Projections

CHAPTER 3

In the previous chapter, we saw that the general trend in trunk highway spending has been upward since the mid-1970s, although spending has declined from the peak reached in 1988. Spending has also not kept up with the growth in traffic on Minnesota's trunk highways since the mid-1970s.

In this chapter, we examine the projected revenues for the Trunk Highway Fund and Mn/DOT's spending plans through fiscal year 2001. We consider the implications of financial projections and spending plans for the condition of trunk highway pavements and bridges. In particular, we address the following questions:

- **How does projected revenue growth for the Trunk Highway Fund compare with expected inflation?**
- **How does Mn/DOT propose to spend trunk highway revenues over the next two to four years?**
- **What are the implications of these financial projections for the condition of trunk highway pavements and bridges?**
- **Does Mn/DOT have adequate methods for projecting trunk highway needs?**

To analyze Trunk Highway Fund revenues and expenditures, we used projections recently prepared by Mn/DOT. Mn/DOT estimated revenues and expenditures for fiscal year 1997, as well as for the next four years. Revenue projections were based on current law. Expenditure projections incorporated the Governor's recommendations for the 1998-99 Biennial Budget.

We compared estimated revenues and expenditures for the 5-year period 1997-2001 with actual revenues and expenditures for the last 10 years, 1987-96. All revenues and expenditures were converted to 1996 dollars using estimates of past and future inflation rates obtained from the Department of Finance and

prepared by Data Resources, Inc.[1] The comparison period includes a period (1988-90) of historically high revenues and expenditures, as well as a period (1991-94) of generally declining revenues and expenditures.

These projections of revenues and expenditures are reasonable estimates. However, future economic conditions, the public's desire to travel on highways, and Congressional decisions about federal aid are all difficult to forecast and will play a key role in determining the actual level of future revenues and, indirectly, expenditures.

REVENUES

Projections indicate that:

- **Average annual revenues for the Trunk Highway Fund over the next 5 years will probably be close to the average experienced over the last 10 years.**

Table 3.1 shows that average annual revenues for 1997-2001 are estimated to be $871 million in 1996 dollars. This estimate is within 1 percent of the 1987-96 average of $879 million. Despite no increase in the tax rate, state gasoline taxes are expected to keep up with inflation, as measured by the deflator for state and

Table 3.1: Comparison of Projected 1997-2001 Trunk Highway Fund Revenues with the 10-Year Average for 1987-96

	Average Annual Revenue (in millions of 1996 dollars)			Average Annual Revenue per Capita (in 1996 dollars)		
	1997-2001 (Projected)	1987-96 (Actual)	Percentage Difference from 10-Year Average	1997-2001 (Projected)	1987-96 (Actual)	Percentage Difference from 10-Year Average
REVENUES						
Gas Tax	$311	$298	4%	$65	$67	(3)%
Vehicle Registration Tax	267	225	18	56	50	10
Other State Sources	76	94	(19)	16	21	(25)
Federal Aid	217	262	(17)	45	59	(23)
Total Revenues	$871	$879	(1)%	$182	$198	(8)%

Source: Legislative Auditor's analysis of data from Mn/DOT, the Department of Finance, and Minnesota Planning.

1 We used the state and local government deflator for consumption expenditures and gross investment to convert historical and projected revenues and non-construction expenditures to 1996 dollars. As in Chapter 2, we used the Minnesota Highway Construction Cost Index to convert highway construction expenditures to 1996 dollars. Because projected values of the index are not available, we constructed a proxy from indices for which forecasts are available. The proxy consist of 60 percent of the state and local government deflator for expenditures on structures and 40 percent of the deflator for residual fuels in the oil refining process. The 60 percent weight reflects the significance of concrete and steel in highway construction work, while the 40 percent weight reflects the importance of bituminous products, which are a by-product of the oil refining process. Our results would not have been significantly different if we had used the same deflator for future highway construction spending as we used for future revenues and other expenditures.

local government purchases.[2] Average annual revenues from vehicle registration taxes are projected to be 18 percent higher during the next 5 years than during the last 10 years. The growth in vehicle registration taxes is primarily due to the projected increase in vehicle prices. Registration taxes are based on the value of vehicles sold and are thus more responsive to general inflation in the economy than the current fixed-rate gasoline tax. Other state sources of revenues and federal aid are, however, expected to be lower over the 1997-2001 period.

On a per capita basis, average annual revenues are projected to be 8 percent lower over the next 5 years than the last 10 years. Only revenues from vehicle registration taxes are expected to exceed the level experienced from 1987 to 1996. If traffic levels continue to increase faster than population, then revenues per vehicle mile traveled over the period 1997-2001 will be more than 8 percent lower than they were over the last 10 years.

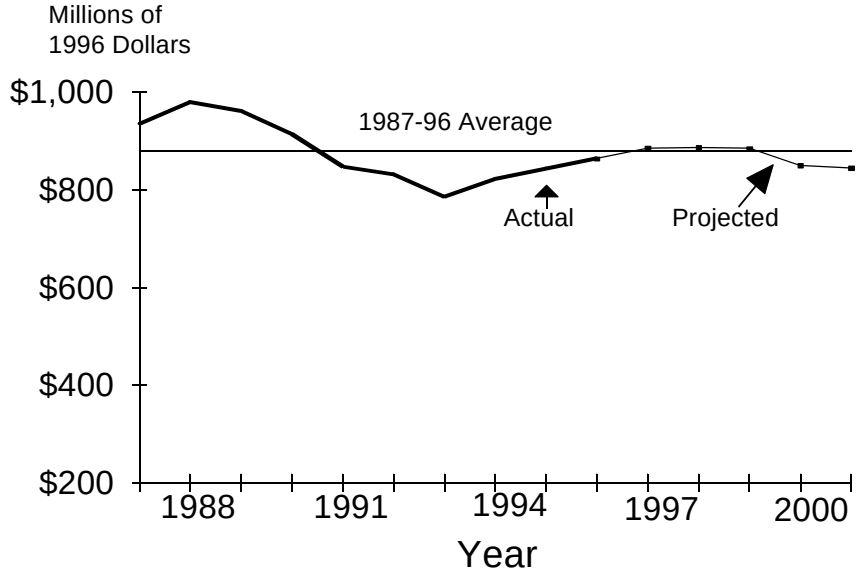
Figure 3.1 shows that:

- **Trunk Highway Fund revenues are expected to increase through fiscal year 1999 and then decline slightly.**

Overall, the estimated decline in revenues is about 5 percent from 1999 to 2001. Most of this decline is due to lower levels of expected federal aid in the years 2000 and 2001. Mn/DOT expects the levels in 1998 and 1999 to be higher due to

Trunk highway revenues are expected to be close to the 10-year historical average.

Figure 3.1: Trunk Highway Fund Revenues, Actual and Projected, 1987-2001



Source: Program Evaluation Division analysis of Mn/DOT data.

2 By the year 2000, the growth in gasoline tax revenues is projected to slow down and be slightly less than the inflation rate. This modest slowdown in the expected rate of revenue growth is because the phase-out of the blender's credit for ethanol will have been completed by 1999.

demonstration grants from the federal government. However, projections of federal aid are subject to some uncertainty, particularly at this time.[3] Congress will be considering the reauthorization of the Intermodal Surface Transportation Efficiency Act later this year. Better information on future levels of federal aid will be available after Congress acts on this legislation.

SPENDING

Table 3.2 indicates that:

- **Average annual trunk highway expenditures from 1997 through 2001 are expected to be about 5 percent above the average for the last 10 years.**

Spending is also expected to be close to the historical average.

Table 3.2: Comparison of Projected 1997-2001 Trunk Highway Expenditures with the 10-Year Average for 1987-96

	Annual Averages (in millions of 1996 dollars)		
	1997-2001 (Projected)	1987-96 (Actual)	Percentage Difference from 10-Year Average
Trunk Highway Construction	$405	$407	(1)%
Other Mn/DOT	376	355	6
Other Departments	82	75	10
Miscellaneous[a]	30	12	139
Total	$892	$849	5%

Source: Legislative Auditor's analysis of data from Mn/DOT and the Department of Finance.

[a]Includes buildings, shared construction, and Mn/DOT spending in non-trunk highway program are as.

In 1996 dollars, average annual spending on trunk highway construction projects over the next 5 years is estimated to be about one percent less than the average experienced over the last 10 years. Expenditures by Mn/DOT for operations, engineering, general support, administration, equipment, and debt service are expected to be about 6 percent higher on average over the next 5 years than they were over the last 10 years.[4] Average annual spending by the Department of Public Safety and other departments out of the Trunk Highway Fund is estimated to increase by 10 percent. Spending on other miscellaneous activities is expected to more than double. About two-thirds of the increase in this relatively small

3 Due to uncertainty about federal aid, Mn/DOT included a $20 million reserve in its budget plan for the Trunk Highway Fund. This reserve would be needed in case expected federal aid during 1998 and 1999 falls short of projections.

4 We amended Mn/DOT's projections to reflect its recent request to add $16 million in 1997 to its operations budget for the additional costs of snow and ice control this winter. That change also reduced projected highway construction expenditures in 1997 by $16 million.

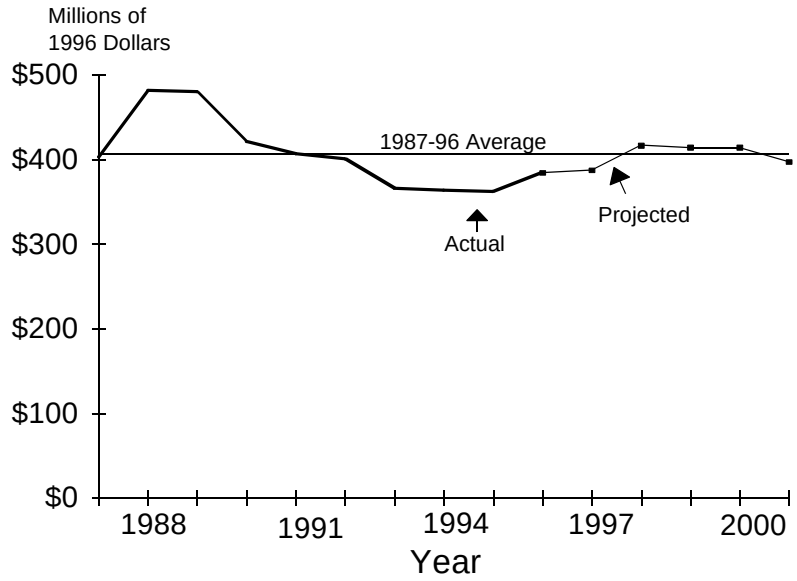
category is due to the new shared construction program.[5] The remainder is due to increased spending on capital building projects.

Figure 3.2 shows how trunk highway construction spending has varied over the last 10 years and how it is projected to change over the next 5 years. Similar to the trend we saw in overall revenues:

- **Highway construction spending is expected to increase through 1998 and then decline by about 5 percent by 2001.**

Construction spending is expected to increase during the 1998-99 biennium but decrease during the following biennium.

