# County State Aid Highway System: Follow-Up

July 1987

Program Evaluation Division
Office of the Legislative Auditor
State of Minnesota

# Program Evaluation Division

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# COUNTY STATE AID HIGHWAY SYSTEM FOLLOW-UP

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State of Minnesota

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JAMES R. NOBLES, LEGISLATIVE AUDITOR

July 15, 1987

Representative Phillip J. Riveness, Chairman
Legislative Audit Commission

Dear Representative Riveness:

In April 1985 the Program Evaluation Division published a report on Minnesota's County State Aid Highway System. The report analyzed the state's role in financing and overseeing the construction and repair of county state aid roads and recommended changes in the way the state allocates financial aid.

This follow-up report summarizes developments since the 1985 evaluation, describes the types of expenditures counties have made with their state aid allocations, and further discusses the aid allocation formula.

We received the full cooperation of the Department of Transportation.

This report was written by Joel Alter and Allan Baumgarten.

Sincerely yours,

James R. Nobles
Legislative Auditor

Roger A. Brooks
Deputy Legislative Auditor
for Program Evaluation

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# Executive Summary

This report updates our 1985 evaluation of the County State Aid Highway system and presents the results of additional research. In this follow-up study, we asked:

- On which types of roads are counties spending their state construction aid?
- Is it realistic to assume (as the state aid distribution formula does) that Minnesota's state aid highways can all be constructed to current design standards?
- Are the traffic projections used in the state aid allocation process valid and reliable?

## A. BACKGROUND

The Minnesota Legislature created the County State Aid Highway (CSAH) system in 1957, and the highway department chose nearly 30,000 miles for state aid designation. The Minnesota Constitution requires that 29 percent of the state's gas tax revenues and motor vehicle registration fees be used to fund construction and maintenance on this system. The aid distributed to counties grew from $24 million in 1958 to $169 million in 1987.

State law requires highway aid to be allocated to counties as follows: 30 percent in proportion to the CSAH mileage in each county; 10 percent in proportion to the number of vehicle registrations in each county; 10 percent shared equally among the 87 counties; 50 percent in proportion to counties' estimates of their future construction "needs." The Office of State Aid in Minnesota's Department of Transportation (MnDOT) administers the system, reviewing county construction plans and providing technical assistance to counties. The office also provides staff assistance to counties for their annual determination of highway construction needs.

The Legislative Audit Commission authorized a study of the CSAH system in December 1984; our office issued an evaluation report in April 1985. The report concluded that, even with dramatically higher funding levels, building the entire state aid system to existing design standards is unrealistic. This contrasts with the "needs-based" state aid allocation formula, which assumes that all 30,000 CSAH miles can be built to standard in the

foreseeable future. Our report also found that the "needs-based" allocations provided excessive aid to some counties with large numbers of low-traffic roads, many of which will never be built. We concluded that the method of state aid allocation did not reflect the true needs of the CSAH system, and we recommended various changes to improve the equity of the aid distributions.

The 1985 report also examined highway property tax burdens in Minnesota counties and the appropriateness of CSAH design standards. The report found that highway mill rates and per capita levies are higher in rural counties than urban counties. Also, rural counties receive a larger proportion of their highway budgets from state aid than urban counties. Finally, the report noted that it may be possible to implement flexible CSAH design standards without adding to safety risks.

## B. PROGRESS IN UPGRADING THE STATE AID SYSTEM: AN UPDATE

Since 1958, counties have spent more than $1.2 billion in state highway user revenues and fees to construct highways. In 1987, counties received $101 million in state aid for highway construction.

Our 1985 study found that only one-third of state aid highways meet current design standards. We reported that the rate of bringing "deficient" roads up to existing standards has slowed in recent years. In fact, our follow-up research revealed that:

- The proportion of state aid highways meeting state design standards actually declined slightly in the past two years.

This decline occurred despite significant increases in state highway aid. There are three possible explanations for the reduced number of highways meeting standards. First, *increases in projected traffic levels* may have caused roads to be judged against more stringest design standards, thus increasing the number of roads deemed "deficient." Second, *recent action by the CSAH Screening Board* (a nine-member board of county engineers) declared highways graded more than 25 years ago to be "deficient." Third, *counties are increasingly choosing simply to resurface existing roads, rather than upgrading the roads' designs.*

The trend away from design upgrading was confirmed by our follow-up analysis. We found that counties are paving only about 100 miles of gravel state aid highways per year, which is one-third the rate of paving done 10 years ago. Over 8,000 miles of gravel road remain on the state aid system. Furthermore, we found that counties are choosing to spend about one-fifth of their state aid construction funds to overlay highways without bringing them up to design standards, despite financial disincentives in the state aid allocation system to improve roads without meeting standards.

Based on our updated analysis of construction progress, we conclude that:

- Consistent with our 1985 findings, it is unrealistic to expect the entire CSAH system to be built to current design standards.

## C. RECENT COUNTY CONSTRUCTION ACTIVITY

During our 1985 study, county engineers told us they were not spending much money on low-traffic roads. This supported our conclusion that a large portion of highway aid is distributed on the basis of roads that will probably not be built. In our follow-up research, we examined county construction activity in more detail, examining those projects for which contracts were let in 1986. We found that:

- County spending on low-traffic roads was small compared to the "needs" reported by counties on these roads.

For example, roads with fewer than 100 vehicles per day constitute 19 percent of all CSAH miles and represent 15 percent of the construction "needs" claimed by counties. However, we found that county spending on these roads was less than eight percent of total CSAH spending.

We also examined the 22 counties in which more than 25 percent of estimated construction "needs" are on roads with fewer than 100 vehicles per day. We found that:

- Most of the counties do little actual construction work on those roads. Ten of these counties spent no 1986 construction funds on roads with traffic less than 100 vehicles per day.

The state aid allocations of many counties are substantially increased by their reported construction needs on low-traffic roads. For example, about $12.4 million in state aid was allocated to counties on the basis of their needs on highways with fewer than 100 vehicles per day. However, we found that the counties reporting the most 1986 construction needs on low-traffic roads spent less than half of the aid generated by these roads to improve them.

## E. TRAFFIC PROJECTIONS

The Minnesota Department of Transportation estimates future traffic on state aid highways. Since counties' construction needs estimates are based on projected traffic rather than current traffic, these projections affect the distribution of aid to counties. The projections also determine the design standards to which highways are built.

Our 1985 report questioned the validity of the projections, which assume that each county's rate of increase in traffic levels will be the same during the next 20 years as it was in the past 20. Our follow-up research confirmed problems with these straight-line projections:

- The department's projections overstated the most recent traffic counts in more than 70 percent of the counties, suggesting a slowdown in the rate of CSAH traffic growth.

In fact, CSAH traffic levels actually declined in 10 counties between their last two traffic counts. Most of these counties were in parts of the state where population is stable or declining.

We also examined the margin of error in MnDOT's traffic projections. Because the straight-line projections usually are based on only four previous traffic counts, MnDOT's traffic projections have very wide margins of error and they do not reliably distinguish between the traffic trends of different counties.

## F. RECOMMENDATIONS

Our findings are consistent with those of our 1985 report. We think that the Legislature should consider changing the method of state aid allocation (as recommended in the previous report). The critical first step is for the Legislature to acquaint itself more closely with the workings of the state aid system. There has been little legislative attention to the CSAH system since its creation in 1957. We recommend:

- The joint House-Senate transportation finance study commission created by the 1987 Legislature should hold interim hearings to discuss the state aid system and its methods of fund allocation.

Fifty percent of state aid is allocated on the basis of counties' "needs" estimates, defined as the cost of building all state aid highways to current design standards. Since it is unrealistic to construct the entire CSAH system to standard, the Legislature should consider alternatives to "standards-based funding." The Legislature should also consider limiting counties' reported "needs" to certain roads, such as those with more than 100 vehicles per day. In addition, we recommend:

- Estimates of county highway "needs" for purposes of CSAH allocations should be based on current traffic levels, not projected traffic. For the purpose of determining design standards for highways scheduled for construction work, the Minnesota Department of Transportation should work with counties to develop more reliable methods of estimating future traffic.

- MnDOT should more actively address CSAH policy issues, providing the Legislature with ongoing information and with policy guidance.

In addition, the Legislature should continue to consider important CSAH changes recommended in our earlier report. Specifically:

- The Legislature should change the CSAH formula's "mileage factor" to a measure of lane miles per county. The Legislature should change the "motor vehicle registration factor" to a measure of CSAH vehicle miles. The Legislature should repeal the "equalization factor."

- The Legislature should repeal the statutory provision that prevents counties from receiving less than their 1958 share of state aid. The Legislature should replace the "mill levy needs deduction" with a better measure of local effort.

