115.0 million.** This is for cost effective treatments to preserve and maintain the network performance to established VTrans performance measures.

3. **Composite Pavements: $85.4 million.** About 9 percent of Vermont's network miles are composite pavements (asphalt on concrete highway segments). The agency has established a long-term goal of reconstructing these sections over a 20-year period. This investment is to address many of the distresses, including reflective cracking from the slab beneath, and differences in settling because of roadway widening.

4. **Reconstruction of State Routes: $46.5 million.** Over 50 percent of state routes in Vermont are farm to market roads intended for horse and wagon. Large vehicle traffic volumes on these routes are accelerating surface and base deterioration. Over a 20-year period, VTrans plans to reconstruct 5 percent and rehabilitate 20 percent of the state highway system with the greatest needs.

5. **Reconstruction of Interstate Routes: $17.7 million.** The majority of Vermont's interstate system was constructed in the 1970s with an estimated 20 years of pavement life and 40 years of subbase life. The pavements are reaching the end of their life with increasing challenges to maintain slopes, sinkholes and deteriorating segments. This annual funding aims to systematically reconstruct and rehabilitate the interstate over a 40-year period. In the 20-year plan, Vermont is projecting to reconstruct 12.5 percent and rehabilitate using reclamation 37.5 percent of its interstates.

6. **Lifecycle Improvement of Bridges: $152 million.** VTrans is basing its current bridge needs on a 2012 legislative report recognizing this as an area to refine in the future. Using the most recent information available, VTrans has developed a plan for all its bridges based on bridge age, condition, and improvement needs. The

needs are based on the strategy to do major preventive maintenance every 15, 30 and 45 years, rehabilitation every 60 years, reconstruction every 80 years in the life of long structures, and replacement every 50 years in the life of shorter structures.

7. **Infrastructure Maintenance: $93.4 million.** VTrans currently spends 55 percent of its maintenance appropriation on personnel costs. This leaves approximately an average of $42 million for non-personnel related items. In addition, there is an estimated average annual funding gap of $18 million required to meet its maintenance needs. The total maintenance cost over a 20-year period is anticipated to vary between $60 million (in year 1) and $126 million (in year 20). The amount reported represents the maintenance cost annualized over the 20-year period.

8. **Culverts: $23.9 million.** This includes the necessary repairs to keep small culverts (6 ft. and less in diameter) in good and fair condition, and replace poor and critical culverts based on the 2015 data. These repairs represent needs that cannot be addressed by regular maintenance funds.

9. **Signals: $3.7 million.** This projected need is based on a 10-year replacement cycle annualized over the 10-year period and then extrapolated over 20-years.

10. **Signs: $1 Million.** VTrans has recently invested heavily in sign replacements and is currently in a maintenance cycle for most of their sign assets. There is an anticipated jump in investment from $1 million to $7 million in year 20. VTrans will need to keep track of this asset's condition in order to correlate actual asset deterioration with future anticipated investment needs.

11. **Rock Slopes: $2.7 million.** Although VTrans' goal is to achieve a 1 percent annual reduction in the total rock fall hazard rating score for all "A" ranked rock cuts, the actual need is defined as an annual reduction of 4 percent at a cost of $2.7 million.

12. **Town Highway Program: $48.6 million.** This includes grants and other annual appropriations of state aid to preserve and maintain town highways based on town highway mileage and classification. This program also includes funding for Federal and non-Federal disaster declarations.

13. **Stormwater Runoff: $7.9 million.** Vermont's Agency of Natural Resources estimates that there will be significant costs to address unregulated storm water runoff from the road network. VTrans has crafted an asset specific investment plan to anticipate needs associated with current storm water legislation and resulting environmental compliance initiatives.

TAMP Rule:
Definition of Financial Plan

Is a long-term plan spanning 10 years or longer, presenting a State DOT's estimates of projected available financial resources and predicted expenditures in major asset categories that can be used to achieve State DOT targets for asset condition during the plan period, and highlighting how resources are expected to be allocated based on asset strategies, needs, shortfalls, and agency policies.

VTrans is also considering the funding needs of all the assets in the TAMP. In addition to funding constraints, VTrans' ability to deliver the projected program and projects in its asset management plan will directly influence the final TAM Financial Plan.

3. Financial Plan

3.1 Background

The Federal risk-based asset management plan rule addressing the 10-year TAMP states that, "a State DOT shall establish a process for the development of a financial plan that identifies annual costs over a minimum period of 10 years. It states that the financial plan shall, at a minimum, include:

- The estimated cost of expected future work to implement investment strategies contained in the asset management plan, by State fiscal year and work type:
- The estimated funding levels that are expected to be reasonably available, by fiscal year, to address the costs of future work types. State DOTs may estimate the amount of available funding using historical values where the future funding amount is uncertain;
- Identification of anticipated funding sources; and
- An estimate of the value of the agency's pavements and bridge assets and the needed investment on an annual basis to maintain the value of these assets."

According to the rule, FHWA considers the best evidence of plan implementation to be State DOT funding allocations that are reasonably consistent with the investment strategies in the State DOT's asset management plan; and this approach takes into account the alignment between the actual and planned levels of investment for various work types (i.e., initial construction, maintenance, preservation, rehabilitation and reconstruction).

The financial planning effort thus necessitates the development of investment strategies to support the implementation of the 10-year TAMP.

In Vermont, over the last decade, there has been an increased public understanding of the need for investment in bridges and pavements. In 2008, the Snelling Center for Government conducted a survey, and convened business leaders to get responses from across Vermont on the preservation of Vermont's roads and bridges.[v] The Snelling Center report titled, "Vermont Roads and Bridges: To Fix or Abandon", noted that when increasing revenues to expedite preservation and rehabilitation investments, the preference was to generate user related revenues such as fuel taxes and support for public debt. This has resulted in the use of bonds and some fuel tax increases to close the funding gap and address the financial needs associated with bridge and pavement assets.

The Snelling Report titled, "Vermont Roads and Bridges: To Fix or Abandon", concluded that there was a strong bias for increasing investment in preservation of roads and bridges. It acknowledged that delays in preservation would be very expensive especially in rehabilitating bridges.

Vision for Asset Management and Financial Planning

VTrans' asset management vision is to develop individual 10-year management plans for all of its assets (including those beyond bridges and pavements). With this approach, eventually culverts, signals, signs, dump trucks, rock cuts and slopes will each have its own asset management plan. The financial plan for each asset type will include performance targets planned over a 10 year-period and the dollar amounts needed each year to achieve them.

3.2 Revenue Sources

The major funding sources for VTrans are,

- Federal transportation fund revenues
- State revenues
  - Fuel taxes (gasoline and diesel taxes, and assessments)
  - Motor Vehicle registration and other fees
  - Vehicle purchase and use taxes

Federal Revenues

The overall VTrans annual budget including from the Transportation Infrastructure Bonds (TIB) has dropped from $685.8 million in 2015 to $573.6 million in 2016. Approximately 55 percent of the VTrans transportation budget comes from Federal funding. About 38 percent comes from fuel tax and motor vehicle fees, and the remaining comes from vehicle purchase and use taxes. To-date, state and local communities have also received over $575 million in Federal assistance to properly rebuild infrastructure that was damaged due to Hurricane Irene in 2011. Also, from 2009 to 2012, Vermont received close to $251.2 million from the American Recovery and Reinvestment Act (ARRA). This influx of ARRA funding enabled VTrans to expedite and complete many projects. The loss of the temporary influx of these Federal funds has a big impact on VTrans' long-term plans. Figure 4 (see next page) shows the overall trend in funding from 2000 to 2016. It also shows an increase from 2010 through 2015, followed by a decline in 2016.

State Revenues

Figure 5 (see next page) shows the 2016 projections for state revenues. It shows the general distribution of the sources of revenue for VTrans and provides a glimpse of revenue sources that can be expected in future years.

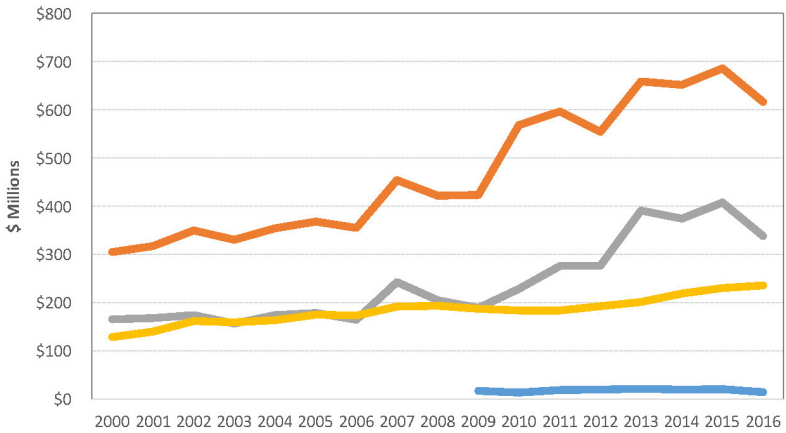

Figure 4. Major Revenue Sources (SOURCE: VTRANS)

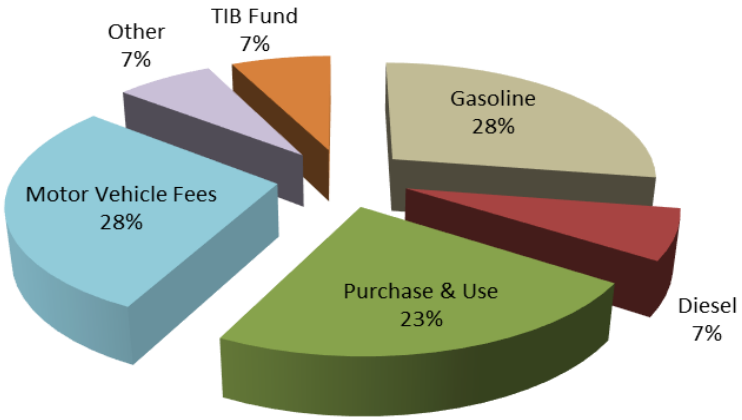

Figure 5. Vermont 2016 State Revenue Forecast (SOURCE: VTRANS)

The three major state revenue sources are motor vehicle fees, gasoline taxes, and purchase and use fees. Twenty nine percent of the state revenue comes from motor vehicle fees, 28 percent comes from gasoline taxes, and 24 percent comes from purchase and use fees.

