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A "BACKBONE" CONCEPT

FOR DEVELOPMENT OF

MINNESOTA TRUNK HIGHWAYS



A Proposal by the Minnesota Highway Department of a "Limited Funding Capability" Approach to State Highway System Construction

July, 1972

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SUMMARY OF

A "BACKBONE" CONCEPT FOR DEVELOPMENT OF MINNESOTA TRUNK HIGHWAYS

A careful examination of our State Trunk Highway System in 1972 revealed the following:

- Demands and requests for highway improvements throughout the state far exceeded our ability to finance them.
- Road improvements contained in the program surpassed

available finances.

- Construction standards had been increased by the Federal Government for all projects involving federal funds resulting in sharply increased costs.
- Inflationary forces had reduced the amount of construction that could be obtained.
- Revenues had not been increased for state highway construction by the 1971 State Legislature.

Obviously, a financially realistic highway plan was needed.

Financial Capability

- For several years the Minnesota Highway Department has been spending \$70 to \$75 million annually on improvements to the trunk highway system excluding the interstate highway system.
- By the end of fiscal year 1973, all bond revenues authorized by the 1967 Legislature will have been utilized. Beginning in fiscal year 1974, therefore,

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a serious reduction in highway funding will occur at a time when more, not less, ought to be invested in our highway facilities, particularly in out-state regions.

- The outlook for increased Federal-aid for highway improvements is not good at this time.
- Our financial forecasts indicate that beginning in fiscal year 1974, approximately \$55 million of state and federal funds will be available annually for trunk highway capital and noncapital improvements, excluding the interstate system funding. We estimate an annual minimum of \$15 million in noncapital "stop-gap" improvements will be necessary to protect the existing facilities and retain them in a minimum tolerable condition. The remaining \$40 million annually would be devoted to capital improvement of the backbone routes.

The Backbone Concept

- The long-range plan developed by the Highway Department in 1966 identified needed improvements that will cost approximately \$3.2 billion, obviously financially unrealistic.
- In developing a financially realistic plan, emphasis was placed on three factors:

- (1) To promote out-state economic development
- (2) To satisfy travel demands on major recreation routes

(3) To serve the maximum number of highway users.
Routes identified as being of major importance in all three categories (economic development, recreation, and road user benefits) are the most important routes; routes identified as major in two categories are the second most important routes.

- In the Twin Cities metropolitan area, the backbone system was based on data developed through the Transportation Planning Program which is a cooperative effort of the Minnesota Highway Department, Metropolitan Council, Metropolitan Transit Commission, the seven counties, and the municipalities.
- Excluding interstate routes, the backbone system will cost \$1.2 billion. The first priority routes are estimated to cost \$313 million which, at \$40 million per year, will take 20 years to accomplish. The second priority routes have an estimated cost of \$410 million which will require an additional 10 years to accomplish.
- The first priority routes fulfill our objective of developing a financially realistic 20-year highway improvement plan.

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- We believe the available funds will be best utilized by concentrating them on a backbone system of highways serving the most important travel corridors in Minnesota, serving all regions of the state, and serving the greatest number of people.
- Adoption of a backbone system will permit the most effective and efficient use of the limited funds available for highway improvements.

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INTRODUCTION

In 1966 the Highway Department adopted the "Interim Service Level Plan" as the basis for developing the State Trunk Highway System. The goal of this plan was to provide a completely adequate highway system by 1986. To date, however, the Department's level of funding has not been sufficient to make this goal attainable. The Department, therefore, felt a need to re-evaluate its Highway Plan and implementation programs from the standpoint of adjusting to a relatively permanent climate of limited financial capability.

This report presents the Department's recommendation of a financially realistic highway plan as well as the criteria considered in the development of the plan. The plan reflects a concentration of resources on a "backbone" system of routes which, in the judgement of the Minnesota Highway Department, represents the best investment of available resources for the State of Minnesota.

The result of the plan is that, while those routes which are most important to the State as a whole will be improved, there will be many hundreds of miles of State trunk highway routes that will be maintained in a "minimum tolerable" condition without any major improvement or upgrading.

