discussed above. For each year of the time span chosen, the cash flows corresponding to the column headings in each table are given.

USE OF RESULTS OF CASH-FLOW MODEL

The results of the cash-flow analyses are being used in the short-, intermediate-, and long-range budgeting processes of the Dade County Metropolitan Transit Agency (the present bus operator) and the Dade County Office of Transportation Administration. The operator is working interactively in the fiscal planning process and the development of the short-range operating budget. The transportation overview function in Dade County (the Office of Transportation Administration) is using the results in financial planning and programming and in the development of the county strategy for securing legislative support for bus and rail transit development. Based on these analy-

ses, a number of fiscal programming strategies have been considered and rejected and a course of action for the Dade County Board of Commissioners relative to deficit management has been and continues to be explored. The fiscal impact of delay and other construction staging decisions have been explored by using this planning tool.

Abridgment
Maryland's Primary Highway System: Criteria, Policies, and Financial Considerations

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The state highway system in Maryland, like that in most states, has evolved over the years. Additions to the system are continually being proposed, but no specific criteria for additions or deletions have been developed.

In 1972, the state legislature required the designation of a state primary highway system and, in July 1972, the Maryland Department of Transportation (MDOT) adopted such a system, in accordance with this state law. However, the legislation does not define a primary highway and provides no substantive guidance.

In mid-1976, in preparing a statewide transportation plan, MDOT initiated an analysis of the primary highway system to develop departmental criteria and policies for system designation and development. This analysis included a review of the adopted primary system; the development of objective, consistent system guidelines; and a strategy for system development recognizing limited resources. This paper describes this analysis and its results to date.

ANALYSIS OF PRIMARY HIGHWAY CORRIDORS AND DEVELOPMENT OF CRITERIA FOR SYSTEM DESIGNATION

System Objectives

From the beginning, the study found that the objectives of the state primary highway system are similar to those of the national Interstate system. They were defined as

1. The provision of direct routes for major interstate and interregional traffic flows;
2. The connection of major urban areas and traffic generators;
3. The concentration of long-distance, high-volume travel on a limited high-level-of-service system;

4. The support of statewide developmental objectives; and
5. The concentration of funds on needed major highway facilities that serve interregional travel flows.

These objectives established the framework by which roadways and corridors of primary statewide importance could be identified.

Corridor Analysis

Based on these objectives, the primary highway corridor service to centers of economic activity, land use, population, and other major trip generators were analyzed. This resulted in overlays of areas that had population centers of more than 10 000 persons, employment centers of more than 2000 persons, major recreational centers, major transportation terminals, military installations, and national and state parks on maps showing the existing primary system. The series of overlays was an effective illustration of the number of times the links in the system connected activity centers of statewide interest. There were links that appeared to be nonessential and others that were identified as possible additions.

A similar analysis was conducted by using traffic-service information and developed overlays of average daily traffic, percentage of truck traffic, level of service, and access control. The traffic-service information was then used to identify those corridors serving high-volume, long-distance travel. This analysis led to the conclusion that several of the routes in the previously adopted primary highway system were lower volume routes (less than 5000 average daily traffic) and candidates for deletion from the system.

Table 1. Available funding for Interstate and primary highways.

Nature of Revenue Estimate	Available Funding (millions of constant 1976 $)						
	Interstate		Primary		Total		
	State	Federal	State	Federal	State	Federal	Total
Low or conservative	10	90	34	79	44	169	213
High or optimistic	60	540	1170	217	1230	757	1987
Constant purchasing power	60	540	1418	217	1478	757	2235

System Criteria

The analyses of traffic generators and traffic-service information were then compared to the Maryland functional classification system. (This classification system is based on the federal system although it also includes an intermediate-arterial category.) It was concluded that the state functional classification system is a good expression of the service provided by various facilities to land use and economic activity; thus, this system was used as the base from which to develop the criteria for primary highway system designation.