Revenue Trends and Uncertainties

Gasoline Consumption Taxes

The pattern and public use of different transportation modes is changing in Vermont. As shown in Figure 6, one of VTrans' concerns has been the declining trend of gasoline consumption in the state from 2005 to 2013. With the decline in gasoline consumption, the corresponding revenue also declined.

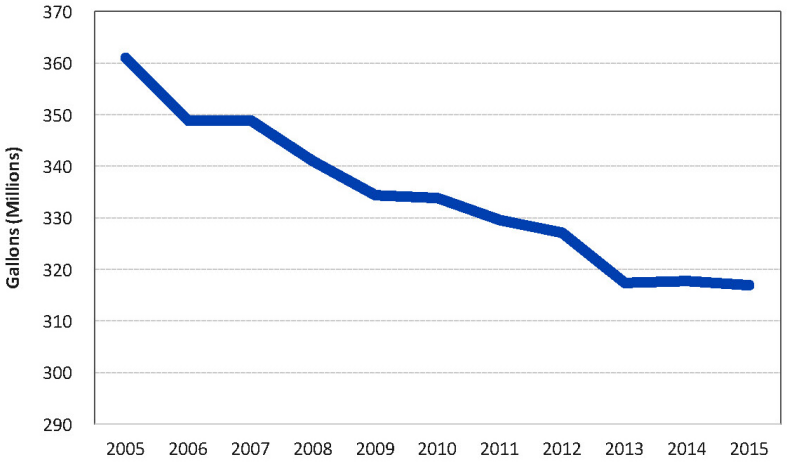

Figure 6. Historic Gasoline Consumption in Vermont
(SOURCE: VTRANS)

VTrans' concern is that without a corresponding increase in gasoline consumption, the revenue generated will not keep pace with inflation. Figure 7 (see next page) shows that the trend in Vehicle Miles Traveled (VMT) in Vermont is also declining. The figure shows that the VMT in 2014 is at its lowest point since the year 2000 when the VMT was at a low of 6.5 million. While some of the reduction in gasoline consumption can be attributed to increasing fuel efficiencies in vehicles, the reducing consumption is consistent with the correspondingly declining VMT trend.

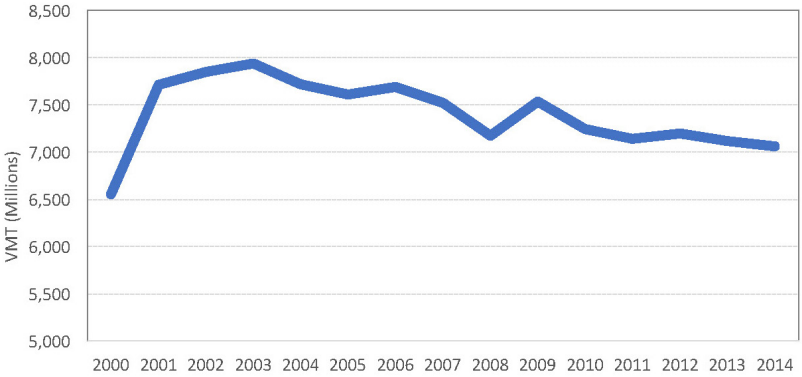

Figure 7. Vermont's Vehicle Miles Traveled in millions from 2000 to 2014

Motor Vehicle Registration Fees

Since 2014, the revenue from the gas tax has remained flat. In 2013, the state offset some of the revenue decline through adjustments to gas and diesel taxes and to motor vehicle registration fees. This assessment on retail gas prices resulted in an increase in revenue in 2014. Overall, the motor vehicle registration fees have been a steady source of revenue except during the 2008 and 2009 recession. This revenue source provides approximately $65 million annually. However, there is a concern that since this revenue is dependent on the economy and the related uncertainties, future recessions can impact it. Vehicle registration fees make up approximately 29 percent of VTrans revenue from State sources, and the uncertainty associated with this source poses a substantial risk to funding the Agency's asset management investment strategies and closing asset funding gaps. Additionally, there is concern that as more millienials choose not to drive, the revenues from vehicle registration fees could steadily decline.

Federal Revenues

Approximately fifty-five percent of the VTrans transportation funding comes from Federal funds. Uncertainty in

Federal funding is a major risk being considered by the agency. The five-year FAST Act does not provide the long-term funding required by VTrans to address its long-term transportation needs.

The Congressional Budget Office (CBO) May 2012 report[vi] predicts an almost 21 percent reduction in gasoline revenues by 2040 due to higher fuel economy vehicles. The expectation is that there will be further reduction in gasoline consumption and revenues due to future improvements to engines and battery technologies in alternative fuel vehicles. The disbursement to states by 2022 from the Highway Trust Fund (HTF) is projected to be $589 billion, while inputs to the HTF are only expected to be $442 billion. The projected shortfall of $147 billion in the HTF is staggering and can have significant consequences to Vermont and other states that depend on these funds.

Past Revenue Allocations

Figure 8 (see next page) shows the details of VTrans' $616,128,196 budget allocation for FY 2017. The biggest share of 45 percent was allocated to program development activities that include, but are not limited to, the scoping, design and construction of bridges, roadway, pavements, traffic and safety programs. Town highway programs received the second largest share of 17 percent, while maintenance received the third largest budget allocation of 14 percent.

VTrans tracks the use of both State and Federal funds across the fiscal calendar and compares those expenses against the anticipated revenue allocations. The current approach of addressing asset management investment strategies for various work types used by VTrans aligns as practically as possible the actual and planned levels of investment. This approach is in-line with FHWA's expectation of the best evidence of plan implementation as noted in the Rule. Table 3 (see next page) shows the summary of the VTrans FY 2017

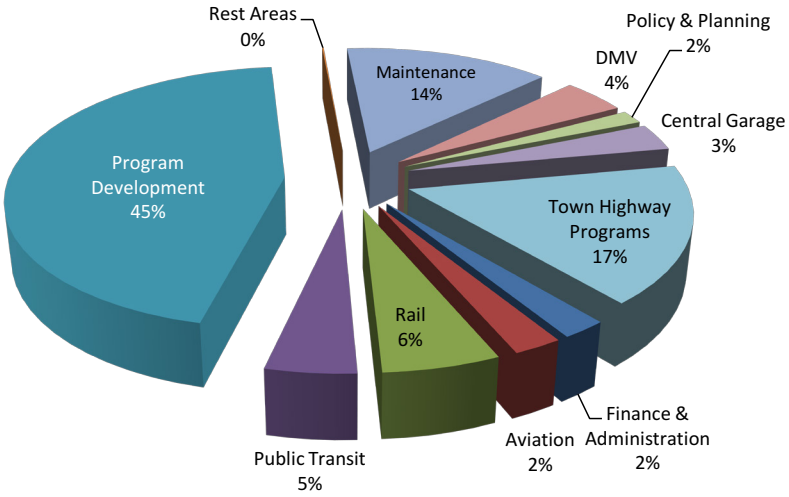

Figure 8. FY 2017 VTrans Budget Allocations by Program Areas

Table 3. FY 17 Budget Tracking of VTrans Expenses for Bridge, Pavement, Roadway, and Traffic and Safety Projects

Budget Reporting Category	As Passed (Budget)	Adjustments (Carry Forward from Prior Year)	Current Budget (CB) (Budget +Adjustments)	Expected Budget	CB–Expected Forecast
Interstate Bridges	$ 4,791,818		$ 4,791,818	$ 3,972,985	$ 818,833
Paving	$ 22,730,033	($2,000,000)	$ 20,730,033	$ 21,263,953	$ (1,112,980)
Roadway Projects	$ 2,637,595		$ 2,637,595	$ 3,530,222	$ (892,627)
State Highway Bridges	$ 6,023,866		$ 6,023,866	$ 6,514,253	$ (490,387)
Traffic & Safety	$ 278,478		$ 278,478	$ 493,236	$ (214,759)
Town Highway Bridges	$ 2,654,284	$ 271,364	$ 2,925,648	$ 3,032,722	$ (107,074)

budget tracking effort for selected categories of assets. The table shows the dollars allocated to various programs (for illustrative purposes, only the traffic & safety, pavement, bridge and roadway appropriations are displayed in this table). As currently projected, all programs are expected to end up with a deficit with respect to the Current Budget (adjusted for carry forwards) except for Interstate Bridges, which shows a surplus of $818,833. The aggregate deficit projected is approximately $2.0 million.

Table 3 also shows that the Paving program started with a carry forward deficit from 2016 of $2 million, while the Town Highway Bridge Program commenced with a carry forward surplus of $271,364.

Based on these carry forward deficits, the largest projected budget deficits are in Paving (approximately $1.1 million) and Roadway (approximately $0.9 million). VTrans monitors its expenses across the fiscal calendar to ensure that it makes the best use of its State dollars and does not leave any Federal dollars "on the table". The Agency expects such surpluses and deficits to continue, and where possible, considers these gaps while making adjustments to subsequent years' allocations to meet the longer-term asset management strategy needs.

Projected Revenue Sources

States differ in how and which agency within a state manages each of the different transportation modes. In Vermont, VTrans is responsible for a diverse, multi-modal transportation network. The VTrans 10-year TAMP and financial plan are thus influenced by and reflect these diverse multi-modal responsibilities. This multi-modal responsibility is reflected in the 10-year revenue projections shown in Table 4 (see next page).