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Financial Capability

For the past several years, the Minnesota Highway Department has been expending approximately \$70 to \$75 million annually on capital and non-capital improvements on the State Trunk Highway System routes, excluding the Interstate Highway System. This amount includes State and Federal funds combined, and represents the costs expended for non-interstate trunk highway rights-of-way acquisition and major improvement contracts (capital improvements) as well as the following contract expenditures for "non-capital" improvements: roadway resurfacing, bridge repairs, spot safety improvements, and municipal cooperative work.

This level of expenditure has been made possible only as a result of the \$100 million bonding authority authorized by the 1967 Legislature. By the end of fiscal year 1973, however, all bond revenue will have been utilized resulting in a reduction in annual financial capability of \$20 million <u>plus</u> the annual revenue required to pay off the bonds. Beginning in fiscal year 1974, therefore, a serious reduction in highway funding capability will occur at a time when it appears to the Department that <u>more</u>, not less, ought to be invested in our highway transportation facilities - particularly those in the outstate regions.

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The outlook for additional or increased federal aid for highway improvements is not good at this time. In fact, strong pressures are being exerted by various groups to enact changes in Federal trust fund legislation that would cause a reduction in (as well as increased uncertainty of) present federal aid highway fund allotments. It also appears a certainty at this time that funding of the Interstate System will be stretched out to at least 1980, which means that resources presently devoted towards that effort cannot be re-directed to the trunk highway system for many years. Moreover, because the Interstate System effort is financed with 90% Federal Aid, and because we are not optimistic that those federal aids will be re-directed to any significant extent to satisfy highway needs, it does not appear likely that a "bonanza" of additional funds will be available for State highway improvements upon completion of the Interstate System.

In summary, then, our financial forecasts indicate that, beginning in fiscal year 1974, approximately \$55 million of State and Federal funds will be available annually for noninterstate trunk highway capital and non-capital improvements. With no increases in State road user tax rates or increased bonding authority, this amount should remain approximately at that level through fiscal year 1980, which is the presently estimated

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"last year" of Interstate financing. After 1980 an additional annual amount of approximately \$10 million should be available for non-interstate trunk highway improvements.

In proposing a "backbone" approach to utilization of available resources, it was assumed that our first priority for funds would be to finance those non-capital improvements, such as roadway resurfacing, and bridge repairs, necessary to protect our existing facilities and retain them in a "minimum tolerable" condition. Additionally, it was recognized that because of the age and state of deterioration of our trunk highway system, we could not realistically ignore the fact that some minor upgrading of "non-backbone" routes would be necessary in order to correct critical safety deficiencies or, where critical need exists, provide increased load carrying capacity to certain highways. Collectively, we refer to these needs (resurfacing, bridge repairs, spot safety improvements, reconditioning, etc.) as "stop-gap" needs and estimate they will require an initial annual minimum investment of \$15 million with the amount increasing to about \$25 million annually by the mid-1980's. The remaining funds available for capital improvements on the "backbone" routes would average approximately \$40 million annually for the next 20 years. Approximately 25% of the \$40 million will be required for rightof-way acquisition and design costs, leaving about 75% or \$30

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million annually available for construction contracts which is about one-half the current level of Trunk Highway System capital improvement contracts.

It is important to note that our financial forecast does not project growth caused by increased fuel consumption or increases in the number of vehicles registered. Also, our estimates for the costs of highway improvements are based on current prices and do not reflect inflationary trends. Because we believe these two factors will offset each other, we have left them out for simplicity.

Replacement of major bridges on "non-backbone" routes, which may become critically deficient and beyond repair, will require adjustment of funding capability to the extent that special federal funds are not available for such replacements.