Figure 3.2: Trunk Highway Construction Expenditures, Actual and Projected, 1987-2001



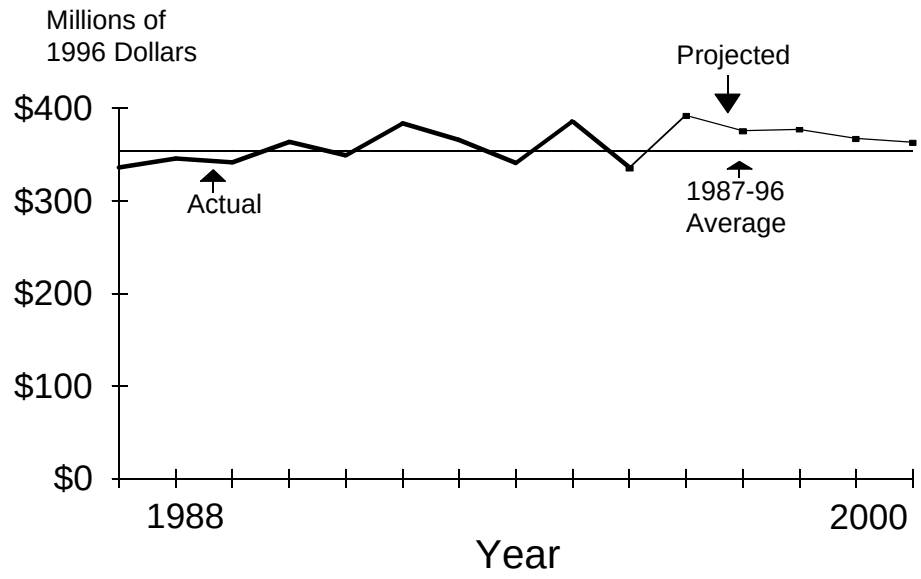
Source: Program Evaluation Division analysis of Mn/DOT data.

Projections for other trunk highway expenditures by Mn/DOT are shown in Figure 3.3. These projections also show spending declining in 2000 and 2001. Other trunk highway spending by Mn/DOT is expected to increase in 1997 and then decline by 9 percent by the year 2001. The decline is a little larger than for construction spending because Mn/DOT carried over part of its non-construction appropriations for 1996 to 1997. As a result, spending in 1996 was lower than previously anticipated and spending in 1997 will be higher than it otherwise would have been.

Overall spending and revenue trends for the Trunk Highway Fund seem somewhat inconsistent. We saw in Table 3.1 that revenues over the next 5 years are expected to average about 1 percent less than the annual average over the last 10 years.

5 Under the shared construction program, Mn/DOT does construction work at the request of various political subdivisions, and the Trunk Highway Fund is ultimately reimbursed for these expenditures. As a result, the cost of the shared construction program to the Trunk Highway Fund is a relatively minor reduction in investment earnings. The increase reflected in Table 3.2 greatly overstates the ultimate net cost to the fund.

Figure 3.3: Other Trunk Highway Expenditures by Mn/DOT, Actual and Projected, 1987-2001



Source: Program Evaluation Division analysis of Mn/DOT data.

However, average expenditures from 1997 through 2001 are estimated to be 5 percent higher than the 10-year historical average.

There are two reasons for this apparent inconsistency. First, we used a different inflation index to deflate construction expenditures than we used for other expenditures and for revenues. As we explained in Chapter 2, prices paid by Mn/DOT for highway construction have been relatively stable over the last 10 years. While prices faced by state and local governments rose 30 percent between 1987 and 1996, construction prices paid by Mn/DOT increased less than 10 percent. Our use of the Minnesota Highway Construction Cost Index to deflate past construction spending is responsible for about half of the overall difference between revenue and expenditure trends.

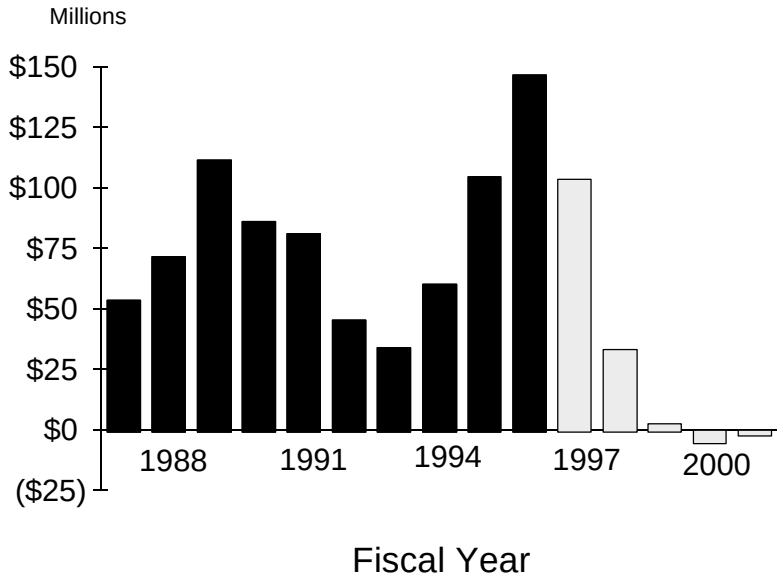
Second, most of the remaining difference results from the spending down of Trunk Highway Fund balances. As Figure 3.4 shows, the fund balance was about $147 million at the end of 1996 and will be less than $3 million by the end of 1999 if the Governor's proposed budget is adopted. Mn/DOT has forecast small year-end deficits for 2000 and 2001.[6] Mn/DOT's spending plans essentially anticipate the spending down of fund balances during the 1997-99 period. As a result:

- **Trunk highway spending during the 2000-01 biennium is expected to be about 4 percent lower than during the 1998-99 biennium.**

6 Mn/DOT's projections include some contingency funds for 1997-99, which, if not needed, may preclude the fund from running a deficit after 1999. The projection for 1997 includes a $6.75 million contingency, while the projections for 1998 and 1999 each include a $10 million contingency.

The boost in spending during the 1998-99 biennium is possible because of the large fund balance in the Trunk Highway Fund.

Figure 3.4: Year-End Balances in the Trunk Highway Fund, Actual and Projected, 1987-2001



Source: Minnesota Department of Transportation.