Table 4. VTrans annual and total revenue source projections in dollars for the 10-year TAMP period (2018 to 2027)

Revenue Sources–Projected Funding (by SFY)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018-2027
FHWA annual formula	$203,310	$207,488	$211,945	$216,781	$220,917	$225,135	$229,438	$233,827	$238,303	$242,870	$2,230,015
Federal discretionary	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$150,000
FHWA: unspent from prior years	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$500,000
Total Funding from FHWA	**$268,310**	**$272,488**	**$276,945**	**$281,781**	**$285,917**	**$290,135**	**$294,438**	**$298,827**	**$303,303**	**$307,870**	**$2,880,015**
FTA	$15,000	$15,300	$15,606	$15,918	$16,236	$16,561	$16,892	$17,230	$17,575	$17,926	$164,246
FAA	$14,124	$4,000	$4,080	$4,162	$4,245	$4,330	$4,416	$4,505	$4,595	$4,687	$53,143
FRA	$8,000	$8,160	$8,323	$8,490	$8,659	$8,833	$9,009	$9,189	$9,373	$9,561	$87,598
Other federal	$10,000	$10,200	$10,404	$10,612	$10,824	$11,041	$11,262	$11,487	$11,717	$11,951	$109,497
Total Federal	**$315,434**	**$310,148**	**$315,358**	**$320,963**	**$325,882**	**$330,900**	**$336,018**	**$341,238**	**$346,563**	**$351,994**	**$3,294,498**
Local/Other (VTrans managed)	$5,000	$5,100	$5,202	$5,306	$5,412	$5,520	$5,631	$5,743	$5,858	$5,975	$54,749
State Transportation Fund	$249,074	$254,055	$259,137	$271,319	$276,746	$282,281	$294,926	$300,825	$306,841	$319,978	$2,815,182
State TIB Fund	$12,269	$12,514	$12,765	$13,020	$13,280	$13,546	$13,817	$14,093	$14,375	$14,663	$134,342
Total Projected Revenues	**$581,777**	**$581,817**	**$592,461**	**$610,608**	**$621,320**	**$632,247**	**$650,392**	**$661,900**	**$673,638**	**$692,610**	**$6,298,771**

Revenue Sources ($ Thousands)

The VTrans Financial Planning Process

The VTrans TAM financial planning process started with preliminary revenue projections for a 20-year financial plan. This 20-year plan was then refined to develop the 10-year projections. The projected revenue apportionments for 2017 were used to establish the 2018 baseline values for the 10-year TAMP period. Several assumptions were made in projecting the availability of future funds. VTrans developed multiple scenarios in projecting annual growth in funding sources for the TAMP period, ranging from 0 to 5 percent growth for different revenue sources. VTrans selected the most likely scenario that considered a growth of 2.5 and 2 percent growth in some revenue sources, and a lump sum amount in other sources. VTrans will closely monitor these assumptions and revise the 10-year projections to reflect changes as they occur. VTrans has based the 10-year financial plan funding projections on 2012 dollars. The actual costs over the 10-year period will change as inflation and other cost factors change.

Revenue Projection Assumptions

The revenue projections used by VTrans for the 10-year TAMP period as shown in Tables 4 do not account for any high priority earmarks. In developing these 10-year revenue projections, VTrans has assumed that the revenues from various FHWA programs will grow annually at 2 percent. These programs include, National Highway Performance Program, State Transportation Program, Highway Safety Improvement Program, Railway and Highway Crossing Programs, Congestion Mitigation and Air Quality Improvement Program, Metropolitan Planning Program, and National Highway Freight Program. VTrans assumes for its 2018 baseline that it will have an obligation limit equal to approximately 97 percent of the 2017 total apportionment of $210 million in Federal funds for the highway mode. This obligation limit assumption is applied for FHWA revenue sources for each of the ten years of the TAMP period. VTrans expects that the annual increase of 2.0 percent will be a little more

than the amount required to adjust for the loss in value of money in future years. It further assumes availability of $15 million dollars of Federal discretionary revenues and obligated unspent revenues of $50 million from the prior year from the FHWA funds for each year of the TAMP period.

In projecting the Federal Aviation Administration revenues, VTrans assumes that these will drop from $14 million in 2018 to $4 million in 2019 and subsequently grow annually at 2 percent for the remaining plan period. In projecting revenue amounts from Federal Transit Administration, VTrans assumes $15 million-dollar in 2018 and assumes that the revenue from this source will grow annually at 2 percent. Revenues from the Federal Railroad Administration are projected to grow at 2 percent per year from 2018 from a base value of $8 million. Other Federal funds (base value of $10 million) are projected to increase by 2 percent for the plan period.

VTrans assumes that revenues from all local and state sources, i.e., VTrans managed Local revenues, State transportation funds, and State bonds, will increase annually by 2 percent, with additional incremental increases of 2 to 3 percent every third year, resulting in an average annual increase of approximately 3 percent during the plan period.

This financial plan shows a total of $6.3 billion in projected revenue for the period 2018 through 2027. It shows the total Federal funds for all modes to be approximately $3.3 billion, of which, the total Federal highway funding is approximately $2.9 billion. The plan also shows approximately $3.0 billion of state and local funds managed by VTrans.

3.3 Funding Needs

The projected funding needs capture the investment required to support the agency's strategies to achieve and maintain the asset condition targets it has established for

the plan period. Historically, these projections had a shorter term. With the requirements of the 10-year TAMP, VTrans has projected the funding needs for a 10-year period from 2018 to 2027. The goal is to develop a financial plan that will support the 10-year funding required to sustain, preserve, and improve the condition of the assets. Sustainability is measured by whether strategies and investments achieve and maintain asset condition targets for at least the 10-year period of the TAMP.

Past Funding Needs

Historically, VTrans projected its funding needs on the basis of the cost to preserve, maintain and operate the existing transportation network for a shorter period—typically three years. The VTrans asset management philosophy of providing the right treatment, at the right cost and at the right time, guided the projection of the funding needs. It prioritized maintenance and preservation over new capacity. VTrans does a total-system data collection every two years. Aligned with the data collection, once in two years, the pavement funding need is reevaluated. The 2014 through 2016 funding categories and needs projections are shown in Table 5 (see next page).

VTrans has consistently questioned its priorities and its performance targets. For pavements, VTrans has two long standing performance benchmarks that have been used to communicate pavement performance to the Legislature and other stakeholders. As shown in Table 6 (see page 32), VTrans has communicated the need for a $115 million pavement investment in 2018 to meet two pavement performance targets of 1) limiting percent of pavements in very poor condition to not exceed 25 percent, and 2) achieving a travel weighted average (TWA) pavement condition of 70. These two performance measures compete for funding within the pavement management system. However, VTrans has found that these two measures help to identify the

level of investment necessary to achieve both customer satisfaction and asset sustainability.

Recently, there has been some cultural growth within the Agency relative to both asset and performance management. Leaders who have committed funds and resources to programmatic areas in the past are now asking, 1) what is the performance target? 2) what is the right target? and 3) how were those targets established?

Figure 9 shows how these performance measures are used to determine the annual amount of pavement funds to request on a biannual basis. It shows that if VTrans took care of only its higher volume roadways then it could achieve its TWA pavement condition goal of 70 with an investment in the $70 to $75 million-dollar range. However, in order to achieve both performance targets the needed annual investment is approximately $115 million.

Table 5. Transportation Needs for 2014, 2015 and 2016 as reported in VTrans 2012 Section 40 Report

Transportation Needs	2014	2015	2016
Highway Pavements and Safety	$ 252,000,000	$ 252,000,000	$ 252,000,000
Bridges (including Town Highway Bridges)	$ 152,000,000	$ 152,000,000	$ 152,000,000
Maintenance & Buildings	$ 73,504,251	$ 74,974,336	$ 76,473,823
Town Highway Aid Programs	$ 54,977,244	$ 54,977,244	$ 54,977,244
Rail	$ 56,150,000	$ 50,300,000	$ 48,454,500
Aviation	$ 5,845,000	$ 12,842,000	$ 6,090,000
Public Transit	$ 27,485,565	$ 27,485,565	$ 29,485,565
Park and Ride	$ 4,000,000	$ 4,000,000	$ 4,000,000
Transportation Alternatives	$ 3,000,000	$ 3,000,000	$ 3,000,000
Others (DMV, Planning, Finance, Admin, Rest areas.)	$ 70,844,111	$ 70,844,111	$ 70,844,111
Total Funding Needs	**$ 699,806,171**	**$ 702,423,256**	**$ 697,325,243**

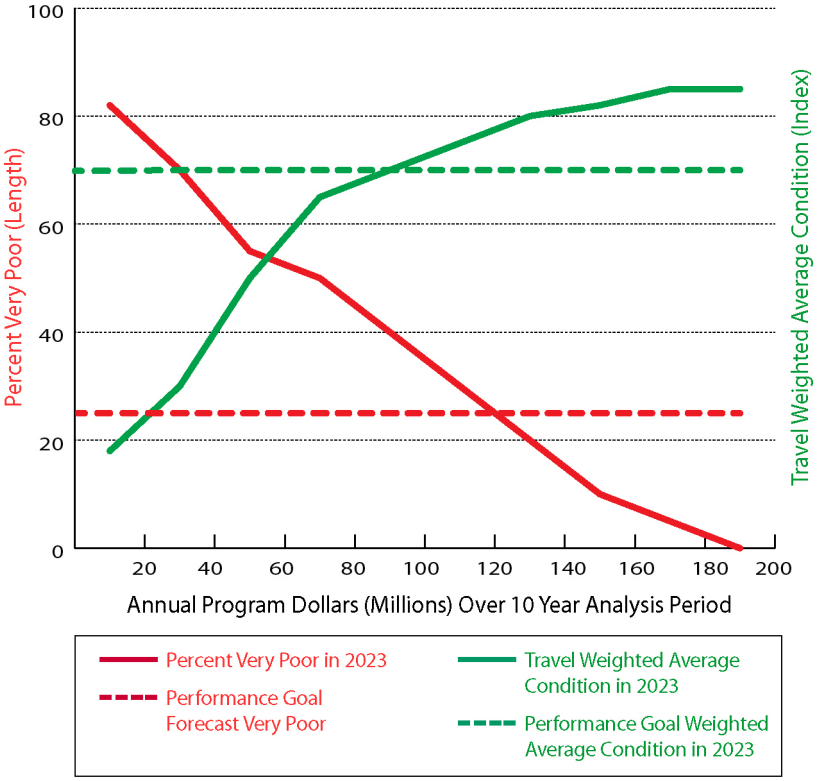

Figure 9. Funding Needed to Meet Performance Goals for 10 Year Analysis Period (SOURCE: VTRANS)

VTrans is currently working on developing a communication strategy to share the information about asset management in a way that increases transparency and changes the conversation from what percentage of the network is in very poor condition to what percent of the network is in fair or good condition. This provides more of a proactive context for a discussion on pavement investments.