- The Minnesota Department of Transportation should consider making its CSAH design standards less stringent, especially for low-traffic roads.

# Introduction

In April 1985, at the request of the Legislative Audit Commission, our office issued a report on Minnesota's 30,000-mile County State Aid Highway (CSAH) system. The report examined (1) the progress of construction on this system since its establishment in 1958, (2) the method of allocating state aid to counties, (3) the extent to which counties fund highways from local property taxes, and (4) the standards to which state aid highways are constructed. The report's primary conclusion was that closer legislative scrutiny of the state aid system is needed. We made several recommendations for specific changes in the way funds are allocated. During the 1985 session, the Legislature followed one recommendation when it repealed the law that limited the highway needs claimed by counties to the center 24 feet of highway.

Highway funding emerged as an important issue during the 1987 legislative session. A 1981 law required a phased transfer of Minnesota's motor vehicle excise tax revenues from the General Fund to the Highway User Tax Distribution Fund; 50 percent of these revenues were to be transferred in the 1988-89 biennium. However, the Governor's budget proposed no such transfer during the coming biennium, and the Legislature ultimately transferred only five percent of the excise tax revenues. In effect, this action reduced total CSAH funding for the biennium from $416 million to $367 million. But, regardless of the total amount of aid available statewide, the equity of aid distributions among counties is an issue deserving attention by the Legislature.

This report updates our 1985 study and presents new findings and conclusions. In our new study we asked:

- How do counties spend their state aid allocations?
- Is it realistic to assume (as the state aid distribution formula does) that Minnesota's state aid highways can all be constructed to current design standards?
- Are the traffic projections used in the state aid allocation process valid and reliable?

Chapter 1 of this report provides background on the CSAH system and our 1985 report. Chapter 2 updates data from our earlier report on the rate of construction progress on state aid highways. Chapter 3 examines how counties are spending their state construction aid. Chapter 4 evaluates the adequacy of the CSAH traffic projections that effect state aid allocations. Finally, Chapter 5 summarizes our conclusions and recommendations.

# Background

## CHAPTER 1

### A. MINNESOTA'S COUNTY STATE AID HIGHWAY SYSTEM

In 1953, the Legislature created a Highway Study Commission to determine the appropriate size of the state's highway systems and estimate funding needs. The commission estimated that a 30,000 mile county state aid highway system could be built to "minimum conditions" within 15 years using existing highway user taxes. For roads with very little traffic, "minimum conditions" meant gravel roads; for roads with more traffic, the commission wanted "dustless surface construction." In 1957, the Legislature authorized creation of the County State Aid Highway (CSAH) system, and the Minnesota Highway Department designated 29,000 miles of state aid highways.

The number of CSAH miles varies widely by county, and the number of miles in each county has changed little since 1958. Washington County has the fewest miles (189), while St. Louis County has the most (1,362). The portion of each county's roads receiving state aid also varies widely. While all county roads in Houston and Meeker counties are eligible for state aid, only about 41 percent of Pennington County's roads are state aid highways.

### B. FUNDING

Since 1958, counties have received more than $2 billion in state highway aid.[1] As provided in the Minnesota Constitution, counties annually receive 29 percent of the Highway User Tax Distribution Fund, which is composed of motor fuel taxes and vehicle registration fees. The trunk highway system receives 62 percent of this fund, and municipalities with over 5,000 population receive nine percent for designated streets. Counties received $24 million in state highway aid in 1958; they received $169 million in 1987.

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[1]State law requires that at least 60 percent of aid be spent for highway construction, and the remainder for maintenance.

The 1957 Legislature established a formula for allocating highway aid to counties. This formula, which remains in existence today, allocates state aid on the basis of four factors:

(1) *Equalization factor.* Ten percent of state aid is divided evenly among the 87 counties.

(2) *Mileage factor.* Thirty percent of state aid is allocated in proportion to each county's share of the state's CSAH miles.

(3) *Motor vehicle registration factor.* Ten percent of state aid is allocated in proportion to each county's share of motor vehicles registered in the state.

(4) *"Money needs".* Fifty percent of state aid is allocated in proportion to each county's estimate of its construction needs for the next 25 years.

The fourth factor, "money needs," has grown enormously since the state aid system was established. Between 1958 and 1986, 25-year construction needs increased from $705 million to $4.8 billion, despite major investments in new highway construction.[2] A nine-member Screening Board (composed of one county engineer from each of MnDOT's districts) advises the Commissioner of Transportation on methods for determining these needs. "Money needs" have been interpreted by the board to be the estimated cost of building all state aid roads to current design standards.

One cause of the growth in needs is the increase in construction standards for state aid roads. As these standards increased, more roads were deemed "deficient." Another source of growth in needs has been actions by the Screening Board. The board has made numerous additions to the needs computations, resulting in an extremely complex method for allocating state aid. Our 1985 report discussed these changes in detail.

## C. 1985 EVALUATION

At the request of the Legislative Audit Commission, our office studied the CSAH system in 1985 and reached the following conclusions:

- The pace at which counties are paving gravel roads and bringing roads up to design standards slowed in the past 10 to 15 years. The slow progress is due both to increasingly stringent construction standards and to counties' increasing interest in resurfacing roads rather than upgrading their designs.

- Even with dramatic funding increases, it is unrealistic to expect the CSAH system to be completely built to current design standards in the foreseeable future, although that goal is currently assumed by the CSAH funding formula. The current method of "standards-based funding" allocates funds to counties using a wish list, not a realistic assessment of county needs.

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[2]There was a $1.2 billion increase between 1984 and 1986. Most of this increase is attributable to adjustments made by the Screening Board to better reflect the cost of grading rural highways.

- It may be possible to implement more flexible design standards for state aid highways without adding to highway safety risks.

- Roads with little traffic, many of which are unpaved and which counties say will never be built, account for a significant proportion of some counties' construction "needs." It is inequitable for the fund allocation formula to favor counties with large numbers of these very low-traffic roads.

- It is not clear that the Screening Board's incremental adjustments to county needs assessments have improved the overall equity of the state aid system.

- Road and bridge mill rates and per capita levies are higher in rural counties than in urban counties. Rural counties receive a larger proportion of their highway budget from state aid than urban counties do.

- State aid covers all highway maintenance costs in some counties and covers only one-third of maintenance costs in other counties.

The 1985 report concluded that the CSAH system receives too little attention from policy-makers, and that the CSAH funding formula needs revision. Recommendations included:

- The Legislature should either establish a commission or hold interim hearings to review the state aid system and recommend goals and priorities for the future.

- The Legislature should adopt an alternative to "standards-based funding" for county state aid highways. The report presented several alternatives.

- The Legislature should: (1) change the CSAH allocation formula's mileage factor to a measure of lane miles per county; (2) change the motor vehicle registration factor to a measure of CSAH vehicle miles; and (3) repeal the equalization factor.

- The Legislature should repeal the "24-foot restriction" on county needs and the statutory provision that protects counties from receiving less than their 1958 share of state aid. The Legislature should replace the mill levy needs deduction with a better measure of local tax effort.

- Regional development commissions should review the jurisdiction and state aid designations of their county road systems, suggesting changes where appropriate.

The report suggested that future discussions of CSAH funding options should focus on the statewide merits of these options, with less attention to the specific "winners" and "losers" among the 87 counties.

Subsequent to our 1985 report, a major national study echoed some similar themes. The National Council on Public Works Improvement issued a report to the President and Congress in 1986 that critically examined various ways of determining the "need" for infrastructure improvements. As to the practice of determining needs by comparing current highway conditions to engineering standards, the report concluded:

> When resources are insufficient to meet all needs, this type of information is not very useful. . . . (N)eeds studies tied to

standards are shorthand approximations that omit both overall budget constraints and a weighing of project benefits against costs.[3]

## D. RESPONSES TO THE REPORT

### 1. Legislature

Following our study, the 1985 Legislature passed legislation removing the "24-foot restriction" from counties' annual estimates of "money needs," effective with the January 1988 CSAH apportionment.[4] The legislation authorized a phase-in of this change during the 1986-1987 biennium, with 50 percent of the change effective during the 1986 apportionment and 100 percent of the change effective during the 1987 apportionment.

However, the Legislature made the two-year phase-in contingent on an increase in total funds available for county state aid highways. The Legislature expected that an increase would result from the transfer of motor vehicle excise taxes from the General Fund to the Highway User Tax Distribution Fund, which had been mandated by law in 1981.[5] The planned transfer occurred as expected in the first year of the current biennium. But, as in several previous years, the Legislature delayed the motor vehicle excise tax transfer during the second year. Consequently, complete elimination of the "24-foot restriction" on needs will not take place until the 1988 CSAH apportionment.