The availability of sizeable fund balances make it possible to increase spending in 1997 and during the 1998-99 biennium more than revenues alone would allow. However, these spending levels are not sustainable, and spending is expected to decrease the following biennium. Spending trends beyond 2001 will depend on revenues, which are not likely to grow faster than inflation unless state tax rates are increased or the federal government increases federal aid to Minnesota.

IMPLICATIONS

In the 1998-99 Biennial Budget, Mn/DOT presented information on the expected impact of funding levels on the condition of state trunk highways.[7] Table 3.3 shows how Mn/DOT expects trunk highways to be affected under either the base level of funding or the change level of funding. The revenue and expenditure projections we examined earlier in this chapter reflect the change level of funding.

According to Mn/DOT, recent trends in pavement quality, bridge conditions, Twin Cities metropolitan area freeway congestion, and spring road restrictions are expected to continue if the Legislature adopts the change level of funding. Pavement quality is expected to improve, bridge condition ratings are expected to decline, the share of metropolitan area freeways with peak-hour congestion will remain the same, and fewer roads will be subject to spring road restrictions. Mn/DOT also expects crash and fatality rates to decline and engineering costs as a percentage of construction expenditures to decline. Although not shown in Table

7 *1998-99 Minnesota Biennial Budget: Transportation and Other Agencies*, G-70.

Table 3.3: Expected Impact of Funding on the State Trunk Highway System

	Level of Funding	
	Base Level	Change Level[a]
Pavement Quality Index	No Change	Increase
Bridge Condition Ratings	Decrease	Decrease
Percentage of Metro Area Freeway Miles Congested During Peak Hours	Increase	Same
Percentage of Miles with Spring Road Restrictions	Minor Decrease	Decrease
Crash and Fatality Rates	Increase	Decrease
Ratio of Program Delivery Costs to Construction Expenditures	No Change	Decrease

Source: Minnesota Department of Transportation.

[a]The revenue and expenditure projections in this chapter are based on the change level of fund ing.

3.3, Mn/DOT also expects highway user satisfaction with travel time, safety, and winter road condition information to increase.

While Mn/DOT is to be commended for attempting to link funding with performance, we do not think Mn/DOT has sufficiently analyzed its construction program or budget in preparing these forecasts of highway and bridge conditions over the 1998-99 biennium. Mn/DOT's forecasts are rough estimates at best and are not based on an analysis of the construction work programmed for this year and the 1998-99 biennium. In addition, Mn/DOT has not used its pavement and bridge management systems to analyze the implications of the construction program.

We estimate that Mn/DOT's proposed highway construction budget for the 1998-99 biennium will be about 8 percent higher in inflation-adjusted dollars than it was during the previous two years. This suggests that there is room for a small amount of improvement in trunk highway conditions during the next biennium.[8] However, it is unclear what implications the overall increase would have for particular performance measures.

For the most part, Mn/DOT's forecasts of highway conditions in the next biennium are based on this overall increase planned for the construction budget (or other budgets when relevant) without any detailed information on how much certain programs within the construction budget would receive. So, for example, the effect on bridge condition ratings was forecast without knowing how much additional money, if any, would be allocated to the bridge replacement program or the bridge improvement and repair program. Similarly, trends in pavement quality would be difficult to project without knowing how much of the construction

8 We estimate that inflation-adjusted construction expenditures in the 2000-01 biennium would be about 3 percent lower than in the 1998-99 biennium.

budget would be allocated to resurfacing, reconditioning, road repair, and reconstruction.

More important, these forecasts cover a short period of time. Changes in highway or bridge conditions over a two-year period are likely to be relatively small. Even as funding changed over the last 10 years, any changes in highway and bridge conditions were small and slow to occur. It is more essential to know what performance Mn/DOT can sustain over a longer period of time given projected funding levels based on current state tax rates. In the remainder of this chapter, we consider what long run changes might be expected and how Mn/DOT could better forecast these and provide policy makers and the public with clearer and more accurate information on the implications of funding levels for trunk highways. In addition, we will assess the adequacy of funding for trunk highways.

Pavements

In the past, Mn/DOT has attempted to forecast future pavement needs. One method Mn/DOT has used involves making assumptions about how frequently trunk highways need to be resurfaced and reconstructed. This method is somewhat unsatisfactory because it is not clear that a highway needs to be reconstructed unless it was poorly built in the first place or has not been adequately maintained and resurfaced over time.[9] In fact, many of the highway reconstructions done by Mn/DOT are done for reasons other than pavement condition.[10] Mn/DOT is much more likely to reconstruct a road as part of an expansion or safety project. As a result, it is difficult to project the reconstruction costs that will be necessary due to pavement conditions.

We estimate that Mn/DOT's annual pavement rehabilitation needs are $160 million.

We used a different method to estimate the amount of resurfacing and reconstruction work necessary to maintain a constant pavement quality index on Minnesota's trunk highways in the future. We asked staff in Mn/DOT's Pavement Management Unit to use the Pavement Management System (PMS) to estimate the number of miles of resurfacing and other work necessary to maintain a constant PQI from 1995 through 2005. In addition, we requested that Mn/DOT staff use the PMS to estimate the cost of the work over the 10-year period running from 1996 through 2005.[11] The results were as follows:

- **Maintaining a constant systemwide average pavement quality index on Minnesota's trunk highways would require an estimated $160**

9 In addition, a road might not have been built to handle the heavy truck loads it is carrying.

10 Erland O. Lukanen and Chunhua Han, Braun Intertec Corporation, "Performance History and Prediction Modeling for Minnesota Pavements," Conference Proceedings: *Third International Conference on Managing Pavements, Volume 1* (Washington, D.C.: National Academy Press, 1994), 68.

11 At the time Mn/DOT made these estimates, actual data on the PQI was available through 1995. As a result, the estimates were made for 1996 through 2005. The optimization procedure used by Mn/DOT selects resurfacing and other projects which have the greatest cost-effectiveness given the constraint of a fixed annual budget. We had Mn/DOT staff run several optimizations at different annual budget levels until we could estimate the annual expenditure level necessary to maintain a relatively constant PQI over the 10-year period.

million per year (in 1996 dollars) to be spent on resurfacing and other pavement rehabilitation projects.

