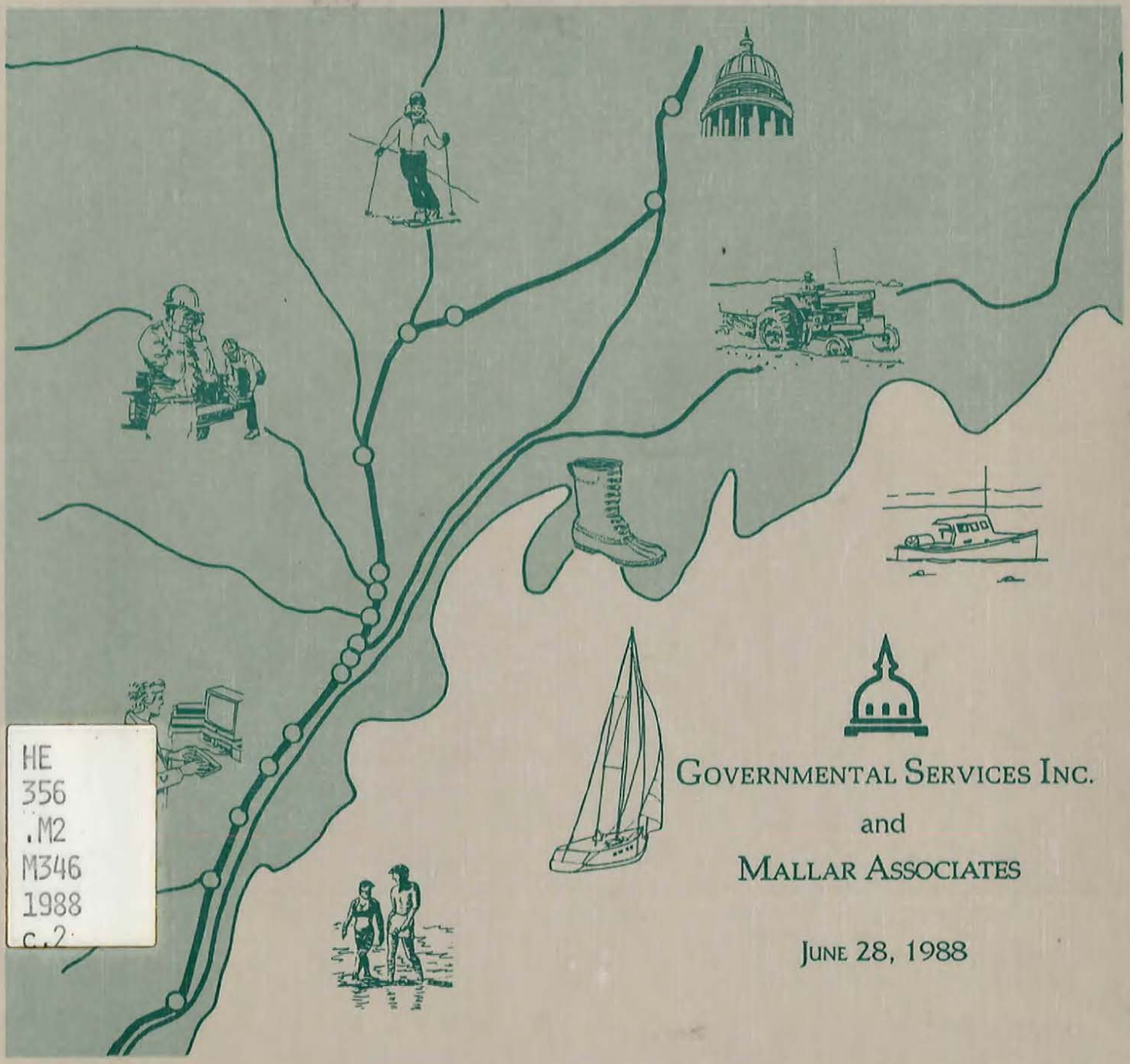
MAINE TURNPIKE AUTHORITY

PORTLAND, MAINE

A Comprehensive Review and Analysis Of Proposed Improvement Projects



GOVERNMENTAL SERVICES INC.
and
MALLAR ASSOCIATES

JUNE 28, 1988

June 28, 1988

To Members of the Maine Turnpike Authority:

It is our pleasure to provide the Maine Turnpike Authority with the enclosed report, "The Maine Turnpike Authority - A Comprehensive Review and Analysis of Proposed Improvement Projects," which provides perhaps the most comprehensive assessment ever of the Turnpike's existing needs and future considerations.

The capital improvement program recommended in this report responds to the specific needs in the southerly corridor, northerly corridor and in the area to be served by the proposed Westerly Connector.

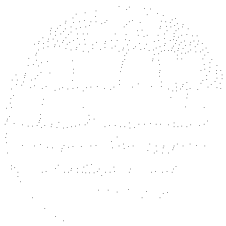
The program includes a total southerly corridor widening cost of $99,600,000, including a three-lane road and four-lane bridges, and widening 31 bridges. In addition, $62,700,000 has been allocated for interchange improvements, fare collection changes, access, planning and engineering involving the three separate corridor areas.

The total cost can be accommodated by an $86 million bond issue and pay-as-you-go-money from the existing revenue base and a 15 percent fare increase beginning Jan. 1, 1989. The financial analysis further assumes a $4 million increase in Turnpike contribution to the Maine Department of Transportation for use on adjacent roads within the Turnpike corridor, as authorized by the Legislature. As the time for actual borrowing gets closer, the Authority should further evaluate options for structuring the debt, i.e., term flexibility for repayment, etc.

(continued)

MALLAR ASSOCIATES

GOVERNMENTAL SERVICES INC.



The conclusions of this report were reached after a critical review of the Turnpike from two perspectives:

1. Its vital role in carrying through traffic into Maine to enhance the economic development of the state's interior; and

2. Its ability to meet the distinct needs of three separate areas of the corridor.

Last, but hardly least, the report acknowledges the existence of a new era of transportation planning in Maine. It is imperative that the Maine Turnpike Authority and the Maine Department of Transportation continue and build upon integrating their traffic improvement programs in the Turnpike corridor. Integration is necessary to ensure that highway planning and public expenditure decisions are made judiciously and that construction monies provide the most value for the dollar.

Integration is also necessary because highway planning is no longer an isolated function involving separate governmental entities. It is a dynamic process that must respond to the various land use changes affecting particular corridors.

Maine is at a critical juncture in its growth management efforts. The approach recommended here is intended to help communities resolve traffic congestion issues resulting from rapid land use changes which have already occurred within the Turnpike corridor, and to ensure that the Turnpike plays a significant role in helping to resolve future issues.

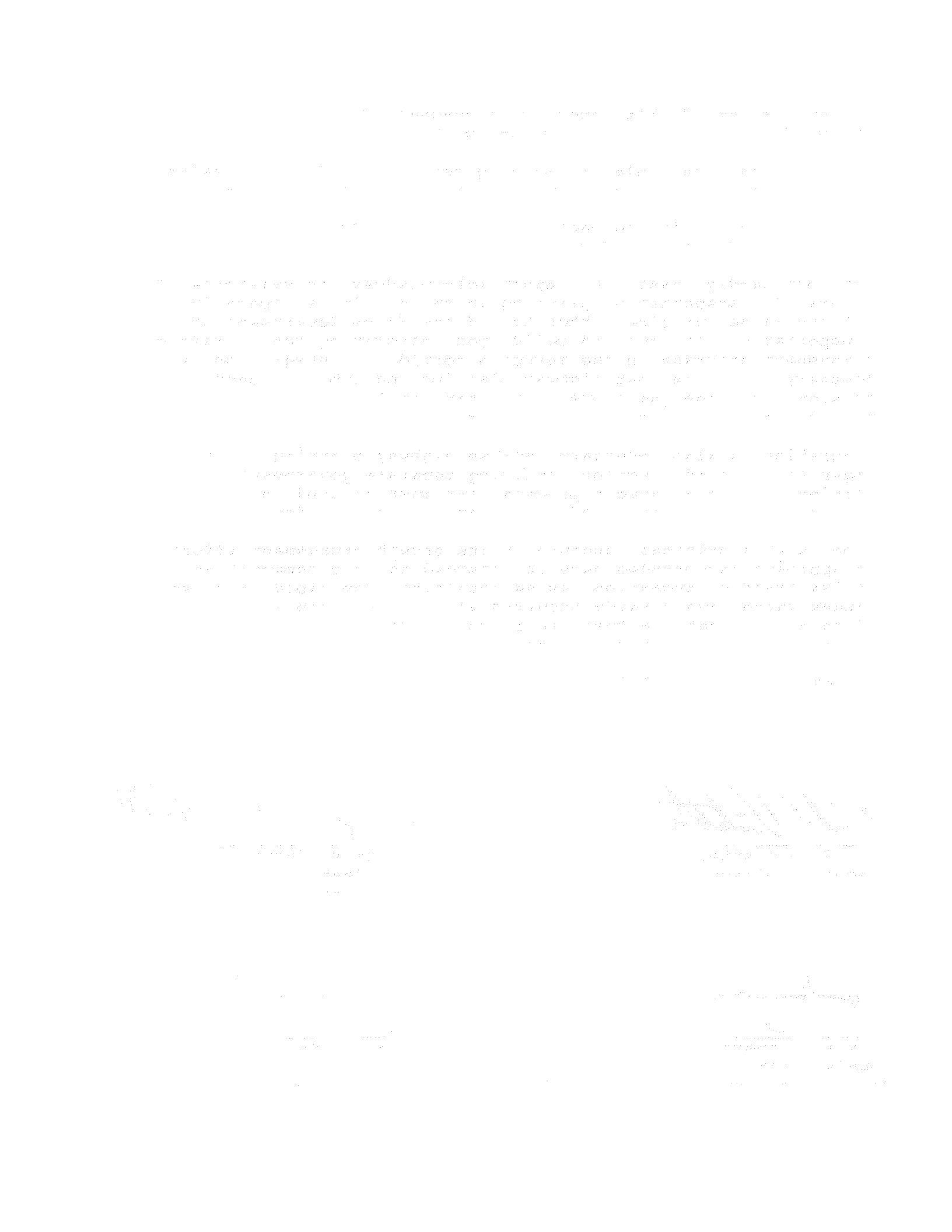
We look forward to helping the Authority implement this important program.

Paul E. Violette,
Executive Director
Maine Turnpike Authority

George N. Campbell, Jr.
President
Governmental Services Inc.

Dana F. Connors
Commissioner
Maine Department of Transportation

Roger L. Mallar
President
Mallar Associates



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PAUL E. VIOLETTE - EXECUTIVE DIRECTOR

ACKNOWLEDGEMENTS

A project of this scope and importance requires the cooperation of diverse groups of people. Many individuals contributed valuable time to ensure the success of this project, working long days under intense deadlines, and giving up personal time on evenings and weekends.

In particular, the groups and individuals listed below deserve special mention:

The Northerly Corridor Advisory Committee; the Westerly Connector Advisory Committee; Community officials in the southerly corridor who responded to surveys and participated in interviews; Wilbur Smith and Associates; and Howard, Needles, Tammen & Bergendoff.

Pulse Unlimited; Perkins, Hinckley, Thompson and Keddy; Squaw Bay Corp., especially John Kennedy; Paul Minor and Carl Croce of the Maine Department of Transportation's Bureau of Planning; Thomas Gallant and Peggy Trueworthy of the Maine Turnpike Authority; Drexel, Burnham, Lambert; and John Oliver, Kim Matthews, John Ferland and Nancy Schmid of Governmental Services, Inc.

In addition, the consultants appreciate the support and advice offered by members of the Maine Turnpike Authority, and the active participation by Executive Director Paul E. Violette and Transportation Commissioner and Ex-Officio Authority Member Dana F. Connors.

George N. Campbell, Jr.
Roger L. Mallar

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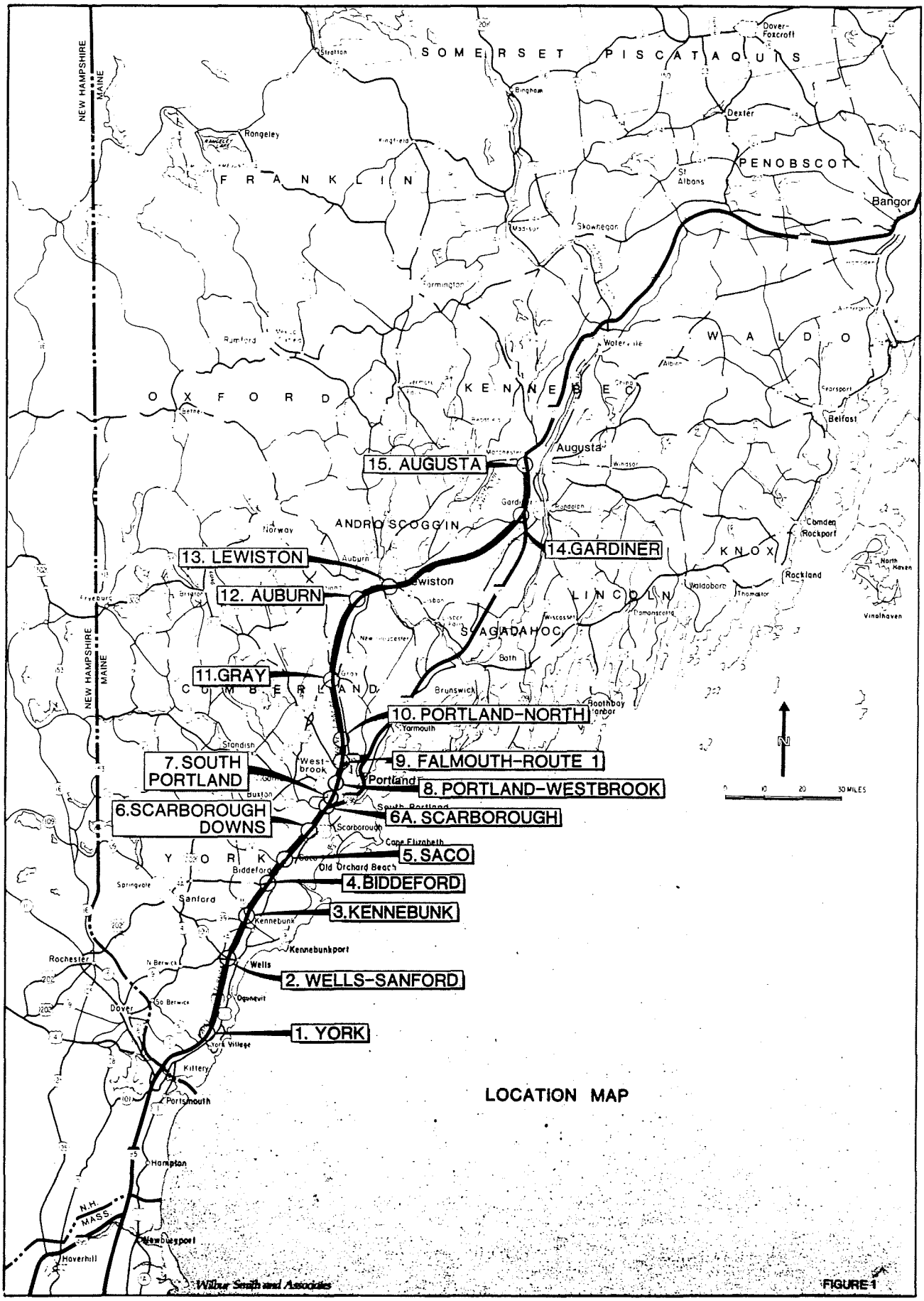
Figure I


15. AUGUSTA
14.GARDINER
13. LEWISTON
12. AUBURN
11.GRAY
10. PORTLAND-NORTH
9. FALMOUTH-ROUTE 1
8. PORTLAND-WESTBROOK
7. SOUTH PORTLAND
6A. SCARBOROUGH
6.SCARBOROUGH DOWNS
5.SACO
4.BIDDEFORD
3.KENNEBUNK
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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

During the past nine months, Governmental Services, Inc., and Mallar Associates, working in close cooperation with the Maine Turnpike Authority and the Maine Department of Transportation, have conducted a comprehensive assessment of the Turnpike Authority's 1986 Capital Improvement Study.

This "second look" at the 1986 study included a variety of issues related to the proposed southerly corridor widening and its relationship to both Route 1 congestion and community impacts; northerly corridor interchange modifications; and the proposed westerly connector which would service the Greater Portland Region.

Among the issues reviewed, analyzed and evaluated were community and municipal officials' attitudes; secondary impacts of widening; legal and fare structure issues; financial issues; traffic management issues; locational issues; and economic development issues.

This report finds an immediate need to undertake the widening of the southerly portion of the Turnpike to three lanes given current and developing congestion conditions, based on updated traffic projections. This finding is supported by a user benefits analysis identifying a $429 million (1987 dollars) savings to travelers arising out of this project over its 20-year life. The need for the project is consistent with observations and prevailing opinion of affected community officials and Maine residents.

The report further finds that given the revenue generating capacity of the MTA, the widening project and additional interchange/access improvements can be financed with a one-time 15 percent increase in tolls applied to the current fare structure. The financial analysis further assumes a $4 million annual increase in Turnpike contribution to the MDOT for use on adjacent roads within the Turnpike corridor.

The report explains the shortcomings of sole reliance on traffic management techniques for resolving congestion issues, and points to the potential for integrating appropriate traffic management strategies into overall Turnpike administration.

The report also demonstrates how the widening will help to alleviate the further compounding of Route 1 congestion instead of worsening conditions. It also highlights recommended interchange additions and access improvements.

Of equal importance is the fact that this report acknowledges the existence of a new era of transportation planning in Maine. It is imperative that the Maine Turnpike Authority (MTA) and the Maine Department of Transportation (MDOT) continue and build upon integrating their traffic improvement programs in the Turnpike corridor. Integration is necessary to ensure that highway planning and public expenditure decisions are made judiciously and that construction monies provide the most value for the dollar.

Integration is also necessary because highway planning is no longer an isolated function involving separate governmental entities. It is a dynamic process which must respond to the various land use changes affecting particular corridors.

In that regard, the capital improvement program recommended in this report responds to the specific needs in the southerly corridor, northerly corridor and in the area to be served by the proposed westerly connector. The program includes a total widening cost of $99,600,000, including a three-lane road and four-lane bridges, and widening 31 bridges. In addition, $62,700,000 has been allocated for interchange improvements, access, planning and engineering. The total cost can be accommodated by an $86 million bond issue, paid for with help from a 15 percent fare increase beginning Jan. 1, 1989.

The program also takes into account the efforts underway by MDOT to address Route 1 in York County and Biddeford/Saco-area traffic issues.

Summary recommendations for each region include:

Southerly Corridor

The widening of the Turnpike from two to three lanes, including the addition of a fourth lane capacity on bridges, is necessary. The expansion should move forward immediately as a way of maintaining the Turnpike as a through road to all regions of Maine.

The immediacy of the need for the widening is documented by the following quantitative and qualitative evidence:

1. The latest traffic figures indicate:

    - Annual traffic volumes have doubled on the Turnpike between 1979 and 1987, from 88,541 vehicles to 175,050 vehicles;

    - Annual average daily traffic between mainline segments of the Turnpike is projected to double between 1987 and 2000; and

    - Even taking into account the low traffic growth years during the gas shortage of the mid-to-late-seventies, the Turnpike has experienced a compounded annual percent volume increase of 8.1 percent since 1975.

2. Utilizing peak hour factors and conservative traffic demand forecasts, it is estimated that by 1989, the 30th highest hour will be operating at Level of Service E, extremely unstable traffic flows, and by 1990, at Level of Service F, forced or breakdown conditions.

3. Motorists using the Turnpike would receive an estimated $429 million in benefits through 2012 from the widening due to accident reduction, operation cost reductions, and reductions in delays.

4. Eighty-one percent of the southerly corridor municipal officials surveyed said they were in favor of the widening.

5. More than half of Maine citizens polled felt that the Turnpike should be widened. Furthermore, when asked if they had to choose between paying higher tolls or experiencing more congestion, 64 percent chose higher tolls.

In order to respond to the continuing congestion problems on Route 1, the MTA should, as the Legislature authorized, provide $4 million annually to the MDOT (above the current $4.7 million the MTA contributes to the MDOT) for the purposes of responding to Turnpike corridor improvement needs.

Additionally, the Authority should provide planning and location engineering money to address Route 1 corridor needs in conjunction with the MDOT and affected communities, as well as plan within its program for project costs in the range of $8 million by 1995 for Biddeford-Saco area access improvements.

Northerly Corridor

The objective of the Turnpike Authority on the northerly section should be to: promote increased use of the toll highway; encourage planned development; and improve local travel service.

In order to accomplish this objective, a closed-barrier system is recommended that would end the present ticket system just north of Gray, relocate the Augusta toll plaza operation to an area north of Lewiston and collect cash tolls at Gardiner, at the relocated toll plaza, north of Lewiston, and on ramps as necessary to assure that all traffic movements are assessed an equitable toll.

In addition, three interchanges were demonstrated in the study to be desirable additions to the region's traffic service needs. They should be included in the Authority's construction planning effort.

Westerly Connector

Potential improvement alternatives in the Route 302 corridor require further evaluation. The Turnpike Authority should assist the MDOT in evaluating the interconnection of those alternatives with the Turnpike.

Considerable effort is needed to identify the appropriate westerly corridor to serve Westbrook and Gorham. This decision rests primarily with the local communities and the MDOT. However, since any of the alternatives connect with the Turnpike and one of the funding sources may be the collection of tolls on the westerly connector, the Turnpike Authority should continue to actively participate in this evaluation process.

In addition to the funding that should be held in reserve for the previously recommended Turnpike interchanges in the Portland area, it is recommended that the Authority share in the location engineering costs in the westerly corridor to more clearly define location alternatives in the corridors which may be determined worthy of further evaluation and plan development.

Program Implementation

In order to implement the aforementioned recommendations, the consultants have identified a series of projects, construction years and costs, in a manner consistent with the priorities expressed during Legislative review of the Turnpike program, i.e., widening the southerly section and implementing the previously identified interchange program.

Areas recommended for interchange additions and access improvements over the next eight years include: Lewiston; Biddeford; Scarborough; Saco; Sabattus/Lewiston (Grove St.); Portland (Congress St.); Portland/Westbrook; Portland (Forest Ave.); Gray; Ogunquit; Sabattus/Lewiston (State Route 9); Biddeford/Saco/Old Orchard Beach; and Auburn (South Main St. and Route 136). In addition, money is recommended for planning and locational engineering regarding Route 1 traffic improvements and westerly connector issues.