Projected Funding Needs

The funding needs component of the VTrans TAM financial plan provides the summary of projected needs for all the major program and spending categories. The 10-year projections of funding needs for the TAMP identify the cost to

meet the agency's asset condition targets during the 10 years of the asset management plan. The cost projections are based on selecting the right treatments, at the right time, based on the life-cycle cost to sustain and improve the asset's useful life. This involved projecting the annual cost of treatments to achieve corresponding condition targets and system performance that aligned with the 10-year TAMP. The level of analysis was more mature for some assets and less so for other assets. For example, VTrans estimates that its level of analysis was very mature for pavements, while it was at an intermediate maturity level for bridges, where deterioration and forecasting models are in the process of being finalized. VTrans has not let this process of improving analysis methodology affect its ability to forecast future funding needs. VTrans understands that the plan development is an iterative process and intends to update the current projections as the models get more mature and reflect changes in updates to the plan.

Table 6 (see page 32) shows the projected funding needs for all the major categories for the 10-year period of the TAMP (in 2012 dollars). The agency estimates that a total of $9.7 billion dollars will be required over the 10-year plan period to make the improvements necessary to maintain the agency's assets in a state of good repair. VTrans understands that it will not be able to fund all of these improvements and will have to adjust performance and condition expectations so as not to exceed available revenues.

Key Assumptions in Projecting Needs

The asset management plan addresses specific long-term strategies that are focused on systematically sustaining and cost-effectively improving the asset conditions and the performance of the transportation system. The strategies are based on a twenty-year plan to methodically rehabilitate and replace a small percentage of the aging infrastructure each year, while ensuring that the existing system components in

"good" or "fair" condition continue to be preserved or improved, as appropriate. Working within the financial constraints to address the State's aging transportation infrastructure, the agency developed a systematic and cost-effective maintenance and preservation plan to extend the useful life of its assets. In cases, where maintenance and preservation were determined to be not effective, i.e., where the assets had exceeded their useful life and deteriorated to a point where maintenance and preservation are not viable solutions, a long-term plan of reconstruction and rehabilitation was considered. These long-term strategies were used in estimating the needs. The funding needs projected for these long-term strategies for the first half of the 20-year plan are included in the 10-year financial plan associated with the TAMP.

Realistically, over the 10-year plan period, the agency will have to review the impacts of inflation and other costs, and update the financial plan appropriately. Also, it will have to review the projects delivered and those planned to be delivered over the 10-year period, and reflect the impacts of schedule changes, cost increases, and scope changes in the financial plan. Other factors can also influence the financial plan. For example, if Vermont faces a severe winter, then snow and ice removal activities will increase and corresponding maintenance budgets will need to reflect the increased need. It will also be necessary for the needs for various budget categories to be updated to reflect any changes to construction material or labor costs. The information in the financial plan and its components will continue to change, requiring the plan to be reviewed and updated appropriately.

Pavement Needs

VTrans has four main budget categories that address pavement needs, Roadway Strategy 1, Roadway Strategy 2, Roadway Strategy 3, and Paving.

Table 6. Projected Total ($) and Annual Funding Needs ($) for the 10-year TAMP period (2018-2027)

Projected Funding Needs by SFY (Based on 2016 Dollars)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018-2027
Personnel Services	113,966	117,385	120,907	124,534	128,270	132,118	136,082	140,164	144,369	148,700	1,306,495
Highway Safety	19,000	19,570	20,157	20,762	21,385	22,026	22,687	23,368	24,069	24,791	217,814
Roadway Strategy-1	85,386	87,948	90,586	93,304	96,103	98,986	101,955	105,014	108,164	111,409	978,855
Roadway Strategy-2	46,540	47,936	49,374	50,856	52,381	53,953	55,571	57,238	58,955	60,724	533,529
Roadway Strategy-3	30,000	30,900	31,827	32,782	33,765	34,778	35,822	36,896	38,003	39,143	343,916
Paving	115,000	118,450	122,004	125,664	129,434	133,317	137,316	141,435	145,679	150,049	1,318,346
Bridges	152,000	156,560	161,257	166,095	171,077	176,210	181,496	186,941	192,549	198,326	1,742,510
Maintenance	60,067	61,869	63,726	65,637	67,606	69,635	71,724	73,875	76,092	78,374	688,606
Transportation Bldg	3,000	3,090	3,183	3,278	3,377	1,500	1,545	1,591	1,639	1,688	23,891
Central Garage(eqip)	7,390	7,612	7,840	8,075	8,318	8,567	8,824	9,089	9,361	9,642	84,718
Large Steel Culverts	3,600	3,708	3,819	3,934	4,052	4,173	4,299	4,428	4,560	4,697	41,270
Small Culverts	23,905	24,623	25,361	26,122	26,906	27,713	28,544	29,401	30,283	31,191	274,049
Signals	3,689	3,799	3,913	4,031	4,151	4,276	4,404	4,536	4,672	4,813	42,285
Signs	1,009	1,039	1,070	1,102	1,136	1,170	1,205	1,241	1,278	1,316	11,566

(Table 6 continued)

Projected Funding Needs by SFY (Based on 2016 Dollars)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018-2027
Retaining Walls	1,058	1,100	1,144	1,190	1,238	1,287	1,339	1,392	1,448	1,506	12,702
Rock Slopes	2,730	2,839	2,953	3,071	3,194	3,321	3,454	3,592	3,736	3,885	32,774
Local Projects	17,229	17,745	18,278	18,826	19,391	19,973	20,572	21,189	21,825	22,479	197,507
Rest Areas	550	567	583	601	619	638	657	676	697	718	6,305
Town Highway Aid	48,619	50,078	51,580	53,128	54,722	56,363	58,054	59,796	61,590	63,437	557,367
Stormwater Assets	7,900	10,300	10,609	10,927	11,255	17,389	17,911	18,448	19,002	19,572	143,313
Rail	34,280	35,308	36,368	37,459	38,582	39,740	40,932	42,160	43,425	44,728	392,982
Aviation	6,000	6,180	6,365	6,556	6,753	6,956	7,164	7,379	7,601	7,829	68,783
Public Transit	37,656	33,421	37,055	38,538	40,122	41,349	42,924	42,121	39,280	46,278	398,744
DMV	28,910	29,777	30,671	31,591	32,538	33,515	34,520	35,556	36,622	37,721	331,421
Total Funding Needs	**849,484**	**871,806**	**900,630**	**928,062**	**956,374**	**988,951**	**1,019,000**	**1,047,527**	**1,074,898**	**1,113,016**	**9,749,748**

Funding Needs ($ Thousands)

Roadway Strategy 1 is the strategy required for removal of concrete slabs under the State Highway System, including full-depth rehabilitation. This constitutes approximately 9.4 percent of the total network.

Roadway Strategy 2 is the reconstruction of the state routes. It assumes that over a 20-year period, 20 percent of the state highway routes will be rehabilitated and 5 percent will be reconstructed.

Roadway Strategy 3 addresses the rehabilitation and reconstruction needs of the interstate routes over a 40-year period. It assumes that 75 percent of the interstate will be rehabilitated and the remaining 25 percent will be reconstructed over the next 40 years.

The Paving Strategy specifically addresses pavement condition targets. VTrans uses the Deighton Pavement Management System to assist in forecasting the pavement funding needs required to meet the 10-year TAMP condition targets. In this system, strategies are included to rehabilitate and reconstruct the network.

As was observed in Figure 3, based on the Federal rule requirements, currently approximately 3 percent of the total interstate pavements and approximately 4.8 percent of NHS pavements (including interstate pavements) are in poor condition (determined per the Federal rule). Based on a travel weighted average, VTrans has projected the needs to meet its internal targets of achieving, (a) less than 25 percent of the system in "very poor" condition, and (b) more than 70 percent of the system in "good" and "fair" condition. As shown in Table 6 (see page 32), these projections indicate a funding need of approximately $277 million in 2018 for pavements to meet the agency's targets. Table 6 also shows the total projected 10-year funding needs for surface treatments to be approximately $1.32 billion and for

pavement structures to be approximately $1.86 billion for the 10-year TAMP period. The agency has not specifically established any targets yet to meet Federal requirements. However, VTrans is confident that by meeting the more stringent, internal targets for customer service levels, asset conditions, and system requirements, it will be in a position to meet the applicable Federal requirements.

As discussed earlier in the report, over 50 percent, of the farm to market roads are in "good" condition. Though not designed for heavier vehicle movement, these roads are being used by heavier vehicles. About ten percent of these need to be reconstructed over a twenty-year period.

The 10-year funding needs for the town highways are separately shown in the Town Highway Aid projections.