### 2. Minnesota Department of Transportation

The Department of Transportation developed a formal reply to the evaluation report in December 1985. MnDOT took the position that its responsibility for the state aid system is primarily administrative, not policy-related. The department said:

> One may conclude that the Legislature intended that this should be a program for local highway programs under (local elected and appointed officials') direction with the Commissioner being responsible for carrying out the direction administratively within the Law and Rules.[6]

Rather than making its own response to the report's recommendations, the department largely relied on the position paper of the Minnesota County Highway Engineers Association, noting that this paper "addressed (the report's) recommendations adequately."

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[3]National Council on Public Works Improvement, *The Nation's Public Works: Defining the Issues*, September 1986, p. 14.

[4]Minn. Stat. §162.071. Laws 1985, Chapter 299, Section 7.

[5]Minn. Stat. §297B.09.

[6]Correspondence from Transportation Commissioner Richard Braun to Legislative Auditor James Nobles, December 26, 1985.

### 3. Minnesota County Highway Engineers Association

In October 1985, the association developed a position paper on the report, noting that the engineers agreed with some parts of the report and disagreed with others.

The engineers' position paper concluded that:

- There should be legislative review of the state aid system to ensure that goals and objectives for the system are met.
- "Standards-based funding" of state aid highways should continue, and counties should remain responsible for planning, programming, constructing, and maintaining their highways.
- A "fair, equitable, and logically sound" funding formula should be maintained. The Legislature should carefully study and discuss possible changes to the current funding formula, such as modification of the "equalization factor," the "mileage factor," the "vehicle registration factor," the "mill levy deduction," and provisions preventing counties from receiving less than their 1958 share of state aid.
- Standards are necessary to ensure safe and uniform conditions for highway users. Any legislative action to modify standards should occur only after careful study of the benefits, costs, and tort liability implications.
- With regard to our recommendation that the state direct regions to reassess the appropriate jurisdictions and state aid designations for state aid highways, the engineers thought that the state should not exercise more control over local highways.

Overall, the association welcomed legislative review of the state aid system, as called for in the 1985 report. The association agreed with us that certain parts of the state aid allocation process may need review, but it urged caution in making changes. The main area in which the association differed from our report was the issue of "standards-based funding." Our report questioned this type of funding, suggesting that it is based on unrealistic construction assumptions. The association believes such funding is sensible, even if all state aid highways cannot be constructed to existing standards.

### 4. CSAH Screening Board General Subcommittee

In June 1986, the CSAH Screening Board asked its General Subcommittee to study the extent to which roads without recent construction expenditures affect state aid allocations. The subcommittee found that one-third of CSAH "needs" are on highway segments that have not been reconstructed for at least 47 years. Assuming the continuation of this trend, the subcommittee concluded that "the CSAH system will probably never be completely built to standard," which is consistent with our 1985 report. The subcommittee proposed alternative ways of allocating state aid so that the distribution would be based on a more realistic assessment of need. The subcommittee recommended the continuation of a "standards-based" funding system, but it urged the county engineers' association to study whether current standards are appropriate.[7]

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[7]"CSAH General Subcommittee Report on Inactive Needs Adjustments," May 1987, reported in *1987 County Screening Board Data*, June 1987, issued by the Office of State Aid, Minnesota Department of Transportation.

# Progress in Upgrading the State Aid System: An Update

## CHAPTER 2

Since 1958, counties have spent more than $1.2 billion in state highway user revenues and fees to construct highways. In 1987, counties received $101 million in state aid for highway construction.

To determine the progress resulting from these expenditures, we examined trends in the number of state aid highways which meet state design standards. These standards dictate the proportions to which highways are built, such as road width, thickness, and alignment. Roads with higher traffic volumes must meet higher standards. For example, they must be wider and they must accommodate heavier vehicles.

To say that a road "meets standards" reflects only its design characteristics, not its surface condition. Thus, roads that "meet standards" may have poor driving surfaces, while roads that are too narrow may have very smooth surfaces. Also, roads are judged by current standards, not by the standards that existed when they were built. As a result of increases in standards over the years, many roads that met standards when they were built no longer do.

In our study two years ago, we found that only one-third of state aid highways meet current standards, and we found that counties were making deficient roads "adequate" at a very slow pace. More recent data indicates that:

- The proportion of state aid highways meeting state design standards has decreased slightly in the past two years.

At the start of 1986, 32.7 percent of state aid highways met state standards. Table 2.1 shows the proportion of state aid roads meeting standards since 1971. The recent downward turn in the number of roads meeting standards is not explained by changes in state aid highway standards; there have been no recent increases in design standards. The trend is also not explained by changes in state funding levels; counties received significant state highway aid increases in both 1984 and 1985, the years during which the number of roads meeting standards declined.[1]

[1]State aid apportioned to counties rose from $127 million in 1983 to $144 million in 1984 and to $171 million in 1985.

TABLE 2.1

PERCENTAGE OF COUNTY STATE AID HIGHWAYS MEETING DESIGN STANDARDS[a]

(Various Years)

| | Percent of CSAH System that Meets All Standards | Percent of CSAH System That Does Not Meet All Standards |
|---|---|---|
| 1971 | 16.5% | 83.5% |
| 1972 | 18.3 | 81.7 |
| 1973 | 22.0 | 78.0 |
| 1974 | 23.7 | 76.3 |
| 1982 | 34.4 | 65.6 |
| 1983 | 33.2 | 66.8 |
| 1984 | 33.3 | 66.7 |
| 1986 | 32.7 | 67.3 |

Source: Minnesota Department of Transportation, Office of State Aid.

[a]Design Standards relate to the speed at which vehicles may travel, the weight of vehicles that may use the road, and the road's horizontal and vertical alignment.

One possible explanation for the decline is an increase in current traffic or in "traffic projection factors" on state aid highways. Increases in traffic or traffic projection factors sometimes cause the adequacy of roads to be judged against more stringent standards. Consider the example of a road projected to have 90 vehicles per day that now meets existing standards for roads with less than 100 vehicles per day. If a new traffic projection suggests that the road will eventually have 120 vehicles per day, the road would be subject to higher design standards. Thus, because of the increase in projected traffic, the road is now deemed "deficient." Later in this report, we discuss the validity and reliability of CSAH traffic projections.

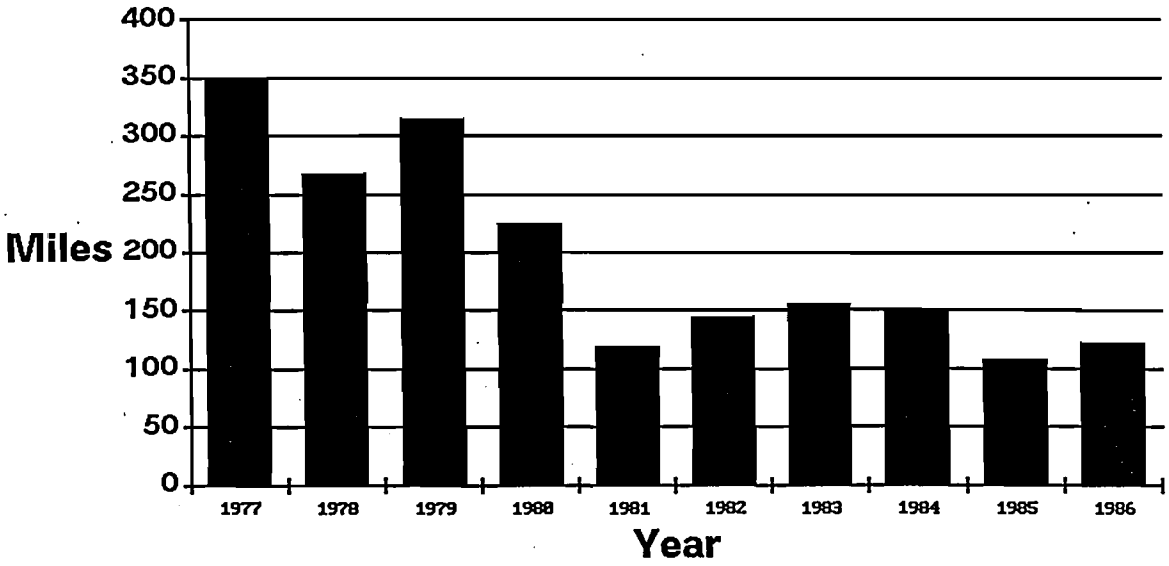
A second explanation for the decline in roads meeting standards is that counties' are paying increasing attention to resurfacing roads rather than upgrading their designs. We documented this trend in our 1985 report, and more recent information confirms it. Specifically, we found that:

- Counties are paving only about 100 miles of gravel state aid highways per year, which is one-third the rate of paving done 10 years ago. Figure 2.1 shows this trend. Over 8,000 miles of gravel road remain on the state aid system.