This report also recommends a 15 percent fare increase in the commuter ticket program. The application of the new fare increase will still leave the level of discount at greater than 50 percent of the new charges. However, no changes should be made to the system until the MTA completes its current review of the program.

Finally, other recommendations contained in this report include:

1. The Turnpike Authority should conduct traffic management studies to address the following issues:

    - Appropriate traffic management approaches and the identification of strategies for implementing them;

    - The characteristics of travelers and how they relate to Route 1 congestion problems; and

    - A cost allocation study to determine the equity distribution of charges among categories of users with particular attention to the feasibility of establishing a seasonal pricing differential once the widening is completed.

2. The Authority's bond issue indenture agreement should be designed with sufficient flexibility so that future, out-year surplus funds can be used to address evolving improvement programs within the corridor.

INTRODUCTION

INTRODUCTION

In the fall of 1987, the Maine Turnpike Authority (MTA) contracted with Governmental Services, Inc., (GSI) and Mallar Associates to take a second look at the Authority's proposed capital improvement program, which focused on widening the Maine Turnpike from two lanes to three lanes between Mile 12 in Wells and Mile 42 at Exit 6-A in Scarborough.

GSI's responsibilities included an overall review of the 1986 "Capital Improvement Study," compiled by Howard, Needles, Tammen & Bergendoff (HNTB); working with southerly corridor communities regarding the secondary impacts of widening; a review of legal and fare structure issues; and an analysis of the proposed widening in the context of the latest trends in highway planning.

Mallar Associates focused on traffic estimates; representation of the Authority regarding the Westerly Connector and Northerly Corridor Studies; and representation of the Authority regarding permitting issues.

This report integrates information from the three studies involving the southerly corridor, northerly corridor and westerly connector. It also takes into consideration the efforts underway by the Maine Department of Transportation (MDOT) to address Route 1 in York County and Biddeford/Saco area traffic issues. This approach recognizes a new era of transportation development in Maine. It reflects the integration of needs in the corridor and the coordination of local municipalities with the MTA and the MDOT.

An integrated approach to highway improvements recognizes the diversity of needs at various sections along the Turnpike corridor, and coordinates planning and public expenditures, ensuring that construction monies provide the most value for the dollar.

The Turnpike Authority directed the consultants, former transportation commissioner George N. Campbell, Jr. of GSI, and former transportation commissioner Roger L. Mallar of Mallar Associates, to work closely with and coordinate their study efforts with the current transportation commissioner and Authority board member, Dana F. Connors.

By way of further background, a brief history of the widening issues follows.

Proposals to widen the Maine Turnpike have been debated since the early 1970s. At that time, the Turnpike was widened from York to Mile 12, (miles 0 - 6 by the MDOT and miles 6 - 12 by the MTA), but further work was shelved by a Maine Supreme Court decision.

The Court ruled that the building of additional lanes, or the expansion of Turnpike bridges and overpasses to accommodate these lanes, was not empowered by the Enabling Act of the Maine Turnpike Authority that existed at that time. The Court also ruled that the financing of additional lanes by tolls and revenues exceeded the authority granted by the Enabling Act, and that the Authority's power to reconstruct the Turnpike did not include the building of additional lanes.

Following the Authority's 1986 Capital Improvement Program proposal, the Authority received Legislative approval to increase its bonding limit to help finance the latest expansion plan. In addition, the Turnpike Authority was asked to study economic issues associated with potential interchange improvements in the Turnpike's northern corridor between the Lewiston/Auburn area and Augusta. Also, at the request of the MDOT, the Authority authorized a feasibility study of a westerly connector linking Portland with its western suburbs.

In the meantime, concern was raised by the Authority about the secondary impacts of the proposed widening. As a result, the Authority agreed to delay a decision on a proposed fare increase that was to help pay for the widening.

A more thorough explanation of the history of the Maine Turnpike may be found in Appendix A.

ORGANIZATION AND METHODOLOGY

ORGANIZATION AND METHODOLOGY

A project of this type requires a comprehensive and integrated approach involving a review of Maine Turnpike Authority historical documents and studies; coordination with local communities affected by Turnpike traffic; and a financial analysis to determine the feasibility of the work proposed.

This section describes the methodology used within each of the study components. In addition, a legal review was conducted to assess the constitutional, statutory and contractual parameters surrounding these issues. The specific subject areas of this report include:

- Part I — Review of Capital Improvement Program: Widening and Interchanges;
- Part II — Review of Capital Costs, and Operating and Maintenance Projections; and
- Part III — Review of Revenue Projections, Fare Structure and Charges.

PART I - REVIEW OF CAPITAL IMPROVEMENT PROGRAM: WIDENING AND INTERCHANGES

The review of the capital improvement program involved seeking answers to the following questions:

1. Is the widening justified?
2. What are the alternatives to widening?
3. What are the potential impacts on the Route 1 corridor?
4. What is the responsibility of the Turnpike in regard to mitigating congestion conditions in the Route 1 corridor?

The methodology used in this review included:

1. Literature search;
2. Survey of, and interviews with, community officials;
3. Attitudinal survey;
4. Review of Route 1 Corridor Committee Studies;

5. Review of interchange program;

6. Review of traffic growth forecasts;

7. User-benefit analysis of the widening; and

8. Legal review of related issues.

I-1 Literature Search

A literature search was conducted which covered both historical trends and current studies in the areas of highway finance, congestion management, road pricing and travel demand.

To accomplish this objective, a computer search was undertaken using the Transportation Research Information Services system. "Key words" were provided that ere expected to generate a bibliography of appropriate highway transportation literature in the areas listed above. The key words used included:

- Road user preferences;
- Secondary impact studies;
- Travel demand;
- Seasonal traffic patterns;
- Peak-hour traffic and pricing; and
- Traffic congestion.

In addition to the computer-generated list of articles, a number of articles and research studies were obtained through a general library literature search at both the University of Maine (Orono) and the Massachusetts Institute of Technology libraries. As articles were reviewed, their associated bibliographies were also used as a source for additional articles.

The literature search also included a review of newspaper articles and editorials pertaining to the Turnpike project, including the MaineWatch Institute study, "Widening the Maine Turnpike: the Case for a Management Alternative," commissioned by and published in the Maine Times (1/8/88).

The articles generated by the computer search are listed in a bibliography in Appendix B.

I-2 Survey of Community Officials

A survey was conducted of officials from communities along the corridor from Exit 6-A south to York to determine their views and perceptions of the proposed Turnpike widening, the interchange construction program, the commuter discount program, and the perceived impacts of the widening on Route 1.

The Maine Turnpike Authority favored this survey approach, in combination with an attitude survey of Maine residents, to that of a steering committee approach, because it ensured broad community participation on the part of chief administrative and appointed officials, and the general public.

The information collection process was two-fold. Beginning in December, 1987, the consultants met with representatives from Scarborough, Biddeford and Old Orchard Beach to discuss the capital improvement program issues, and to help frame the questions that would be included in the formal questionnaire to be completed by the municipal officials.

The survey was then prepared and distributed to individuals from the following communities: Alfred, Arundel, Biddeford, Kennebunk, Kennebunkport, Kittery, Lyman, North Berwick, Ogunquit, Old Orchard Beach, Saco, Sanford, Scarborough, South Berwick, Wells, and York.

The survey was discussed with each recipient, as well as various selectmen and town planners who were present at some of the meetings. The representatives from each community were asked to identify others who should complete a survey and sufficient copies of the questionnaire were then provided.

Thirty-five surveys in all were completed, with one town, Biddeford, providing a verbal response, for a total of 36 responses. In some cases, surveys were completed by a small group of people. However, most were completed by one person only. The findings from the survey of municipal officials are contained in the Findings section of this report. The survey questionnaire and a summary of responses are in Appendix C.

I-3 Attitudinal Survey

An attitudinal survey of Maine residents was conducted to determine the perceptions and opinions of Maine residents regarding the proposed Turnpike widening project.

A variety of Turnpike issues were examined, among them:

1. The perceived impact of the Turnpike widening on Route 1 congestion;
2. Public perception of Turnpike service levels and charges;
3. The relationship of new interchanges to the widening project;
4. Public opinion regarding toll fare increases and pricing schemes; and
5. The mitigating factors that might alter public opinion in the future.

In all, 632 Maine residents were surveyed during the month of February, 1988. The statistical margin of error associated with the study was .039 at the 95 percent confidence level for the aggregates. The survey instrument consisted of 59 questions and all interviews were conducted by telephone. The results of this survey are reviewed in the Findings section of this report. The questionnaire used for this survey and a summary of responses are in Appendix D.

I-4 Review of Route 1 Corridor Studies

A number of traffic studies have been conducted on the Route 1 corridor, including a 1969 study by Murray D. Segal, and a more recent study completed in 1987 by the Route 1 Corridor Committee. GSI has reviewed these studies in light of the potential secondary impacts from the Turnpike widening.

The implications of these earlier studies are enumerated in the Findings section of this report, where applicable.

I-5 Review of Interchange Program

The interchange program explained in the HNTB report was reviewed from both a cost perspective and a community needs standpoint. Both the survey of community officials and the attitudinal survey sought to determine public opinion regarding the proposed interchange program. In addition, any suggestions for interchanges other than those proposed in the program were recorded.

Specific interchange suggestions and comments by Maine citizens and municipal officials were reviewed with representatives from the Planning Department of the MDOT to

determine the extent to which each request had been previously studied by the Department and to discuss the feasibility of each suggested improvement.

Finally, the suggested improvements affecting the Route 1 corridor were reviewed from the standpoint of dealing with congestion problems in the region and the Turnpike's ability and/or responsibility to respond to these improvement needs. See the Findings section for an analysis of the suggested improvement projects.

I-6 Review of Traffic Growth Estimates

Traffic estimates developed in the 1986 HNTB report were reviewed and adjustments were made based on the experience gained in the intervening years.

I-7 User-Benefits Analysis of the Widening

A user-benefits analysis was conducted to determine the estimated benefits to motorists that could be realized by the widening of the Turnpike from two lanes to three lanes. These estimates were based on a forecast using updated interchange growth assumptions and performed at five-year increments with interpretation of the years in between. The impacts were investigated by mainline section and were performed for both the base condition (existing interchanges) and the build condition (proposed interchanges).

User benefits were then converted to monetary equivalents and summarized over the projection period for both the base and improved access condition. The benefits were examined in terms of impacts on travel time, operating cost and accidents.

I-8 Legal Review of Related Issues

The legal review was conducted for the consultants in order to ensure that findings and conclusions conform with constitutional, statutory, and contractual limitations surrounding the study issues. Particular attention was given to the permissible uses of Turnpike funds, the Turnpike's authority to undertake improvements, and the legal limits of pricing alternatives.

PART II - REVIEW OF CAPITAL COSTS, AND OPERATING AND MAINTENANCE PROJECTIONS

The review of capital costs and operating and maintenance projections was undertaken to:

1. Examine the reasonableness of assumptions used in estimating project costs;

2. Examine the time frame for project construction and evaluate the effect of delay on costs;

3. Examine and update the interchange improvement plan and expected project year costs;

4. Examine HNTB's proposed preparation of a fourth lane in conjunction with third lane construction in terms of economic impact on project costs;

5. Evaluate operating and maintenance cost projections in light of inflation and volume trends.

II-1 Capital Cost Estimates

The consultants reviewed the capital cost estimates set forth in the earlier HNTB reports. The analysis included the cost of the third lane as well as new or altered interchanges.

The 1985 cost projections were updated to reflect cost experience in terms of 1987 dollars. Cost projections were based on the MDOT weighted unit costs for 1987. Based on yearly cost increases for similar type projects between 1983 and 1987, an inflationary factor was developed to project construction year costs. The analysis was confined to the portion of the Turnpike from Exit 6-A to the South, with the exception of the more northerly interchanges encompassed in the original improvement program. For the remaining interchanges, estimates were provided by HNTB based upon its work with the Northerly Corridor Committee.

In addition, the consultants studied the impact of road improvements on the necessary funding level of the reserve maintenance fund. Estimates and assumptions related to the proposed reserve maintenance budget were reviewed in light of the new construction projects and their impact on repair needs.

An analysis of the updated cost figures is contained in the Findings Section of this report.

II-2 Operating and Maintenance Expenses

The MTA's operating and maintenance expenses were reviewed for the 10-year period from 1977 to 1987. This review was intended to highlight the trends in operating expenses and to identify any major changes in expenses by component in the past decade.

The operating expenses reported in the yearly financial reports of the MTA were compared with the HNTB estimates to determine the accuracy of the projections.

The results of the above analysis are contained in the Findings Section of this report.

PART III - REVIEW OF REVENUE PROJECTIONS, FARE STRUCTURE AND CHARGES

The review of revenue projections, fare structure and charges was conducted to determine:

1. The impact of new traffic growth estimates on revenue forecasts to the year 2000;

2. How the MTA's fares compare to those of similar toll roads; and

3. The effect of revenue projections on proposed fare increases needed to complete improvement programs and meet other demands on revenue for the Turnpike.

III-1 Revenue Projections

A review of the Maine Turnpike revenue projections was conducted based on traffic forecasts developed by Mallar Associates. The primary goal was to produce a revised forecast of Turnpike traffic reflecting revised growth rates by interchange and vehicle class. A fratar process was then used to develop new trip tables at five-year increments. From this information, a base condition was developed to reflect the existing interchanges and toll schedule on the Maine Turnpike throughout the entire projection period.

A secondary goal was the development of updated traffic and revenue forecasts under a condition whereby the various new interchanges or interchange improvements, including those covered as part of the 10-year improvement plan, would be superimposed on the system. In addition, the revised configuration assumed conversion of the northern end of the Turnpike to a closed barrier system. The traffic estimates under the build condition were then furnished in terms of annual toll revenue estimates.

III-2 Fare Structure and Charges

A literature search on toll road financing and pricing issues was conducted. Peak period pricing studies were reviewed to determine the feasibility of peak period pricing and the extent to which it would affect the Turnpike revenue generating potential and the potential for diversion to other roads.

The Maine Turnpike's current toll structure was compared to industry norms to place the Turnpike's tolls in the context of other regional toll facilities.

An electronic spreadsheet analysis was performed to determine the toll increase requirements under different pricing scenarios, to establish the most appropriate fare

level for accomplishing the construction program while equitably charging highway users.

The Maine Turnpike's Commuter Discount Program was reviewed to determine the success of the program in terms of the volume of users over time. The survey of community officials and the attitudinal study both contained questions pertaining to the degree of satisfaction with the commuter program as well as recommendations for changes in the program.

A legal review of differential pricing was conducted to determine whether charging differential rates during specific times in the year would negatively impact interstate commerce in violation of constitutional provisions.

FINDINGS

FINDINGS

In keeping with the previous section, "Organization and Methodology", this section is divided as follows:

- Part I — Review of Capital Improvement Program: Widening and Interchanges;
- Part II — Review of Capital Costs, and Operating and Maintenance Projections; and
- Part III — Review of Revenue Projections, Fare Structure and Charges.

In addition to the widening issues related to the southerly corridor, this report integrates the analysis and findings associated with the Northerly Corridor Study and the Westerly Connector Study. The discussion begins with the Southerly Corridor Study, followed by the Northerly Corridor and Westerly Connector studies.

PART I - REVIEW OF CAPITAL IMPROVEMENT PROGRAM: WIDENING AND INTERCHANGES

Introduction

For the purposes of this study, the widening is defined as the addition of a third travel lane, the construction of 4-lane bridges, and the rebuilding of 31 bridges from mile 12 to mile 42 on the Maine Turnpike.

This project as described here varies from the earlier project in that the earlier project envisioned the preparation of a fourth lane road bed. The current study, however, defines the project without the fourth travel lane preparation for reasons stated in the Project Costs section of this report.

The proposed widening project has been subject to particularly close scrutiny given the broader question of state-wide and regional road improvement projects and strong growth in Southern Maine.

While some feel that the congestion on the Turnpike is getting progressively worse and that only the addition of new highway capacity will ease it, others have suggested that "bigger is not better" and that traffic management solutions will adequately solve the problem of congestion.

Whether one is for or against the widening project, most Turnpike users would agree that a congestion problem exists. The major debate then becomes how best to deal with the issue of congestion.

A major goal of the study undertaken by the consultants was to open the question of a third lane and related issues for discussion with municipal officials in the southerly corridor communities and with a representative sample of Maine residents from communities across the state.

The intent was to develop an understanding of the attitudes and opinions of those who would be affected by the new construction and to let Maine residents know that their feelings toward highway improvements do matter to those who make the final decisions.

The following quotes by community officials are indicative of the strong feelings expressed toward the positive and negative effects of the Turnpike widening.

From a proponent of the widening:

> 'The MTA should realize that Turnpike improvements, especially new interchanges and widening, are the single most efficient tool to promote economic vitality and traffic safety by reducing congestion. The dollar benefits of improved commerce, etc., far outweigh construction costs and to ignore the hazards of two-lane congestion as routine as it is, borders on criminal neglect."

From an opponent of the widening:

> "What are we trying to do here? Do we want Maine to follow the lead of primarily urban states where to ease traffic congestion, states spend hundreds of millions of dollars creating and expanding multi-lane superhighways. Every time a bigger road is built, more people, even those who used mass transit before, choose to ride on it because it is faster, safer and easier. The new road soon becomes as overcrowded as the original road. Must all the access to Maine be through York County? I don't think so. I am not anti-progress, but I am anti-chaos."

To place the issue of the Turnpike widening in the proper context, the following four questions each required an answer:

1. Is the widening justified?
2. What are the alternatives to widening?
3. What are the impacts on the Route 1 corridor?
4. What is the responsibility of the MTA in regard to mitigating the congestion conditions in the Route 1 corridor?

I-1 TRAFFIC DEMAND

The earlier estimates of traffic growth used for the justification of the widening in the HNTB report may or may not have supported the need for widening the Turnpike. It was not within the scope of the current study to determine the appropriateness of the conclusions made in the earlier HNTB report.

The consultants were, however, charged with the responsibility of assessing the traffic situation in light of up-to-date traffic estimates and determining from this new information whether or not the widening is justified.

It is clear from the new traffic data, explained below, that traffic growth is expected to be far greater than was earlier estimated.

Developing traffic estimates for a Turnpike requires an unusually sensitive balance since overestimates could result in excessive revenue expectations and potentially serious operating deficits, while underestimates would tend to understate the timing of improvement needs and create serious traffic tie-ups. For these reasons, particular care has been given to assure that the estimates are as realistic as current methods allow and yet tend to assure reasonably sound revenue estimates.

I-1.1 Traffic Demand Forecast

A review of actual traffic growth since the previous study suggests two conclusions:

1. Since growth has occurred at significantly greater rates than projected, new estimates obviously start at a higher base level. A chart listing actual 1987 average daily traffic may be found in Appendix E.

2. The continuation of exceptionally strong economic and traffic growth in the corridor provides increased confidence of further increases in demand for vehicles using the Maine Turnpike.

Table I displays the Annual Entering and Exiting Traffic Trends by interchange for four three-year segments over a 12-year period. The aggregate compounded annual percent increases are displayed across the bottom of the Table.

For the period from 1975 to 1978, the compounded annual percent increase in total vehicles was 9.4 percent. The years from 1978 to 1981 were recessionary years in the regional and national economy, characterized by gas shortages and extreme gas price shocks. Even during this three year period, the compounded annual percent increase was 1.7 percent.

The three years following the recessionary period, from 1981 to 1984 showed a compounded annual percent increase of 9.5 percent.

Table I

Annual Entering and Exiting Traffic Trends

Total Vehicles

Interchange	Year	Year	Compounded Annual Percent Change	Year	Year	Compounded Annual Percent Change	Year	Year	Compounded Annual Percent Change	Year	Year	Compounded Annual Percent Change	Compounded Annual Percent Change	Compounded Annual Percent Change
	1975	1978	1975-78	1978	1981	1978-81	1981	1984	1981-84	1984	1987	1984-87	1975-87	1980-1987
1 York	16,200	18,986	5.4	18,986	19,460	0.8	19,460	23,533	6.5	23,533	30,960	9.6	5.5	7.8
2 Wells-Sanford	2,549	3,533	11.5	3,533	3,997	4.2	3,997	5,341	10.1	5,341	7,691	12.9	9.6	10.9
3 Kennebunk	1,567	2,315	13.9	2,315	2,684	5.1	2,684	3,563	9.9	3,563	5,041	12.3	10.2	10.4
4 Biddeford	2,967	4,287	13.1	4,287	5,018	5.4	5,016	6,798	10.7	6,798	9,432	11.5	10.1	10.6
5 Saco	2,797	4,127	13.8	4,127	4,809	5.2	4,809	8,097	19.0	8,097	12,864	16.7	13.6	15.9
6 Scar. Downs					SEASONAL INTERCHANGE									
6A Scar.	3,732	6,638	21.2	8,838	7,871	5.8	7,871	10,445	9.9	10,445	13,408	8.7	11.2	9.2
7 S. Pld.	6,557	8,463	8.9	8,463	8,698	0.9	8,698	12,401	12.6	12,401	17,723	12.6	8.6	11.2
8 Portland-Westbrook	8,944	8,144	5.5	8,144	8,158	0.1	8,158	10,568	9.0	10,568	15,159	12.8	6.7	10.1
9 Falmouth-Rt. 1	4,338	4,604	2.0	4,604	4,482	(0.9)	4,482	5,662	8.1	5,662	9,511	18.9	6.8	12.1
10 Portland North	1,769	2,051	5.1	2,051	2,130	1.3	2,130	3,123	13.6	3,123	5,023	17.2	9.1	13.7
11 Gray	2,494	3,171	8.3	3,171	3,158	(.14)	3,158	4,252	10.4	4,252	6,616	15.9	8.5	11.8
12 Auburn	3,572	4,701	7.8	4,701	4,936	1.6	4,936	6,252	8.2	6,252	8,515	10.9	7.1	8.9
13 Lewiston	2,930	3,810	9.2	3,810	3,519	(2.7)	3,519	4,359	7.4	4,359	5,649	9.0	5.6	7.8
14 Gardiner	2,102	5,127	34.6	5,127	5,668	3.4	5,668	7,400	9.3	7,400	10,451	12.2	14.3	10.1
15 Augusta	8,200	10,347	6.1	10,347	10,424	0.3	10,424	12,794	7.1	12,794	17,007	10.0	6.3	7.9
TOTAL	68,898	90,304	9.4	90,304	95,010	1.7	95,010	124,588	9.5	124,588	175,050	12.0	8.1	10.0

Note: The period from 1978 to 1981 displayed in Table I was a recessionary period, characterized by gas shortages and gas price shocks, yet the compounded annual percent increase for the period was still 1.7 percent.