Bridges

Vermont is facing the challenge of aging bridges similar to other states across the nation. Vermont has many bridges that have exceeded the expected life and are in dire need of investment. Table 7 shows the 2015-2017 allocations for

Table 7. VTrans 2015 through 2017 Bridge Budget

Bridge Budget Categories and % Split by SFY	2015	% Split Computed	2016	% Split Computed	2017	% Split Computed
Interstate Bridge Budget	51,967,015	37%	44,010,852	38%	52,785,722	50%
State Highway Bridge Budget	71,810,914	51%	49,164,341	42%	32,251,548	31%
Town Highway Bridge Budget	16,482,361	12%	22,956,001	20%	20,021,730	19%
Total Bridge Budget	**140,260,290**	**100%**	**116,131,194**	**100%**	**105,059,000**	**100%**

Table 8. VTrans Projections for Revenue Sources and Funding Needs for Bridges for 2018 through 2027

Bridge Revenue Sources and Funding Needs Projections /SFY	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018–2027
State Highway Bridge Revenue Projections	$46,577	$47,975	$49,414	$50,896	$52,423	$53,996	$55,616	$57,284	$59,003	$60,773	$533,957
Interstate Bridge Revenue Projections	$33,007	$33,997	$35,017	$36,067	$37,149	$38,264	$39,412	$40,594	$41,812	$43,066	$378,385
Town Highway Bridge Revenue Projections	$22,999	$23,689	$24,400	$25,131	$25,885	$26,662	$27,462	$28,286	$29,134	$30,008	$263,656
Total Projected Bridge Revenues	**$102,583**	**$105,660**	**$108,830**	**$112,095**	**$115,458**	**$118,922**	**$122,489**	**$126,164**	**$129,949**	**$133,847**	**$1,175,998**
Bridge Funding Needs	$152,000	$156,560	$161,257	$166,095	$171,077	$176,210	$181,496	$186,941	$192,549	$198,326	$1,742,510
Large Culverts Funding Needs	$3,600	$3,708	$3,819	$3,934	$4,052	$4,173	$4,299	$4,428	$4,560	$4,697	$41,270
Total Bridge and Large Culvert Funding Needs	**$155,600**	**$160,268**	**$165,076**	**$170,028**	**$175,129**	**$180,383**	**$185,795**	**$191,368**	**$197,109**	**$203,023**	**$1,783,780**
Projected Funding Gap for Bridges	**$53,017**	**$54,608**	**$56,246**	**$57,933**	**$59,671**	**$61,461**	**$63,305**	**$65,204**	**$67,160**	**$69,175**	**$607,782**

Revenue Sources and Funding Needs ($ Thousands)

different categories of bridges. The total amount ranged from a high of $140 million in 2015 to a low of $105 million in 2017. The estimated cost of strategies for bridges and pavements are shown in the funding needs section of the financial plan.

As explained in the beginning of this report, over the 10-year period, a plot of the age of bridges (Figure 1) shows steep hills and valleys. The projected bridge investment needs as computed by VTrans, which are a function of age, condition and performance, therefore also vary significantly from year-to-year. VTrans assumes that if the need so estimated in a given year is at a peak level, the funding and other resources available during that year will most likely be insufficient to meet such a high need. VTrans believes that based on life cycle planning and proactive preservation and maintenance it will be able to manage the projects planned for yearly delivery over the 10-year plan period in a manner whereby the needs are flattened out versus fluctuating significantly from year to year. To deliver an implementable and realistic TAMP, VTrans has projected annual funding needs based on such a flattening (averaging) of the long-term needs. It has projected a bridge funding need of $152 million for 2018 (Table 6), escalating annually at 3 percent for a total of over $1.7 billion over the ten year TAMP period. The funding needs are projected on the basis of many assumptions, and as underlying assumptions on project schedules, resource availability, and other factors change, VTrans expects that the yearly funding needs will also change.

Operation and Maintenance

The operations and maintenance needs include several essential costs that are captured under the "Personnel Services" category in Table 6. The Personnel Services category includes estimates for personal services, equipment, material costs, staff safety training, impact of addressing environmental regulations, implementation and updates to

asset management systems, maintaining inventories, and the collection, management and analysis of data. The TAMP financial plan, also addresses increasing personnel costs. It is noted that personnel costs have surpassed the cost of equipment and materials over the past few years. An experienced internal workforce brings significantly more practical knowledge to the agency. However, the higher salaries and compensation for such a workforce contribute to the overall administrative cost increases in the agency. These increases are reflected in the financial plan by a 3 percent increase each year for the plan period. The projected need for 2018 is approximately $113 million, which aggregates to approximately $1. 3 billion over the 10-year plan period.

Capacity Projects

The agency's focus as detailed in its report titled, "Road to Affordability" is to prioritize maintaining and managing existing assets. This focus is reflected in the absence of major capacity projects in the asset management plan. As discussed earlier in this report, any expansion is limited to project elements and minor lane additions that are functionally necessary. Based on current planning projections, VTrans does not have plans for addition of through lanes to the interstate or state roadways or new interchanges during the 10-year TAMP.

Other External Factors including Leadership Changes

The recession between 2008 and 2009, hurricane Irene in 2011, and a change in administration in 2006, all had a significant impact on VTrans' ability to deliver on its "Road to Affordability" plan. There have since been a lot of internal discussions and actions that have resulted in VTrans returning to its "Road to Affordability" approach. Overall, this approach which entails a focus on preserving and improving existing infrastructure has remained a part of the VTrans plan.

3.4 Funding Gaps

Comparing the agency's projections of Revenue Sources and Funding Needs, it is evident that Vtrans' funding needs exceed the projected revenues from all sources. Figure 10 (see next page) shows the funding gap based on the forecasted revenue sources and the projected funding needed to implement the draft TAMP. Not taking into consideration any adjustment for inflation, VTrans projects a funding gap in every year of the 10-year TAMP period, accumulating to approximately $3.45 billion (figured in 2012 dollars) over the plan period.

These projections demonstrate the constraints faced by the agency in its ability to sustain and improve the assets in "fair" and "good" condition, while replacing the assets that have deteriorated beyond the point where they cannot be addressed by preservation and maintenance.

Asset Sustainability Index

The Asset Sustainability Index is a measure of an agency's ability to deliver its asset management plan. An ideal Asset Sustainability Index (ASI) for an agency is 1.0. Figure 11 (see next page) shows that the projected Overall ASI for VTrans (for all assets) through 2027 is consistently lower than the desired 1.0, with a steadily declining trend over the second half of the plan period. This indicates that VTrans does not have the revenue sources necessary to fund the needs each year of the 10-year plan. The ASI trends can change as investment strategies change, other funding needs increase, revenues change, or funding gets redirected from asset management activities to other agency priorities.

Asset Sustainability Index is the ratio of the funds needed to deliver the plan to the revenue forecasted to be available for the plan period.

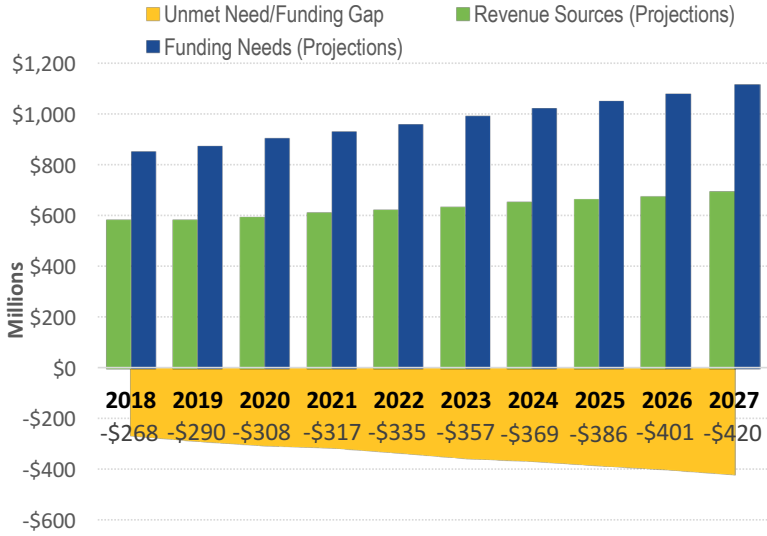

Figure 10. The Funding Gap in Millions Based on the 10-year Financial Plan (SOURCE: VTRANS)

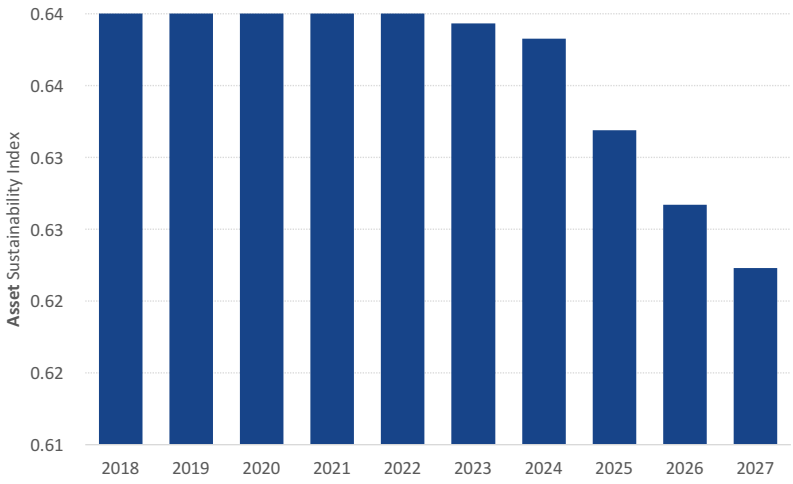

Figure 11. Overall Asset Sustainability Index for VTrans for the TAMP Period

Funding Gaps—Projected Revenue Sources and Funding Needs for Bridges

Table 8 provides further detail into the projected revenues sources and amounts, funding needs and gaps for the specific sub-category of bridges during the 10-year plan period.