FIGURE 2.1

MILES OF GRAVEL STATE AID HIGHWAYS PAVED ANNUALLY[a]

1977 - 1986




Source: Program Evaluation Division analysis of data from the Minnesota Department of Transportation's Office of State Aid.

[a]This figure shows the annual decrease in miles of gravel road on the state aid highway system. The annual increase in paved CSAH miles follows a roughly similar pattern.

TABLE 2.2

MATERIALS USED IN RURAL STATE AID HIGHWAY CONSTRUCTION
1971 and 1984

| Material | 1971 Tons | 1984 Tons | Percent Change |
|---|---|---|---|
| Sub-base | 2,090,773 | 634,976 | -69.6% |
| Gravel base | 3,000,346 | 1,713,625 | -42.9 |
| Bituminous | 1,505,877 | 2,038,778 | +35.4 |
| Bituminous surface[a] | 122,775 | 162,488 | +32.3 |

Source: Minnesota Department of Transportation, Office of State Aid

[a]Bituminous surface type 2341.

- The use of bituminous materials for road surfaces continues to increase, while the use of materials needed for construction and reconstruction continues to decline. This suggests an increasing trend toward overlays, rather than road construction. Table 2.2 shows this trend.

- Counties continue to do large numbers of "special resurfacing" projects--projects that preserve the road without bringing it up to standard. Table 2.3 shows the number of such projects in recent years.

TABLE 2.3

"SPECIAL RESURFACING" DONE BY COUNTIES

1974-1986

| Year | Number of Projects | Cost (millions) |
|---|---|---|
| 1974 | 34 | $ 2.7 |
| 1976 | 52 | 4.5 |
| 1978 | 63 | 6.4 |
| 1980 | 57 | 8.8 |
| 1982 | 97 | 13.2 |
| 1984 | 86 | 13.1 |
| 1986[a] | 102 | 19.4 |

Source: Minnesota Department of Transportation, Office of State Aid, 1987.

[a]Preliminary data.

Counties face financial disincentives to do "special resurfacing" projects. By a 1967 resolution of the CSAH Screening Board, counties that spend state aid funds for these projects receive allocation deductions for a period of 10 years following the work.[2] Furthermore, the "needs" analysis on which state aid allocations are based does not consider highway preservation work (such as resurfacing) to be a legitimate need unless a road already meets all design standards. Despite these financial disincentives, counties still are choosing to spend about one-fifth of their construction funds for these "special resurfacing" projects. In fact, nine counties spent more than half of their 1985 state aid construction allocation for special resurfacing.

[2]Counties using state funds for special resurfacing have the state cost of these projects annually deducted from their "construction needs" for a 10 year period. Some counties are able to fund these types of projects with local tax revenues, thus avoiding the needs deduction. This creates an equity issue, since our earlier study showed that the ability to raise local revenues varies widely among counties.

A third possible explanation for the decline in the percentage of roads meeting design standards is a recent action by the CSAH Screening Board. In 1983, the board decided that highways that have not been graded for 25 years should be considered in need of complete reconstruction for purposes of the annual aid allocation.[3] In effect, this meant that some roads previously deemed "adequate" were subsequently judged "deficient."

Overall:

- Our update of construction progress on the CSAH system confirms our 1985 conclusion that the goal of building the entire state aid system to standard is unrealistic.

In that report, we suggested that current funding would have to at least double or triple to allow the system to be "completed." If, in fact, the system cannot be built to standard in the foreseeable future, then the current method of state aid allocations is inequitable. By assuming that all roads can be built, the current system unduly benefits those counties that have large numbers of state aid highways that will never be built. We continue to believe that it makes more sense for a funding system to reflect realistic construction assumptions, rather than a construction wish list.

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[3]In order to "reinstate" complete reconstruction needs on a road 25 years after it was graded, counties must request and justify this need to their district state aid engineer. A Screening Board subcommittee recently recommended modifying the 25-year period during which counties may not claim complete reconstruction needs. Noting that "over 80 percent of the CSAH system is over 25 years old and appears to be functioning satisfactorily," the subcommittee recommended that needs not be reinstated until 35 to 40 years after a road's construction. The Screening Board has not yet acted on the recommendation.

# Construction Projects

## CHAPTER 3

Counties spent nearly $125 million to construct and improve state aid highways in 1986. Contracts were let for 539 projects of all sizes; 14 cost more than $1 million, while 53 cost less than $25,000. Thirteen counties spent more than $2 million from all sources, while five spent less than $500,000, including one county that had no contracts in 1986.

As shown in Table 3.1, state aid from the highway user tax distribution fund is the largest source of funds for these projects, providing 78 percent of county spending. Federal money is also available for projects on designated routes within the county state aid system. To replace bridges, counties may request money from a special bond fund first established by the Legislature in 1977.

TABLE 3.1

FUNDING SOURCES FOR CONSTRUCTION ON COUNTY STATE AID HIGHWAYS: 1986

| Fund | Amount | Percentage |
|---|---|---|
| State Aid | $ 96,853,706 | 77.7% |
| Federal Aid | 13,269,228 | 10.6 |
| State Bridge Bond | 2,434,163 | 2.0 |
| Local | 12,080,974 | 9.7 |
| TOTAL | $124,638,071 | 100.0% |

Source: Program Evaluation Division analysis of 1986 county construction projects, Office of State Aid, Minnesota Department of Transportation.

As part of this follow-up study, we asked:

- How are counties spending their state construction aid? Which highways are they working on?

During our 1985 study, county engineers told us they were not spending much money on low traffic roads. This supported our conclusion that aids are distributed on the basis of roads that would not likely be built. To analyze how counties spend their construction funds, we examined county state aid highway projects for which contracts were let in 1986. Our review was based on plans and reports submitted by counties to the Minnesota Department of Transportation Office of State Aid and reports prepared by that office. The Office of State Aid reviews county plans for projects which use state or federal aid and authorizes release of the funds.

## A. WORK ACTIVITIES

As shown in Table 3.2, counties spent $55 million (44 percent of construction funds) to surface roads with bituminous asphalt. As we noted in Chapter 1, this includes an estimated $19.6 million for special resurfacing projects in which a county overlays a road without bringing it up to standard. The second largest category of work ($33 million) was for grading roads as a first step in building them to standard. Nearly $10 million was spent for replacement and rehabilitation of bridges on county state aid highways.

TABLE 3.2

CONSTRUCTION ACTIVITIES ON COUNTY STATE AID HIGHWAYS: 1986

| Activity[a] | Amount | Percentage |
|---|---|---|
| Grading | $ 33,403,450 | 26.8% |
| Base | 8,714,594 | 7.0 |
| Bituminous Surface | 55,188,897 | 44.3 |
| Concrete Pavement | 320,268 | 0.3 |
| Bridge | 9,699,084 | 7.8 |
| Other | 17,311,778 | 3.9 |
| TOTAL | $124,638,071 | 100.0% |

Source: Program Evaluation Division analysis of 1986 county construction projects, Office of State Aid, Minnesota Department of Transportation.

[a]*Grading* is preparation of the right-of-way for constructing a road. In this report, it also includes excavation of the roadway and removal of trees and old pavement.
*Base* is the material which supports the roadway.
*Bituminous surface* (blacktop) for new construction or resurfacing of existing roads.
*Other* includes shoulders, gravel surfacing, storm sewers, curb and gutter, installation of signals, mobilization of workers and equipment, and other miscellaneous costs.

### 1. By Traffic Volume

Table 3.3 shows construction activities on roads of different traffic volumes. We found:

- County spending was directed toward higher traffic roads.

While 15 percent of the 30,000 miles of county state aid highway carries average traffic of 750 or more vehicles per day, counties spent 29 percent of their construction money on those relatively high traffic roads. Less than eight percent was spent on very low traffic roads carrying fewer than 100 vehicles per day. These roads are 19 percent of the CSAH system.

As described in Chapter 2, the Department of Transportation allocates half of the state highway aid on the basis of counties' estimated costs of constructing their state aid highways to state design standards. In 1986, counties projected that more than $4.8 billion would be needed to build their state aid highways to standard. We compared county expenditures to those estimates. We found:

- County spending on low-traffic roads is low in proportion to reported needs on those roads.