During the most recent period, from 1984 to 1987, the compounded annual percent increase jumped to 12 percent.

The last column in Table I shows a compounded annual percent increase of 10 percent for the period 1980 to 1987. During this period, traffic on the Turnpike doubled as a clear result of the economic activities in York County and the greater Portland area.

Even taking into account the low traffic growth years during the recessionary period, the average annual percent increase for the 12-year period was 8.1 percent. A complete Table showing all traffic growth trends from 1975 to 1987 may be found in Appendix F.

The increasing demand for growth management efforts, building moratoria in the corridor, and the always present uncertainty of national economic conditions, as well as gasoline supply and pricing, clearly demonstrate the need for adjusting future growth to account for these factors.

As a result of these adjustments, the 6 to 7 percent final projections resulting from this study are significantly more conservative than recent historical evidence would suggest, although the actual traffic demands are somewhat greater than those estimated in the previous study.

The consultant developed estimates of growth at each interchange for each of three traffic types:

A. Passenger cars — cash payment
B. Commuters
C. Commercial vehicles

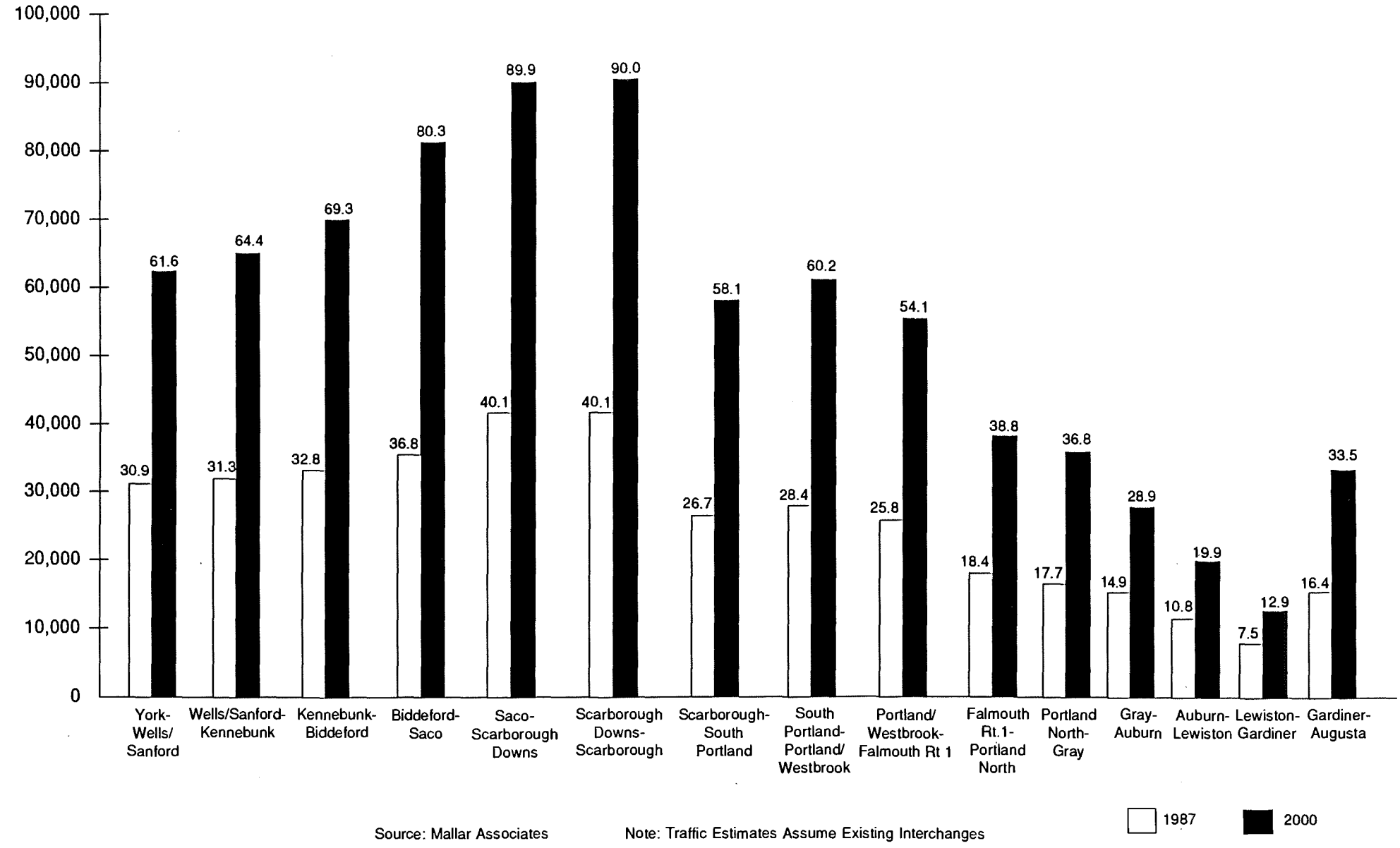
Utilizing these factors and actual 1987 trip information for each vehicle class, future trip distribution was determined using the Fratar process, a traffic forecasting technique widely utilized for such work.

Table II shows a comparison of average daily traffic figures for mainline segments of the Turnpike for 1987 and 2000. As the Table shows, average daily traffic is expected to at least double at these mainline segments by the year 2000.

The detailed results of the traffic demands are listed in Appendices G and H, and show average daily traffic figures for the year 2000 with existing interchanges and future interchanges. Estimates were also developed for the intervening years 1992 and 1997.

While these figures show significant future traffic demand, the average long-term growth rate resulting from the process is significantly less than actual experience in the corridor, particularly over the last several years. For that reason one should expect actual traffic in the early years of the forecast to exceed estimates with longer term estimates becoming more reliable if a significant slowing of economic growth occurs.

Table II
Average Daily Traffic
Mainline Segments
1987 and 2000



Source: Mallar Associates

Note: Traffic Estimates Assume Existing Interchanges

I-1.2 Capacity and Level of Service

A considerable effort has been made on a national level to more clearly define the capacity of various highways to handle traffic demands, or conversely, the level of service (LOS) provided to the traveling public under differing conditions.

Of particular importance to this anaiysis are LOS D, E, and F. These levels of service are briefly described below:

Level of Service D refers to a relatively unstable flow of traffic. In this range, small increases in flow cause substantial deterioration in service.

Level of Service E describes operation at capacity. Operations in this level are extremely unstable, because there are virtually no usable gaps in the traffic stream.

Level of Service F describes forced or breakdown conditions. Such conditions generally exist within queues forming behind breakdown points.

A more detailed description of levels of service is located in Appendix I.

While the average daily traffic estimates discussed earlier are of particular importance in developing revenue estimates, traffic service is normally measured on the basis of hourly traffic due to the wide variations throughout the course of the day.

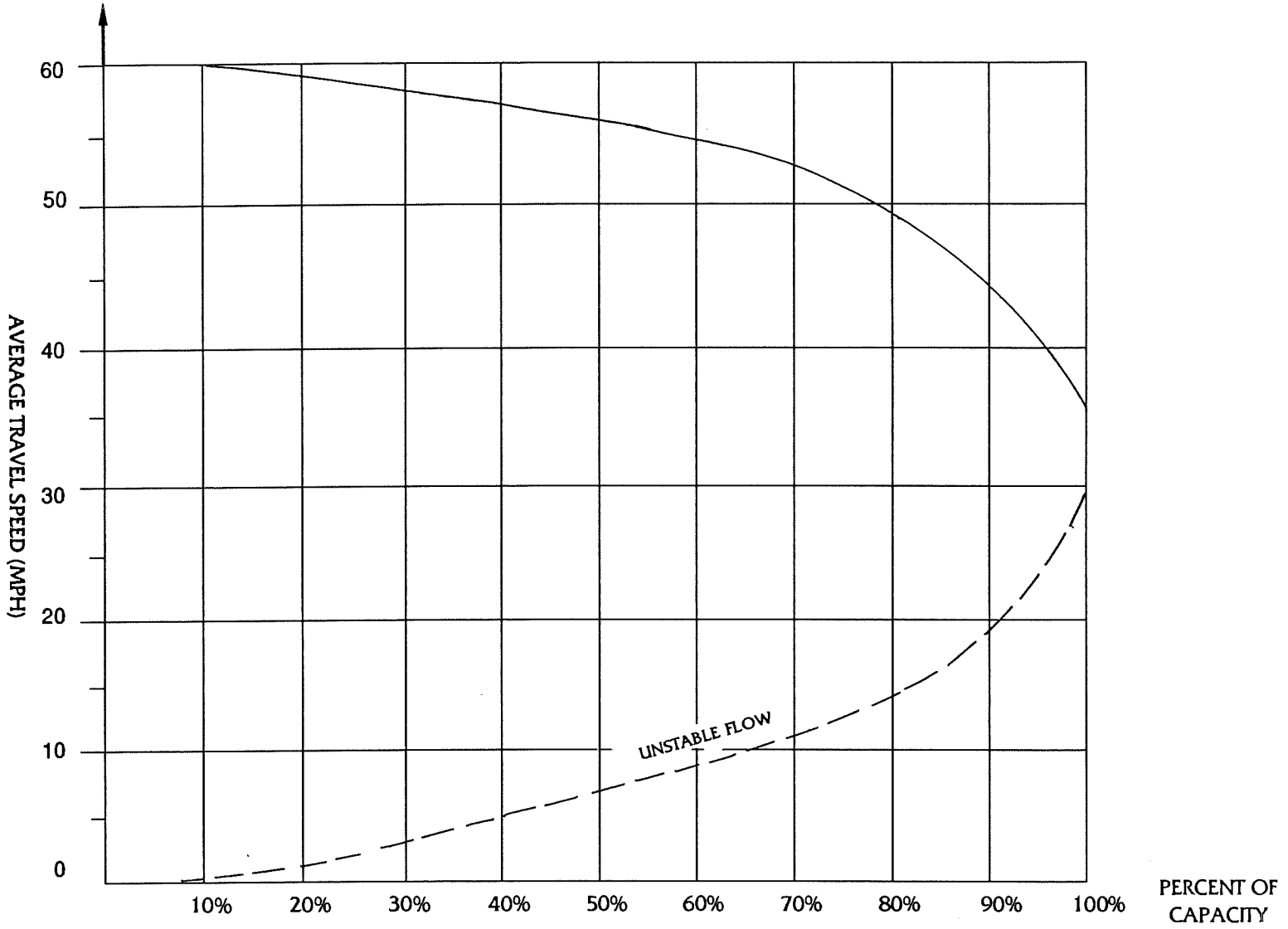
In terms of actual values, the maximum number of passenger vehicles, (commuter traffic) that two lanes in one direction can accommodate is 4,000 vehicles per hour.

On the Maine Turnpike, adjusting for driver and traffic characteristics, such as recreational and other vehicles in the traffic stream, the number of vehicles that can be reasonably accommodated in one hour is approximately 3,400 vehicles, the point at which traffic service drops to LOS E, extremely unstable conditions. Similarly, traffic service will drop from LOS E to LOS F - stop-and-go conditions - for volumes exceeding about 3,600 vehicles in an hour.

Some observers suggest that existing traffic on the Maine Turnpike has not reached "capacity." A review of Table III derived from the Highway Capacity Manual demonstrates how modest increases in traffic volumes will result in major decreases in traffic speed and service. Throughout much of the volume range in the chart, average speeds do not vary significantly; however, once the capacity of the facility is approached, traffic speeds and service deteriorate very rapidly. As will be demonstrated, these conditions are imminent.

TABLE III

Effect of Traffic Volume/Capacity on Travel Speed



Source: Derived from Highway Capacity Manual, Special Report 209, 1985

Based upon such parameters, the Turnpike Authority must balance the traffic service it is, and will be, providing for those who pay to use the Turnpike against the cost and financial feasibility of providing improved facilities.

I-1.3 Peak Hour Traffic

The MTA has not historically identified or retained hourly traffic volume information. With the exception of some traffic counting in 1985 and some anecdotal information regarding certain peak hours, little direct historical hourly Turnpike information exists. To provide a basis for such figures for this analysis, the Turnpike staff coded 1986 hourly traffic statistics at the York toll plaza. In addition, the consultant reviewed historical information from a continuous traffic recorder operated by the MDOT on I-95 in Kittery. The continuous traffic recorder data was reviewed from an historical perspective, since most of the traffic at York also uses I-95 and represents a significant portion of the Kittery traffic.

The growth of peak hour traffic on I-95 at Kittery has been quite significant, and has generally reflected annual traffic growth in the corridor.

An analysis of the 1986 southbound hourly traffic at York on the Maine Turnpike reveals that the 30th highest hour represents 21.25 percent of the average daily traffic (ADT) and the 50th highest hour represents 19.6 percent.

The 30th highest hour is the national highway design standard utilized by traffic professionals throughout the country to determine highway configurations. Analysis has shown that the actual hourly volumes that exceed this level rise very rapidly and would create uneconomic expenditures if one were to attempt to satisfy these higher hourly needs. On the other hand, using a lesser figure quickly adds many hours that will exceed the design parameters, during which time many vehicles will face service deterioration.

On occasion, the 50th highest hour has been considered for use on non-toll, highly recreational roads, generally with peak hours 25 to 30 percent or more of ADT.

While we do not recommend that the Turnpike use this figure for design purposes, it is useful as a part of the level of service analysis to evaluate this range of impacts.

It is also useful to note that at this time, the first 30 to 50 highest hours at York on the Turnpike generally occur on the holidays from Memorial Day to Labor Day and on summer weekends.

While a high percentage of the traffic at York during those periods are out-of-state tourists, it should be noted that during this same period, out-of-state travelers have historically generated 70 percent of the toll revenue on the Turnpike. It is also of interest that after the first fifty hours, weekends in the fall and spring and other holidays

become involved, with increased percentages of Maine students and citizens contributing to the traffic stream.

I-1.4 Widening Needs

Utilizing the peak hour factors previously discussed, and the conservative traffic demand forecasts, it is estimated that the 30th highest hour in just four years, (1992) would approximate 4,400 vehicles and the 50th hour would be nearly 4,100 vehicles at York, with only slightly less on the Saco-Scarborough section.

Both of those levels exceed the ability of a two lane (one direction) facility to physically accommodate the vehicles even if they were all passenger cars.

By this point in time, 1992, traffic demands will exceed capacity (drop to level of service E) approximately 120 hours during the year and actual stop-and-go traffic conditions will occur during almost 100 of these hours. These are traffic conditions that the consultant believes Maine Turnpike users and Maine citizens will find intolerable and unacceptable.

In evaluating the peak hour traffic growth between the present and the 1992 period, it is clear that the following conditions will occur on the southern end of the Maine Turnpike no later than the years indicated:

	30th hour	50th hour
Level of Service E	1989	1990
Level of Service F	1990	1991

Since the minimum construction period for the proposed widening project is anticipated to be three years, it is clear that if the Turnpike is to provide even reasonable traffic service to its users, construction should begin at the earliest possible time.

I-1.5 Commuter Traffic

From the standpoint of average annual daily traffic, the segment of heaviest Turnpike travel actually occurs between Saco and Scarborough. Based on previous analyses, however, the actual *peak hour* traffic volume is slightly less on the Scarborough end than at York. This condition obviously exists because of the larger amount of year-round commuter traffic approaching the Portland area which increases total traffic, without appreciably adding to the normal peak conditions.

One of the areas of concern has been the capability of the Turnpike to serve these commuter traffic peaks in the future. Based upon a review of a variety of traffic records,

the consultant believes that the commuter peaks represent 11 to 12 percent of the average daily traffic. Based on this premise, the Turnpike would be operating at capacity for commuter trips between Saco and Scarborough within a year or two after the earliest possible date for completion of widening.

I-1.6 Construction Period Traffic Service

It should be noted that the capacity and level of service figures previously discussed assume full width highway lanes and shoulders and high-speed alignment.

Decreases in lane or shoulder widths, detours, etc., which may be necessary during the construction period will greatly reduce the capacity for handling traffic. Unless unusual care is taken in the management of traffic during construction, monumental traffic backups will occur.

It is important to note that proceeding with the Turnpike widening project does not necessarily preclude the employment of traffic management alternatives. The possibility exists for employing these techniques wherever possible to help minimize congestion both during and after the construction of a third lane on the Turnpike.

I-2 USER BENEFITS ANALYSIS

The probable user benefits associated with the proposed Turnpike widening were analyzed. The study was undertaken to determine the estimated benefits to motorists that would result from the widening related to accident reduction, operating cost reductions and reduction in delay to motorists.

Converted to monetary values, the total discounted value of net user benefits is estimated at $429,003,000.

The full report of the users benefits analysis is contained in Appendix J.

Table IV presents a summary of net user benefits, which were calculated annually between 1992 and 2000. As shown in Table IV, small increases associated with the widening are greatly offset by sizable reductions in annual delay and accident savings. In the opening year, 1992, total net annual user benefits are estimated to be $8.2 million, projected to increase to over $49 million by the year 2000.

TABLE IV

SUMMARY OF NET USER BENEFITS

YEAR	ANNUAL VEHICLE OPERATING SAVINGS	ANNUAL DELAY SAVINGS	ANNUAL ACCIDENT SAVINGS	TOTAL ANNUAL BENEFITS	PRESENT VALUE OF BENEFITS [1]
	(----------thousands----------)				
1992	$ (493)	$ 5,751	$ 2,944	$ 8,202	$ 6,426
1993	(507)	8,266	3,492	11,202	8,395
1994	(522)	11,130	4,067	14,675	10,430
1995	(537)	14,382	4,933	18,778	12,709
1996	(553)	18,064	5,834	23,345	15,048
1997	(569)	22,231	6,775	28,437	17,457
1998	(137)	27,498	7,483	34,844	20,373
1999	(33)	33,487	8,344	41,798	23,273
2000	(8)	40,265	9,227	49,484	26,241
			Next 11 years Annually:		$ 26,241
			20-Year Total:		$ 429,003

[1] Calculated at a discount rate of 5 percent per year to 1987 dollars.

Source: Wilbur Smith and Associates, User Benefits Analysis, 1988

In evaluating the economic justification for major transportation investments such as the proposed widening program, it is customary to determine the net present value of future benefits. In accordance with procedures suggested in the AASHTO Manual for such studies, future benefits were discounted at an annual rate of 5 percent per year to a 1987 base year level. In this way, the total net present value of benefits over the entire analysis period can be related to the uninflated 1987-level cost of the improvement ($78.9 million for the widening) in determining a benefit/cost ratio.

Even after discounting to present value, net user benefits associated with the widening increase steadily through the year 2000. Over $26.2 million in discounted benefits are shown for that year.

While traffic forecasts beyond the year 2000 were not available for use in the analysis, it is clear that the economic justification for major transportation investments should be

evaluated over a longer design life than the nine years shown in Table IV. A 20-year evaluation period is considered more reasonable. A conservative estimate of net user benefits subsequent to the year 2000 was made by assuming that the discounted level of benefits remains constant for the next 11 years annually.

In effect, this assumes that increases in annual user benefits beyond the year 2000 occur at a rate equal to the 5 percent compounded annual discount rate.

The total discounted present value of net user benefits of $429,003,000 is considered to be a conservative estimate for the following reasons:

- Net discounted benefits subsequent to the year 2000 are assumed to remain constant, in the face of an increasing pattern prior to the year 2000.

- The method used in computing annual benefits involved an iterative cycling throughout the year using typical hourly, daily and monthly variations. While this is considered a reasonable approach on an annualized basis, it understates potential benefits during uniquely high periods of congestion, such as peak summer holiday weekends.

- The lowest average speed at volume/capacity (V/C) ratios greater than 1.0 was assumed to be 20 mph; in practice, under periods of totally forced flow, average travel speeds below this level may be quite common. In addition, the maximum average free-flow speeds were computed at approximately 58 mph, based on prior research; in practice, with the recently increased speed limits, maximum free-flow speeds may be somewhat higher.

I-3 PUBLIC SUPPORT FOR THE WIDENING

In addition to the quantitative evidence that the widening is justified is the qualitative evidence that emerged from both the survey of community officials and the attitudinal survey of Maine residents.

I-3.1 Municipal Officials' Comments on the Widening

When asked their opinion of adding a third lane on the Turnpike, 29 municipal officials (81 percent) indicated that they were in favor of third lane construction. Six officials (17 percent) were not in favor of the expansion and one individual was undecided.

Regarding the preparation of a fourth lane, 23 officials (64 percent) were in favor, nine (25 percent) were not in favor, and four (11 percent) indicated that it might be a good idea at a later date. It is important to note that those who were in favor of preparing for a fourth lane believed that it would make the most sense in economic terms and in terms

of minimizing disruptions at a later time when fourth lane preparation may become necessary.

I-3.2 Maine Residents' Comments on the Widening

More than half of the Maine citizens polled felt that the Turnpike should be widened. Fifty-six percent were in favor of the widening, 37 percent were opposed and seven percent didn't know if the Turnpike should be widened or not.

Regarding congestion on the Turnpike, of the Maine citizens polled, 50.9 percent said that "congestion is getting worse and we need to do something about it," while 15.2 percent said that "congestion is getting worse, but we don't have to do anything about it at this time. 20.3 percent felt that congestion was not getting worse. 13.6 percent had no opinion.

When asked if they had experienced any significant delays in their travels on the turnpike, a sizeable group of frequent users of the turnpike (58 percent) stated that they had. Frequent users are defined as those who use the Turnpike five days a week or more. Of the total respondents surveyed, 27.7 percent indicated that they had experienced significant delays, while 70.4 percent had not. 1.9 percent had no opinion.

On the question of the effect of widening on congestion, 57.6 percent of those surveyed felt that widening the highway would relieve congestion. 16.5 percent felt that it would not relieve congestion, and 16 percent said that it would have no effect. 10 percent didn't know how widening would affect congestion. 62.5 percent of frequent users felt that widening the Turnpike would relieve congestion.