VTrans used the average bridge revenue allocations from 2008 through 2011 to establish the baseline for projecting the future revenue allocations for bridges during the TAMP period. Although the agency had received some ARRA funds along with other funds to address its funding needs during the aftermath of hurricane Irene, VTrans did not consider it realistic to plan the implementation of the TAMP based on an assumption that there would be a similar future influx of such temporary funds. Therefore, the baseline for bridge revenue projections excludes such temporary funds. Beyond 2010, VTrans merged the bridge maintenance funding allocations with the State Highway System (SHS) and Interstate Highway System (IHS) projections. This approach to funding bridge maintenance is expected to continue and has been adopted in projecting bridge revenue allocations for the 10-year TAMP. The allocation of bridge revenues beyond 2018 has been assumed to grow at 3 percent. Table 8 shows the revenue sources, funding needs and the funding gap for bridges for the 10-year plan period. The funding gap starts at approximately $53 million in 2018, increasing each year to approximately $69 million in 2027. Table 8 shows a total gap for bridges of approximately $607 million between the projected funding needed and the estimates of revenues for the 10-year plan.

Funding Gaps—Projected Revenue Sources and Funding Needs for Pavements

As shown in Table 9 (see next page), VTrans assumes that in 2018, it will receive approximately $142 million for pavement surface and structure improvements, an approximately 2.5 percent increase over the amount it received in 2017. Projecting for the 10-year period, the agency assumes that revenues

Table 9. VTrans Projections for Revenue Sources and Funding Needs for Pavements for 2018 through 2027

Pavement Revenue Sources and Funding Needs and Gap Projections /SFY	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2018 –2027
Paving Projected Revenues	$113,238	$116,069	$118,971	$121,945	$124,994	$128,119	$131,322	$134,605	$137,970	$141,419	$1,268,650
Roadway Projected Revenues (Pavement Structure Improvements)	$28,891	$30,342	$31,809	$36,145	$33,390	$26,261	$32,379	$33,189	$34,018	$34,869	$321,294
Total Projected Pavement Revenues	**$142,130**	**$146,411**	**$150,779**	**$158,090**	**$158,384**	**$154,379**	**$163,701**	**$167,793**	**$171,988**	**$176,288**	**$1,589,944**
Pavement Surface Funding Needs	$115,000	$118,450	$122,004	$125,664	$129,434	$133,317	$137,316	$141,435	$145,679	$150,049	$1,318,346
Pavement Structure Funding Needs	$161,926	$166,784	$171,787	$176,941	$182,249	$187,717	$193,348	$199,149	$205,123	$211,277	$1,856,300
Total Pavement Funding Needs	**$276,926**	**$285,234**	**$293,791**	**$302,605**	**$311,683**	**$321,033**	**$330,664**	**$340,584**	**$350,802**	**$361,326**	**$3,174,646**
Total Projected Funding Gap	**$(134,796)**	**$(138,822)**	**$(143,011)**	**$(144,514)**	**$(153,299)**	**$(166,654)**	**$(166,963)**	**$(172,791)**	**$(178,814)**	**$(185,038)**	**$(1,584,703)**

Revenue Sources, Funding Needs, and Gaps ($ Thousands)

for paving will grow annually at 2.5 percent, while those for structure improvements will likely see some annual variability. Overall, the revenues for pavement surface and structure improvements are assumed to grow at an average of approximately 2.5 percent annually during the plan period. Table 9 shows the funding needed and revenue source projections required for the systematic rehabilitation and reconstruction discussed earlier in this report in addition to the preservation and maintenance. The projected needs from Table 6 are incorporated in Table 9 to compute the projected funding gaps for pavements. The projections in the 10-year plan show a total funding gap for pavements of approximately $1.58 billion. VTrans expects to bridge the funding gap by taking into account the agency's long-term asset management objectives and other influencing factors. These will continue to address VTrans' risk tolerance, refinements to assumptions, life cycle planning, long-term asset condition targets, system performance objectives, customer service level expectations, and the long-term financial needs and revenue projections. VTrans expects to make further iterations of its financial plan and be ready to submit the final TAMP submission to meet the Federal requirements.

3.5 Financial Challenges to Delivering the Plan

Vehicle Miles Traveled

Revenue uncertainties are the biggest concern for VTrans. Approximately 28 percent of VTrans' state revenues are dependent on gasoline taxes, which are in turn dependent on the VMT, making the VMT an important factor for VTrans revenues. The state has seen a decrease in VMT over the years. As shown in Figure 7, VMT in Vermont increased an average of 2 percent annually, peaking in 2003 at 7.9 billion miles. Since then, VMT declined by 820 million miles, or 10.2 percent, posting its largest decline since 1925. A continuation of this trend can have a substantial impact on VTrans revenues.

More Fuel-efficient Vehicles

In 2012, the Corporate Average Fuel Economy (CAFÉ) Standard was 25 miles per gallon (mpg) for new vehicles. It increased to 35.5 mpg in 2016, and is projected to be 54.5 mpg in 2025. Even a reasonably estimated increase in VMT is not expected to offset the reduced fuel taxes resulting from new vehicles built to the CAFÉ standards. Consensus forecasts in the state project flat gas tax revenue through 2017. They also project a decrease beyond 2017 resulting from improved standards for more efficient vehicles.

Delays can be Costly

If the revenue gaps continue or get exacerbated, the pavements and bridges that are currently being maintained and preserved can deteriorate, costing the state millions of additional dollars to rehabilitate and reconstructs these assets. The agency estimates that it will cost 17 times more to perform deck rehabilitation and 50 times more for reconstruction, as compared to timely preventive maintenance on the interstate bridges. It also estimates that it will cost 30 times more for rehabilitation and 66 times more for reconstruction of long structures. Delaying preventive maintenance and not treating the assets at the right time in their life-cycle can be costly. This can further compound the financial needs and add to the existing deferred liabilities.

Dependence on General Fund

Vermont relies on Federal funds to contribute to more than 55 percent of the agency's total transportation budget needs. The increased dependence of Federal transportation funds on general fund revenues, poses risks to transportation appropriation levels. The CBO projection of a shortfall of approximately $147 billion in the Highway Trust Fund by year 2022[vii] is a serious concern for VTrans. In the first year of FAST Act, several VTrans authorized rail capital assistance programs failed to receive appropriations. Such funding

issues can impact highway projects and programs, and the delivery of the TAMP.

Future Federal Funding

The FAST bill does not provide sufficient funding to reduce the backlog of projects to enable VTrans to make steady long-term progress in preserving and maintaining its highway assets. The VTrans financial plan shows a funding gap every year from 2018-2027 with a cumulative deficit of over $3.4 billion over the plan period. Additionally, since VTrans is not a donor state, it expects that in the future, if the FAST Act increases the minimum returns to donor states from 92 to 95 percent[viii], there can be a further reduction in Federal funding to VTrans.

Customer Service Levels

The agency is currently conducting a survey to understand customer expectations. Customer service levels have been identified by VTrans as an important factor guiding its TAMP as described earlier in this report. The survey results are expected to influence the project work proposed in the TAMP. VTrans also intends to conduct specific risk management exercises to understand and categorize all the risks to achieving its asset management and strategic objectives. The status of high priority risks will also influence the plan and result in some realignment of the budget allocations.

Additional Risks to Achieving the TAMP Objectives

Historically, VTrans' state budget allocations and the financial plan development were stand-alone activities, not aligned with the long-term asset funding needs. In developing the TAMP financial plan, it has been challenging for VTrans to reconcile the different categories of funding needs with the categories of available resources. Traditionally, as pressing short term needs arise, budgets are reshuffled to meet the needs. This approach complicates the

development of a long-term financial plan. Without a formal TAMP financial plan detailing the annual funding needs and the revenue sources for the TAMP period, understanding the impact of such budget changes on the TAMP and the ability of VTrans to meet the yearly and long-term targets, become challenging.

3.6 Use of the Financial Plan by VTrans

Communicating Lowest Cost of Ownership to External Stakeholders

VTrans understands that a well-developed asset management financial plan is a very powerful tool that provides the summarized big-picture view of the financial health of an organization and its ability to deliver its mission and objectives. Transportation organizations in Australia and the United Kingdom have used their plans to communicate to stakeholders, to demonstrate how they used (and plan to continue using) the monies allocated to them cost-effectively and efficiently, to maintain and improve their transportation assets. They also used their plans to communicate the funding gaps, and the implications of these gaps on what customers should expect in the services being provided, as well as, any accruing and deferred liabilities. VTrans plans to use its financial plan to present a long-term view of its financial ability to sustain the useful life of its assets cost effectively. VTrans also intends to use the financial plan to communicate how its asset management strategies will result in the lowest cost of ownership for its stakeholders and reduce accrued liabilities for the future generation.

Asset Management Catalyzing Internal Alignment and Prioritization

VTrans has been using the draft TAMP to catalyze decisions, both, horizontally and vertically within the agency, with a focus on prioritizing and evaluating risks. The agency personnel involved in the effort explain that the asset management

work groups have benefited from the TAMP and financial planning activities. Group members now have a better understanding of risk-based management and the importance of managing high priority risks. They understand the long-term implications of delaying treatments, and of the significantly higher cost of delaying preservation and maintenance on long-living assets. The exercise of developing a financial plan for the TAMP has thus served well in educating and training agency personnel on (a) the benefits of asset management, and (b) the need for long-term financial planning. This education is also expected to facilitate cultural changes within VTrans not just as it relates to long-term asset management, but also in day-to-day decisions, and the importance of preservation and maintenance treatments.

Driving Budget Recommendations

VTrans is in the process of refining individual asset management plans for all its assets. It intends to address customer expectations in establishing targets for each of the individual assets. Each plan will address the funding needed to achieve that asset's condition targets. The current financial plan focuses on bridge and pavement funding needs. As the plans for other assets get completed, the funding needs from each of these plans will be consolidated into an overall agency plan. Based on agency priorities and risk tolerance, investment scenarios will be developed to balance the funding needs for all assets with the available resources. The final projections for all funding needs will be used to drive budget recommendations.

Risk tolerance is the amount of risk an agency is willing to take.

Driving Right Mix of Projects

VTrans has been focused on implementing "the right treatments on right assets at the right time", as stated by

Sustain assets cost-effectively with right treatments on right assets at the right time.