Table 3.4 compares counties' expenditures with their reported construction needs. About 15 percent of needs are for building roads that are currently used by fewer than 100 vehicles per day. By comparison, less than eight percent of county construction spending was on these low-traffic roads in 1986.

It is important to note that some counties are completing significant improvements on roads that now carry little traffic. We found 35 projects in which counties spent more than $100,000 on roads with current average traffic of less than 100 vehicles per day. In two of those projects, counties spent more than half a million dollars to improve a low-traffic road.

### 2. By Functional Class

Another way of categorizing state aid highways is by their "functional classification." Highways serve a variety of functions, ranging from continuous, long-distance travel on "arterial" highways to short-distance, residential access on "local roads." Table 3.5 shows the proportion of CSAH roads in each functional class. Nearly half of the roads in the county state aid system are classified as "major collectors," and one-third are classified as "minor collectors."

"Local roads" account for about 14 percent of the estimated construction needs on the county state aid system. However, counties spent less than eight percent of their construction funds on these roads. More than 60 percent of construction funds were spent on arterials and major collectors.

### 3. Compared to Reported Needs

In 1986, 22 counties reported more than 25 percent of their estimated construction needs on roads carrying fewer than 100 vehicles per day. Thus, a significant portion of these counties' construction needs is on low-traffic roads. We reviewed the construction

TABLE 3.3

1986 CONSTRUCTION SPENDING BY CURRENT TRAFFIC LEVEL
(From All Fund Sources)[a]

| Activity | All Projects | Average Daily Traffic 0-99 | 100-199 | 200-299 | 300-399 | 400-499 | 500-749 | 750 Plus |
|---|---|---|---|---|---|---|---|---|
| Grading | $ 33,403,450 | $5,013,844 | $ 4,035,681 | $ 4,292,584 | $1,962,390 | $2,698,559 | $ 4,228,544 | $11,171,848 |
| Base | 8,714,594 | 883,555 | 1,707,037 | 1,432,879 | 513,821 | 653,310 | 1,104,607 | 2,419,385 |
| Bituminous | 55,188,897 | 1,790,463 | 15,601,425 | 8,815,884 | 5,504,848 | 4,577,280 | 7,942,010 | 10,956,987 |
| Concrete | 320,268 | 0 | 0 | 0 | 0 | 0 | 0 | 320,268 |
| Bridge | 9,699,084 | 1,468,193 | 1,262,698 | 1,115,096 | 542,650 | 151,257 | 1,339,057 | 3,820,133 |
| Other | 17,311,778 | 549,619 | 2,927,213 | 2,321,171 | 1,021,278 | 837,077 | 2,639,203 | 7,016,217 |
| SPENDING FROM ALL SOURCES | $124,638,071 | $9,705,674 | $25,534,054 | $17,977,614 | $9,544,987 | $8,917,483 | $17,253,421 | $35,704,838 |
| | (100.0%) | (7.8%) | (20.5%) | (14.4%) | (7.7%) | (7.2%) | (13.8%) | (28.6%) |

Source: Program Evaluation Division analysis of 1986 county construction projects, Office of State Aid, Minnesota Department of Transportation.

[a]State aid represented $96.8 million of all construction funds spent in 1986. Counties spent state aid dollars as follows: 8.2 percent on roads with 0-99 ADT; 21.2 percent on 100-199 ADT; 15.0 percent on 200-299 ADT; 9.4 percent on 300-399 ADT; 8.2 percent on 400-499 ADT; 14.8 percent on 500-749 ADT; 23.1 percent on roads with more than 750 ADT.

activity in those counties to see whether the counties were actually working on those low-traffic roads. We found:

- Most counties with a high proportion of low-traffic roads do little work on those roads.

As shown in Table 3.6, nine of those counties spent none of their state aid construction money for work on those low-traffic roads; three other counties spent less than ten percent. On the other hand, two counties spent more than 80 percent of their construction funds on low-traffic roads.

We also compared county spending on low-traffic roads with the amount of construction aid generated by county estimates of the "needs" on those roads. In 1986, 23 counties reported needs of more than $10 million each on roads with current traffic of less than 100 vehicles per day. These counties reported $457 million in needs on low-traffic roads, or 62 percent of all Minnesota's needs on low-traffic county state aid roads. Based on these needs, the 23 counties received about $7.7 million in state construction aid in 1986.[1] We found:

- Counties with many low-traffic roads spend less than half of the state construction aid generated by these roads to improve them.

TABLE 3.4

COMPARISON OF COUNTIES' CONSTRUCTION NEEDS AND 1986 EXPENDITURES

| | Proportion of | | |
|---|---|---|---|
| Average Daily Traffic | Counties' Needs | 1986 Expenditures | Miles of Road |
| 0-99 | 15.2% | 7.8% | 18.7% |
| 100-199 | 16.7 | 20.5 | 21.1 |
| 200-299 | 11.1 | 14.4 | 16.2 |
| 300-399 | 9.1 | 7.7 | 11.2 |
| 400-499 | 7.0 | 7.2 | 7.6 |
| 500-749 | 11.0 | 13.8 | 10.2 |
| 750 Plus | 29.9 | 28.6 | 15.1 |

Source: Program Evaluation Division analysis of county construction projects, Office of State Aid, Minnesota Department of Transportation.

[1]In 1986, $1 million in construction needs generated about $17,000 in state construction aids.

TABLE 3.5

COMPARISON OF COUNTIES' CONSTRUCTION NEEDS
AND 1986 EXPENDITURES BY FUNCTIONAL CLASSIFICATION

| Functional Class[a] | Proportion of: Counties' Needs | 1986 Expenditures | Miles of Road |
|---|---|---|---|
| Local | 12.6% | 7.5% | 14.2% |
| Local-Urban | 0.9 | 0.1 | 0.2 |
| Minor Collector | 26.8 | 27.4 | 33.6 |
| Major Collector | 45.9 | 52.6 | 48.1 |
| Major Collector-Urban | 4.8 | 1.5 | 1.3 |
| Minor Arterial-Urban | 8.6 | 7.9 | 2.4 |
| Principal Arterial-Urban | 0.5 | 2.9 | 0.2 |
| TOTAL | 100.1%[b] | 100.0% | 100.0% |

Sources: Program Evaluation Division analysis of 1986 county construction projects and 1986 study of county highway construction needs, Office of State Aid, Minnesota Department of Transportation. Classes based on U.S. Deparment of Transportation, Federal Highway Administration, *Highway Functional Classification: Concepts, Criteria and Procedures*, Transmittal 155, July 1974.

[a]Functional classifications are listed in descending order of their importance in a statewide system of county highways:

*Principal Arterials*: Serve major centers of activity of a metropolitan area, the highest traffic volume corridors, and should carry a high proportion of the total urban area travel.
*Minor Arterials*: Provide service to trips of moderate length at a somewhat lower level of travel mobility than principal arterials and distribute travel to geographic areas smaller than those identified with principal arterials.
*Major Collectors*: In rural areas, provide service to larger towns and county seats not served by arterials, and to other traffic generators of high intracounty importance, such as consolidated schools, shipping points, county parks, important mining and agricultural areas, etc. In urban areas, provides access and traffic circulation within residential neighborhoods, commercial and industrial areas.
*Minor Collectors*: Spaced at intervals, consistent with population density, to collect traffic from local roads and bring developed areas within a reasonable distance of a collector road. Provide service to remain smaller communities and link local important traffic generators with their rural hinterland.
*Local Roads*: Provide access to adjacent land and service to travel over relatively short distances.

[b]Does not add to 100 percent due to rounding

TABLE 3.6

COMPARISON OF CONSTRUCTION NEEDS AND SPENDING
IN COUNTIES WITH MORE THAN 25 PERCENT OF NEEDS REPORTED
ON ROADS WITH 0-99 VEHICLES PER DAY

| County | Proportion of County "Needs" on Roads With 0-99 ADT[a] | Proportion of All Funds Spent on Roads With 0-99 ADT[b] |
|---|---|---|
| Aitkin | 41.8% | 5.1% |
| Beltrami | 26.3 | 12.2 |
| Big Stone | 39.7 | 0.0 |
| Clearwater | 37.5 | 0.0 |
| Cook | 31.7 | 0.0 |
| Grant | 25.5 | 0.0 |
| Kittson | 46.8 | 65.3 |
| Koochiching | 52.6 | 24.9 |
| Lac Qui Parle | 25.4 | 0.0 |
| Lake | 25.9 | 0.0 |
| Lake of the Woods | 67.4 | 2.8 |
| Mahnomen | 32.1 | 100.0 |
| Marshall | 49.6 | 37.5 |
| Norman | 48.6 | 83.4 |
| Pennington | 54.5 | 16.4 |
| Pine | 34.5 | 19.2 |
| Polk | 30.2 | 0.0 |
| Red Lake | 38.9 | 0.0 |
| Roseau | 47.3 | 7.0 |
| Stevens | 33.5 | 0.0 |
| Traverse | 59.4 | 10.6 |
| Wilkin | 41.6 | 36.2 |

Source: Program Evaluation Division analysis of 1986 county construction projects, Office of State Aid, Mininesota Department of Transportation.