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THE BACKBONE CONCEPT

The Present Plan Re-evaluation

In 1966, the Department developed and adopted the "Interim Service Level Classification Plan" as our long-range plan for development of the State Trunk Highway System. This plan identified the corridors in which the highways should be developed to freeway, expressway, major trunk, and trunk highway standards. These standards are defined as follows:

- Freeway : A multilane divided facility with full control of access. Similar to the Interstate Highway System, all crossroads are separated, access is provided only through interchanges, and no direct access to adjacent land is permitted.
- Expressway : A multilane divided facility with partial control of access; that is, some at-grade crossings and some direct access to adjacent land will be permitted.
- Major Trunk: Normally an undivided two-lane facility with partial control of access to adjacent land that will by-pass the congested areas of the municipalities it directly serves.

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Trunk Highway: Normally an undivided two-lane facility with partial control of access that will continue to penetrate the congested areas of the municipalities it serves.

In developing the "Interim Service Level Plan", which is depicted in Figure I, we utilized data developed by John R. Borchert and Russell B. Adams for the Upper Midwest Economic Study which is summarized in their report <u>Trade Centers and</u> <u>Trade Areas of the Upper Midwest</u>. In their study, they categorized all municipalities into one of eight trade center classes on the basis of the types and the dollar volume of business in each municipality. These classes, ranked in descending order, are: (1) Metropolitan, (2) Primary Wholesale-Retail, (3) Secondary Wholesale-Retail, (4) Complete Shopping, (5) Partial Shopping, (6) Full Convenience, (7) Minimum Convenience, and (3) Hamlet.

Cities are the main generators of traffic and the amount of traffic any city will generate is proportional to the amount of its economic activity. Therefore, based on the Borchert and Adams Study, a network of highways was established that interconnected our Metropolitan Center, the Twin Cities, to Metropolitan Centers in nearby states. To this network was added highways connecting all Primary Wholesale-Retail Centers

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to each other and all nearby Metropolitan Centers. This process was continued for the Secondary Wholesale-Retail and Complete Shopping Centers. The highway network established at this stage provided service to almost all areas of the State. Additional highways were added to the network to serve the most important trade centers in those previously unserved areas. This network of highways when fully improved would meet the requirements established for the major network; they would provide fast, safe travel between all places in the State that are major long-distance traffic generators and would serve all areas of the State.

Projected traffic volumes were then analyzed to determine which service level each route should be assigned. The highest volume routes on the network were classified as freeways, the second highest routes were classified as expressways, and the lower volume routes were classified as major trunks. All State Trunk Highways that were not part of this network were classified as trunk highways. Figure II shows the Interim Service Level Plan together with the trade centers having a partial shopping or higher classification.

Since the Interim Service Level Classification Plan was developed some new concepts have been introduced. In 1969, the Legislature enacted the Regional Development Act and in 1972

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Dr. John R. Borchert and Donald D. Carroll's study for the State Planning Agency entitled <u>Minnesota Land Use and Settlement 1985</u> was published. We reviewed our plan to see what impact these new concepts had on our planning.

Figure III shows the regional boundaries established under the Regional Development Act superimposed on the Interim Service Level Plan. The freeway, expressway, and major trunk highway system does serve all of the regions with each region being served by at least one expressway route. We concluded that no changes in our highway plan were necessitated by the Regional Development Act concepts.

The report, <u>Minnesota Land Use and Settlement 1985</u>, shows that large areas of the State are structured equivalent to an extremely low density metropolitan area. Different municipalities within the area provide different functions similar to different areas within the Twin Cities Metropolitan Area. For example, some municipalities have a high amount of industry and act equivalent to a major industrial area of the Twin Cities; some municipalities have major colleges and act equivalent to the University of Minnesota in the Twin Cities; some municipalities have major hospital facilities and act equivalent to a major hospital complex in the Twin Cities, and, at the other end of the spectrum, some of the smaller municipalities

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provide limited retail and service functions equivalent to a neighborhood shopping center in the Twin Cities. Dr. Borchert identified the Principal Urban Centers within each of these "Major Urban Clusters" and the transportation links required to permit the centers to interact.