The use of the functional classification system had another benefit. County staff and elected officials in the state had already reviewed and concurred with the revised federal functional classification (approved July 1, 1976, as part of the federal-aid system realignment), which closely relates to the state network.

Thus, the following criteria for designation of the system were developed.

1. Limit the system to 5 percent of the total of state, county, and municipal highways and roads. This percentage is just slightly greater than the maximum allowance for principal arterials in the federal functional classification system.

2. Include all principal arterials (except Interstate highways) on the year 2000 state functional classification maps (legally, Interstate highways are not part of the primary highway system in Maryland, but the analysis described in this paper also included them): (a) connect population centers of 5000-25 000 persons, which are considered to be served when the highway passes within 8 km (5 miles) of the central business district; (b) emphasize direct through travel between population centers; and (c) serve long trips and the high-volume traffic typical of substantial interregional or interstate travel [that is, trip lengths greater than 40 km (25 miles) and traffic volumes greater than 17 000 vehicles/d in rural areas and 55 000 vehicles/d in urban areas].

3. Include those intermediate arterials of major importance: (a) connect population centers of 5000-25 000 persons, which are considered to be served when the highway passes within 8 km of the central business district; (b) connect the major highway corridors in adjacent states; and (c) provide connections between the Maryland portions of the main Northeast Corridor routes.

Revised System

A revised primary highway system that uses the above criteria was prepared. Generally, this system includes most of the elements of the 1972 adopted system, but it reflects a number of significant deletions. Roadways that parallel other primary system elements that carry more interregional traffic or

represent more recent major investments in physical improvement (or both) were deleted. In addition, some elements of the original primary system were recommended for deletion from the revised system based on a determination that their traffic-carrying function was primarily local rather than of statewide importance.

The revised system was compared with the 1972 system on a regional level. The total length of the system was reduced by 298 km (186 miles), the percentage of the primary highways was reduced from 5.5 to 4.9, and the systemwide vehicle travel did not change appreciably. The proposed primary system carries about 57 percent of the vehicle travel of the entire state road system. This is only 4 percent less than the previous system. A comparison of the length of the primary system as a percentage of the length of the total system by region indicated that the system coverage is adequate and within a reasonable distance of all areas of the state.

FINANCIAL CONSIDERATIONS

The study also compared the cost of implementing the primary highway system with the anticipated revenues. There were several steps to this part of the analysis. First, a range of total state revenues available for transportation purposes over the next 20 years were estimated based on the present revenue structures and institutional arrangements. This gave three funding levels that are referred to as the conservative, optimistic, and constant-purchasing-power alternatives (see below).

Nature of Revenue Estimate	State Monies Available to Trust Fund (1976-1996) (1976 constant $)	State Revenue Available for Construction ($)
Low or conservative, low rate of growth in variables affecting MDOT revenues	3.5 billion	0.8 billion
High or optimistic, high rate of growth in variables affecting MDOT revenues, represents most optimistic estimate based on existing revenue structure and three or four tax increases over 20-year period	5.0 billion	2.3 billion
Constant purchasing power, revenue requirement based on maintaining MDOT's recent purchasing power over 20-year period, requires significant increases in revenue	6.0 billion	3.3 billion

Estimates of federal aid (assuming a continuation of present federal-aid formulas, policies, and funding levels) were then developed (see Table 1). Reasonable funding levels for primary highways were developed, based on the total state and federal revenue estimates. Finally, these funding estimates were compared to the MDOT 5-year program.

Comparing the total costs of the primary highway projects in the MDOT 5-year program with the state and federal revenue estimates available for primary highways led to the following conclusions:

1. Under the low or conservative estimate, MDOT cannot complete all the projects in its approved 5-year program within 20 years without additional revenues. By this estimate, only 24 percent of the needed funds to implement all the major capital projects in the 5-year program would be available over

the 20-year period, and only about 10 percent of the funds needed to complete the programmed primary highway projects would be available.