[a]ADT is Average Daily Traffic.

[b]The proportion of state aid spent on these roads is usually very similar to the proportion of funds from all sources spent on these roads.

These 23 counties spent only about $3.8 million in state aids on roads with less than 100 vehicles per day. Statewide, Minnesota's 87 counties received about $12.4 million in state aid on low traffic roads, but spent less than $8 million to construct those roads in 1986.

### 4. Inactive Roads

About 6,000 miles of county state aid highways have never been graded or were last graded before 1940. Although counties have chosen not to improve these roads, they continue to receive aids based on the estimated costs of building these roads to state standards. The estimated cost of constructing these roads is more than $1.5 billion dollars, or about one-third of the needs for the entire system.

We compared 1986 construction expenditures based on when the road was last graded. As shown in Table 3.7:

- Counties spent nearly one-half of their construction funds to improve roads that have been graded within the last twenty-five years.

TABLE 3.7

COMPARISON OF COUNTIES' CONSTRUCTION NEEDS AND ACTIVITIES BY YEAR OF MOST RECENT GRADING

| | Proportion of: | | |
|---|---|---|---|
| Year of Most Recent Grading | Counties' Needs | 1986 Expenditures | Miles of Road |
| Never Graded | 11.9% | 4.8% | 6.9% |
| Before 1940 | 20.5 | 15.4 | 13.1 |
| 1940 - 1949 | 11.3 | 6.4 | 8.3 |
| 1950 - 1960 | 36.4 | 25.4 | 28.3 |
| 1960 - 1985 | 19.9 | 48.0 | 43.5 |
| TOTAL | 100.0% | 100.0% | 100.1%[a] |

Source: Program Evaluation Division analysis of 1986 county construction projects and 1986 study of county highway construction needs, Office of State Aid, Minnesota Department of Transportation. Three construction projects not included because of incomplete information.

[a]Does not add to 100 percent due to rounding

On the other hand, counties spent a relatively small portion of their construction funds on "inactive roads"--those that have not been graded in the past 47 years. Over the years, counties have set priorities and have chosen not to improve these roads. Given limited funds, it is likely that most of these roads will never be built to state standards.

A subcommittee of the county engineers' Screening Board has recently examined the issue of inactive county state aid highways. The subcommittee recommended several options for future consideration. One option is to re-evaluate the importance of all current CSAH routes, leading to a two-tier system in each county. The primary system would continue to draw aid based on estimated construction needs, while the secondary system would draw construction aid only after work was actually performed.

## B. CONCLUSIONS

Using state aid and other funds, counties let contracts for $124.6 million of road construction in 1986. Although a substantial amount of aid is generated by counties' construction needs on low-traffic roads and roads that have not been improved in the last 47 years, relatively little construction activity takes place on those roads. Instead, counties spend more of their funds on roads that carry more traffic and that have already received recent improvements.

# Critique of Traffic Projections

## CHAPTER 4

In this chapter, we review the Minnesota Department of Transportation's method of estimating future traffic on state aid roads and evaluate its validity and reliability. Our 1985 report judged the traffic projections to be of doubtful validity, and our follow-up research shows that the projections are also statistically unreliable.

### A. THE USES OF STATE AID TRAFFIC PROJECTIONS

Traffic projections are important to the state aid system for two reasons. First, the estimates of county highway construction "needs" that are used to allocate half of state aid are based on projected traffic. Estimating needs on the basis of projected traffic rather than current traffic is intended to improve the equity of state aid allocations. By trying to distinguish counties that will likely have large traffic increases from those that will have smaller increases, the current method of state aid allocation targets aid to counties with the largest expected traffic increases.[1]

A second use of traffic projections is to determine the design standards to which counties actually build highways. When a county decides to include a road in its construction program, the width, strength, and design speed of the planned road are determined on the basis of projected traffic, not current traffic.

### B. MN/DOT'S METHOD OF PROJECTING STATE AID TRAFFIC

By a 1961 resolution of the CSAH Screening Board, highway "needs" estimates are based on projections of future traffic. The method used by Minnesota's Department of Transpor-

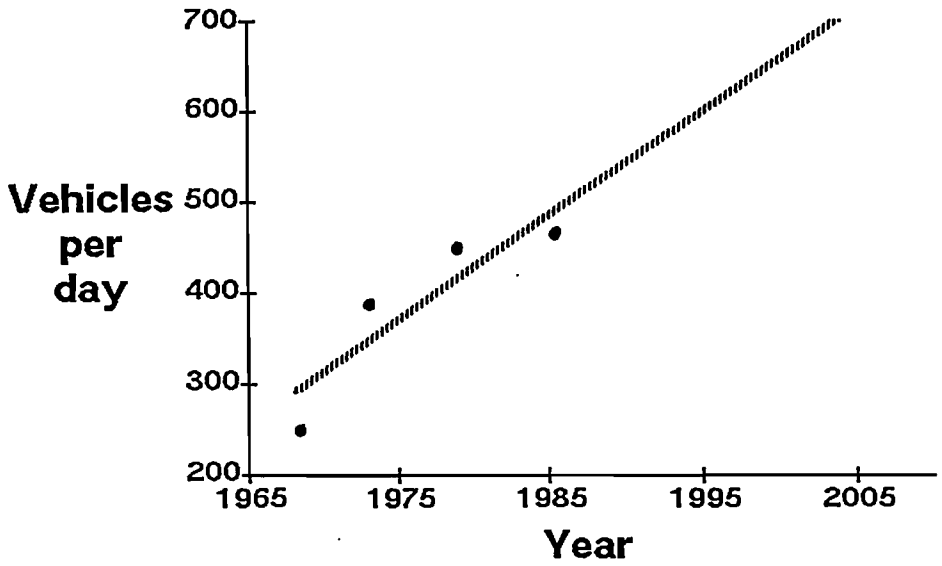
[1]Estimating needs on the basis of projected traffic also increases the total needs claimed by counties, since MnDOT currently projects that all 87 counties will see increases in their CSAH traffic over the next 20 years. Projections of large traffic increases often cause highways to be subject to higher design standards, thus making them more "sub-standard" (i.e., in need of construction) than would otherwise be the case.

tation to project traffic has changed over the years. The current method is called the "least squares" method of projection.

For non-metropolitan counties, the department projects future traffic using four recent traffic counts, typically covering a span of 15 to 25 years. For metropolitan counties, the department bases future projections on seven traffic counts, usually covering a 12 year period. For each year in which there is a traffic count, MnDOT calculates the average daily "vehicle miles driven per CSAH mile" as an estimate of that county's overall traffic.[2] Figure 4.1 illustrates the method using one county's most recent traffic estimates.

FIGURE 4.1

MINNESOTA DEPARTMENT OF TRANSPORTATION'S PROJECTION OF STATE AID HIGHWAY TRAFFIC IN BROWN COUNTY IN THE YEAR 2005[a]




Source: Data from Minnesota Department of Transportation, Office of State Aid.

[a]The dots represent the four traffic counts on which MnDOT's traffic projection is based (1968, 1973, 1979, 1985).

Using the previous traffic counts, the department then fits a straight line through these points; this is known as a "least squares regression." From the year of the most recent traffic count, MnDOT extends this line forward 20 years, thus assuming that the trends of past years will continue into the future. The department calculates a "traffic projection factor" for each county by comparing the projected traffic in 20 years to the most recent traffic count. In the example in Figure 4.1, Brown County has projected traffic

[2]The time of year at which a county's traffic is measured may vary from one count to the next. This raises questions about the reliability of traffic comparisons over time.

of 715 vehicles per day in the year 2005 and actual current traffic of 459 vehicles per day, so its traffic projection factor is 1.6 (715 divided by 459). The traffic projection factor of 1.6 leads MnDOT to estimate that all state aid highways in Brown County will experience traffic increases of 60 percent in the next 20 years.

Among the 87 counties, the median county traffic projection factor is 1.6. The factors range from 1.2 (in Ramsey and Carver counties) to 2.0 (in Chisago and Winona counties). The traffic projection factors of Twin Cities metropolitan area counties and non-metropolitan counties average roughly the same.