Mr. Allen. The agency intends to use the TAMP and the resulting financial needs analysis to drive the right mix of projects. The aging infrastructure, the farm to market road needs, and the roller coaster like numbers of bridges requiring major rehabilitation and reconstruction—all are at the forefront of the agency's financial decisions. By systematically planning reconstruction and rehabilitation projects over a 20-year or longer time period, the agency intends to continue to focus on preservation and maintenance to the extent possible. This will also ensure that life cycle planning activities are supported and ingrained into the VTrans culture ensuring that assets in good and fair condition are preserved and improved cost effectively over their useful life.

Developing Tools to Communicate Value of Asset Management and Tradeoffs

The agency also plans to develop tools to communicate more clearly to its stakeholders, what they can expect to get from the allocated budget. Using these tools, VTrans expects to be better positioned to inform the public and legislators not only what the budget buys, but also the impact of the tradeoffs that were necessitated to balance the budget. With the funding gaps, the tools will clearly communicate reductions to condition targets made, any project work postponed to balance the budget, and the impact of any delays. The simplicity and transparency in communicating the value provided with the budget allocations in the 10-year financial plan will serve as an important tool to inform and engage the stakeholders. It will provide stakeholders the information to appreciate the reason for any reduction in services or future deterioration in asset conditions. It will also provide them information about any loss in asset value and any deferred liabilities. Additionally, if the stakeholders perceive that the

agency is doing a good job with the funds allocated and if they think that the services planned with the allocated funding are inadequate, they will have a clear understanding of the options available to them. With a better understanding of the financial implications, stakeholders can either accept the services and acknowledge any loss in asset value, or voice their expectations for better services and support or lead measures to raise resources to achieve these higher customer expectations.

Reinforcing the Link between Performance, Risk, and Asset Management

The TAMP financial plan development effort has also forced a discussion within the agency about the high priority risks that need to be addressed, and expectations for the performance levels, service levels, and asset conditions. The TAMP teams have to balance the asset and financial risks of deferring treatments in developing and recommending long-term funding for the TAMP. Funding needs for multiple objectives and assets have to be balanced in the long-term financial plan. Well-reasoned tradeoff decisions have to be made. Funding shortfalls that result in lowering performance and condition expectations can result in the need for more expensive future treatments. Similarly, reducing funding for certain categories of assets can result in safety risks. Examples include, bridge and culvert collapses, rock falls, and accidents due to pavement deterioration and shoulder drop-offs. The financial plan will reinforce the link between performance, risk and asset management, and enable VTrans to communicate the relationship and delicate balance between these three to stakeholders.

Organizational Alignment to Support Risk and Performance Based Asset Management

VTrans created a new Asset Management and Performance Bureau to support data-driven risk and performance based asset management. This bureau includes three sections that

work closely together to deliver the agency's asset management objectives. It includes, 1) Performance (Risk is included in this section), 2), Budget & Programming, and 3) Data Management. This organizational structure reinforces the organizational commitment of VTrans to ensuring the linkage between performance, assets, risk, and data management.

Highlighting the Importance of Data

Data has been at the center of many VTrans discussions and decisions throughout the TAMP development process. It has been the common critical element in developing the TAMP for each of the assets. All the planning and budgeting decisions being made by VTrans rely on data. The 10-year future projections are based on historical data and trends. The agency relies on data to understand the current asset's location and condition, the historical performance and asset treatments, the traffic volumes, and the use, wear, and tear of assets. Projections of deterioration and future asset conditions also rely on data. For VTrans, obtaining the past, present, and projected future financial information associated with each of the assets has often proved to be difficult. With data being the backbone of decisions, gaps in data while developing the TAMP or a TAMP financial plan, can result in an unusable plan. Also, once developed, in order to be relevant to decision-making, both the TAMP and TAMP financial plans have to be updated to reflect major changes to factors that influence these plans. For the plans to be good decision-making tools, VTrans thinks that having reliable data is important. Towards that end, VTrans initiated a process to identify important input data, document their sources, formalize the analysis of the data, and develop workflows to update the plans when necessary.

Applying the Highway TAMP Financial Planning Experience to Other Modes

Two-thirds of VTrans' budget goes to highway projects. The remaining one-third goes to rail, aviation, and transit assets.

The agency has benefited from the long-term planning, risk prioritization, and tradeoff decisions made in developing the TAMP financial plan for highway assets. It intends to use this experience to develop long-term financial plans for other modes.

Enhancing Understanding and Influence Internal Processes

Engaging in asset management financial planning has generated a better appreciation of the asset needs and the funding constraints. It has organically led to some streamlining of internal processes. It also led to agency teams identifying the need to document processes and data sources to update the plans in the future. The agency is in the process of developing cost information and deterioration models for bridges. These will be used to generate investment scenarios and treatment options for long-term, cost effective management of bridges.

Expanding the Adoption of Asset Management

The asset management plan development effort has catalyzed interest from other asset owners within the agency. In the past, the TAMP planning horizon was shorter, the process was less rigorous, and the effort was limited to fewer people. This made engaging agency personnel in asset management more difficult. Now, with the benefits more visible and the process more mature, the benefits of the TAMP have become part of routine conversations. This TAMP development effort has made asset owners who have so far not been involved in the TAMP development, eager to start developing asset management plans for their assets.

Corridor Level Thinking

The financial plan has highlighted long-term resource constraints faced by VTrans. It has brought to the forefront, the reality of having to work with less than the required amounts of funds. This led to more innovative approaches to managing the network. One such innovation is the understanding of

"Corridor Needs." For VTrans, this is about understanding issues at a geographic location along a state maintained highway that poses a problem to normal maintenance and operations of the highway system. Historically, the VTrans Maintenance and Operations Bureau has addressed such issues. However, the reality is that such issues cannot be properly managed with the limited maintenance resources available to the Bureau. To address such corridor needs, the agency developed a "Corridor Needs Toolkit" that serves as a long-term planning tool. This enables a holistic approach to managing and treating the entire corridor. It provides a mechanism for the Asset Management and Performance Bureau to collaboratively and strategically plan and coordinate treatments with other Bureaus for the entire corridor. It allows VTrans to use the maintenance personnel to address safety and other urgent needs while planning strategically and applying asset management for emerging needs. This will also help avoid duplication of work on the corridors. The tool will influence budget allocations and help VTrans balance important maintenance and capital improvement priorities on the corridors cost-effectively.

Conducting More Risk Prioritization Exercises

Addressing the growing needs of the aging infrastructure with the financial constraints demands an assessment of risks and prioritization of work. The agency has already conducted several risk management exercises to assess and prioritize risks to bridges, pavements, and other high priority assets. With safety as a high priority, the agency plans to conduct more risk assessment exercises in the future. This will enable VTrans to further refine the high priority risks based on impact and likelihood. From the financial perspective, the results will provide decision-makers a better understanding of (a) new risks, (b) the financial implications of timely versus delayed risk mitigation, (c) related cost implications, and (d) the magnitude of deferred liabilities.

4. Updating the Plan

VTrans intends to use its asset management financial plan as a decision-making tool. Its perspective is that if kept updated, the plan will provide executives a pulse of the agency's long-term financial plan to manage its assets. It will also provide an overview of the agency's financial ability to deliver a planned portfolio of projects to 1) improve, manage and maintain the assets in good condition, 2) improve or retain asset value, 3) show its financial ability to service its customers, 4) convey, in a simple way that stakeholders can understand, how the agency is effectively managing the cost of ownership, and 5) show the risks and accumulated liability of deferred action.

Since asset management is strategic, it is a long-term approach to managing these long-living assets. VTrans believes that it is important for each year's strategies that address preserving and maintaining the health of its assets to thread together and be aligned with providing the long-term cadre of projects and activities that, (a) maximize the overall asset value of its transportation infrastructure, (b) yield the highest rate of return, and (c) lower the cost of ownership for its stakeholders. Though political factors do influence agency strategies, there are many non-political factors that directly influence future conditions and performance of assets. Management strategies depend on many such non-political factors including the budget allocated, the treatments planned and completed, the effectiveness of the treatments, asset deterioration, and the volume and type of traffic. Other external factors, such as, changes in technology, availability of construction resources and materials, inflation, snow, fire, floods, and other climate related factors, also impact the plan. Any changes to these influencing factors may require some change to the agency's overall asset management plan. Some of these changes may enable the agency to do more projects, others may require a shift

in priorities, while yet others may require delays to some projects. For example, extreme natural events, such as, hurricanes, fires and earthquakes, may require a change in strategy to stabilize or reconstruct affected assets that were not part of the plan. Similarly, constraints in construction material availability may necessitate stock piling material or delaying projects.

An outdated asset management plan and financial plan loses value to decision makers and erodes the agency's credibility. An updated asset management plan that is not reflected in a financial plan may not be implementable. VTrans recognizes that as influencing factors change, updates have to made to both the asset management plan and the financial plan for them to be relevant decision-making tools.

5. Benefitting from the Efforts: The VTrans Approach

Change Management Process: To address the changes that can impact the validity of the plans, VTrans plans to dedicate some resources to keeping the plan updated. Since these documents will serve as decision tools, the updated plan can provide valuable inputs to accomplishing the agency's strategic objectives.

Reviews with State Transportation Improvement Programs or State Budget: The agency does not expect to make updates to the TAMP financial plan with every update to the state budget or State Transportation Improvement Program. However, the agency intends to review the assumptions in the plan and as assumptions change, review the impact of the changes. It intends to make internal updates to the plan or develop supplements based on the magnitude of the impact.

Update with New Federal Re-Authorization Update: Updates to Federal authorizations, or new Federal re-authorizations may have an impact on the Federal funding available to VTrans. Since over 55 percent of the VTrans' transportation budget is from Federal funding, VTrans expects that the plans will need to be reviewed and either updated or supplemented to align with Federal reauthorizations or updates.