- **An estimated 1,200 miles of resurfacing and other pavement rehabilitation work would need to be done annually on the State Trunk Highway System in order to maintain a constant pavement quality index.**

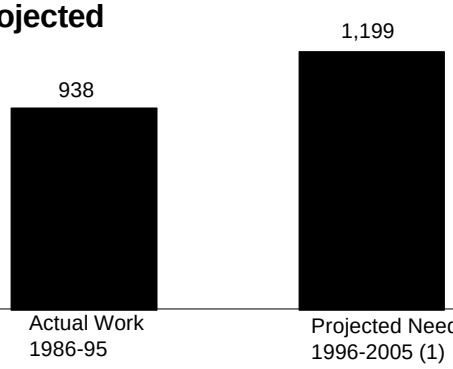
We also compared the annual amount of work necessary to maintain a constant PQI through 2005 with the actual amount of work done from 1986 through 1995. That comparison indicates that:

- **In the future, Mn/DOT may need to increase the average annual number of miles of pavement rehabilitation work in order to maintain the pavement quality index at its current level.**

Mn/DOT may need to resurface highways more frequently in the future.

As Figure 3.5 shows, Mn/DOT averaged 938 miles of resurfacing, concrete pavement repair, and reconstruction work per year on trunk highways from 1986 through 1995. The Pavement Management System predicts that 1,199 miles of annual work, or 28 percent more than the historical average, will need to be done from 1996 through 2005 in order for the pavement quality index to remain constant. If chip and sand seals are included along with these other types of work, then the total projected annual needs are 1,200 miles, which is 13 percent higher than the historical average of 1,066.[12]

Figure 3.5: Average Annual Miles of Resurfacing, Reconditioning, and Reconstruction Work on Trunk Highways, Actual and Projected



Source: Program Evaluation Division analysis of Mn/DOT data.

[1]Amount necessary to maintain a constant pavement quality index.

The estimates generated by the Pavement Management System may indicate that the expected life of a trunk highway surface is changing due to changes in pavement and surface composition, as well as increasing traffic levels and loads. Fewer highways are composed of only their original bituminous or concrete pavements. More highways consist of bituminous surfaces over the original bituminous or concrete pavements, and these overlays may not last as long as the original pavement did before it needed to be resurfaced. In addition, the loads carried by trunk highways have increased along with traffic levels, which have been growing 2 to 3 percent annually.

12 It should be noted that the volume of activity from 1986 to 1995 was sufficient to raise the pavement quality index slightly. This forecast suggests that even more miles of work will need to be done over the next 10 years just to keep the PQI constant.

The above estimate of future pavement needs is not definitive but raises a significant issue which Mn/DOT needs to investigate more thoroughly. We recommend that:

- **Mn/DOT should examine the Pavement Management System to see if it is accurately predicting the rate at which roads deteriorate. If the system is found to be accurate, then Mn/DOT should reexamine how much money it is planning to spend on the preservation of trunk highway surfaces and pavements.**

Mn/DOT is in the process of modifying its Pavement Management System to include more systematic consideration of preventive maintenance activities. After this revision, Mn/DOT should reexamine the optimization procedure we used to estimate the average annual amount of work and expenditures necessary to maintain a constant pavement quality index. It is possible that including preventive maintenance may alter these work and expenditure requirements. As we will discuss in Chapter 4, advocates of preventive maintenance say that preventive maintenance is cost-effective and can reduce the frequency with which pavements need resurfacing.

Bridges

In 1995, Mn/DOT's Office of Bridges and Structures developed an estimate of annual bridge funding needs for the next 10 years. Mn/DOT has used this estimate internally and has presented it to legislative committees. The estimate, including $24 million for bridge preservation and $47 million for bridge replacement, totals $71 million per year in 1996 dollars.

Mn/DOT needs to reestimate its bridge preservation and replacement needs.

The amount of money Mn/DOT spends annually on bridge preservation and replacement has been and is expected to be substantially less than the estimated $71 million in annual needs. From 1988 through 1995, Mn/DOT spent an annual average of $48 million on bridge preservation and replacement. The Office of Bridges and Structures projected that an average of about $41 million would be spent annually from 1996 through 1998.[13]

For several reasons, however, we think that:

- **Mn/DOT should reexamine its estimate of annual bridge preservation and replacement needs.**

We have several concerns about the estimate. First, the estimate includes bridges which have width or other geometric problems but do not have structural problems. We think that the cost of replacing those bridges should be categorized separately. Mn/DOT generally will not replace a bridge only because it does not meet geometric standards. In part, Mn/DOT's practices probably reflect a cost-effective use of resources. Bridges with only geometric deficiencies should

13 Expenditure data are based on the bridge projects let or programmed during each year. These expenditures do not include new bridges built under the expansion program.

only be replaced if the benefits in terms of reduced accidents, travel time, and vehicle operating costs outweigh the cost of replacement. Many geometric problems, particularly on lesser traveled or non-congested bridges, may not justify bridge replacement on a benefit-cost basis.

Second, Mn/DOT's estimate may count some bridges twice: once for preservation work and a second time for replacement. It is not possible to tell how much double counting occurs in the estimate, if any. Mn/DOT should attempt to eliminate any double counting in the estimate.

Third, the replacement cost estimate may include some bridges for which repair work may be more appropriate. One of the criteria used by the Office of Bridges and Structures to identify bridges needing replacement was to include bridges for which any major superstructure or substructure element had more than 5 percent of its area in the least favorable condition or more than 20 percent of its area in the two lowest conditions.[14] It is not entirely clear that a limited amount of structurally deficient area requires replacement rather than repair work. This criterion should be examined by Mn/DOT.