## C. CRITICISMS OF THE PROJECTIONS

In our 1985 report, we criticized the use of "straight-line" traffic projections. We suggested that those factors that contributed to traffic increases in the past 20 years will probably not cause comparable increases in the coming 20 years. Past traffic increases were largely prompted by increases in the number of drivers, working women, households, and cars per household, as well as increased leisure travel and longer trips to work. Many of these trends are slowing and will likely have less impact on traffic levels than in the past. Population decreases are projected for some Minnesota counties in coming years.

In our follow-up research, we more closely examined whether MnDOT's "least squares" traffic estimates overstate traffic levels on state aid highways. If traffic on the CSAH system has been increasing at a slower pace or declining in recent years, then we would expect straight-line estimates of traffic trends to overstate current traffic levels. Indeed, we found that:

- The department's straight-line traffic estimates overstated the most recent traffic counts in more than 70 percent of the counties, suggesting a slowdown in CSAH traffic growth.

For example, note that Brown County's 1985 traffic count was 459 vehicles per day, which is less than the 486 vehicles per day estimated by the "least squares" method. The observed pattern of large traffic increases in the 1960s and 1970s followed by smaller increases in the 1980s suggests that traffic changes follow a non-linear pattern in many Minnesota counties.[3]

In addition, despite the fact that MnDOT estimates that all 87 counties will see increasing traffic in coming years, we found that:

- State aid highway traffic actually declined in 10 counties between their last two traffic counts.

Most of these 10 counties were in the western or southwestern part of Minnesota, where some county populations are declining. They included Chippewa, Cottonwood, Jackson,

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[3]We found that a non-linear estimation model more accurately reflected past traffic trends than a linear model in about half of a sample of counties we examined. The non-linear model we used assumed a rapid increase in county traffic starting in 1960, followed by gradual slowing in the rate of traffic increases.

Lake, Lake of the Woods, Lincoln, Murray, Pipestone, Stevens, and Yellow Medicine counties.

Overall, our review of MnDOT's straight-line projections suggests that this "least squares" method is not a *valid* way to estimate CSAH traffic. State aid highway traffic in many counties is not following the linear pattern assumed by the department's method of traffic projection. There is also a flaw of logic in traffic projections (either linear or non-linear) that assume that traffic levels change at a constant rate over time.

In addition to these questions about the validity of traffic projections, we also found serious problems with the projections' *reliability. Even if we assume that future traffic trends will follow a straight-line pattern*, we found that:

- The department's current method of traffic projection does not reliably distinguish between the traffic trends of different counties.

Since projected traffic levels determine the standards to which roads are built and affect the construction "needs" reported by counties, the counties projected to have larger-than-average traffic increases receive larger aid allocations than they would otherwise receive. Thus, a key reason that the Screening Board permits needs to be calculated on the basis of projected traffic is to target aid to counties where the highway needs are greatest.

However, unless MnDOT can reliably distinguish among counties on the basis of traffic projections, the use of these projections does not enhance the equity of CSAH allocations. We evaluated the reliability of the department's projections using accepted statistical methods described in Appendix A. Since it would be rare for a "least squares" method of projection to estimate traffic trends perfectly, we asked: to what degree are the department's methods imperfect?

We found that the department's traffic projections have an extremely wide margin of error; Table 4.1 shows this margin of error for a sample of Minnesota's counties. Much of this error occurs because the projections are based on very few traffic counts; projections based on many traffic counts are generally more reliable than projections based on few. The department projects traffic in most Minnesota counties on the basis of only four traffic counts, usually taken over a 15 to 20 year period. As a result, it is impossible to confidently pinpoint counties' "traffic projection factors" any more precisely than shown in the right column of Table 4.1. Notice that it is conceivable that each county shown has a traffic projection factor of 1.5.

In 1986, the traffic projection factors of most counties were tightly clustered around the state median of 1.6. Since two-thirds of all counties had traffic projection factors between 1.5 and 1.7, the wide margins of error we found negate any usefulness that the factors may have in distinguishing the unique needs of counties.

As a result of the problems of validly and reliably projecting traffic counts, we recommend:

- Estimates of county highway "needs" for purposes of CSAH allocations should be based on current traffic levels, not projected traffic levels.

TABLE 4.1

MARGIN OF ERROR IN THE COUNTY STATE AID TRAFFIC PROJECTIONS

| County | COLUMN A<br>Traffic Projection Factor Used by MnDOT | COLUMN B<br>Range of Possible Traffic Projection Factors[a] |
|---|---|---|
| Aitkin | 1.4 | 0.8 - 1.9 |
| Anoka | 1.3 | 1.0 - 1.5 |
| Becker | 1.7 | 1.3 - 2.0 |
| Beltrami | 1.8 | 1.2 - 2.5 |
| Benton | 1.8 | 1.3 - 2.3 |
| Big Stone | 1.5 | 1.1 - 1.8 |
| Blue Earth | 1.7 | 1.0 - 2.3 |
| Brown | 1.6 | 0.9 - 2.2 |
| Carlton | 1.7 | 1.4 - 2.0 |
| Carver | 1.2 | 0.9 - 1.5 |
| Cass | 1.6 | 1.4 - 1.9 |
| Chippewa | 1.5 | 0.3 - 2.6 |
| Chisago | 1.7 | 1.4 - 2.1 |
| Clay | 1.8 | 1.1 - 2.6 |
| Clearwater | 1.6 | 1.1 - 2.1 |
| Cook | 1.5 | 0.9 - 2.2 |
| Cottonwood | 1.5 | 0.5 - 2.5 |
| Crow Wing | 1.6 | 1.5 - 1.8 |
| Dakota | 1.8 | 1.3 - 2.2 |
| Dodge | 1.7 | 1.3 - 2.0 |
| Douglas | 1.7 | 1.3 - 2.0 |
| Faribault | 1.6 | 0.5 - 2.6 |
| Fillmore | 1.5 | 1.1 - 1.9 |
| Goodhue | 1.6 | 0.9 - 2.4 |
| Grant | 1.3 | 0.9 - 1.6 |
| Hennepin | 1.4 | 1.2 - 1.6 |
| Itasca | 1.5 | 1.5 - 1.6 |

Source: Program Evaluation Division analysis of Minnesota Department of Transportation state aid traffic data, 1987.

[a]Column B shows the degree of imprecision in the traffic projection factors of Column A. Although MnDOT uses the factor shown in Column A to estimate future highway needs, traffic data do not permit any greater accuracy than the range of estimates shown in Column B. The ranges shown in Column B assume (as does MnDOT) that future traffic will increase in a linear way. If this is not the case, the margins of error will be larger.

Such action should be initiated either by the Legislature or the CSAH Screening Board. We think that use of "least squares" traffic projection factors in the annual CSAH "needs" study should be discontinued. While this recommendation does not preclude the possibility that better methods of traffic projection exist and can be implemented, we doubt that there is any single method that could reliably estimate the future traffic on all of Minnesota's state aid highways. Better projections would probably require more frequent traffic counts and the use of various non-linear traffic projection models.

Although we do not recommend the use of traffic projections during the CSAH fund allocation process, we recognize the need to project traffic accurately on roads that are scheduled for construction in the near future. It makes sense to consider the future traffic of a road when determining the standards to which it will be constructed. Thus, we recommend that:

- The Department of Transportation should work with counties to develop more reliable methods of projecting traffic for those highway segments included in county construction programs.

These methods should be more than straight-line projections. Projections based on non-linear traffic models or on patterns of demographic change should be considered. Perhaps these efforts will suggest useful ways in which traffic projections could be included in the fund allocation process at some future date. For now, however, we think it is more realistic to expect accurate projections on a small number of highways each year than on the entire CSAH network of roads.

# Discussion

## CHAPTER 5

In 1985, our office issued a report examining the County State Aid Highway (CSAH) system, which has received more than $2 billion in state construction and maintenance funds since its creation in 1958. Despite the importance of this 30,000 mile system, there has been relatively little attention paid by policy-makers to state aid highway construction progress or the method of county aid allocations.

This follow-up report updates some of the trends noted in the 1985 report and expands on our previous research. In general, our findings are consistent with those in the 1985 report. We think that the Legislature should consider some changes in the method of state aid allocation. The critical first step is for the Legislature to acquaint itself more closely with the workings of the state aid system. To that end, we recommend:

- The joint House-Senate transportation finance study commission created by the 1987 Legislature should fully consider the state aid system and its method of fund allocation.