I-4 TRAFFIC MANAGEMENT ALTERNATIVES

The obvious alternative to widening the Turnpike is very simply not to widen the Turnpike. Under "no-build" conditions, the problem of traffic congestion would presumably be dealt with by using traffic management approaches. The idea of traffic management is not new. However, its operational effectiveness has been the subject of much debate over the years. The following discussion illustrates why.

Traffic management strategies include, but are not limited to: ride sharing, staggered work hours, parking controls, communication techniques, and land-use planning. Techniques involving peak hour pricing and toll reductions will be addressed in Part III in the Fare Structure section.

The literature on traffic management alternatives includes a number of studies designed to measure the effectiveness of management techniques. The majority of these studies focus on highly congested urban areas with on-going, highly predictable congestion

periods. Few studies directly relate traffic management strategies to the nature of the problems experienced on the Maine Turnpike.

A 1980 study conducted for the MTA examined the trip purpose distribution of passenger vehicles by state of registration. The results showed that the trip purposes of drivers on the Turnpike were quite varied. Table V shows the results.

TABLE V

Trip Purpose	% of ME Registered Users	% of MA Registered Users	% of NH Registered Users
To/From Work	31	2	13
Work Related Trip	18	14	22
Personal Business	15	9	13
Shopping	11	4	6
Social/Recreation	16	21	20
School	1	1	1
Vacation	6	44	23
Camping	1	4	1
Sightseeing	1	1	1

*NOTE: Percentages do not add to 100 because of rounding of numbers.

Source: Wilbur Smith and Associates, MTA Commuter Plan, 1981

Table V is indicative of the diverse driver population on the Turnpike. The Maine drivers' destinations are primarily work related; the Massachusetts drivers have vacation and recreation as their primary trip purposes; and the New Hampshire drivers are almost evenly split between work-related and vacation/social related trip purposes.

Judging from the study of driver characteristics, it is clear that the composition of Maine Turnpike drivers does not offer a particularly good target population in terms of employing traffic management strategies. Furthermore, even if it were realistic to remove a significant portion of the commuter vehicles (the primary target of traffic management efforts) during current congested periods, such vehicles would constitute only a small percentage of the Turnpike users.

Given the economic and personal costs involved in implementing such management techniques as ride sharing and staggered work hours, it would not be cost effective given that a large part of the driver population would not be affected.

One study that addressed the issue of recreational traffic management (Hughes, 1982) compared the effectiveness of route diversion and time diversion strategies. Hughes found that route diversion strategies were effective in reducing recreational traffic congestion in intercity corridors.

However, Hughes acknowledged that route diversion strategies will only work if the recreational corridor has acceptable alternate routes. An alternate route is considered acceptable if "1) it has enough excess capacity to adequately accommodate the proposed diverted traffic, 2) drivers are aware of it, and 3) guidance is provided such that drivers, once diverted from the primary route, can progress easily and confidently along it." (Hughes, 1982)

Clearly, this diversion strategy is not a viable management alternative for the Maine Turnpike. The most obvious alternate route, Route 1, does not have the capacity to handle Turnpike overflow, nor can travelers progress easily and confidently down this corridor during peak traffic demand periods.

On the issue of time diversion strategies, Hughes found few studies pertaining to recreational traffic management. He did, however, cite one study in which a radio message was broadcast on commercial radio in Baltimore and Washington to divert traffic to off-peak times on the Chesapeake Bay Bridge. This experiment was considered successful.

Again, this method of traffic management is somewhat difficult to employ in Maine, due to the geographical make-up of travelers entering the state via the Turnpike. Travelers originating in Boston, New York, Connecticut, etc. would obviously not be in the same radio market and would therefore not hear a traffic diversion message in time to alter their trips. Even if this logistical problem could be overcome, these same travelers would be more conscious of other congested areas as they departed on their trips. For example, those traveling through the Boston area would have the tendency to place greater priority on avoiding commuter congestion problems in that area.

However, the MTA already provides traffic condition bulletins in various radio markets. When accidents occur, the Turnpike alerts local radio and TV stations, and depending on the severity of the traffic impact, radio stations in other geographical areas. In addition, the Turnpike is in the process of implementing a traffic condition phone line which will provide a taped recording of current traffic conditions. These efforts are worthwhile, yet even integrated with other techniques, they cannot realistically be expected to significantly affect congestion conditions.

In considering the impact of parking controls on congestion, it is important to bear in mind that not only are parking controls out of the jurisdiction of the Maine Turnpike Authority, but that even if they were employed, it would be difficult to assess the effect on peak period travelers.

Since the majority of travelers in the peak period traffic stream are out-of-staters, it is likely that imposing parking charges at common destinations such as malls would have little impact on these travelers.

Similarly, given the type of traveler in the peak period congestion flow, i.e. tourists from all over the Northeast, it would be virtually impossible to employ ride sharing and staggered work hours on this population.

The literature clearly indicates that in order for ride sharing and staggered work hour programs to work, there must be a significant commitment on the part of local employers to provide the support and resources necessary to accomplish the goal of traffic reduction.

But even in the best of all worlds, where a city's congestion problem is directly related to commuter traffic, and employers are committed to traffic management concepts, the traffic management techniques are still not widely accepted as having a major effect on congestion.

Thus, there is little in the research literature to indicate that management approaches can be a substitute for, or delay the need for, the widening - especially with the latest traffic projections showing quite clearly that strong future growth will occur on the Turnpike.

This does not mean that management approaches are not worth investigating. It does mean that an intelligent discussion of traffic management must begin with hard data relating to the origin and destination of Turnpike users, their trip purposes and times of use.

An update of the aforementioned 1980 origin and destination study is needed. The formation of basic trip pattern data would lay the foundation for an on-going analysis of the necessity and applicability of management techniques and provide the framework for developing specific strategies for relieving future Turnpike congestion, as well as, and more importantly, Route 1 congestion.

It is much more practical at this time for the Maine Turnpike Authority to consider seasonal pricing and toll reduction techniques (e.g. the commuter discount program) in conjunction with the widening. (A discussion of pricing issues is found in Part III of the Findings section, under Fare Structure.)

Finally, according to one study, (Schoenfeld and Chadda, 1985), land-use planning is probably the single most effective long-range option for reducing travel demand in urban areas. By encouraging mixed type of land use, i.e. commercial, office, and recreational facilities all on the same site, there would be less dependence on private automobiles, and trip frequency and length would also likely decrease. It is important to note that the Maine Legislature has recently enacted a program to increase land-use planning efforts.

Also, in developing traffic estimates for the purposes of this report, the consultants considered the possible effects of land-use planning and building moratoria on traffic demand and the traffic estimates are thought to be quite conservative.

I-4.1 Maine Residents' Comments on Traffic Management

Regarding management alternatives, the responses to the attitudinal survey of Maine residents were quite informative.

When Maine residents were asked how they felt about staggered work hours, 32.6 percent of respondents were strongly in favor of this traffic management technique, 18.2 percent were somewhat in favor, 26.6 percent were strongly against, and 10.3 percent were somewhat against the plan. 12.2 percent had no opinion.

However, when asked if they would personally be willing to work staggered work hours or staggered work days, only 26.6 percent were strongly in favor and 11.9 percent were somewhat in favor. Those who were strongly against the idea represented 34.7 percent of the sample while 7.2 percent were somewhat against it. 19.7 percent had no opinion.

These numbers represent a shift in terms of those individuals who are theoretically in favor of staggered work hours versus those who would actually agree to participate in such a program. Whereas 50.8 percent of respondents were somewhat or strongly in favor of participating on a theoretical basis, only 38.5 percent of the respondents were somewhat or strongly in favor of actually participating in a staggered work hour plan.

A similar gap between theory and practice was found in the responses to the question regarding ride sharing programs. The individuals polled in the attitudinal survey were asked if they would be in favor of or against ride sharing. Two thirds of respondents (66 percent) were in favor of ride sharing. However, when asked if they would be willing to participate in a ride sharing program, 50.8 percent responded that they would not.

Thus, it would seem that the general attitude toward traffic management alternatives in theory is relatively favorable, but in reality, the level of interest in participation in these programs is not very strong.

I-5 SECONDARY IMPACTS

The task of assessing secondary impacts of Turnpike widening on those communities most directly affected (southerly corridor communities) must stem from an evaluation of changes in traffic patterns. If Turnpike widening itself were to place additional traffic burdens on corridor communities, the assessment of secondary impacts would be derived from a process of tracing the affects of this additional burden on area communities.

At the outset, it should be noted that the southerly corridor communities are undergoing extreme pressures from economic growth and development, hence increasing traffic burdens and congestion. The consultants' initial task, therefore, was to evaluate the independent effect that Turnpike widening would have on traffic conditions in an area already experiencing and projected to continue to experience, heavy growth and development.

This heavy growth and development arises out of the area's desirability as a place to live, work and enjoy recreation, given its proximity to the Portland and Boston economic centers and its coastal location.

When considering the question of secondary impacts, one must remember that the growth and development in the region is not a direct product of derived demand from availability of Turnpike capacity. Rather, it is a product of independent economic choice and land use decision-making. In fact, the need for Turnpike widening is in itself a secondary impact of growth in the corridor.

It should be noted that this assessment does not include a review of environmental impacts. The direct environmental impacts of Turnpike construction will be subject to environmental review and permitting through the Department of Environmental Protection's required process. The preparation of an environmental assessment is currently underway.

Specifically quantifying the impact of the Turnpike widening on Route 1 is difficult in the absence of concrete measurements of traffic patterns in the Route 1 corridor. There are, however, sufficient sources of information to draw sound conclusions from a qualitative review. Some concern was expressed following the original capital improvement study that not enough attention had been paid to traffic impacts, hence secondary impacts, on the Route 1 corridor. This broadened study was designed to assure community input regarding traffic implications of the widening. Residents of the communities lining the Route 1 corridor were understandably concerned about the potential impacts on an area that has experienced a significant increase in traffic congestion.

I-5.1 Municipal Officials' Opinions Regarding Secondary Impacts

Slightly more than half of the municipal officials surveyed felt that the Turnpike widening would have an effect on Route 1 traffic, with the majority believing that it would help ease congestion on Route 1.

Of those who believed the widening would impact on Route 1, fourteen respondents (64 percent of 22) felt that the widening would decrease traffic on Route 1, while four (18 percent) believed that it would increase traffic on Route 1. The remaining four

individuals who felt Route 1 would be impacted were not sure whether it would create more congestion on Route 1 or relieve congestion.

I-5.2 Maine Residents and Route 1

While Maine residents polled in the attitudinal survey were not specifically asked whether or not they felt the widening would impact Route 1, they *were* asked if they ever avoid Route 1 because they know it will be too crowded.

Seventy-two percent responded that they avoid Route 1 because they know it will be too crowded. Of those 72 percent, 53 percent frequently avoid Route 1 and the other 19 percent occasionally avoid it. Twenty-four percent stated that they do not avoid Route 1 because they think it will be crowded and three percent had no opinion.

These results may indicate that if presented with the choice of driving on the Turnpike or Route 1, the majority of those polled (72 percent) are at least familiar with the congestion problem on Route 1 and make a conscious decision to drive on the Turnpike whenever possible.

In addition to surveying community officials and Maine residents on the subject of the Route 1 impacts, a review of Route 1 corridor studies and related route selection studies was also conducted.

I-5.3 Review of Route 1 Corridor and Diversion Studies

In an attempt to determine the potential secondary impacts of the widening on Route 1 traffic, three studies were examined:

1. A 1966 study conducted by Richard M. Michaels of the U.S. Bureau of Public Roads, which examined drivers attitudes toward route selection and the reasons for choosing to drive on one road or the other. The two roads studied were the Maine Turnpike and Route 1.

2. A Route 1 traffic survey conducted in 1969 by consultant Murray D. Segal, which examined the reasons why motorists chose to use Route 1 as opposed to the Maine Turnpike.

3. A recent traffic study prepared by the Maine Department of Transportation for the Route 1 Corridor Committee which examined the rate of growth in traffic for the period from 1975 to 1987.

Michaels found that drivers evaluate alternative highways in a rational, though subjective fashion and that these evaluations appear to be independent of the usual monetary schemes for rationalizing highway benefits and costs.

According to Michaels, drivers learn the characteristics of particular roadways and form an opinion of each roadway that then affects their route selection choices. Interestingly, the study suggested that the overall stress incurred in driving was a more important determinant of route selection than either operating costs or travel time costs. This may explain why the majority of Maine residents in the attitudinal survey, when asked if they had to choose between paying higher tolls or experiencing more congestion, chose higher tolls (64 percent) over more congestion (22 percent).

In studying drivers route choice of either Route 1 or the Maine Turnpike, Michaels found that the more drivers experienced both highways, the more Route 1 was viewed less favorably. Using a stress management technique, Michaels compared the level of stress of Route 1 drivers versus Maine Turnpike drivers. He found that the tension aroused in drivers on the Turnpike was approximately half the amount generated in Route 1 drivers. The tension was thought to be derived from interferences experienced on Route 1.

Michaels believed that the stress experienced on Route 1 was the basis upon which many drivers chose to use the Turnpike. The findings further indicated that the more frequent a trip and the longer the duration of a trip, the more drivers used the Turnpike.

The Michaels findings are interesting in terms of estimating secondary impacts on Route 1 from the Turnpike widening. The study points to the fact that drivers will choose the path of least resistance, meaning the one that causes them the least tension and provides the fewest obstacles. It would follow that after a driver has experienced driving on Route 1 on any particular day in the summer, he or she would be unlikely to choose this route again in the future and would opt for the Turnpike instead.

A second study conducted in 1969 by consultant Murray D. Segal examined the reasons why motorists chose to use Route 1 as opposed to the Maine Turnpike. The reasons for using Route 1 and the percentage breakdown in each category were as follows:

• Avoid tolls	10.7%
• Stops on Route 1	8.1%
• Scenic drive	28.8%
• More convenient	43.9%
• Other	8.4%
• TOTAL	100.00%

While an update of the 1969 route choice study has not yet been done, one would expect that with a significant increase in congestion along the Route 1 corridor during the peak summer months, there would be a sharp decrease in drivers using Route 1 for "scenic" purposes.

Similarly, the percentage of drivers who used Route 1 to avoid tolls on the turnpike would likely decrease if the driving time saved on the Turnpike was significant. The drivers remaining on Route 1 would likely be those who had short-term stops to make or those for whom Route 1 was the most convenient road to their destination.

A more recent traffic review done by MDOT planners for the Route 1 Corridor Committee examined the rate of growth in traffic for the period from 1975 to 1987.

The MDOT found that the rate of travel growth at selected locations along Route 1 between the Maine/New Hampshire border and the Arundel/Biddeford town line ranged from a low of 1 percent to a high of 5.8 percent per year with an overall average for the corridor of 3.8 percent. For the same period of time, 1975-1987, the Turnpike experienced a 10 percent annual increase in traffic growth.

The MDOT review found the traffic growth rate of 3.8 percent to be somewhat greater than that experienced on a statewide basis for the same period, however it was thought to be relatively low considering the extent of development that had occurred along the corridor in the same period of time.

This may suggest that Route 1 had in fact reached its saturation point. The MDOT planners concluded that during heavy peak traffic periods in the summer months, drivers may deliberately choose other roadways to avoid congestion, where altematives exist.

This would suggest that drivers are sensitive to congestion delays and will alter their choice of routes in favor of the least congested and most convenient roadway.

The findings mentioned above may seem quite obvious. They parallel the observations made by community officials and Maine residents polled in the attitudinal surveys.

If people avoided Route 1 due to congestion back in 1970, one can only assume that in light of the traffic growth since that time, they will continue to avoid Route 1 today. However, given the increasing problem of congestion on the Turnpike, one must question how this will affect route selection. When two parallel roads are similarly congested at the same times of the year, very few viable choices for drivers remain.

In summary, growth and development along the Route 1 corridor is occurring in a fashion independent of Turnpike travel capacity. There is no creditable evidence to suggest that not widening the Turnpike will slow or ameliorate Route 1 congestion.

On the contrary, all indications suggest that failure to widen will not only compromise through travel to other regions of the state, but will contribute to congestion in the southerly corridor. The lost trips that travelers into Maine may be expected to forego due to congestion are the not as likely to be the closer trips into this southern-most region as they are the longer trips into other regions in the State. Lack of available Turnpike capacity during congested periods will diminish the viability of the Turnpike

as an alternative route for travel within the region during periods of simultaneous congestion between Route 1 and the Turnpike.

While the impacts of not widening carry significant implications for Route 1 communities, the widening itself only prevents a bad situation from worsening. As will be seen in the following sections, there is much that the Turnpike can do to help alleviate the serious traffic problems in the region.

I-6 INTERCHANGE/ACCESS IMPROVEMENT PROJECTS

I-6.1 Municipal Officials' Opinions Regarding Interchange/Access Improvement Projects

Municipal officials along the Route 1 corridor were asked for their comments and suggestions regarding the proposed interchange improvement program.

Before delving into the specifics of the suggestions, an overview of the MDOT's Maine Turnpike Interchange Program, primarily funded by the MTA, is needed to place the suggestions within the context of Maine's overall transportation program.

State Legislation allows for the development of new or improved interchange access to the Maine Turnpike along with connecting roadways. According to the Legislation, before new interchanges or access roads may be constructed, it must first be determined that they have a sufficient relationship to the public's use of the Turnpike and the orderly flow of traffic on the Turnpike so that the use of the Turnpike revenues is warranted to pay all or part of the cost of maintaining or constructing the access roads or interchanges.

The factors that are considered in making this determination include: vehicle volume on access roads, the availability of alternative roads, the effects of construction on the flow of traffic, the effect of the failure of the Authority to pay or help in the payment of associated costs, and the availability of Turnpike revenues to cover costs.

Since 1981, projects in Lewiston/Auburn and in southern Maine have benefitted from this program. An access road in Auburn has already been completed and an access/interchange project in Lewiston is scheduled for completion in 1989.

In addition to interchanges, the Turnpike Authority provides $4.7 million annually to the MDOT to help support costs beyond the Turnpike itself. In addition, the 113th Maine Legislature allowed the Turnpike Authority to fund up to an additional $4 million/year for improvements on roads through which the Turnpike passes, if funds are available.

Over the next two years, one project scheduled for work is an $11.2 million connector/interchange facility in Scarborough, of which the Turnpike's share is $8.6 million. Already under construction is a $6.4 million access road improvement project

between U.S. Route 1 and State Route 111 in Biddeford to service the existing Maine Turnpike interchange, of which the Turnpike's share is 50 percent ($3.2 million).

Highway administrators are constantly faced with the task of addressing the needs of a deteriorating roadway network. Statewide, many improvements made in the 1960s and 1970s have reached or are now approaching the end of their useful lives and are in need of restoration or rehabilitation.

Maine citizens have historically recognized the importance of a well-functioning road network, and the concern was re-emphasized in 1987 when the Governor's Economic Development Task Force conducted meetings around the state. At every Task Force hearing, the message was clear: Maine's highways need to be improved to modern standards if economic growth is to be sustained.

Maine has almost 22,000 miles of public roadway. The MDOT estimates show that improvements to 1,300 miles of roads known as "corridors of economic significance" will cost approximately $600 million. Over the next two years, the State's Transportation Improvement Program plans $221.56 million worth of work, combining funds from federal, state and local sources.

Maine is entering a period of increased highway needs and dwindling sources of federal money to help with the problems. Thus, potential improvements must meet several criteria and be rated for priority. Evaluative criteria include a project's relationship to economic development, traffic impacts, safety and, of course, budget considerations.

In the course of this study, a preliminary assessment of the community interest in Route 1 improvements was conducted. This assessment is preliminary in nature because an examination of Route 1 corridor improvements is currently underway through the MDOT.

The MDOT study focuses on the communities of Kittery, York, Ogunquit and Wells and involves a thorough assessment of the traffic problems along the Route 1 corridor. A primary focus of the study will be the development of land use regulations to better address traffic impacts in the area.

Beyond that study area, the MDOT is undertaking a study directed at the Biddeford/Saco/Old Orchard Beach area which includes the feasibility of an I-195 connector in Old Orchard Beach and a Biddeford Bridge and by-pass of the downtown area.

The following is an overview of the status of projects brought to the consultant's attention in the course of surveying the municipal officials along the southern corridor. Possible changes or improvements are listed and are followed by brief responses to these suggestions. The suggestions were reviewed with the planning office of the Maine Department of Transportation (MDOT) to determine to what extent they have been requested and examined in the past or are currently under review.

The specific improvement needs mentioned, by town, are as follows:

York

- Move first toll gate in York further south
- Provide more direct access to York Beach area

It is not clear what would be accomplished by moving the York toll gate south, and it does not appear to be a viable alternative. While it is necessary to replace the toll plaza due to settlement problems at the current location, the plan is to relocate the toll booth north of its current location, in a flat, plateau area.

The recommendation to increase access to the York Beach area has been proposed in the past. Previously it has been strongly opposed by the community and therefore was not approved. While the plan still has merit from a traffic management standpoint, it would be more difficult to pursue this plan today, given the extent to which the area has been developed and the past opposition to the idea.

Ogunquit

- New interchange at Ogunquit
- New interchange north and south of Ogunquit
- New interchange at Ogunquit/Wells/Moody Beach area
- Seasonal interchange at Ogunquit
- Add by-pass from Ogunquit to Cozy Corner (Route 1 one-way, by-pass the other way)

The municipal officials who participated in the survey most frequently mentioned Ogunquit as the area most in need of a new interchange.

There was some concern expressed that a new interchange at Ogunquit would negatively impact Route 1. However, a large majority felt that it would relieve congestion on Route 1. This opinion was shared by the MDOT planners. The MDOT consulting engineers are currently reviewing a number of different configurations in the Ogunquit area.

The MDOT planners feel that a new interchange south of Ogunquit would not do much for the area in terms of reconfiguring the existing traffic patterns, but that an interchange north of Ogunquit would help alleviate congestion.

It is assumed that a northern interchange would help to move more traffic out of the congested Route 1 area than it brings in. The Moody Beach area was thought to be a logical place for a new interchange.

The MDOT also felt that a new interchange in Ogunquit should be year-round, not seasonal, because this stretch of the Route 1 corridor has become less seasonal in nature over the years and the current traffic volume warrants a year-round interchange.

The recommendation for a new Cozy Corner configuration was considered in the past, but was met with strong opposition from the business community.