The Principal Urban Centers and their required transportation links are overlaid on the Interim Service Level Plan in Figure IV. As shown all of the Principal Urban Centers are served by a freeway, expressway, or major trunk. Most of the transportation links are also served by this system. With the exception of the Crookston-Thief River Falls transportation link, the trunk highway routes, with only slight indirection, serve all links not served by the higher classified system. Our analysis concluded that the Interim Service Level Plan would serve the Major Urban Cluster concept.

We, therefore, believe that the Interim Service Level Plan is still a good plan for the development of the State's highway system. The question at this point is - does the Highway Department have sufficient funds to develop this system?

The Present Plan's Cost

As a major part of our 1966 study, an estimate was made of the cost of constructing this system of freeways, express-

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ways, major trunks, and trunk highways. The study has been periodically updated to reflect construction accomplishments and changing unit costs. Our latest update estimates that between 1970 and 1986 we will need improvements totaling \$2.0 billion (at 1969 unit costs) to have a completely adequate State Trunk Highway System excluding the Interstate System. However, a comparison of the needs study cost estimates to the costs of contracts awarded in recent years shows that our needs study costs are conservative. The costs for highways have been increasing rapidly due to the general inflationary trends in the economy as a whole and also because of the increased costs required to lessen the adverse environmental and social impacts of highway construction. It now appears that \$3.2 billion may be a more realistic estimate of our highway needs. Subclassified by service level, these needs are:

Freeways and expressways	\$1.6 billion on 1870 miles
Major trunks	0.4 billion on 1950 miles
Trunk highways	1.2 billion on 6740 miles
Total needs	\$3.2 billion on 10,560 miles

Earlier in this report we pointed out that under present financing we will have approximately \$40 million annually to invest in accomplishing these needs. At this rate it will take 80 years to accomplish the \$3.2 billion of needs - needs that the plan proposes should be accomplished by 1986 to adequately serve anticipated traffic volumes.

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The Backbone System

Because the Interim Service Level Plan is obviously financially unrealistic, we undertook development of a financially realistic plan - a plan that could be accomplished in 20 years. It was obvious that most of our routes will have to remain in their present inadequate condition. The question is which highways should be improved?

We concluded that the people of Minnesota as a whole would receive the most benefit if we concentrated our improvements on those routes which:

- 1. Promote outstate economic development.
- 2. Improve accessibility to the major recreation areas of the state.
- 3. Serve the greatest number of highway users.

Because improvement of the major routes will provide better transportation to large areas of the State thereby benefiting the majority of our citizens, we concluded that the freeway, expressway, major trunk system would best satisfy the three criteria. However, because the cost of developing this system will cost about \$2.0 billion, we had to evaluate which portions of this system <u>best</u> met the established criteria. The Interstate Highway System of freeways has special Federal funding with the commitment of being completed within 10 years. This system was, therefore, not subjected to further evaluation.

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Our evaluation of routes to promote outstate economic development was based on Dr. Borchert's urban cluster concept. We first connected each of the urban clusters to their major market, the Twin Cities. We then interconnected those urban clusters that have the largest amounts of interaction. There are many other routes needed to promote outstate economic development but at this point we had identified the routes of highest importance. As depicted in Figure V, the results of this process identifies routes directly serving 34 of the 40 principal urban centers. The six centers not directly served are all within 30 miles of an identified route.

Identification of the major recreational travel routes was based on our traffic counting and roadside interview data. Through years of data collection we have found that the major recreational routes have much greater traffic volumes in the summer season than in the winter season. In recent years, winter recreation has grown significantly but increasing summer recreation travel has offset its impact on the seasonal traffic variations. Figure V also shows the major recreational routes - those planned freeways, expressways, and major trunks that carry 70% or more traffic in the summer season than they carry in the winter season.