Our current research supports our earlier conclusion that building the entire CSAH system to current design standards is unrealistic, even if state aid funding were increased dramatically. Only one-third of state aid highways meet these standards, and this percentage actually decreased slightly in the past two years. Although more than 8,000 miles of gravel roads are part of the state aid system, the rate of paving gravel roads (about 100 miles per year) is less than at any time in the CSAH system's history. Counties are spending significant portions of their state aid funds to simply resurface existing paved highway segments, rather than upgrading roads to meet design standards. It appears that the state aid highways with very low traffic levels are the roads least likely to be upgraded by counties. We found that counties are spending relatively small amounts of state aid on low-traffic roads. Even the counties that claim to have extensive "needs" on low-traffic roads are spending little construction money on these roads.

The current state aid allocation method assumes that it is possible to build the CSAH system completely to standard in the foreseeable future. If this is unrealistic, then the Legislature should consider whether it makes sense to allocate aid based on this overly-optimistic assumption about state aid highway construction.

In our 1985 report, we suggested alternative approaches to state aid highway funding for the Legislature to consider. These included:

(1) *Life-cycle costing.* To better reflect the resurfacing activities that consume a large portion of county highway spending, CSAH allocations could be focused more on preservation needs than on new construction needs.

(2) *Block grant.* To reduce the complexity of the current aid allocation system, the Legislature could opt for more simple measures of highway needs on which to base allocations.

(3) *Targeted improvements.* For example, to better reflect state priorities or current county highway spending patterns, the Legislature could consider restricting counties' "needs" (on which 50 percent of the aid allocation is based) to those roads which currently have more than 100 vehicles per day. Similarly, the Legislature could prohibit counties from reporting construction needs on individual highways for more than 25 years.

Understandably, there is county concern about the fiscal impacts of any changes to the funding formula. While these impacts should be considered, they should not prevent the Legislature from enacting changes that make sense from a statewide perspective.

There is further concern that any funding changes could place additional burdens on those counties most dependent on property tax revenues. Our 1985 report showed that counties outside the Twin Cities metropolitan area usually have higher local highway levies per capita than metropolitan counties. If the Legislature is concerned that funding changes would decrease the portion of state aid going to non-metropolitan counties, it could create separate metropolitan and non-metropolitan CSAH funds, with legislatively-determined portions of total state aid funds going to each.

We think it is encouraging that a subcommittee of county engineers serving on the CSAH Screening Board recently urged that state aid distributions be based on a more realistic assessment of highway needs. The subcommittee recommended several funding alternatives for the CSAH system. Among the alternatives was designation of "primary" and "secondary" state aid highways, with aid allocations based largely on the needs of primary state aid highways. Such a funding option is consistent with the "targeted improvements" strategy outlined above and in our 1985 report; aid could be targeted to better reflect state goals and priorities.

In addition to fundamental changes in state aid allocations such as those just discussed, our 1985 report recommended a variety of other changes in CSAH funding. We continue to support the following:

- Changing the state aid allocation formula's "mileage factor" to a measure of lane miles per county;
- Changing the formula's "motor vehicle registration factor" to a measure of CSAH vehicle miles traveled;
- Repealing the "equalization factor;"
- Eliminating the statutory provision preventing counties from receiving less than their 1958 share of state aid;
- Replacing the "mill levy deduction" with a better measure of local effort.

Our follow-up research also documents serious problems with the traffic projection methods used by the Minnesota Department of Transportation to estimate future highway needs on all state aid highways. Because these methods appear to be neither valid nor reliable for most counties, we recommend:

- Estimates of county highway "needs" for purposes of CSAH allocations should be based on current traffic levels, not projected traffic levels. For the purpose of determining appropriate design standards for scheduled construction projects, the Minnesota Department of Transportation should work with counties to develop more reliable methods of projecting traffic.

We think it is probably unrealistic to expect accurate, ongoing estimates of projected traffic for all 30,000 miles of state aid highway. However, if there is sentiment to continue allocating state aid on the basis of projected traffic levels, MnDOT would have to address the serious flaws with the current method of projection. Better projections would probably require more frequent traffic counts and the use of non-linear traffic projection models.[1]

Finally, we think that MnDOT should play a more active role in the policy issues facing the state aid system. To date, the department has viewed its role in the CSAH system primarily as administrative. However, as the primary agency overseeing state transportation issues, MnDOT should provide the Legislature with more leadership and policy guidance. Specifically, the department should (1) periodically inform the Legislature about CSAH construction progress, Screening Board actions, and procedures for allocating aid, and (2) propose or comment on legislation related to aid allocations. While the department's good working relationship with counties has proven to be an important asset to the state, it is equally important that MnDOT assume an independent leadership role.

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[1]The cost of implementing more accurate projection methods would likely reduce funding somewhat for road improvements. State law permits MnDOT to spend up to 1.5 percent of CSAH funds for administrative costs, such as traffic projections. However, since CSAH administrative costs have historically been much less than this percentage, the balance has been allocated to counties for highway construction and maintenance.

# Appendix

## THE RELIABILITY OF STATE AID HIGHWAY TRAFFIC PROJECTIONS

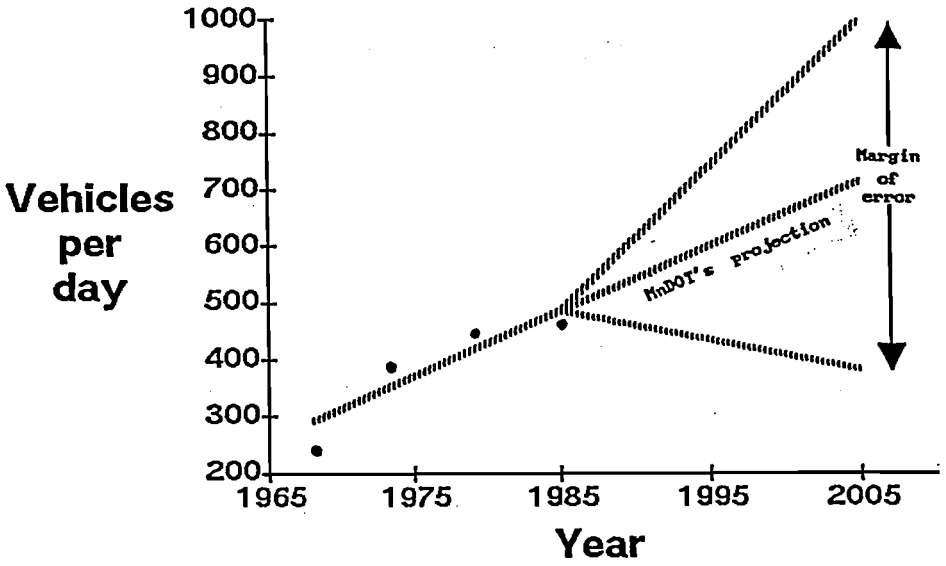
Chapter 4 of this report contains a critique of the method used by the Minnesota Department of Transportation to project traffic on state aid highways. That method is described in the report, using the example of Brown County. This appendix explains in more detail why we consider the "least squares" method of projecting traffic to be unreliable.

Using past traffic counts, the department estimates a straight line that approximates these traffic trends and continues them into the future (shown for Brown County in Figure A.1). However, it would be rare for all traffic counts to fall exactly on this line; the actual traffic measured at various points in time differs from the straight-line estimate of traffic. Because of these differences, it is not possible for us to know the slope of the straight-line traffic estimate with certainty. There is some margin of error in this estimate.

We looked at the margin of error by determining a "confidence interval" for the traffic projections made in various counties. That is, we asked: Between what two "traffic projection factors" can we be 95 percent certain that the true traffic projection factor lies? As shown below by the upper and lower traffic estimates for the year 2005, we constructed a margin of error for county traffic projections. If traffic trends actually follow a straight-line pattern (an assumption questioned in this report), then we can be 95 percent certain that the actual traffic at some future date lies between the upper and lower lines pictured. However, we cannot be certain about *where* in this area the true future traffic counts will lie. Table 4.1 of the report shows the margin of error for a sample of counties. In the case of Brown County, the data indicate that traffic in 2005 could be as much as 120 percent higher than in 1985 or it may be slightly lower than in 1985; the data do not permit any greater precision.

FIGURE A.1

RELIABILITY OF MINNESOTA DEPARTMENT OF TRANSPORTATION TRAFFIC PROJECTIONS FOR BROWN COUNTY[a]




Source: The margin of error was calculated by the Program Evaluation Division using Minnesota Department of Transportation data.

[a]MnDOT's straight-line projection is based on four traffic counts (shown as dots) made in 1965, 1973, 1979, and 1985.

## STUDIES OF THE PROGRAM EVALUATION DIVISION

Evaluation reports can be obtained free of charge from the Program Evaluation Division, 122 Veterans Service Building, Saint Paul, Minnesota 55155, 612/296-4708.

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*These reports are also available through the U.S. Department of Education ERIC Clearinghouse.