The Route 1 Corridor Committee is studying other by-pass options in this area and evaluating whether or not community views have changed.

Wells

- Install light at Wells exit with more stacking capacity
- Move York toll booth so Turnpike is free past Wells

The Turnpike Authority should evaluate the the need for a light at the Wells exit and implement it if a close examination of traffic conditions warrants it.

It would be impossible to move the York toll booth without losing necessary revenue. It might be possible to partially overcome this by charging northbound travelers, but there would be no way to capture the revenue southbound unless all traffic was charged for the full length of the road, which would result in serious overcharging of drivers exiting at Wells.

Kennebunk/Arundel

- Widen overpass on Old Alfred Road
- Add pedestrian walkway over the Old Limerick Road overpass next to the school

The overpass on the Old Alfred Road is currently a one-lane bridge that will be widened in conjunction with the widening project.

The pedestrian walkway is being considered in the final design stages of that overpass.

Sanford

- New interchange at Sanford

There is no question that Sanford has experienced rapid growth in the past few years. In fact, Route 109 and Route 111 have been identified as areas for improvement and funds have been set aside in the MDOT's supplemental budget for improving these roads. Routes 109 and 111 already provide fairly direct access to the Turnpike. As long as they are upgraded, this should lessen the need for a new interchange in Sanford.

Biddeford

- Biddeford exit should be changed to make entering Route 1 easier
- Add temporary traffic light at Exit 4
- Need longer approach to toll booth at Exit 4
- Widen Route 111
- New interchange at South Street
- New crossing over the Saco River

Comments have been received that relate to the problem of entering Route 1 from Biddeford. A new extension from the Turnpike to Route 1 would effectively allow drivers to by-pass the Five Points area in Biddeford and enter and exit the Turnpike more easily.

The MTA has considered a temporary traffic light at Exit 4 and determined that it would cause more problems during the construction phase than it would alleviate. However, the MTA is currently considering having a traffic control officer on duty during congested hours.

Once the extension is completed, the intersection will be signalized which should resolve the traffic backup at Exit 4. The MDOT will also be examining the options for turnouts from this road.

Route 111 is currently intended as a two-lane roadway, but there is a possibility of adding a third lane for use as a turning lane near the Route 1 intersection. MDOT planners indicated that this is under review. Additionally, during the final design stage of the Turnpike widening, the Turnpike engineer will consider the need for a 4-lane overpass given the planned commercial growth in this area of Route 111.

The MDOT study that is underway in Biddeford is looking at the possibility of a third Saco River crossing that would be connected with a by-pass road of the downtown area. This would result in a change of configuration in this area that will likely improve the congestion in the downtown Biddeford/Saco area. The MDOT recognizes the need for future year funding for this purpose.

The addition of a new South Street interchange would allow direct access from downtown Biddeford and Saco. This seeks in part to address the same problem of downtown congestion by way of providing greater access from this area to the Turnpike. The Turnpike should be prepared to address this problem area in cooperation with the MDOT.

The congestion is real and growing. It may well be that a new bridge and by-pass road can be combined with an extension to the existing Saco exit of the Turnpike, thereby addressing the access issue. The decision as to whether the problem should be handled this way or by way of a separate interchange should await the results of the MDOT's detailed study. In either instance, the Turnpike should be prepared to share in the costs of solving this problem.

Saco

- Improve traffic operations at current Exit 5 at the Turnpike connection
- New seasonal interchange at Saco parallel to Flag Pond Road (Cascade Road)

The traffic operations issue at Exit 5 has been an ongoing concern which is being evaluated by Turnpike engineers. The Exit 5 configuration was meant to be a temporary

design until another access road was constructed, however the other road has not yet been built.

Another interchange north of Saco to serve Old Orchard Beach needs to be considered. The issue of traffic approaching Old Orchard Beach through the Saco interchange during summer months is such that an evaluation of a seasonal interchange at Cascade Road should be carefully considered in terms of its contribution to further easing of I-195 and Route 1/Saco congestion problems.

MDOT is already planning an assessment this summer of an I-195 connector road that has been requested by Old Orchard Beach and designed to by-pass congested intersections of Old Orchard Beach.

The effects of an I-195 connector road, the possibility of a Biddeford bridge and by-pass, the completion of the originally planned westerly connector off Exit 5 and the possibility of a seasonal exit at Cascade Road need to be reviewed in combination and evaluated to determine which set of options would produce the best results.

The Turnpike should plan in its program to play a cooperative financial role in addressing these problems of Route 1 congestion and Turnpike access in and around the Biddeford/Saco/Old Orchard Beach area.

The above discussion points to the vital role that the Turnpike plays as a through road that must engage in integrated planning efforts to ensure that the Route 1 area is equally well served with adequate access to the Turnpike and that the pressure on neighboring routes is relieved to whatever extent possible.

I-6.2 Maine Residents-Interchange/Access Improvement Projects

The Maine residents included in the attitudinal survey were asked which area they felt was most in need of a new interchange. A large percentage (47.8 percent) had no opinion. Those who did have an opinion on new interchanges chose the following:

Ogunquit	16.6%
Old Orchard Beach	2.5%
Between Biddeford and Kennebunkport	9.4%
Biddeford	7.2%
York Beach	5.6%
Arundel	.9%

I-7 THE ROLE OF THE TURNPIKE IN SOUTHERLY CORRIDOR TRAFFIC CONGESTION

It is imperative that the Maine Turnpike Authority and the Maine Department of Transportation continue and build upon integrating their traffic improvement programs in the Turnpike corridor.

Turnpike widening does not in itself solve Route 1's congestion problems, but it will help to prevent the problems from worsening.

Transportation development in Maine has entered a new era. In the past, highway programs responded to straightforward increases in traffic volume. Today, highway programs must respond to land-use changes within the roadway corridors.

This change in traffic characteristics requires an integrated approach to highway improvements. Integration coordinates highway planning and public expenditures and ensures that construction monies are providing the most value for the dollar.

In addition, integration is necessary because highway planning is no longer an isolated function involving separate governmental entities. It is a dynamic process which must respond to the various land use changes affecting particular corridors.

The Authority must establish close relationships with communities along the Turnpike to keep track of changing needs and trends.

The Authority currently works closely with the Maine Department of Transportation regarding highway needs in the corridor. The relationship should be expanded as a way of helping the MDOT accommodate its future challenges.

At this time, there are a number of opportunities for joint efforts by the Authority and the MDOT.

In the coming years, the MDOT must address an estimated $600 million worth of highway and bridge needs statewide. The Legislature recently approved a gas tax increase to go toward funding that effort.

MDOT is also directing more attention to resolving Route 1 congestion problems, and the Legislature has authorized the Turnpike Authority to provide the MDOT up to an additional $4 million annually over the next 20 years for solving traffic impacts in the Turnpike corridor, of which Route 1 is part.

And last, but hardly least, the MDOT is laying the foundation for a major east-west highway connector in the Greater Portland Region, as well as planning improvements associated with Turnpike programs.

A key consideration for the Maine Turnpike Authority is the assurance that its indenture agreements be flexible enough to meet the financial requirements of this new

transportation era as it affects the Turnpike corridor. In particular, the Authority's out-year surplus funds should be used for addressing future needs regarding interchange/access/Route 1 and east/west issues.

Also important is the fact that integration between the Authority and the MDOT helps address specific characteristics within the corridor. The Lewiston/Auburn area, the Greater Portland area and the southern Maine area each have distinct needs that must be addressed. This report recognizes the diversity of those areas and the different problems they face. That is why solutions may require separate programs for those areas.

I-7.1 Northerly Corridor Study

The Turnpike Authority was requested, as part of the legislative deliberations on the widening project, to identify and evaluate strategies to optimize use of the Maine Turnpike, north of Interchange 10, Portland North.

Conditions and needs of the northerly end of the Turnpike are markedly different from those on the southern end. The southern section of the Turnpike is the only through route serving traffic to and from all points in Maine and the south. There is a clear need to accommodate that traffic demand and to help relieve crowded Route 1 of many inter-local trips.

The northern section is one of two routes serving the central and more northerly sections of the state (the other being I-95 through Brunswick) and traffic usage is significantly less. The objective on the northern section of the Turnpike is to find ways to allow more use of the facility, to improve local service and to allow and encourage planned development.

The study, which is available in detail under separate cover, was conducted in close cooperation with a local advisory committee and focused on two specific areas:

1. Alternative toll collection systems, including open or closed barrier operations, and
2. Possible additional interchanges to increase access to the Turnpike.

The study clearly demonstrated several features of importance:

1. A toll collection system can be devised on the northern section (the closed barrier system) that assures that all users continue to pay equitable tolls and allows for the construction of future interchanges at significantly less cost than under the existing toll collection system.

2. Potential interchange locations exist which would provide much improved traffic service and more effective use of the Turnpike and encourage future development.

3. The toll collection system could be converted in a way that would, at worst, provide long-term "revenue neutrality" to Turnpike operations.

I-7.2 Westerly Corridor Study

In response to a request from the Maine Department of Transportation, the Turnpike Authority agreed to finance and coordinate a westerly connector study in the Portland area. The study objective was to define corridors that could reasonably accommodate east-west traffic movements and identify preliminary costs, traffic service, and other features.

The study was conducted with the assistance and advice of a local advisory committee. Two relatively distinct traffic service corridors were identified, one to attempt to relieve traffic conditions in Westbrook and Gorham, and the other to respond to needs in the U.S. Route 302 corridor to North Windham. A complete study report is available under separate cover.

A review of the study material and the response and input of local communities suggests the following:

1. Considerable effort needs to be made in coordination with local communities in the Route 302 corridor, particularly in evaluating Route 302 needs along a much longer section than could be included in the recent corridor review.

2. Four alternative corridors were identified in the Westbrook-Gorham service area. It is essential that the local communities involved cooperatively evaluate those alternatives.

3. In light of the rapid development in the Portland area, a location decision and right-of-way reservation is essential if the area is to avoid foreclosure of its ability to provide for this transportation access alternative.

4. The costs of any of the alternatives significantly exceed the revenue that could be generated from tolls to support the construction. Financial feasibility of these options will require funding from multiple sources.

PART II - REVIEW OF CAPITAL COSTS, AND OPERATING AND MAINTENANCE PROJECTIONS

II-1 Project Cost Estimates

The consultant applied average MDOT unit price costs to the quantity estimates set forth in the HNTB studies in order to calculate the new costs for a 1987 base year. Based on an examination of MDOT average percentage construction cost increases for the years

from 1983 to 1987, 6% was used as an inflation factor to escalate construction costs to the predicted construction year.

Apart from the costs associated with the passage of time between the HNTB report and this report, the new cost estimates included the addition of engineering costs, construction surveys, design engineering and on-site design and observation during construction.

Because of the preliminary nature of the estimates, it was deemed prudent to also include a contingency fund to anticipate unforeseen situations which may arise during the design/construction process. Taken together, these engineering and contingency costs represent 25 percent of the widening project construction cost.

It is important to bear in mind that the cost estimates are strictly an opinion of costs, rather than a guarantee of costs. Other factors may come into play in the future that will affect the costs of construction. These may include changes in the construction labor market, the workloads of various contractors, changes in the general economy, etc.

It is also important to note that in preparing cost estimates, the consultant relied on the historical data set forth in the HNTB reports, on conversations with HNTB consultants, and on historical data from the Maine Turnpike Authority and the Maine Department of Transportation. In addition, the consultant's own engineering expertise contributed to the development of appropriate assumptions regarding the costs of construction.

The updated Turnpike construction costs with northerly corridor improvements are listed in Table VI.

Table VI presents these costs in actual project year dollars, conforming to the recommendations made in the final section of this report. In 1987 dollars, total project costs are estimated to be $130 million.

The Table displays updated interchange additions and access improvement projects incorporating the project costs identified in the Northerly Corridor and Westerly Connector studies. Also included are additional costs associated with the southerly corridor improvements. The areas to be focused on in the southerly corridor are Biddeford and Saco, where improved access to the Turnpike is needed to relieve congestion. In addition, the Saco Interchange will be redesigned to address the existing operations issue.

The interchange cost column also includes costs of fare collection system conversion for the northerly part of the Turnpike, a project which resulted from the findings of the Northerly Corridor Study.

All cost figures for the interchange additions and access improvements represent only the Turnpike's share of the costs, which are based on the proportion of traffic corridor improvements that originate and/or terminate with travel on the Turnpike. The York toll

Table VI
Turnpike Construction Costs with Northerly Corridor Improvements
(Thousands)

Widening Contracts		**Costs**	**Year**
Contract II	(Mile 12-18)	$19,900	1990
Contract III	(Mile 18-24)	$24,900	1991
Contract IV	(Mile 24-30)	$20,200	1992
Contract V	(Mile 30-34)	$12,900	1991
Contract VI	(Mile 34-42)	$21,700	1991
SUBTOTAL		$99,600	
Interchange Additions and Access Improvements			
Ogunquit		$5,700	1994
Biddeford		$3,200	1988
Saco (redesign)		$400	1989
Biddeford/Saco/OOB Access		$8,000	1995
Scarborough		$8,600	1989
Congress St./Portland		$7,100	1991
Portland/Westbrook		$6,000	1992
Forest Ave./Portland		$2,500	1993
Gray		$400	1994
So. Main/Rt. 136/Auburn		$7,500	1996
Lewiston		$1,400	1988
St. Rt. #9/Sabattus/Lewiston		$3,100	1995
Grove St./Sabattus/Lewiston		$2,500	1991
Northerly Fare System Conversion		$6,300	1989
SUBTOTAL		$62,700	
Planning/Location Engineering			
		$2,500	1989
		$2,500	1990
SUBTOTAL		$5,000	
TOTAL		$167,300	

Notes:

1. All costs are rounded to the nearest $100,000.
2. Widening costs assume 3-lane road and 4-lane bridges.
3. Widening costs include 25% contingency and engineering costs.
4. Interchange and access improvement costs reflect the MTA's share only, which is based on the proportion of traffic corridor improvements that originate and/or terminate with travel on the Turnpike.
5. The York toll booth relocation costs are to be paid out of Reserve Maintenance.

booth replacement costs are to be paid out of reserve maintenance and are not reflected in this Table.

The widening costs include the construction of bridges and structures to accommodate a possible future fourth travel lane. The original HNTB report envisioned the construction of four-lane bridges and the preparation of a four-lane road bed.

The engineering consultants have determined that the preparation of the bridge structures to accommodate a possible fourth lane in the future would be a prudent investment given the large future costs associated with having to redo this work. However, the preparation of the fourth lane road bed, while reasonable to consider given a project of this kind, does not have the same economic imperative behind it that the preparation of a fourth lane bridge structure does.

The consultants are not able to make a definitive case at this time for the use of a fourth lane. Even though traffic projections do point to its strong potential in the future, the costs of future preparation of the road bed for fourth lane travel must be weighed against its level of certainty. It must also be considered in terms of environmental impacts.

Based upon a careful balance of these issues, the consultants determined not to recommend the inclusion of the fourth lane road *bed* preparation in project cost estimates. The conclusion was reached knowing full well that future year costs will be greater than they are now should the fourth lane eventually be needed.

The Planning and Location Engineering costs shown in Table VI represent dollars that are being earmarked for future work in the southerly and westerly corridor areas. This is money that will enable the Maine Turnpike to participate in the planning and locational aspects of further work in both areas.

For the Portland area, the money is intended to be used to help narrow down the many possible design options and feasibility analyses for increasing access from the west. For the southerly corridor, these funds will permit the Turnpike to participate in solutions to Route 1 corridor congestion problems.

It is quite apparent that the addition of one interchange or access road will not solve all of the problems, but that an integrated plan to develop by-pass roads and restructure existing roadways will need to be developed. The Route 1 Corridor Committee has undertaken a study of Kittery, York, Ogunquit and Wells. The MDOT will be doing an assessment of the Saco bridge and a by-pass in Biddeford as well as the examination of the potential for an I-195 connector in the Old Orchard Beach area. Through the allocation of these additional funds, plus $8 million in Biddeford/Saco access monies that is built into project cost estimates, the MTA will be able to play a significant role in the amelioration of the Turnpike access problems in the Biddeford, Saco, and Old Orchard Beach areas.

The planning and location engineering costs can run up to 4 percent of overall project costs. The monies set aside in this program for these purposes are anticipated to represent only the Turnpike's share of contribution to the planning and engineering costs.

II-2 Review of Operating and Maintenance Expenses

Operating and maintenance expenses are driven not only by inflationary factors, but also by volume. For example, roadway maintenance costs are directly related to vehicle miles traveled. The more vehicles using the highway, the greater the need for maintenance. Similarly, fare collection costs are directly related to the number of fare transactions. There is a direct cause and effect relationship in these areas.

The average annual increase in expenditures for the 10-year period from 1977-1987 was 10 percent. While a 10 percent growth factor may sound high, this results from the fact that the earlier years saw double digit inflation while later years were influenced by large increases in vehicle volume.

A closer examination of specific line items shows that there are no extraordinary or unusual cost factors that cannot be accounted for by changes that occurred in particular years.

For example, the line item with the greatest annual increase was Administration and General Expense. The increase for the 10-year period was 15 percent. This may be attributed to major increases in insurance costs, including Workers' Compensation, Blue Cross/Blue Shield, dental, Maine State Retirement System, and group life insurance. Also included in these costs are the newly required contributions to Medicare for government employees hired after April 1, 1986. Since the above mentioned costs are all components of the Administration and General Expense category, they tend to cause an uneven and unpredictable growth pattern.

In the Accounts and Control category, one major increase, 34.6 percent in 1984, is related to the implementation of both a new computer system and a new fare collection system for the MTA. While the installation of the computer system resulted in short-term cost increases, it eventually led to a reduction in staffing.

Eighty-five percent of the Patrol and Radio expenses are out of the control of the MTA. Twenty-three state troopers accounted for approximately $1.3 million of the 1987 Patrol and Radio budget. The MTA's input in the decisions conceming these expenditures is limited to cooperatively determining the manpower level for this functional area.

Fare collection is the cost area that warrants the closest attention. Having adequate service levels to keep traffic moving smoothly is of critical importance. Also, as new interchanges are added, fare collection costs will necessarily increase to compensate for the added personnel at each toll booth. Also, it is important to note that reducing delays

at toll booths may require more than adding new staff; it can frequently require the addition of new lane capacity as well.

The 9 percent annual increase in budgeted operating expenses previously projected by HNTB is a reasonable figure to use in projecting future MTA operating expenses. However, the Turnpike should undertake an efficiency study of fare collection staffing, automation options and new interchange configuration alternatives in order to keep collection costs in line given planned improvements with new turnpike access. Without optimum efficiency in design and collection methods, this additional access could lead to faster growth trends in forecasted collection expenditures.

Another component of operating and maintenance costs is the Reserve Maintenance Fund. In reviewing the earlier reserve maintenance estimates, the engineering consultant determined that certain costs could be foregone compared to earlier forecasts due to improvements on sections of the Turnpike; some of the planned reserve maintenance expenditures would duplicate work done under the proposed widening and interchange program.

III. REVIEW OF REVENUE PROJECTIONS, FARE STRUCTURE AND CHARGES

III-1 Review of Revenue Projections

Revenue projections were developed by Wilbur Smith Associates using updated traffic estimates provided by Mallar Associates. Updated revenue forecasts were developed under a condition whereby the various new interchanges or interchange improvements, including those covered as part of the Ten Year Improvement Plan, were superimposed on the system. In addition, the revised configuration assumed conversion of the north end of the Turnpike to a closed barrier system under Concept E, as defined in the recent Northerly Corridor study, including implementation of new interchanges.

For this build condition, utilizing the fratar model developed and growth rates provided by Mr. Mallar, an updated traffic and revenue forecast was developed. The traffic was furnished in the form of trip tables and the revenues were furnished in terms of annual toll revenues.

Table VII displays a comparison of these new updated revenue projections with the earlier projections set forth in the 1986 Howard, Needles, Tammen, and Bergendoff study.

The revenue forecasts in Table VII are based on current toll charges and represent the build condition under new and old traffic estimates. As can be seen from the Table, the revenue growth is anticipated to be at a much faster pace than earlier estimates indicated. The 1988 traffic revenue to date is already exceeding even the most recent projections.

Table VII
Estimated Annual Gross Revenues
Build Condition
Comparison to Earlier Revenue Projections
No Fare Increase

1987-2000
(Thousands)

Year	Updated Revenue Estimates Current Trend	Earlier Revenue Estimates (1986 Study)
1988	$31,233	$27,340
1989	$33,219	$28,659
1990	$35,331	$29,841
1991	$38,894	$32,250
1992	$41,371	$33,549
1993	$44,443	$34,787
1994	$47,284	$36,067
1995	$50,257	$37,393
1996	$54,106	
1997	$56,966	
1998	$59,806	
1999	$62,788	
2000	$65,919	$43,376

Given the nature of the forecast, this would not be unexpected. The earlier years may exceed the forecasted rate of growth because the growth estimates were designed to ensure reasonable estimates for the longer term. The implications of this revenue picture on the Turnpike program will be further detailed in the Conclusions and Recommendations section of this report.

III-2 Fare Structure

The major attraction toll facilities offer is their potential self-sufficiency, especially in light of strict budget constraints and the need for additional capacity. By providing a steady revenue stream, toll facilities are able to expedite new construction programs that might otherwise be delayed without adequate funding. Tolls can also lead to a more cost-effective investment in new highway capacity by linking user payments to a specific highway project. Tolls may also be used as a means of allocating costs among categories of users in order to equitably distribute the cost burden based on direct use of the highway. (Congressional Budget Office Study, December, 1985.)

In contrast to the concept of using tolls to finance new construction projects is the strategy of using tolls as a means of congestion pricing; this technique has been discussed as a way to limit use of a congested highway during peak travel periods. There are two basic theories about "peak period" pricing.

The first theory is that higher peak period tolls can be used to discourage travel during the most congested times and encourage the use of alternative routes. In addition to the use of alternative routes, drivers would theoretically be encouraged to alter their travel times and to drive during off-peak hours. According to traffic planners, in order to cause drivers to change their travel behavior, tolls would have to be increased by as much as three or four times their normal rate.

The second theory of peak pricing associates the costs of building and operating the turnpike with drivers' use of the turnpike. While higher tolls would be charged under this method, the increase would likely be of a smaller magnitude than in the diversion method. The goal of this method would not be to divert traffic, but rather to more equitably relate costs to use.