Fourth, Mn/DOT needs to make sure that the recently discovered problems with fatigue-prone steel bridges are incorporated in its estimate of bridge replacement and repair needs. Some of these bridges are already in its $71 million estimate, but others are not included in the estimate and should be added.

Finally, it is unclear how spending $71 million per year on the bridges identified by the Office of Bridges and Structures would affect overall bridge performance measures. For example, the office has not attempted to determine how statewide average bridge condition ratings would change if the preservation and replacement work recommended by the office were done. It is not known whether the $71 million would be adequate to maintain constant condition ratings or would increase the statewide average ratings for decks, superstructures, substructures, and culverts. Similarly, it is not known how implementing the office's recommended spending level would affect the backlog of deficient bridges.

The estimate of bridge needs should be linked to performance and benefit-cost criteria.

We think it is important to link any estimate of needs to some performance measure. For example, in considering pavement needs, we estimated the cost of maintaining a constant PQI on trunk highway pavements. Similarly, for bridges, we recommend that:

- **Mn/DOT should attempt to provide an overall estimate of bridge needs based on an easily understood performance criterion such as maintaining constant systemwide bridge condition ratings.**

In addition to this estimate, Mn/DOT could also provide estimates of the cost of eliminating all geometric deficiencies, although we would prefer that the estimate be limited to those deficiencies which should be addressed because the societal benefits of eliminating the deficiency exceed the costs.

14 Generally, the condition of a major element can be characterized as being in one of four or five categories.

Congestion

According to the Metropolitan Council:

- **Congestion in the Twin Cities metropolitan area is expected to grow by the year 2020 even though current funding levels will probably permit some expansion of and significant improvements to the metropolitan area highway system.**

Congestion is expected to grow.

In its recently adopted 20-year transportation plan, the Metropolitan Council projects that the number of congested miles will increase from 100 miles in 1995 to 220 in the year 2020.[15] While it is currently possible to access almost any point within the 7-county metropolitan area within 60 minutes during the peak hour of traffic, the Council projects that only 60 to 70 percent of the area will have the same accessibility by 2020. Unpublished data from the Council also show that the average speed during the afternoon peak hour will decrease from 36 miles per hour in 1995 to 28 miles per hour in 2020. These average speeds apply to all roads in the metro area which are principal arterials, minor arterials, or collectors and thus include roads other than those on the trunk highway system. The average off-peak speed is not expected to change much from the 1995 estimate of 41 miles per hour.

According to the Metropolitan Council, the metropolitan area could not possibly build enough multi-purpose lanes to significantly reduce congestion--it would cost much more than is available. In addition, the Council feels that the environmental, social, and political impacts would be too severe if the area attempted to build its way out of congestion.

The Metropolitan Council believes it should focus on the most cost-effective improvements first. As a result, Mn/DOT and the Council have focused first on ramp meters, ramp by-passes, and HOV lanes. In the future, they will pursue additional ramp improvements and HOV lanes, and will also be able to fund some highway expansion and improvement projects designed to address current bottlenecks. However, a number of large projects such as those involving LRT and major highway reconstruction cannot be completely funded within the 20-year transportation plan. Limited funding, as well as other constraints, mean that congestion in the metropolitan area will probably grow, but its growth will be lessened by the projects Mn/DOT and the Council have placed in the 20-year plan.

Mn/DOT publicly reports only a limited measure of congestion on metropolitan area freeways and does not routinely report long-term projections for congestion. The measure used by Mn/DOT in its biennial performance report counts the number of freeway miles on which average speeds fall below 45 miles per hour for at least one hour during the morning and afternoon peak periods. We think it would be useful if Mn/DOT regularly reported additional congestion measures.

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15 For this plan, the Metropolitan Council defined a congested highway mile as one for which traffic volume exceeds highway capacity during the peak hour of the day. Most of these congested miles are on the trunk highway system. See Metropolitan Council, *Transportation Development Guide/Policy Plan* (St. Paul, December 1996 Draft).

Mn/DOT should report additional congestion measures and make projections.

Elsewhere, we have suggested that Mn/DOT consider some additional congestion measures.[16] The current measure does not capture the increased amount of time vehicles spend waiting on freeway ramps before entering freeways. In addition, it does not reflect any growth in the average number of hours that a highway is congested during a typical day.

We also think it would be useful if Mn/DOT used the Metropolitan Council's models to project how congestion on metro area trunk highways is expected to change. The council does not publish estimates that focus exclusively on trunk highways.

Furthermore, we suggest that Mn/DOT publicly report data on congestion outside the Twin Cities metropolitan area. A simple measure such as the volume-to-capacity ratio or the average daily traffic per lane may be appropriate for this purpose. Such a measure would help to inform policy makers about statewide needs for additional lane capacity.

Engineering Expenditures

Mn/DOT forecasts that its spending on design and construction engineering, while increasing over the 1998-99 biennium, will decline as a percentage of construction spending. We agree with Mn/DOT about this trend, although the change is likely to be slight and occurs only because Mn/DOT uses a 3-year moving average to calculate spending. On a current year basis, engineering spending as a percentage of construction declined in 1996 and is expected to increase in 1998. Mn/DOT estimates a decrease during the 1998-99 biennium because its 3-year moving average in 1998 will include the 1996-97 biennium when the percentage was lower than during the 1994-95 biennium.

We calculated engineering spending as a percentage of construction expenditures over the 23-year period from 1974 to 1996 and projected this percentage for the years 1997 through 2001 based on Mn/DOT's spending plans.[17] While engineering expenditures as a percentage of construction spending has varied considerably from year to year--ranging from 19 percent to 48 percent--we found that:

Engineering spending is expected to be close to long-run averages.