Unplanned Changes to Major Assumptions: The TAMP financial plan addresses long-term needs. The financial projections are based on many assumptions of investment needs and of revenues from multiple sources for a 10-year period. The agency intends to review these assumptions at least on an annual basis, if not more frequently. It intends to make refinements to its strategies based on the impact of changes to the plan's assumptions and projections. Further, it plans to formally update the asset management plan and financial plan every two years.

6. Lessons Learned

The complexity and difficulty of developing an asset management plan and the related financial plan can seem onerous. VTrans notes that heading into the development of the TAMP and the related financial plan, the team responsible for their development felt that it was going to be a hard task to complete. On completing the first draft, the agency team concluded that it was not as difficult as they expected. Team members augment that sentiment by explaining that once they started the project, they realized that a lot of the content and data for the financial plan were already available and these needed to be refined and compiled. Historically, though financial plans have been developed for budget allocations, they did not cover a period of 10 years and did not have the level of detail needed to support the TAMP requirements. Also, assumptions were periodically revised

while the financial plan was being developed. The projection and alignment of funding needs and revenue sources is a very dynamic and iterative process and an agency can expect multiple iterations before a final plan is achieved. The sentiment of VTrans personnel involved in the planning effort is that they never feel like they have a "final" plan. Rather they plan to evolve and improve upon the guidance and structure included in their initial TAM financial plan. This exercise has helped the team understand that such changes are to be expected, and as the financial plan development process matures, the team will get more comfortable with incorporating the changes, understanding the implications to the TAMP, and also be able to make decisions on risk prioritizations and tradeoffs.

Invest Time on Team Makeup: VTrans, like several other state transportation agencies, has a lot of data in silos. Without an integrated enterprise source for agency data, identifying and locating data can be time-consuming. In the VTrans experience, time spent upfront in engaging the right people in each of the asset management groups paid dividends. The agency also benefited from having the person developing the statewide long-range transportation plan (SLRTP) also organize the asset management planning effort. The SLRTP effort required identifying various data sources and collecting a significant amount of data. However, because of the organization of the project teams, this data served the development of both the TAMP and the SLRTP. Also, because of the collaboration between the TAMP and SLRTP efforts, team members sitting around the table either had the data or knew from where or from whom to obtain the data. This was a big timesaver in the TAMP financial plan development process.

Facilitation in Documenting Assumptions: VTrans believes that expert facilitation can be helpful to ensure the right balance between discussions and diversions. As simple as

it may seem, the process of identifying assumptions and understanding them was one of the more difficult and time consuming activities. Often the assumptions were understood by just one person and explaining the details would sidetrack the teams into general discussions that were tangential to the main discussion. Overall, this proved to be a good activity that helped expand the understanding and background behind various assumptions to many more agency personnel. These discussions also helped the team to question and refine the assumptions.

Data Supporting the Plan: Identification of the necessary data can be time-consuming. Data that feeds the financial plan is a vital and driving component that contributes to the credibility of the plan. To ensure consistency and continuity of this data feed, VTrans felt that it was important to document the data supporting the plan and understand the sources. Having identified the source of the data for the plans, the agency is making sure that the source data is updated, reliable and accurate for planning purposes, and accessible for future plan updates.

Rigorous Analysis and Right Metrics: In VTrans' experience, the analysis used and the financial metrics developed to communicate asset performance measures form the heart of the story being conveyed in the financial plan. Knowing the right metrics to use to convey the agency's decisions to stakeholders with clarity is important and can impact the agency's credibility. Therefore, it is very important to develop good metrics, conduct rigorous analysis, be able to clearly explain the metrics, and effectively present the information to stakeholders in simple formats.

Automate Data Routines and Use Simple Charts and Graphs: Charts and graphs can be useful to summarize complex details and present them in ways that are easy to understand. Developing the necessary charts and graphs for

the plan can be time-consuming. The VTrans experience is that in the long-run it is important to automate, to the extent possible, the data routines to backfill the charts and graphs in real-time with actual financial data.

Modeling and Scenario Planning: This is a future growth area for the agency. Early models and scenario planning may not be mature, but that should not be a reason to delay developing the plan. VTrans expects that in time, agency personnel will develop asset management programming skills, gain expertise in developing individualized asset management plans, and incorporate customer service levels for specific assets. As personnel continue to work on the models, they will gain a better understanding of the variables that impact the financial plan. Maturity in modeling is also expected to result in better scenario planning and improvements in condition level forecasts.

Revenue and Inflation Forecasting to Improve Financial Planning: VTrans has become fairly good in this area. However, to assess and refine these skills, VTrans believes that a process to compare and refine the forecasting process is important. This will mean that in 3 to 5 years, it will be essential to look back, review the forecasts prepared earlier, and ask questions such as, “Are we where we thought we would be?”, “How well did we forecast?”, “How close were our forecasts on revenues and needs?”, “How good was our analysis?”, and “Did we capture, prioritize and analyze the risks well?”. The responses to these questions will be used by VTrans to identify and augment gaps, and to improve its financial forecasting capabilities.

Simple, Meaningful, Accurate, Reflecting Agency Processes and Tiered (SMART) Performance Metrics: VTrans believes that in the future, developing financial performance metrics that are SMART will be useful to realistic asset management financial planning throughout the agency. The next step of

maturity that can be beneficial to the agency is to have performance metrics that are simple, meaningful, easy to understand, and accurate. They should reflect the agency's business processes so that they can be used at all levels and tiers of the agency.

7. Suggestions for Peers

VTrans has been working on its asset management plan and the financial plan for nearly two years. Throughout the process, the agency sought and learned from the experiences of other states. From its own experience with the plan development effort, it suggests the following for other peer states that are in the early phases of developing their asset management financial plans:

Expect Bumps in the Journey: Starting the plan development may not be smooth. Expect road-bumps throughout the plan development process. Expect organizational support as well as resistance to the process. Expect gaps in data, but do not let that delay the process.

Involve the Right Stakeholders: Take time to assemble the plan. Include personnel involved in developing the agency's strategic and long range plans in the asset management plan development effort. Include the leadership team, financial officers, subject matter experts from different asset areas, construction, planning, programming and maintenance, analysts, and data experts.

Align Plan Development and Updates with Other Agency Efforts: Try and align the development of the asset management and financial plan with the development of the agency's long-range and other strategic plans. Align updates to the plan with other similar strategic plan efforts to have synergy, eliminate duplication and redundancy in resource utilization,

and reduce data inconsistencies. If possible, try to include asset valuation as a factor in the development of the plans.

Data is the Backbone: It is important to understand that data is the backbone of the asset management financial plans. The results achieved from past investment in different treatments provide valuable information on recommendations for future allocations. Information on expenditures, revenues, future funding projections, realistic past use and future allocations to asset categories, major work activities, and treatments, are important inputs. Proactive identification and tracking of financial data that serves as input to the plan makes analysis and scenario planning routine, rather than a one-off effort that hinges on the availability of experts or specific personnel for access, analysis, and updates.

Make Data Access Easy: Providing easy access to financial data can make asset management financial data analysis routine. Financial realities thus take center stage in asset management decision making, and strengthening and routinizing realistic tradeoffs. It expands the understanding of various asset management strategies and the financial implications of cancelling, delaying, or accelerating the implementation of the TAMP to more agency personnel. With more personnel accessing the data and understanding the long-term decisions as-well-as the link to day-to-day activities, the potential for institutionalizing asset management increases.

Align Risk Prioritization to Accomplishing Agency Objectives: Align and prioritize risks based on asset condition and system performance, and link it to achieving agency objectives. Base the financial plan on real scenarios to serve as a decision-making tool. Developing a financial plan for the sake of completing one is a waste of resources. Instead, develop a plan that serves multiple users at multiple levels of the agency.

Plan Preparation is Iterative: The plan is a working document. Once a draft is completed, be prepared to iterate and refine the plan as new information becomes available, and assumptions and influencing factors change. Also, be prepared to review and update the plan periodically over the course of the plan period.

Emphasize Ripple Effect of Incremental Budgeting: In the past, budgeters often worked on annual or short term budget allocations with annual incremental increases or decreases based on historic allocations. This coupled with the reality that often asset management personnel are not engaged in the budgeting process can result in short-term budgets that are not linked to long-term, cost effective strategies. These short-term budgets can result in selection of treatments that may not effectively address asset deterioration. This approach over time can cause a ripple effect resulting in the need for treatments that are significantly more expensive.

Prioritization and Separation of Roadway Tiers: If an agency is not separating the different tiers of roadways to the levels required by the Federal regulations, then starting the separation sooner will be helpful in the long-run. The VTrans experience indicated that it helped to (i) look at the long-term asset needs, (ii) ensure that Federal requirements were addressed, and (iii) look beyond the Federal requirements at the overall system performance.

8. Endnotes

[i] Asset management mandated by Vermont Legislature (Act 64 in 2001) and documented under 19 V.S.A. § 10k—Highways.

[ii] Sec. 24: 19 V.S.A. § 10k, Sections 24 and 25 of Act No. 488 passed by the General Assembly of Vermont in 2001/2002.

[iii] Policy for Enhancement of Transportation Projects, Vermont Agency of Transportation, Policy Manual, effective Dec 6, 2007.

[iv] Vermont Agency of Transportation, 2016 Fact Book and Annual Report, Page 8.

[v] Snelling Center for Government: Vermont Roads and Bridges, "To Fix or Abandon", November 2008.

[vi] https://www.cbo.gov/publication/43198, "How Would Proposed Fuel Economy Standards Affect the Highway Trust Fund?", Congressional Budget Office, May 2012.

[vii] https://www.cbo.gov/publication/43198, "How Would Proposed Fuel Economy Standards Affect the Highway Trust Fund?", Congressional Budget Office, May 2012.

[viii] Final Report, Vermont Transportation Funding Options, Section 40, Act 153(2012), Committee on Transportation Funding, page 2.

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