In light of the Maine Turnpike's circumstances, the first theory of peak pricing has the potential for increasing the problem of congestion on Route 1. Since one of the goals of the diversion method is to force drivers onto less congested alternative routes, the impact on Route 1 would be an unacceptable tradeoff. During the times when the Maine Turnpike is extremely congested, Route 1 is similarly congested and does not have the capacity to handle cars that are diverted from the Turnpike.

Additionally, if peak pricing for diversion purposes is implemented on a weekend by weekend or on an hour by hour basis, a major problem could arise if drivers decide to wait at the toll-booth until the charges are reduced or speed up to avoid them. Further,

the frequent price fluctuations would render internal financial control mechanisms ineffective.

The results from the survey of Maine citizens points to the problem of diversion to alternative routes. Nearly 80 percent of the respondents were opposed to the idea of tripling tolls during selected hours on summer weekends, while 66 percent indicated that it would cause them to change their driving habits. However, when the survey participants were asked if they ever avoid Route 1 because they know it will be too crowded, 72 percent indicated that they do. Thus, while the majority of respondents would divert to alternate routes if tolls were drastically increased, they are not inclined to divert to Route 1.

Of course, one alternative for drivers is to alter their travel times in an attempt to avoid paying high peak period fares. Some travelers may even go so far as to alter their destinations altogether. Those travelers whose end destinations are the uncongested regions of Maine would be just as affected by a tripling of tolls as those traveling to Southern Maine. Thus, in considering alternative fare structures, it is important to bear in mind that the changes will not only affect those visitors coming to Portland, but also those traveling to Bar Harbor or Bangor, or Rangeley.

The second theory of differential pricing, based on costs occasioned by use, would be more appropriately employed at the Maine Turnpike given the high volume of tourist travel during the congested period and the desire to collect somewhat higher tolls from those who create the congestion.

Of course, Maine drivers would not be exempt from paying higher tolls as well, but if higher tolls are charged during the summer months, it may lessen the overall cost to Maine drivers and others during less congested periods.

Another difference between this approach and the diversion method is that higher tolls would presumably be levied over a longer time period, for instance, during June, July and August, rather than by weekend or by particular hours of travel. This would lessen the costs associated with the administration of such a plan.

A legal review conducted as part of this study has concluded that charging differential toll rates during certain times of year is constitutionally sound. As long as seasonal pricing applies equally to intrastate and interstate users and reflects appropriate compensation for the use of the Turnpike, in that it relates the costs of heavier summer traffic with the costs of the new construction to alleviate congestion, the differential toll structure should be considered non-discriminatory. Therefore, the seasonal pricing should not be considered a burden to interstate commerce.

A seasonal pricing scheme, if implemented following completion of Turnpike widening, offers the advantage of more closely allgning the user charges to user benefits. Higher charges during peak season reduces the prospects of traffic diversion, since the availability of alternate routes during the season is limited. Alternatively, this pricing

capacity is available and local commuter routes are experiencing crowding. This concept has not been used on any comparable roads in the U.S. Before implementation, it will require careful analysis including updated data from summer season origin and destination surveys. Motorist and corridor community reaction should be included as part of a feasibility study. It should be noted that those responding to the attitude survey of Maine residents were split in their views on seasonal pricing. Nearly 52 percent of respondents did not favor summer pricing differentials while 40 percent were in favor.

III-3 Toll Charges

In Table VIII, a sample of toll rates for passenger vehicles shows the Maine Turnpike's fares in comparison to neighboring highways. The Table shows that in the average rate per mile charged within the general travel region, Maine falls below the midpoint in relation to its immediate neighbors, with Massachusetts, New Hampshire, and New York toll roads showing higher rates per mile than the Maine Turnpike.

TABLE VIII
PASSENGER CAR TOLL RATES

Highway/ Mileage Length	Maximum Rate	Average Rate/Mile
N.H. Turnpike (16.1)	$.75	4.7
NY State Thruway (559)	$12.10	3.1
Mass. Turnpike (123)	$3.60	2.9
Maine Turnpike (100)	$2.70	2.7
NJ Turnpike (118)	$2.70	2.3

III-3.1 Municipal Officials—Tolls

Twenty-five out of thirty-six (69 percent) of the municipal officials surveyed indicated that they would support toll increases on the Turnpike if it were necessary for maintenance of the highway. Eight respondents (22 percent) were not in favor of toll increases; one respondent felt that increased tolls may be necessary, and one felt that no toll should be charged on the Turnpike.

III-3.2 Maine Residents—Tolls

Of the Maine residents polled, 79 percent believe that the current toll rates are justified given the level of service on the Turnpike. 14 percent felt that the rates were not justified and seven percent had no opinion.

Similarly, 74 percent of those polled believe that the Turnpike should continue to be a toll road, while 20 percent believe that it should not. 6 percent had no opinion.

III-3.3 Commuter Ticket System

In 1982, the Maine Turnpike's Commuter Discount Plan had approximately 3,000 participants. By 1988, that figure had grown to 9,500. The plan involves four quarterly prepayments and drivers are required to specify the two interchanges they most frequently use. These interchanges are then noted on their quarterly passes and when they enter an interchange, they receive a special commuter ticket. The driver then exits at the prechosen interchange and receives the reduced rate. If a driver exits at any other interchange than the one previously chosen, he pays the full toll. The average savings for commuters, assuming 10 trips per week for a 13 week period is approximately 62% of the present fare.

The results from the survey of municipal officials showed that most are quite pleased with the current commuter program. The majority (75 percent) wanted to maintain the exit-to-exit provision rather than switch to a county-wide program. The majority were also in favor of maintaining the current discount rate, while a few would like to see the rate reduced. Of the Maine citizens identified as frequent users of the Turnpike in the state-wide attitude survey, 9.4 percent were participants in the commuter plan. Of those individuals, 90 percent said they were satisfied with the amount of the commuter discount and 71 percent stated that the exit-to-exit restriction made sense to them.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS AND RECOMMENDATIONS

Introduction

It is clear from the most up-to-date traffic data that traffic growth is expected to be far greater than was earlier estimated, and that the widening is indeed justified.

The continuation of strong economic and traffic growth in the corridor provides increased confidence of further increases in demand for vehicles using the Maine Turnpike. Traffic has doubled on the Turnpike between 1980 and 1987 as a clear result of the economic activities in York County and the Greater Portland area.

In addition, the user benefits analysis shows that motorists would gain $429 million (in 1987 dollars) in benefits related to accident reduction, operating cost reductions and reduction in delays due to congestion over a 20-year time span.

It is imperative that the Maine Turnpike Authority and the Maine Department of Transportation continue and build upon integrating their traffic improvement programs in the Turnpike corridor. Integration involves the coordination of highway planning and public expenditures, to ensure that construction monies are providing the most value for the dollar.

Integration is necessary because highway planning is no longer an isolated function involving separate governmental entities. It is a dynamic process which must respond to the various land use changes affecting particular corridors.

In that regard, the capital improvement program recommended in this report responds to specific needs in the southerly corridor, northerly corridor and in the area to be served by a proposed westerly connector in the Greater Portland region.

In general, the components of the program in each region are:

I. Southerly Corridor

The widening of the Maine Turnpike from two to three lanes and the addition of a fourth lane capacity on bridges is necessary. The expansion should move forward immediately in order to maintain the Turnpike as a through road to all regions of Maine.

In so doing, the widening will help to alleviate the further compounding of Route 1 congestion, although it will not be the ultimate solution to Route 1's needs. In order to respond to the continuing congestion problem on Route 1, the Authority should provide MDOT $4 million annually, as authorized by the Legislature (above the current $4.7 million the Authority provides to MDOT) for the purposes of responding to Turnpike corridor road needs, in particular this southern section of Route 1.

Additionally, the Authority should provide planning and location engineering money to address Route 1 corridor needs in conjunction with MDOT and affected communities, as well as plan within its program for project costs in the range of $8 million by 1995 for Biddeford-Saco area access improvements.

II. Northerly Corridor

The objective of the Turnpike Authority on the northern section should be to promote increased use of the toll highway, encourage planned development, and improve local travel service.

In order to accomplish that objective, a closed-barrier system is recommended that would end the present ticket system just North of Gray, relocate the Augusta toll plaza operation to an area north of Lewiston and collect cash tolls at Gardiner, the relocated toll plaza, and on ramps as necessary to assure that all traffic movements are assessed an equitable toll. This concept is described in the northerly corridor study as Alternative "E". The costs of the conversion are nearly offset by the reduction in costs created by simplifying the Lewiston interchange under the new concept.

In addition, three interchanges were demonstrated in the study to be desirable additions to the region's traffic service needs. These should be included in the Authority's construction planning effort.

III. Westerly Connector

Potential improvement alternatives in the Route 302 corridor require further evaluation. The Turnpike Authority should assist the Maine Department of Transportation in evaluating the interconnection of those alternatives with the Turnpike.

Considerable effort is needed to identify the appropriate westerly corridor to serve Westbrook and Gorham. This decision rests primarily with the local communities and the Maine Department of Transportation. However, since any of the alternatives connect with the Turnpike and one of the funding sources may be the collection of tolls on the westerly connector, the Turnpike Authority should continue to actively participate in this evaluation process.

Also of importance is the impact that this decision will have on the interchange program in the Portland area, which should not proceed until the westerly connector location is resolved. In addition to the funding that should be held in reserve for the previously recommended Turnpike interchanges in the Portland area, it is recommended that the Authority share in the location engineering costs in the westerly corridor to more clearly define location alternatives in the corridors which may be determined worthy of further evaluation and plan development.

IV. PROJECT IMPLEMENTATION

IV-1 Construction Costs

In order to implement the aforementioned recommendations, the consultants have identified a series of projects, construction years and costs, in a manner consistent with the priorities expressed during Legislative review of the Turnpike program, i.e., widening the southern section and implementing the previously identified interchange program. Additionally, Table IX below reflects other project costs identified as priority during the course of this review. These projects address improvement needs within each of the three previously discussed sections of the Turnpike corridor.

The Table lists the construction year, the location and cost of the interchange additions and access improvements, and the amount of money needed for planning and location engineering. The table also divides the work associated with the widening into five different contracts.

The Table shows a total widening cost of $99,600,000, including a three lane road and four-lane bridges, and widening 31 bridges. In addition, $67,000,000 has been allocated for interchange improvements, access, planning and engineering.

IV-2 Pro Forma Income Statement

Table X displays the pro forma income statement which provides the economic justification for the widening. The Table assumes:

- A one-time 15 percent fare increase beginning Jan. 1, 1989, dramatically below the compounded 80 percent increase projected in the previous Turnpike improvement program;

- $8.7 million transferred annually from the Authority to MDOT, with the only exception to this noted in the Expenses section that follows; and

- A bond issue of $86 million, which meets the bond level authorization of the Turnpike Authority.

The Table shows that the improvement program proposed here can be completed by the Turnpike, while at the same time allowing the Turnpike to meet its operation, maintenance and debt obligations. Furthermore, the Table projects future year surpluses, which can allow the Authority to play a dynamic role regarding future corridor needs.

The Table lists finances under the following categories: Revenues, Expenses, Sources of Funds and Uses of Funds. Each is explained further below:

Table IX

Construction Costs
With Northerly Corridor Improvements

(THOUSANDS)

Construction Year	Interchange Additions & Access Improvements		Planning Location Engineering (Rt 1 So. & Port-West)	Widening	Total
1988	Lewiston Biddeford	$1,400 $3,200		0	$ 4,600
1989	Scarborough Saco(redesign)	$8,600 $400	$2,500	0	
	Northerly fare system conversion costs	$6,300			$ 17,800
1990			$2,500	Contract II $19,900	$ 22,400
1991	Congress St./ Portland Grove St. Sabattus/ Lewiston	$7,100 $2,500		Contract III, V, VI $59,500	$ 69,100
1992	Portland/ Westbrook	$6,000		Contract IV $20,200	$ 26,200
1993	Forest Ave./ Portland	$2,500			$2,500
1994	Gray Ogunquit	$400 $5,700			$6,100
1995	St. Rt.#9/ Sabattus/Lew Biddeford/Saco OOB Access	$3,100 $8,000			$ 11,100
1996	So. Main/Rt. 136/Auburn	$7,500			$7,500
TOTALS		$62,700	$5,000	$99,600	$167,300

NOTES:

1. The cost breakdown for each contract is as follows:

Contract	III	$24,900
	V	$12,900
	VI	$21,700
TOTAL		$59,500

2. Widening costs assume 3-lane road and 4-lane bridges.
3. Widening costs include 25% contingency and engineering costs.
4. Interchange and access improvement costs reflect the MTA's share only, based on the proportion of traffic corridor improvements that originate and/or terminate with travel on the Turnpike.
5. The York toll booth relocation costs are to be paid out of Reserve Maintenance.

Table X

Maine Turnpike Authority
Pro Forma Income Statement

Case 1: Toll increase equal to 15.00% - 30 year bond term

Schedule 1 of 2

Revenues

Year	Gross	Total Receipts Discount	Net	Concession	Other	Total Revenue
1988	31,233,000	562,194	30,670,806	1,422,000	500,000	32,592,806
1989	37,703,565	678,664	37,024,901	1,700,000	500,000	39,224,901
1990	40,100,685	721,812	39,378,873	1,870,000	500,000	41,748,873
1991	44,145,227	794,614	43,350,613	2,057,000	500,000	45,907,613
1992	46,955,747	845,203	46,110,543	2,262,700	500,000	48,873,243
1993	50,443,333	907,980	49,535,353	2,488,970	500,000	52,524,323
1994	53,667,750	966,019	52,701,730	2,737,867	500,000	55,939,597
1995	57,041,217	1,026,742	56,014,475	3,011,654	500,000	59,526,129
1996	61,410,254	1,105,385	60,304,870	3,312,819	500,000	64,117,689
1997	64,656,410	1,163,815	63,492,595	3,644,101	500,000	67,636,696
1998	67,879,810	1,221,837	66,657,973	4,008,511	500,000	71,166,484
1999	71,264,380	1,282,759	69,981,621	4,409,362	500,000	74,890,983
2000	74,818,065	1,346,725	73,471,340	4,850,298	500,000	78,821,638

Revenue Parameters

Total Increase Rate	15.00
Revenue Increase	13.50
Volume Discount Rate	1.80
Concession Base Amount	1,700,000
Concession Growth Rate	10.00
Other Base Amount	500,000
Other Growth Rate	0.00

Expenses

Year	Operating Maintenance	Current D/S	Reserve Maintenance	DOT Transfer	Total Expenses	Net Income
1988	14,908,000	0	6,000,000	4,700,000	25,608,000	6,984,806
1989	16,249,720	1,162,000	5,120,000	8,700,000	31,231,720	7,993,181
1990	17,712,195	555,000	5,440,000	8,700,000	32,407,195	9,341,678
1991	19,306,292		6,520,000	8,700,000	34,526,292	11,381,320
1992	21,043,859		7,035,000	7,925,000	36,003,859	12,869,385
1993	22,937,806		5,960,000	8,700,000	37,597,806	14,926,517
1994	25,002,208		3,590,000	8,700,000	37,292,208	18,647,389
1995	27,252,407		10,240,000	8,700,000	46,192,407	18,333,722
1996	29,705,124		6,985,000	8,700,000	45,390,124	18,727,565
1997	32,378,585		3,900,000	8,700,000	44,978,585	22,658,111
1998	35,292,658		4,945,000	8,700,000	48,937,658	22,228,827
1999	38,468,997		4,385,000	8,700,000	51,553,997	23,336,986
2000	41,931,207		8,385,000	8,700,000	59,016,207	19,805,432

Expense Parameters

Operating Maintenance Base Amount	14,908,000
Maintenance Operating Growth Rate	9.00
DOT Transfer Base Amount	8,700,000
DOT Transfer Growth Rate	0.00

Schedule 2 of 2

Sources of Funds

Year	Net Income	Improvement Fund Balance	Earnings	Available Funds
1988	6,984,306	20,500,000		27,484,806
1989	7,993,181	22,884,806	1,025,000	31,902,987
1990	9,341,678	83,794,223	1,144,240	94,280,142
1991	11,381,320	84,880,142	4,189,711	100,451,173
1992	12,869,385	36,264,199	4,244,007	53,377,590
1993	14,926,517	8,390,616	1,813,210	25,130,343
1994	18,647,389	9,543,368	419,531	28,610,288
1995	13,333,722	15,523,313	477,168	29,334,203
1996	18,727,565	11,247,229	776,166	30,750,960
1997	22,658,111	16,263,985	562,361	39,484,457
1998	22,228,827	32,497,483	813,199	55,539,509
1999	23,336,986	48,552,534	1,624,874	73,514,395
2000	19,805,432	66,527,420	2,427,627	88,760,479

Parameters

Per Amount of Bonds	86,000,000
Costs of Issuance	1,720,000
Reserve Fund	7,588,763
Bond Proceeds	76,691,237
Cost of Capital	7.93
Improvement Fund Earnings Rate	5.00
Reserve Fund Earnings Rate	7.93
Term of Bonds	30

Uses of Funds

Year	Project Costs	Debt Service Gross	Debt Service Earnings	Debt Service Net	Total Uses	Cumulative Surplus	Net Coverage Ratio
1988	4,600,000				4,600,000	22,884,806	
1989	24,800,000				24,800,000	7,102,987	
1990	9,400,000				9,400,000	84,880,142	
1991	57,200,000	7,588,763	601,789	6,986,975	64,186,975	36,264,199	5.19
1992	38,000,000	7,588,763	601,789	6,986,975	44,986,975	8,390,616	1.20
1993	8,600,000	7,588,763	601,789	6,986,975	15,586,975	9,543,368	1.37
1994	6,100,000	7,588,763	601,789	6,986,975	13,086,975	15,523,313	2.22
1995	11,100,000	7,588,763	601,789	6,986,975	18,086,975	11,247,229	1.61
1996	7,500,000	7,588,763	601,789	6,986,975	14,486,975	16,263,985	2.33
1997		7,588,763	601,789	6,986,975	6,986,975	32,497,483	4.65
1998		7,588,763	601,789	6,986,975	6,986,975	48,552,534	6.95
1999		7,588,763	601,789	6,986,975	6,986,975	66,527,420	9.52
2000		7,588,763	601,789	6,986,975	6,986,975	81,773,504	11.70

Revenues:

- Gross: Assuming a 15 percent fare increase on Jan. 1, 1989, estimated gross income would grow from $31 million in 1988 to $75 million in 2000. This is based on new and updated traffic estimated under the build condition, including the northerly conversion to a closed barrier fare collection system.

- Toll Receipts Discount: Represents the revenue deducted from the total gross due to the volume discount plan. The volume discount is calculated as 1.8 percent of gross toll revenues, based on current experience.

- Net: Represents the net income to the MTA after the deduction of the toll receipts discount from gross revenues.

- Concession: Represents earnings through lease agreements with operators of service areas on the Turnpike. Concession revenue projections are based on a 10 percent growth rate. The base year is 1989, with $1.7 million being the anticipated base on the new concession contract in that year.

- Other: Represents largely interest income from operating revenues.

- Total Revenue: Shows the net revenue available to the Turnpike. The chart shows that net revenue will grow from approximately $33 million in 1988 to $79 million in 2000.

Expenses:

- This section of the chart shows the annual expenses projected to be generated in the following four categories:

  1. Operating and maintenance. Operating and maintenance expenditures are projected at a 9 percent annual growth rate.

  2. Debt service. For the years 1989 and 1990, the figures represent remaining debt service payments on currently outstanding bonds.

  3. Reserve maintenance. The reserve maintenance fund covers on-going maintenance costs for existing Turnpike facilities. The estimate in the year 1995 includes $6.5 million to cover the relocation and reconstruction of the York toll plaza, a project required due to settlement problems at the existing location.

  4. MDOT deposits. This column includes the historical $4.7 million annual contribution to the MDOT for all years. Beginning in 1989, this column assumes an additional annual contribution of $4 million to the MDOT, as permitted by the 113th Legislature.

The additional amount, which brings the annual contribution to $8.7 million, is assumed to be paid in all years except 1992. In 1992, the amount transferred is less than the $8.7 million in order to ensure, for the purposes of this forecast a minimum ratio of 1.2 of surplus funds to debt service for that year. In actuality, the Turnpike may well be able to transfer the entire $8.7 million, assuming revenue continues to outrun even these forecasts in the earlier years. This is further discussed in the Revenue section of this report.

- Net Income. This column reflects surplus funds over and above expenses for each year in the forecast period.

Sources of Funds:

The sources of funds columns reflect the combined contribution of revenue derived from:

- Existing improvement fund balances;
- Annual net income; and
- The deposit of bond proceeds in the amount of $76,691,237 from the issuance of an $86 million bond in 1990.

Uses of Funds:

- The first column displays the project cost envisioned in this program for each year through 1996;
- The next column displays the annual debt service requirement on the issuance of an $86 million bond. The bond is assumed to have a cost of capital of 7.93 percent and a term of 30 years;
- The next column reflects the net debt service requirement after accounting for earnings from the improvement fund and debt service reserves;
- The cumulative surplus column displays annual surplus accumulations over project costs; and
- The net coverage ratio column demonstrates that the cumulative surplus will cover the minimum investment market ratio of 1.2 percent of annual debt service.

IV-3 Commuter System Recommendations

The Legislation that created the commuter ticket program permits the charging of commuter tickets up to 50 percent of regular charges. The system currently charges 50 percent of the pre-1982 toll charges, which is less than current charges. The across the board 15 percent fare increase will be applied to the commuter fare program, and will leave the level of discount at greater than 50 percent of the new charges. The consultants recommend no change at this time to the level of discount. The system will be undergoing a thorough review by the MTA designed to assess the administrative aspects of operating the system, including the development of better data regarding pattems of use, equity of charges and revenue implications of the commuter program.

One of the prime reasons for having a commuter fare system is to help divert traffic during the week to the Turnpike, thereby taking advantage of the underutilization at that time and relieving other congested roadways. Any changes that are made to the system should encourage and expand commuter use and ensure access to all commuters. However, no changes should be made to the system until the MTA's review is completed.

IV-4 Other Recommendations

1. The Turnpike Authority should conduct traffic management studies to address the following issues:

    - Appropriate traffic management approaches and the identification of strategies for implementing them;

    - The characteristics of travelers and how they relate to Route 1 congestion problems; and

    - A cost allocation study to determine the equity distribution of charges among categories of users with particular attention to the feasibility of establishing a seasonal pricing differential once widening is completed.