- **Engineering spending from 1997 to 2001 as a percentage of either construction spending or all Trunk Highway Fund spending is expected to be close to the long-run average.**

Using Mn/DOT's spending projections, we estimate that engineering spending as a percentage of construction spending will be about 30.1 percent of highway construction spending during the 1997-2001 period, which is exactly the same as

16 Office of the Legislative Auditor, *Comments on the Department of Transportation's 1996 Biennial Performance Report* (St. Paul, January 1997), 2.

17 The percentage was calculated on a current year basis. We included all engineering and research spending, as well as spending on investment management.

the 23-year average from 1974 to 1996.[18] We also calculated engineering spending as a percentage of all Trunk Highway Fund spending. That percentage is expected to be lower (13.7 percent) over the next 5 years than the 23-year average (14.1 percent).

ADEQUACY OF FUNDING

Construction Funding

Policy makers have been deadlocked in recent years over highway and transit funding. Part of this deadlock involves rural-urban policy differences over the relative merits of highways and transit. In addition, there have been questions raised about whether highway funding is adequate. Furthermore, some policy makers have been reluctant to support a tax increase.

It is apparent to us that Mn/DOT does not have enough funding to meet all potential highway needs. We previously estimated pavement preservation and replacement needs to be about $160 million per year in 1996 dollars. Mn/DOT estimated bridge preservation and replacement needs to be about $71 million per year in 1996 dollars. Although we think this bridge estimate needs to be revised, we will use it below for purposes of illustration.

Mn/DOT's funding is not likely to be adequate to address all trunk highway needs.

Over the 5-year period 1997-2001, Mn/DOT's construction budget will average about $405 million in 1996 dollars. Bridge and pavement preservation and replacement needs account for an estimated 57 percent of the construction budget.[19] About $174 million per year (in 1996 dollars) would be left for expansion projects and management and operations projects. The latter category includes safety projects, right-of-way costs, traffic management, cooperative agreements, and miscellaneous types of projects such as enhancements, junkyard screening, planning, rest areas and beautification, and rail safety.

As we saw above, funding is not adequate to address all of Minnesota's highway congestion problems or even to prevent congestion from growing in the Twin Cities metropolitan area. Mn/DOT's funding is also insufficient to fully fund mega-projects such as those on Interstate 35W south of Minneapolis and on Interstate 94 between St. Paul and Minneapolis, which include multiple objectives such as construction of light rail transit, safety improvements, and reconstruction of aging pavements. Funding is sufficient to fund parts of those mega-projects in a piecemeal fashion. In addition, funding is not sufficient to fully address the backlog of structurally deficient bridges, perform adequate preventive maintenance on trunk highways and bridges, and reconstruct those heavily used

18 Spending was calculated in 1996 dollars.

19 When comparing pavement needs with the construction budget, the $160 million figure could be reduced somewhat since Mn/DOT crews, not contractors, do a small share of the total bituminous overlays.

highways which may be more cost-effective to reconstruct than to overlay frequently.[20]

But Mn/DOT should develop the capability to provide better information on its funding needs.

Despite years of discussion about whether trunk highway funding is adequate:

- **Mn/DOT does not have some of the basic information and has not done some of the analysis necessary to draw precise conclusions about the adequacy of funding for Minnesota's trunk highways.**

The adequacy of funding should not be measured by simply comparing available funds to a list of potential projects.[21] Comparisons such as this invariably result in a conclusion that infrastructure needs exceed available funding. Instead, it is better to link the amount of funding to performance objectives, such as maintaining a constant PQI, and to know how different levels of funding would affect performance. Furthermore, highway projects involving expansion or safety need to be evaluated on a benefit-cost basis. Projects which cannot be justified on that basis should not be considered to be part of highway needs. While it might be nice to improve safety or relieve congestion on a highway, it should not be considered a need if the costs of doing so exceed the benefits to highway users.

There have been several previous studies of transportation funding adequacy in Minnesota. In 1991 the Transportation Study Board issued its final report and found substantial needs in all areas of Minnesota's transportation system over the next 20 years.[22] The report compared existing funding levels to inflation-adjusted estimates of ''full-service'' needs and needs under ''acceptable levels of service.'' Also, a 1992 Mn/DOT study looked at transportation needs through the year 2000 and identified the funding necessary to achieve various scenarios labeled as the deteriorating infrastructure, investment preservation plus transit, economic development, and competitive advantage scenarios.

While these studies were helpful in understanding transportation needs, neither study considered specific performance targets and the funding needed to achieve them. The studies also did not consider how the benefits of projects included in various scenarios compared with their costs.

Mn/DOT does not currently have the information which would have enabled us to reach a more specific conclusion about the adequacy of funding for trunk highways. Mn/DOT has not developed an estimate of the funding needed for highway preservation and replacement in order to achieve certain pavement quality targets. Its estimate of bridge preservation and replacement needs is

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20 Chapter 4 discusses the reasons for performing more preventive maintenance. We think that performing more preventive maintenance may lower the long term costs of pavement preservation and replacement. However, Mn/DOT finds it difficult to allocate more funds to preventive maintenance because the immediate pavement, bridge, and expansion needs of the trunk highway system would have to be compromised.

21 For example, see Peggy L. Cuciti and E. Sam Overman, *The Assessment of Investment Needs: A Review of Current Estimates and Approaches*, prepared for the National Council on Public Works Improvement (Denver, 1986).

22 Transportation Study Board, *Study of Minnesota's Surface Transportation Needs* (St. Paul, January 1991).

flawed in some respects and needs to be developed with specific performance targets. Furthermore, Mn/DOT is in the early stages of using benefit-cost analysis to assess the pros and cons of major transportation investments, including those which reduce projected congestion or improve safety. Mn/DOT expects to have analyzed 10 percent of the major investments made in the year 2000, but will have analyzed all major investments made in 2004.[23]

Mn/DOT should periodically report on its funding needs.