2. Under the most optimistic assumptions of revenues available to MDOT, which includes three or four revenue increases, all projects in the 5-year program can be completed over the 20-year period. However, MDOT would not have the financial capability to initiate any additional major port, aviation, rail, highway, or transit projects within the next 20 years without cutting back on operating services or currently programmed capital projects. Furthermore, because of an anticipated shortfall in federal primary highway funds, about 75 percent of the primary highway funding would have to be provided entirely by the state; i.e., there would be no federal matching funds available for many of the primary highway projects.

3. Under the constant-purchasing-power revenue estimate, MDOT could expect to complete all of the programmed projects plus about $250 million worth of nonprogrammed primary highway projects. Again, all of the new projects would have to be entirely state funded, because all of the estimated federal aid available would have been used on programmed projects.

Comparing the costs to implement the 1972 system and the system proposed here with the estimates of anticipated revenues led to the following conclusions:

1. The proposed revisions to the primary highway system reduce the total costs to complete the system by $500 million.

2. All the critical highway needs (i.e., those needs perceived necessary today) under the proposed system could be met by assuming the most optimistic revenue estimate but, under the adopted system, about $300 million worth of critical needs would remain unmet.

3. Under the constant-purchasing-power revenue estimate, the total costs to implement the proposed primary highway system exceed the revenues that are anticipated to be available. Even assuming that non-Interstate federal aid would double, approximately one-sixth of all primary needs would remain unmet at the end of the 20-year period. Because of this situation, MDOT is considering access-control policies to preserve the traffic-carrying capacities and functions of the existing primary facilities.

SUMMARY AND CONCLUSION

Criteria for system designation and policies for system development have been proposed that recognize that the funding necessary to bring the entire system to freeway standards will not be available in the foreseeable future. Several estimates of state and federal revenues were developed, and it was concluded that (a) MDOT cannot complete all the primary projects in its approved 5-year program within 20 years without additional revenues and (b) even under the most optimistic estimate of revenues, the total cost to implement the primary highway system exceeds the revenues that are anticipated to be available.

Emphasis, therefore, has been placed on making better use of existing facilities, for example, by adding access controls where practical. In addition, several major freeways that were part of the long-range planned freeway system in Maryland were deleted from the primary highway system.

The proposed criteria for system designation will provide, for the first time, an objective process by which to consider suggested additions to the system. Thus far, only the primary system has been analyzed. As a next step, it is proposed to conduct a similar analysis and develop criteria for inclusion of facilities in the secondary system so that the entire state highway system can be rationalized.

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Transportation Programming in Today's Rapidly Changing Fiscal Environment

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Because of decreasing rates of revenue growth, increasing inflation, and growing maintenance and operating costs, revenues for transportation are insufficient to satisfy public expectations. This paper summarizes a discussion of how several states are altering the programming process to meet changing financial conditions. Maryland is emphasizing smaller, less costly highway projects, designing for current rather than future service needs, and planning more projects than can currently be funded. Texas, on the other hand, has embarked on an $11.8 billion 20-year highway construction program. Pennsylvania, concerned over abandonment of railroad branch lines, is providing subsidies for commuter rail lines. To allocate limited resources for airport development, Illinois has instituted a systematic project-selection process. At the local level, the New York Metropolitan Transportation Authority is putting heavy reliance on federal-aid funds. Uncertainty in these funds causes a problem in programming. In an effort to hold local subsidies down, capital funds have been used for transit operations.

Almost every major industrial state in the nation is facing a cost-revenue squeeze. The problem is related to three basic factors:

1. Decreasing rates of revenue growth;
2. Diminishing buying power because of inflation; and
3. Increasing maintenance and operating costs because of the aging of physical facilities, a backlog of maintenance and repair work, and high traffic volumes.

The impacts of this situation can be stated simply: For almost all modes of transportation, revenues are not sufficient to satisfy public expectations for system and service expansion. Furthermore, this cost-revenue squeeze has reduced improvement projects sharply rather than gradually.

This report summarizes a conference session that discussed this topic. Two of the five speakers presented state highway department approaches. One