2. The Authority's bond issue indenture agreement should be designed with sufficient flexibility so that future, out-year surplus funds can be used to address evolving improvement programs within the corridor, once essential Turnpike needs are fulfilled.

APPENDICES

Appendix A
HISTORY OF MAINE TURNPIKE

This section provides an historical overview of how the turnpike evolved to its current state today.

The Maine Turnpike first opened for traffic on December 13, 1947. Developed at a cost of $20.6 million, it began as a 45-mile, four-lane divided highway running from Kittery to Portland.

A 66-mile extension to Augusta, including a four-mile spur to U.S. Route 1 in Falmouth, opened 8 years later in 1955. The cost was $78.6 million, including the refunding of approximately $20 million of the 1945 bond issue.

Through the years, the Turnpike has played a major role in relieving traffic congestion problems in the state's southern tier and addressing economic development issues at inland communities.

It is the intent of the Maine Legislature that the economic and social well-being of the citizens of the State depend upon the safety, efficiency and modern functional state of the Turnpike.

The Legislature's policy also states that safety and welfare requires the rebuilding, redesign or improvement of the existing Turnpike facilities from York to Augusta to accommodate the increased traffic experienced since the opening of the Turnpike and to provide Turnpike facilities which are consistent with modern knowledge of safety design; and that the economy of the State also requires such improvement in order to encourage travel and commerce into and out of the State.

Congestion problems on Route 1 in the 1940s gave impetus to the the creation of the Maine Turnpike Authority in 1941.

Immediately prior to the creation of the Authority, the State Highway Commission was concerned about the inadequate condition of Route 1 between Kittery and Portland. The State Highway Department proposed a number of by-passes to direct traffic away from congested and built-up areas on Route 1, but the Department's proposals were opposed by several municipalities and various groups that considered the by-passes detrimental to their welfare.

As transportation conditions worsened along the southern tip of Route 1, a small group from that section of the state began to consider the feasibility of a turnpike between Kittery and Portland.

Among the group's leaders were George D. Varney of York County, speaker of the Maine House of Representatives; Mrs. George C. Lord of Wells, a member of the State Highway Commission; and Representative Joseph Sayward of Kennebunk. The group was

influenced to a large extent by the construction of the Pennsylvania Turnpike in 1940, and Mr. Varney prepared a bill similar to the Pennsylvania Turnpike legislation. Mr. Sayward then presented it to the Legislature.

The Maine Turnpike Authority was created as an independent state agency and was given the authority to construct a turnpike "from some point at or near Kittery to a point at or near Fort Kent." The Legislature intentionally delegated the responsibility for turnpike construction to the Authority, and precluded any financial commitment by the State for turnpike construction and maintenance.

The Authority was empowered to issue bonds and establish tolls in order to raise revenues required to construct and operate a Turnpike.

The Legislature appropriated $10,000 for operating expenses for the Authority for the interim period between the time of appointment of Authority members and the issuance of Turnpike bonds. No other state monies, however, have been appropriated by the Legislature to the Authority.

Following full redemption of the Turnpike bonds, the Turnpike, by the 1941 Act, would become a toll-free highway administered by the State Highway Department. It was the first toll highway financed by revenue bonds to be built in the United States.

Movement towards an extension to Augusta began in the late 1940s, shortly after the original turnpike opened. The Maine Good Roads Association, a trade group, deemed the Kittery-to-Portland highway a success, and declared in a 1950 report that an extension of the toll road to Augusta, Waterville or Bangor would accelerate economic development in the state.

Traffic and engineering surveys were completed in the early 1950s, leading to the opening of the extension in 1955.

In 1971, the Authority, on a recommendation from its consulting engineers, undertook a comprehensive program of improvements to the southemmost section of the Maine Turnpike. One of these improvements was the enlargement of the Turnpike from a four-lane road to a six-lane road by the construction of two additional lanes, with the aim of eventual expansion of the Turnpike to eight lanes.

The Authority actually built several miles of new lanes and was continuing to build in order to finish its anticipated program. At this point, the State Department of Environmental Protection sought an opinion from the Attorney General as to the Authority's program and conduct in building additional lanes.

In a memorandum, the Attorney General concluded that indeed the Authority was subject to the law. The Maine courts determined that the Authority had exceeded the powers conferred to in its Enabling Act that existed at that time. The planned expansion was ultimately halted as a result of legal challenges.

Since 1973, when energy costs began to increase dramatically, public transportation agencies have been faced with the increasingly difficult problem of adequately funding the maintenance of existing facilities and improvement projects. Costs for asphalt and other oil-related products, so vital to highway maintenance, escalated rapidly, as did maintenance requirements, as the tax-supported Interstate Highway System began to age.

This was worsened by energy conservation measures of the motoring public who, when faced with rising motor fuel costs, made determined efforts to decrease gasoline consumption, thereby decreasing gas tax income to the federal and state governments.

Over the years, tripartite agreements have been entered into by the federal government, the Maine Department of Transportation and the Maine Turnpike Authority for use of federal money on connections between the Turnpike and the Interstate Highway System. The federal monies involved totalled approximately $8.7 million. Under the agreement, the Maine Turnpike would convert to a tax-supported status upon retirement of the then current bonded indebtedness.

As the Turnpike approached the bond repayment date, the issue of whether the road should remain as a toll road became a subject of controversy and debate in the Maine Legislature. In the late 1970s, the Legislature adopted a plan to convert the Turnpike to a barrier system for fare collection, thereby foregoing some level of revenue that could be applied to maintenance and operation.

This issue was revisited again in the early 1980s in the face of declining gas tax dollars and other demands on MDOT revenue. The Legislature reversed the earlier position and decided to maintain the closed system toll structure.

This was accomplished through Legislative Document (L.D.) No. 1691 (Chapter 492, Public Laws of the State of Maine, 1981) relating to the future operations of the Maine Turnpike. In summary, the bill included the continuation of tolls on the turnpike; established a priority system for construction of access roads or interchanges beginning with industrial park areas in Lewiston and Auburn; authorized a $4.7 million Turnpike revenue contribution to MDOT if the funds are available; and led to the implementation of the commuter pass system. A new bond was issued in order to repay the aforementioned federal monies.

MDOT and the Turnpike Authority sought and received congressional approval to repay without interest the initial federal contributions, and to remain as an operating toll road after debt retirement.

In 1987, the Legislature gave the Turnpike Authority permission to widen the Turnpike from two to three lanes, and increased the Authority's bonding capacity to help pay for the work.

Today, the official limits of the Maine Turnpike extends 100 miles from the York Toll Plaza on the south to the Augusta Toll Plaza in the north. There are 14 internal interchanges. Two of the interchanges provide only partial service. The Scarborough Interchange, Exit 6A, serves traffic to and from the south only, while the Scarborough Downs Interchange, Exit 6, is operated seasonally in conjunction with the Scarborough Downs Race Track.

From Kittery to Portland, the Turnpike follows an alignment which is generally parallel to, and in close proximity to, U.S. Route 1. North of Portland, the alignment takes a more inland routing toward the communities of Lewiston and Aubum, onward to the terminal point in Augusta.

The Maine Turnpike section between the York Toll Plaza, Exit 1, and the Falmouth-Route 1 Interchange, Exit 9, has been incorporated into the Interstate Highway System as Interstate 95, or I-95. The section between Exit 9 and Exit 14 is designated as I-495. The I-95 designation is used on the section between the Gardiner Interchange, Exit 14, and the northern terminal point at the Augusta Toll Plaza, Exit 15.

In late 1973, the Scarborough Interchange, Exit 6A, was opened to traffic, providing a connection between the Turnpike and Interstate Route 295. This route traverses an alignment south and east of Portland connecting with Interstate Route 95 at Falmouth. As a result of the Interstate Routes 295 and 95 construction, a highly competitive routing to the Maine Turnpike is available for motorists desiring to travel between Portland and Gardiner, and points beyond.

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APPENDIX C
MUNICIPAL SURVEY QUESTIONNAIRE AND SUMMARY OF RESPONSES

1. Are you familiar with the 1984 Maine Turnpike capital improvement study?

Yes	19
No	9
Somewhat	7
N/A	1

2. What is your opinion of adding a third lane?

Yes	29
No	6
Maybe	1

3. What is your opinion of preparation for a fourth lane?

Yes	23
No	9
Later	3
Maybe	1

4. Do you support the proposed interchange program?

Yes	12
No	7
Maybe	2
Not familiar	13
Only Ogunquit	1
Not Ogunquit	1

4b. Are other interchanges needed? Where?

Yes	2
No	7
Wells/Ogunquit	5
Ogunquit	2
Arundel	2
Biddeford	2
Saco	1
Kittery/York	1
Scarborough	1
York Beach	1
Cutts Road	1
Dennett Road	1
Congress Street—7a	1
N&S of Ogunquit	1
OOB/S Portland	1

4c. Do you believe any interchanges should be seasonal?

Yes	1
No	14
Maybe	1

Which ones?

Wells/Ogunquit	3
Wells/York	2
N&S of Ogunquit	1

5a. Do you believe the Turnpike widening would impact on Route 1?

Yes	19
No	13
Maybe	1
Don't know	1

5b. How will it impact Route 1?

- Relieve congestion, decrease traffic on Route 1 — 14
- Increase traffic along Route 1 — 4
- Bring more tourists to ME/Turnpike more attractive, net effect immeasurable — 2
- Shoppers will use Route 1 regardless — 1
- New interchange will not help, more people seem to enter Route 1 than to exit — 1

6. Ranking of projects/issues

Ranks					**Categories**
1	**2**	**3**	**4**	**5**	
17	8	1	1	0	Third lane
0	10	7	3	2	Prep for fourth lane
5	1	1	0	0	Interchange-Ogunquit
6	2	9	3	1	Use of $ for MDOT
1					Interchange-Saco
1					Interchange-Dennett Road
1					Interchange-Cutts Road
1					Interchange-Congress Street
1					Improve off-Turnpike roads
1					Place MTA under DOT
0	1	0	1	0	Interchange-Wells/Ogunquit
0	1				Remove tolls
0	1				Interchange-Scarborough
0	1				Interchange-N&S of Ogunquit
0	0	1			Interchange-Arundel
0	0	0	1		Interchange-Kennebunk/ Biddeford

7a. Do you support toll increases?

Yes*	25
No	8
Maybe	1
No tolls	1

* Most said, "if necessary to maintain the highway"

7b. Should the toll increases be across the board?

Yes	20
No	8

7c. Should the increase be at the level proposed?

Yes	16
No	6
Don't know	7

7d. Should tolls be higher during peak traffic hours, such as during the summer months and weekends?

Yes	10
No	25

7e. Do you favor county-wide or exit-to-exit commuter passes?

Exit to exit	23
County-wide	6
Both	2

7f. Should the commuter rate remain at its current rate?

Current rate	22
Reduced rate	7
Increased	1
No Answer	3

Appendix D

ATTITUDINAL SURVEY QUESTIONNAIRE AND SUMMARY OF RESPONSES

Hello, I'm _____, and I'm calling for Pulse Unlimited, a public opinion polling company, and I'd like to ask you a few questions on a strictly confidential basis.

1. Are you over 18 years old? (*If not, ask to speak to someone at this number who is 18 years or older. If no person at this number over 18 or the number is not a residence, terminate interview.*)

Yes	1	100%

2. Generally, what is your opinion of the overall transportation system in Maine? (roads, buses, trains)

Excellent	1	2.4%
Good	2	31.5
Fair	3	33.2
Poor	4	14.7
Don't know	5	18.2

3. What about the road system alone?

Excellent	1	2.7%
Good	2	35.1
Fair	3	36.4
Poor	4	24.5
Don't know	5	1.3

4. In your judgment, how important is the road system in Maine for economic development?

Very important	1	75.8%
Somewhat important	2	16.6
Somewhat unimportant	3	2.8
Very unimportant	4	0.2
Don't know	5	4.6

5. In your judgement, how important is the road system in Maine for tourism?

Very important	1	74.1%
Somewhat important	2	18.5
Somewhat unimportant	3	3.6
Very unimportant	4	1.3
Don't know	5	2.5

6. Generally, how would you rate your Legislature in its handling of the road system and related problems?

Very favorable	1	12.5%
Somewhat favorable	2	39.3
Somewhat unfavorable	3	18.4
Very unfavorable	4	11.9
Don't know	5	17.9

7. When you think of the Maine Turnpike and the way it is maintained, which of the following views comes closest to your own?

I believe it is better maintained than other state roads.	1	61.4%
I believe it is less well maintained than other state roads.	2	3.2
I believe it is maintained about the same as other Maine roads.	3	26.9
Don't know.	4	5.9

8. Do you think that the current toll rates are justified, given the level of service on the Maine Turnpike?

Yes	1	79.4%
No	2	13.9
Don't know	3	6.6

9. In your opinion, should the Maine Turnpike continue to be a toll road?

Yes	1	73.9%
No	2	19.9
Don't know	3	6.5

10. Would you be more or less in favor of abolishing the tolls if you knew that over 40% of the money comes from out-of-state visitors?

Much more in favor of abolishing	1	14.6%
Somewhat more in favor of abolishing	2	4.0
Somewhat less in favor of abolishing	3	16.0
Much less in favor of abolishing	4	56.8
Don't know	5	8.7

11. Would you be more or less in favor or charging higher tolls for those who use the Maine Turnpike during the peak summer hours if this meant that a higher percent of revenue would come from out-of-state visitors?

Much more in favor	1	21%
Somewhat more in favor	2	8.2
Somewhat less in favor	3	10.3
Much less in favor	4	54.4
Don't know	5	6.0

12. Would you personally be willing to pay higher tolls in the summer if you knew that it would reduce your toll costs on a yearly basis?

Yes	1	39.5%
No	2	51.9
Don't know	3	8.6

13. What is your current view of the Maine Turnpike Authority?

Very favorable	1	23.1%
Somewhat favorable	2	34.3
Somewhat unfavorable	3	5.1
Very unfavorable	4	3.6
Don't know	5	33.9

14. Speaking of the Maine Turnpike authority, some people say that it should be abolished and its responsibilities taken over by the Department of Transportation directly. Other people say the present system is working well and shouldn't be changed. Which view comes closest to your own?

Feel strongly Authority should be abolished	1	10%
Feel Authority should be abolished	2	5.2
Feel Authority should not be abolished	3	24.5
Feel strongly Authority should not be abolished	4	25.8
Don't know	5	34.5

15. Currently, there are plans to widen the Maine Turnpike from four to six lanes from Kittery to South Portland. At the present time, are you for or against widening the Maine Turnpike?

Very much in favor	1	42.9%
Somewhat in favor	2	12.8
Somewhat against	3	7.3
Very much against	4	30.2
Don't know	5	6.8

16. Who do you think benefits most by widening the Maine Turnpike? (*Do not read*)

All/everybody/most people	1	38%
Truckers	2	4.3
Tourists	3	25.6
Commuters	4	7.8
Communities along the Turnpike	5	10.3
Nobody/no benefit	6	5.5
Other (*keep list*)	7	3.5
Don't know	8	5.1

17. In your opinion, who will ultimately end up paying for most of the cost of widening the Maine Turnpike? (*Do not read*)

Everybody in Maine	1	72.3%
People who use it	2	16.8
Out-of-staters/visitors/tourists	3	4.7
Nobody	4	.2
Other (*keep list*)	5	2.7
Don't know	6	3.3

Would you be more or less in favor of widening the Maine Turnpike and improving it if you knew the following?

18. That the total project would cost $128 million?

Much more in favor	1	20.7%
Somewhat more in favor	2	13.3
Somewhat less in favor	3	15.3
Much less in favor	4	39.7
Don't know	5	10.9

19. That of the total project, $84 million would go for widening the Turnpike and rebuilding 31 bridges and $44 million would go to create or reconstruct 9 interchanges and access roads?

Much more in favor	1	24.2%
Somewhat more in favor	2	22.3
Somewhat less in favor	3	11.6
Much less in favor	4	30.6
Don't know	5	11.3

20. That the project would lead to increased tolls?

Much more in favor	1	18.6%
Somewhat more in favor	2	20.8
Somewhat less in favor	3	16.3
Much less in favor	4	36.5
Don't know	5	7.8

21. That the project *would not* lead to increased tolls?

Much more in favor	1	32.5%
Somewhat more in favor	2	24.6
Somewhat less in favor	3	7.6
Much less in favor	4	26.1
Don't know	5	9.2

22. That it would be much more expensive to widen the road in the future?

Much more in favor	1	33.9%
Somewhat more in favor	2	25.9
Somewhat less in favor	3	7.8
Much less in favor	4	26.1
Don't know	5	6.3

23. That it would lead to more tourists coming to Maine?

Much more in favor	1	33.9%
Somewhat more in favor	2	20.9
Somewhat less in favor	3	9.5
Much less in favor	4	2.8
Don't know	5	7.8

24. That its primary purpose would be to relieve congestion on 10 weekends during the summer?

Much more in favor	1	34.3%
Somewhat more in favor	2	19.3
Somewhat less in favor	3	12.0
Much less in favor	4	29.6
Don't know	5	4.7

25. That traffic flows are increasing 7% per year on the Maine Turnpike?

Much more in favor	1	35.6%
Somewhat more in favor	2	22.6
Somewhat less in favor	3	7.4
Much less in favor	4	26.9
Don't know	5	7.4

26. That projected increases in traffic will lead to stop-and-go driving in the portion of the Turnpike from Kittery to South Portland by the year 1994?

Much more in favor	1	37%
Somewhat more in favor	2	21.1
Somewhat less in favor	3	7.9
Much less in favor	4	26.5
Don't know	5	7.5

27. Speaking of congestion, some people say that the congestion on the Maine Turnpike is bad and getting worse, and we have to do something about it. Others say it's no worse than in the past, and we don't have to do anything about it. Still others say it has gotten worse, but we don't have to do anything about it at this point. Which view comes closest to your own?

Congestion getting worse—we need to do something about it.	1	50.9%
Congestion isn't getting worse—we don't need to do anything about it.	2	20.3
Congestion is getting worse, but we don't have to do anything about it at this point.	3	15.2
Don't know	4	13.6

28. Have you personally experienced any significant delays in your travels on the Maine Turnpike during the past year?

Yes	1	27.7%
No	2	70.4
Don't know	3	1.9

29. In your view, would widening the Maine Turnpike relieve congestion?

Widening the highway will not relieve congestion.	1	16.5%
Widening the highway will have no effect on congestion	2	16.0
Widening the highway will relieve congestion.	3	59.6
Don't know.	4	10.0

30. Do you presently use any portion of the Maine Turnpike?

No	1	20.8%	To county
Yes (portion north of Portland)	2	18.4	use #1
Yes (portion south of Portland)	3	31.2	use #2
Yes (both portions)	4	29.3	use #2
Don't know	5	0.3	

31. What is your primary purpose for using the Turnpike?

Work	1	21.9%
Shopping	2	17.3
Visiting relatives/friends	3	35.5
Recreation (dining out, movies, etc.)	4	24.9
Don't know/don't use it	5	.4

- *If answer to question #30 was "no," go to question #34.*
- *If answer to question #30 was "yes—north," ask question #32 and then go to question #34.*
- *If answer to question #30 was "yes—south" or "yes—both," go to question #33 and proceed.*

32. How often do you use the northern portion of the Turnpike?

Frequently (5 days a week or more)	1	3.2%
Often (2-5 days a week, during the week)	2	4.8
Often (2-5 days a week, some during the weekend)	3	8.1
Occasionally (once every two weeks or less)	4	30.6
Infrequently (1 day a month or less)	5	43.5
Rarely/Don't know	6	9.7

33. How often do you use the southern portion of the Turnpike?

Frequently (5 days a week or more)	1	8.4%
Often (2-5 days a week, during the week)	2	5.8
Often (2-5 days a week, some during the weekend)	3	16.1
Occasionally (once every two weeks or less)	4	26.6
Infrequently (1 day a month or less)	5	31.1
Rarely/Don't know	6	11.9

34. What county do you live in? (*By observation*)

Region I	(Aroostook)	1	(7.7%)	7.6%
Region II	(Hancock/Washington)	2	(6.7%)	6.4
Region III	(Penobscot/Piscataquis)	3	(13.5%)	13.8
Region IV	(Kennebec/Somerset)	4	(13.7%)	13.8
Region V	(Lincoln/Knox/Waldo/Sagadahoc)	5	(10.5%)	10.6
Region VI	(Cumberland)	6	(19.3%)	19.4
Region VII	(Franklin/Oxford/Androscoggin)	7	(15.5%)	15.4
Region VIII	(York)	8	(13.1%)	12.8

(*Ask of Cumberland and York County residents only, all others get marked as "3s'" for question #36.*)

35. How close do you live to the Maine Turnpike south of Portland?

Less than 15 minutes away	1	37.3%
15-30 minutes away	2	7.3
Over 30 minutes away	3	55.4

The following portion of the questionnaire is for those people who say they use the Maine Turnpike "frequently" or "often" ***no matter where they live and for those who live within 30 minutes of the southern portion of the Turnpike.*** *All others go to question #55.*

36. During the summer months, do you ever avoid the Maine Turnpike because you know it will be too crowded?

No	1	72.5%
Yes, occasionally	2	16.3
Yes, frequently	3	10.0
Don't know	4	1.3

37. Do you ever avoid Route One because you know it will be too crowded?

No	1	24.4%
Yes, occasionally	2	19.4
Yes, frequently	3	52.8
Don't know	4	3.4

38. Do you use the Turnpike's frequent commuter discount program?

Yes	1	9.4%
No	2	90.3
Don't know	3	.3

(*If answer to #38 is "yes," ask #39 and #40; otherwise go to #41.*)

39. Are you satisfied with the amount of the discount?

Yes	1	90.3%
No	2	0
Don't know	3	9.7

40. Do you feel that the exit-to-exit restriction makes sense?

Yes	1	71%
No	2	12.9
Don't know	3	16.1

41. What would cause you to use the Turnpike more? (*Do not read*)

Lower tolls	1	5.6%
Better discounts	2	.6
Fewer restrictions	3	.6
Less congestion	4	18.1
More interchanges	5	3.8
Other reasons	6	32.5
Don't know	7	38.8

42. What would cause you to use the Turnpike less? (*Do not read*)

Tolls too high	1	12.6%
Too much congestion	2	24.8
Other reasons	3	9.7
Don't know	4	8.5
Wouldn't less use Turnpike	5	44.3

Some people say there is no need to widen the Turnpike at the present time, that the summer and week-end congestion can be dealt with in other ways.