However, we think it would be useful for policy makers to get a regular report from Mn/DOT regarding the adequacy of funding for trunk highways. Such a report might be helpful in resolving the debate about highway and transit and certainly could provide better information for policy makers about the amount of funding necessary for the trunk highway system to maintain current conditions. We recommend that:

- **Mn/DOT should periodically prepare a report on the funding needs of the trunk highway system. Needs should be defined in terms of what funding is necessary to obtain specific performance targets and should attempt to use benefit-cost criteria where appropriate.**

It would be useful for policy makers to receive a report from Mn/DOT on its funding needs every two years to coincide with consideration of the biennial budget. Mn/DOT believes, however, that it would be more valuable to prepare such a report on a four-year cycle as it is currently proposing for its statewide transportation plan. Mn/DOT does not think that the needs would change significantly in two years time but would change more over a longer time period. We would support the concept of a four-year cycle but would like to see Mn/DOT prepare a needs report by 1999. Mn/DOT is proposing that the next statewide transportation plan should be published in the year 2000.

Needs should be defined relative to performance and benefit-cost criteria.

This type of report would not be unique. The United States Department of Transportation reports to Congress every two years on the status of the nation's surface transportation system, including highways, bridges, transit, and waterborne transportation.[24] The department's report includes estimates of the funding needed over the next 20 years to maintain current conditions on the nation's highways and bridges, as well as additional funding for congestion relief or safety which can be justified on a benefit-cost basis. Mn/DOT should not necessarily use the national report as a model, but it serves to show that such estimates can be made and that funding can be linked with performance targets and benefit-cost analysis.

In addition, Mn/DOT has some recent experience in preparing a needs study which is somewhat linked to performance criteria. In November 1996, Mn/DOT's Metropolitan Division prepared a draft transportation system plan covering the

23 Mn/DOT believes that benefit-cost analysis is best conducted early in the planning stage of a project. Because major transportation investments take 6 or more years to develop, benefit-cost results will not be provided on a regular basis until about 2004. Mn/DOT's Economic Analysis and Special Studies Unit is currently conducting analyses on a number of projects on a demonstration basis.

24 United States Department of Transportation,*1995 Status of the Nation's Surface Transportation System: Conditions and Performance, Report to Congress* (Washington, D.C., October 1995).

years 2001 through 2020. The report is very useful and provides a great deal of information on the division's planning efforts and attempts to estimate trunk highway needs in the metropolitan Twin Cities area. We think the draft report is a good starting point for Mn/DOT in preparing a statewide needs estimate. However, the draft report was not completely explicit about the impact of its plan or its unconstrained needs estimate on pavement quality, bridge conditions, and congestion. In addition, there was limited use of benefit-cost analysis in developing estimates of need for the metropolitan area.

Maintenance Funding

For the most part, this chapter has focused on Mn/DOT's construction budget, which accounts for nearly half of all Trunk Highway Fund expenditures. This choice was appropriate since much of Mn/DOT's impact on the physical condition and capacity of trunk highways comes through construction funding. However, almost one-fourth of Trunk Highway Fund spending is for highway operations, including snow and ice control and various types of routine maintenance. Here, too, Mn/DOT lacks good information on the unit costs, results, and perhaps the adequacy of its current spending level.

Overall, we think Mn/DOT has been pursuing some important issues regarding its operations budget. Mn/DOT has a pilot project operating in District 8 in Willmar to assess how it can better utilize existing staff through the use of a ''transportation worker'' job classification. The more generic classification might help Mn/DOT improve its performance or control costs by enabling districts to use workers for a greater variety of functions.

In addition, Mn/DOT has had several pilot efforts underway to assess the usefulness of activity-based cost accounting. Previous efforts to develop statewide maintenance management systems have not been successful in producing useful information on the costs of various maintenance activities. As a result, Mn/DOT has encouraged district participation in pilot projects to try to build a useful system from the ground up rather than from the top down.

We encourage Mn/DOT to develop a statewide activity cost system.

We think that activity-based costing would be useful for both Mn/DOT and policy makers. We first cited the need for good maintenance activity cost information in a 1985 report on highway maintenance.[25] Mn/DOT and its districts need such information in order to make cost-effective decisions about maintenance operations. Activity-based cost accounting provides information on the unit cost of performing various maintenance activities and can help districts better manage their resources. Oversight from policy makers would also benefit from good information on the cost of various maintenance activities. We encourage Mn/DOT's development of a statewide activity cost system.

25 Office of the Legislative Auditor,*Highway Maintenance* (St. Paul, January 1985).

SUMMARY

In the short term, trunk highway spending is projected to increase under the Governor's proposed budget. In inflation-adjusted dollars, Mn/DOT's construction spending is expected to be 8 percent higher during the 1998-99 biennium than during the 1996-97 biennium. Because part of the increase in spending would occur due to a spending down of the balance in the Trunk Highway Fund, construction spending is expected to drop about 3 percent during the 2000-01 biennium. Overall, we estimate that average annual construction spending from 1997 through 2001 would be almost equal to the 10-year average experienced from 1987 through 1996. Other spending by Mn/DOT out of the Trunk Highway Fund is expected to be about 5 percent above the average for the last 10 years.

Mn/DOT has not prepared any long-range estimates of the implications of current funding levels for highway and bridge conditions. Its short-range estimates for the 1998-99 biennium are questionable, since they were based on incomplete funding information and did not make use of Mn/DOT's pavement and bridge management systems.

In general, we think that projected funding for trunk highways will not be sufficient to address a number of problems. However, Mn/DOT's data were not adequate for us to develop a more precise conclusion. We recommend that Mn/DOT should periodically prepare a report which analyzes trunk highway funding needs. Unlike previous reports, this report should show what funding levels are needed to achieve certain targets such as maintaining a constant systemwide average pavement quality. The report should also attempt to distinguish between expansion and safety projects which have benefits in excess of costs and those which do not. The latter projects should not generally be considered highway needs, since they would cost more to implement than they are valued by highway users.