We decided that including rural routes currently carrying an average annual daily traffic (ADT) volume of 3000 or more would be an effective measurement of the routes serving the maximum

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number of highway users. The amount of traffic a highway carries varies by day of the week and by season of the year. When the total number of vehicles using a particular section of highway in a year's time is divided by the 365 days in a year, we obtain the ADT which averages out all the weekly and seasonal variations in traffic volumes. The average rural State Trunk Highway has an ADT of approximately 1200. Our 3000 ADT minimum cutoff is, therefore, 2^{1}_{2} times the average. Historically, traffic volumes on the average have doubled in 20 years. Routes carrying 3000 ADT or more today can be expected to carry 6000 ADT or more in 20 years. At a 6000 ADT volume, an expressway facility is usually required to provide a reasonable level of service to the highway's users. Figure V shows the planned freeways, expressways, and major trunks that are currently carrying 3000 ADT or greater.

Routes that were identified as being of major importance in all three catagories (rural development, recreation, and road user benefits) are the most important routes; routes identified as major in two categories are the second most important routes; etc. On this basis, we developed the "backbone" system for improvement of the State trunk highway system as shown in Figure VI.

In developing the priorities, the following practical considerations were also evaluated:

1. The condition of the present highway facility: Some routes have been improved in recent years to a condition

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adequate to provide a reasonable level of service without making further improvements. In other instances the priorities had to be adjusted because a route of lower priority - based on the economic development, recreational use, and road user benefit concepts - was in significantly worse condition than some routes of higher priority.

- 2. Closing of gaps: Improvements have been in progress on some routes but some relatively short gaps remain to provide a continuously improved highway. In order to maximize the benefits of the past expenditures, the unimproved gaps were given a high priority.
- 3. Commitments: In the past, we have made commitments to improve certain highways in the near future. To the extent that these commitments were compatible with the "backbone" system concept, we adjusted priorities within the "backbone" concept to accommodate these commitments.
- Status of plan development: Because it takes 6 to 8 years to develop a project for construction, priority was given to projects currently being developed.

In the Twin Cities Metropolitan Area, the backbone system was selected on the basis of data developed through the Transporttation Planning Program which is a cooperative effort of the

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Minnesota Highway Department, the Metropolitan Council, the Metropolitan Transit Commission, the seven counties, and the metropolitan area municipalities.

Excluding the Interstate Routes, the "backbone" system will cost \$1.2 billion. The 1st priority routes are estimated to cost \$813 million which, at \$40 million per year, will take 20 years to accomplish. The 2nd priority routes have an estimated cost of \$410 million which would require an additional 10 years to accomplish. The 1st priority routes fulfill our original objective of developing a financially realistic 20-year highway improvement plan. The 2nd priority group was developed to indicate how later work would tie the 1st priority routes together into a true system and it also shows the routes we would propose to improve if we did obtain an additional \$20 million per year beyond our presently forseeable funding.

The mileages and costs of the backbone system are as follows:

Backbone	Miles	Estimated	Estimated Cost in \$1,000,000		
Sub-System	antizitäässänä" toisitune sakuoraa	Outstate	Metropolitan	Total	
Interstate	914	42x8		t.cat	
Adequate	915		4528	6400	
Priority l	773	511	302	813	
Priority 2	681	257	153	410	
Total	3283	768	455	1,223	

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To evaluate the backbone system we again looked at service to identified planning and development regions and the urban clusters. As shown in Figure VII, every region is served by a backbone route with at least one expressway into each region and all of the urban clusters are tied to the Twin Cities by the backbone system with 36 of the 40 principle urban centers being directly served.

Additionally, we checked to see how much of our present population is directly served by the backbone system. Because direct service to rural populations can only be arbitrarily defined, we limited our analysis to population in incorporated municipalities. Excluding the Metropolitan Twin Cities urbanized area, Minnesota's 1970 population within municipalities was 1,209,635. The backbone system directly serves municipalities containing 74% or 896,307 persons. If the Metropolitan Twin Cities area is included, the backbone system would serve 2,600,730 persons out of 2,914,058 or 89% served.

Development of the backbone system will require changes in our present way of scheduling projects. We presently allocate regular construction funds (excludes Interstate) to each of our 9 districts on the basis of the money needs and the vehicle-miles of travel within each district. To develop the backbone system in a logical sequence, programming will be on a statewide system basis which will result in major fluctuations in the amount of work in any one district over the life of this program.

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