43. One of these proposals would be to have southern Maine employees get out of work at different times (ranging from 3:00 p.m. to 7:00 p.m.) to help prevent congestion during peak use times. Would you be for or against such an alternative?

Strongly for	1	32.6%
Somewhat for	2	18.2
Somewhat against	3	10.3
Strongly against	4	26.6
Don't know	5	12.2

44. Would you **personally** be willing to work staggered work days to help relieve congestion on the Maine Turnpike?

Yes, strongly	1	26.6%
Yes, somewhat	2	11.9
No, somewhat	3	7.2
No, strongly	4	34.7
Don't know	5	19.7

45. Another way which has been suggested is to dramatically increase the highway tolls at the most crowded times, such as tripling the cost of tolls during selected hours on summer weekends. Would you be in favor of or against such an alternative?

Yes, strongly	1	10.9%
Yes, somewhat	2	6.3
No, somewhat	3	7.5
No, strongly	4	71.3
Don't know	5	4.1

46. Would a tripling of tolls during peak hours make you change **your** driving habits and not use the Turnpike during these times?

Very likely	1	55.6%
Somewhat likely	2	10.6
Somewhat unlikely	3	5.9
Not very likely at all	4	22.5
Don't know	5	5.3

47. If you personally had to choose between paying higher tolls or experiencing more congestion, which would you pick?

Higher tolls	1	64.1%
More congestion	2	21.9
Don't know	3	14.1

48. Another way which has been suggested is to expand existing ride share programs offered by private business and state government. Would you be in favor of or against such an alternative?

Strongly for	1	57.2%
Somewhat for	2	19.7
Somewhat against	3	5.6
Strongly against	4	6.6
Don't know	5	10.9

49. How likely is it that **you** would ever join a ride share program?

Very unlikely	1	38.6%
Somewhat unlikely	2	12.2
Somewhat likely	3	15
Very likely	4	26.3
Don't know	5	7.8

50. Still another proposal would be to have such major traffic destinations as the Maine Mall charge for parking, therefore encouraging drivers to car pool or go less frequently. Would you be for or against such a proposal?

Strongly for	1	10.6%
Somewhat for	2	6.3
Somewhat against	3	6.9
Strongly against	4	68.4
Don't know	5	7.8

51. If the Maine Mall charged for parking, would it reduce the number of times **you** went there or make you more likely to car pool?

Much more likely	1	41.6%
Somewhat more likely	2	15.3
Somewhat less likely	3	10.6
Much less likely	4	20.3
Don't know	5	12.2

52. In your judgment, which area most needs an additional interchange on the southern portion of the Maine Turnpike?

Ogunquit	1	16.6%
Old Orchard Beach	2	12.5
Biddeford	3	7.2
Arundel	4	0.9
Between Biddeford and Kennebunkport	5	9.4
York Beach	6	5.6
Don't know	7	47.8

53. Which would be your second choice?

Ogunquit	1	6.6%
Old Orchard Beach	2	9.4
Biddeford	3	4.7
Arundel	4	1.6
Between Biddeford and Kennebunkport	5	8.8
York Beach	6	5.9
Don't know	7	63.1

Now, I'd like to ask you a few questions for purely statistical purposes.

54. Sex/Occupation

Male/works at home	1	13.8%
Male/works outside the home	2	28.8
Female/works at home	3	27.7
Female/works outside the home	4	29.7

55. Age

18-24	1	8.2%
25-44	2	43.7
45-60	3	23.4
Over 60	4	24.7

56. Turnpike Oversample

Base survey (500)	1	79.1%
Corridor Oversample (150)	2	20.9

57.	Town Code		
	Other	1	63.1%
	Kittery	2.1	1.1%
	Kennebunkport	2.2	1.9
	Kennebunk	2.3	1.7
	Wells	2.4	1.6
	Ogunquit	2.5	.8
	Old Orchard	2.6	1.4
	South Berwick	2.7	0.9
	Lyman	2.8	0
	Arundel	2.9	0.5
	North Berwick	3.1	0.3
	Saco	3.2	2.4
	York	3.3	1.7
	Alfred	3.4	.3
	Scarborough	3.5	0.8
	Sanford	3.6	2.1
	Biddeford	3.7	3.2
	South Portland	3.8	4.4
	Portland	3.9	9.2
	Cape Elizabeth	4.1	0.9
	Westbrook	4.2	1.4
58.	Education		
	Grade school	1	7.6%
	High school graduate	2	43.7
	Some college	3	21.1
	College graduate	4	27.6
59.	Approximate total income of household		
	$0-$14,999	1	18.2%
	$15-$29,999	2	32.8
	$30-49,999	3	25.6
	Over $50,000	4	10.0
	Don't know/won't say	5	13.4

Appendix E

Average Annual Daily Traffic
1987

Southbound	Northbound		
8,506	7947	15.	Augusta
3,751	3770	14.	Gardiner
5,458	5,368	13.	Lewiston
7,349	7,406	12.	Auburn
8,859	8,912	11.	Gray
9,226	9,211	10.	Portland-North
13,067	12,759	9.	Falmouth-Route 1
14,298	14,078	8.	Portland-Westbrook
13,555	13,193	7.	South Portland
20,029	20,122	6A.	Scarborough
19,971	20,143	6.	Scarborough Downs
18,473	18,410	5.	Saco
16,481	16,332	4.	Biddeford
15,659	15,653	3.	Kennebunk
15,487	15,469	2.	Wells-Sanford
		1.	York

APPENDIX F

ANNUAL ENTERING AND EXITING TRAFFIC TRENDS

TOTAL VEHICLES

INTERCHANGE	1975	1978	PERCENT CHANGE	1979	PERCENT CHANGE	1980	PERCENT CHANGE	1981	PERCENT CHANGE	1982	PERCENT CHANGE	1983	PERCENT CHANGE	1984	PERCENT CHANGE	1985	PERCENT CHANGE	1986	PERCENT CHANGE	1987	COMPOUNDED ANNUAL PERCENT CHANGE 1975-1987	COMPOUNDED ANNUAL PERCENT CHANGE 1980-1987
1 York	16,200	18,986	(6.2)	17,807	3.0	18,334	6.1	19,460	7.8	20,978	6.4	22,326	5.4	23,533	7.8	25,379	11.5	28,303	9.4	30,960	5.5	7.8
2 Wells-Sanford	2,549	3,533	(3.8)	3,398	9.7	3,728	7.2	3,997	11.6	4,460	6.0	4,727	13.0	5,341	11.0	5,929	16.2	6,888	11.7	7,691	9.6	10.9
3 Kennebunk	1,567	2,315	10.3	2,554	(0.9)	2,530	6.1	2,684	11.6	2,995	5.9	3,173	12.3	3,563	8.7	3,872	17.8	4,562	10.5	5,041	10.2	10.4
4 Biddeford	2,967	4,287	5.0	4,503	3.8	4,674	7.3	5,016	13.2	5,678	6.6	6,051	12.3	6,798	10.4	7,507	12.8	8,468	11.4	9,432	10.1	10.6
5 Saco	2,797	4,127	4.2	4,302	6.3	4,572	5.2	4,809	13.8	5,473	20.7	6,606	22.6	8,097	17.9	9,534	16.8	11,133	15.5	12,864	13.6	15.9
6 Scar. Downs	SEASONAL INTERCHANGE																					
6A Scarborough	3,732	6,638	2.1	6,780	7.2	7,265	8.3	7,871	11.1	8,743	7.9	9,430	10.8	10,445	3.8	10,837	10.5	11,980	11.9	13,408	11.2	9.2
7 So. Portland	6,557	8,463	0.3	8,488	(0.6)	8,436	3.1	8,698	12.8	9,808	8.9	10,685	16.1	12,401	11.5	13,829	15.7	15,994	10.8	17,723	8.6	11.2
8 Port-Westbrook	6,944	8,144	(3.1)	7,891	(1.9)	7,744	5.3	8,158	10.6	9,023	5.6	9,530	10.9	10,568	9.2	11,542	17.0	13,506	12.2	15,159	6.7	10.1
9 Falmouth-Rt 1	4,338	4,604	(6.5)	4,307	(0.8)	4,273	4.9	4,482	8.1	4,846	6.3	5,150	9.9	5,662	17.8	6,668	29.1	8,611	10.5	9,511	6.8	12.1
10 Portland North	1,769	2,051	2.2	2,097	(2.3)	2,049	4.0	2,130	14.3	2,434	9.2	2,657	17.5	3,123	14.8	3,584	19.0	4,265	17.8	5,023	9.1	13.7
11 Gray	2,494	3,171	(3.8)	3,051	(0.7)	3,029	4.3	3,158	10.1	3,477	9.1	3,792	12.1	4,252	10.1	4,681	18.3	5,539	19.4	6,616	8.5	11.8
12 Auburn	3,752	4,701	0.7	4,735	(1.0)	4,686	5.3	4,936	10.3	5,446	6.3	5,787	8.0	6,252	4.8	6,549	14.8	7,515	13.3	8,515	7.1	8.9
13 Lewiston	2,930	3,810	(10.7)	3,403	(1.9)	3,337	5.5	3,519	11.2	3,914	3.7	4,058	7.4	4,359	7.7	4,696	9.3	5,135	10.0	5,649	5.6	7.8
14 Gardiner	2,102	5,127	3.0	5,283	1.2	5,347	6.0	5,668	13.4	6,427	6.3	6,833	8.3	7,400	9.2	8,083	12.6	9,104	29.3	10,451	14.3	10.1
15 Augusta	8,200	10,347	(3.9)	9,942	0.3	9,974	4.5	10,424	7.9	11,252	6.7	12,008	6.5	12,794	6.4	13,612	12.1	15,263	11.4	17,007	6.3	7.9
TOTAL	68,898	90,304	(2.0)	88,541	1.6	89,978	5.6	95,010	10.5	104,954	7.5	112,813	10.4	124,588	9.4	136,302	14.6	156,266	12.0	175,050	8.1	10.0

Appendix G

Average Annual Daily Traffic
Existing Interchanges
2000

Southbound	Northbound		
17,240	16,291	15.	Augusta
6,398	6,505	14.	Gardiner
10,037	9,948	13.	Lewiston
14,389	14,609	12.	Auburn
18,323	18,508	11.	Gray
19,412	19,427	10.	Portland-North
27,361	26,754	9.	Falmouth-Route 1
30,318	29,918	8.	Portland-Westbrook
29,419	28,697	7.	South Portland
44,837	45,213	6A.	Scarborough
44,731	45,262	6.	Scarborough Downs
40,198	40,087	5.	Saco
34,813	34,478	4.	Biddeford
32,204	32,214	3.	Kennebunk
31,012	30,638	2.	Wells-Sanford
		1.	York

Appendix H

Average Annual Daily Traffic
Future Interchanges
2000

Southbound	Northbound		
19,295	18,451	15.	Augusta
9,319	9,619	14.	Gardiner
9,443	9,737	13B.	State Route 9
8,593	8,877	13A.	Grove Street
11,123	11,405	13.	Lewiston
14,501	14,781	12A.	S. Main Street, St. Rt. 136
14,770	15,143	12.	Auburn
18,526	19,756	11.	Gray
20,404	21,492	10.	Portland-North
29,266	30,168	9.	Falmouth-Route 1
31,317	32,218	8A.	Forest Avenue
33,134	33,182	8.	Portland-Westbrook
32,341	32,391	7A.	Congress Street
30,573	30,303	7.	South Portland
44,988	45,934	6A.	Scarborough
44,999	45,935	6.	Scarborough Downs
41,479	41,582	5.	Saco
33,707	33,830	4.	Biddeford
32,034	32,469	3.	Kennebunk
31,489	31,780	2.	Wells-Sanford
31,191	31,484	1A.	Ogunquit-Wells
		1.	York

Appendix I
LEVELS OF SERVICE

The following level of service definitions are derived from the *Highway Capacity Manual*, 1985 Transportation Research Board, National Research Council.

- *Level of Service A* - Level A describes primarily free flow operations. Average travel speeds near 60 mph generally prevail on 70 mph freeway elements. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. This affords the motorist a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed at this level. Although they may cause a deterioration of LOS in the vicinity of the incident, standing queues will not form, and traffic quickly returns to LOS A on passing the disruption.

- *Level of Service B* - Level B also represents reasonably free-flow conditions, speeds of over 57 mph are maintained on 70-mph freeway elements. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and breakdowns are still easily absorbed, though local deterioration in service would be more severe than for LOS A.

- *Level of Service C* - Level C provides for stable operations, but flows approach the range in which small increases in flow will cause substantial deterioration in service. Average travel speeds are still over 54 mph. Freedom to maneuver within the traffic stream is noticeably restricted at LOS C, and lane changes require additional care and vigilance by the driver. Minor accidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage. The driver now experiences a noticeable increase in tension due to the additional vigilance required for safe operation.

- *Level of Service D* - Level D borders on unstable flow. In this range, small increases in flow cause substantial deterioration in service. Average travel speeds of 46 mph or more can still be maintained on 70 mph freeway elements. Freedom to maneuver within the traffic stream is severely limited, and the driver experiences drastically reduced physical and psychological comfort levels. Even minor incidents can be expected to create substantial queueing, because the traffic stream has little space to absorb disruptions.

- *Level of Service E* - The boundary between LOS D and LOS E describes operation at capacity. Operations in this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or a vehicle changing lanes, causes following vehicles to give way to admit the vehicle.

This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruptions. Any incident can be expected to produce a serious breakdown with extensive queueing.

The range of flows encompassed by LOS E is relatively small compared to other levels, but reflects a substantial deterioration in service. Maneuverability within the traffic stream is extremely limited, and the level of physical and psychological comfort afforded to the driver is extremely poor. Average travel speeds at capacity are approximately 30 mph.

- *Level of Service F* - Level F describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points. Such breakdowns occur for a number of reasons:

  1. Traffic incidents cause temporary reduction in the capacity of a short segment, such that the number of vehicles arriving at the point is greater than the number of vehicles that can traverse it.

  2. Recurring points of congestion exist, such as merge or weaving areas and lane drops where the number of vehicles arriving is greater than the number of vehicles traversing the point.

  3. In forecasting situations, any location presents a problem when the projected peak hour (or other) flow rate exceeds the estimated capacity of the location.

Appendix J

Technical Memorandum
User Benefits Analysis
Maine Turnpike Widening Program

We are pleased to submit this Technical memorandum summarizing the results of Task 4 of the Maine Turnpike Special Studies, the User Benefits Analysis. This task was performed to determine the estimated benefits to motorists which could be realized by the widening of the Tumpike form its current four-lane configuration to a six-lane cross section south of Interchange 6A.

Analysis Methodology

An iterative computer process was developed especially for this task to calculate the benefits related to accident reduction, operating cost reductions and reduction in delay to motorists. The analysis was performed for each segment of the Turnpike south of Interchange 6A individually for the years 1987, 1992, 1997, and 2000. As a basic input to this analysis, the results of Task 2 were utilized to obtain the average daily mainline traffic densities at each of the aforementioned years. For all years, except 1987, the "build" condition was assumed which included an interchange at Ogunquit-Wells and other new interchanges in the Portland area. Benefits were estimated by the program for 1987, representing a base condition from which to judge the reasonableness of the results, as well as 1992, the assumed first year of tumpike widening, 1997 and 2000. The interim years were extrapolated from these intervals. However, final net discounted benefits for use in the economic feasibility assessment assumed the widening to be completed by the beginning of 1992. The final benefits covered the 20-year period, 1992 through 2011.

The average daily mainline densities were input into the model for three vehicle class categories by mainline segment. These categories were passenger cars - cash, passenger cars - commuter and commercial vehicles. Each input volume was varied to reflect monthly variations. The monthly variations were based on 1987 monthly traffic data provided by the Authority. The result of this was an average monthly traffic estimate for each vehicle class category for each mainline segment at each of the analysis years. The vehicle classes were then summed for each mainline segment.

The average total monthly traffic was then varied to reflect daily traffic patterns by mainline segment by direction. The peak summer months, that is, May through September, were stratified by daily variations recorded during July, 1987. The remaining months used April daily variation data. The results of this step provided a typical Monday through Sunday for each of the months by direction and mainline segment at each of the analysis year levels.

One further stratification was then necessary to bring the data to the proper analysis level. This was to break up each day by direction into its hourly components for each mainline segment. This was accomplished by utilizing the hourly traffic data provided for a typical week in July for the peak season months and a typical week in April for the remaining months. This resulted in an hourly volume by direction for a Monday through Sunday in each month of each analysis year. The benefit calculations were then performed at this level.

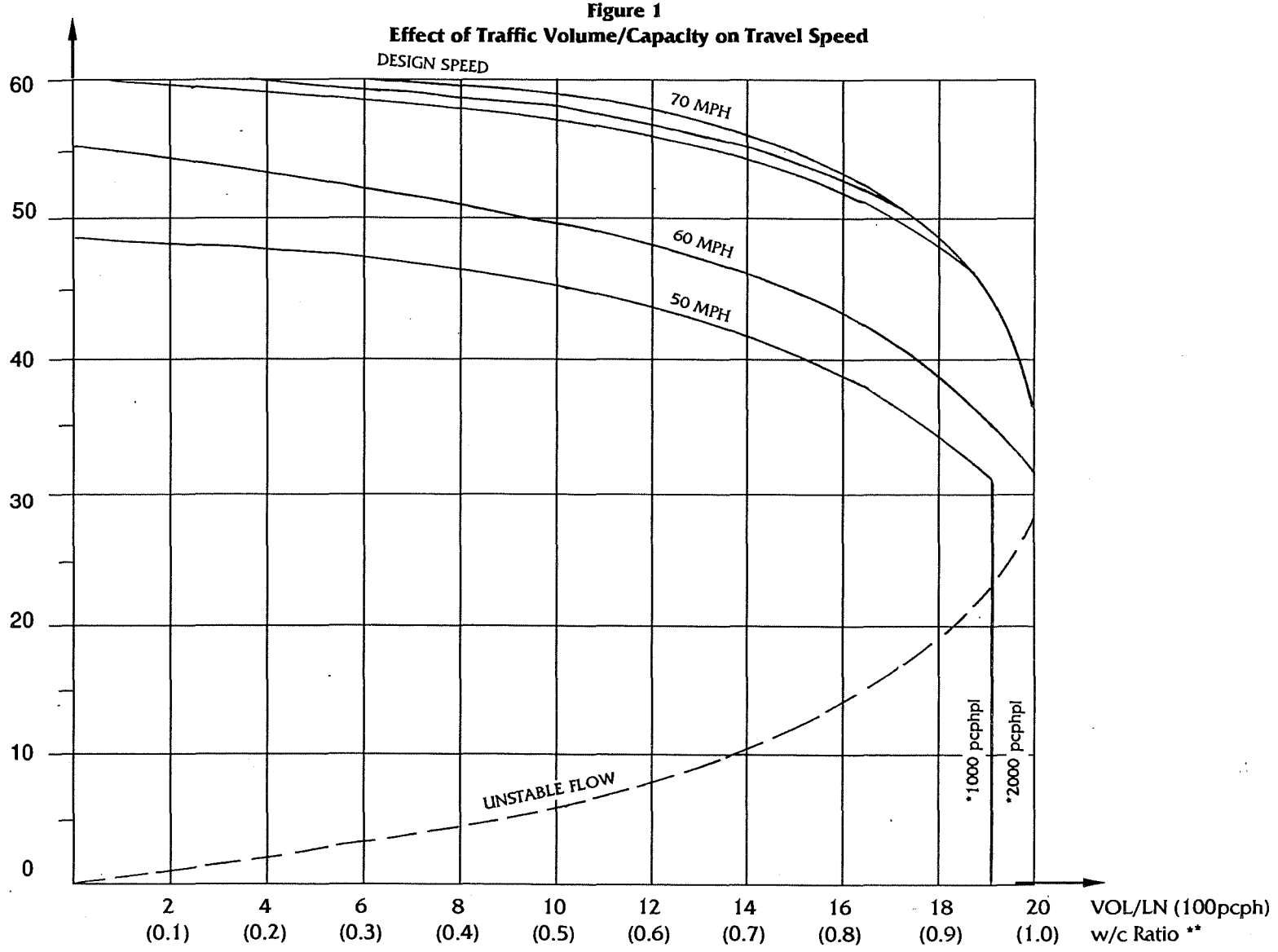
The first calculation performed was to compare the hourly volume to the capacity under the build or widened condition as well as the no-build or existing four-lane condition. A volume/capacity (V/C) ratio was developed in that manner. This ratio was then used to identify the change in speed associated with widening. This was performed by relating the V/C ratio to the average travel speed for freeway segments as presented by the 1985 Highway Capacity Manual. A copy of this functional diagram is shown as Figure 1. As shown, for a 70 mph design speed facility, the average travel speed varies little through a V/C ratio of around 0.7. However, as the volume approaches capacity and the ratio nears 1.0, the average travel speed on a typical freeway section deteriorates rapidly. For example, at a V/C ratio of 0.8, the average travel speed is shown to be around 53 mph deteriorating to around 48 mph at a V/C ratio of 0.9 and an average travel speed of about 30 mph when the V/C ratio is equal to 1.0. This average speed was then related to operating costs.

It is noted that average travel speeds at relatively low V/C ratios, i.e., high levels of service, are shown to converge at approximately 60 mph. In practice, under new posted speed limits now in effect on the Turnpike, average speeds under free flow conditions may well exceed 60 mph. However, for purposes of this comparative analysis, it was considered reasonable to use the results of extensive previous research as reported in the Highway Capacity Manual. As a result, impacts on travel speeds and motorist delay due to the widening computed in this study may be considered somewhat conservative.

An operating cost, which varied based on the average travel speed, was then calculated for each segment for each hour and applied to the vehicle miles traveled calculated for the same segment and hour. The VMT was calculated by simply multiplying the total hourly density by the length of the freeway segment. For purposes of this analysis, if a volume was greater then the theoretical capacity per hour of the roadway segment, an additional mile was added to the distance calculation for each vehicle over the 1.0 capacity threshold. This reflects some usage of the arterial or alternate routing which in most cases closely parallels the Turnpike. The operating costs for the build condition were compared to the no-build condition and a relative operating cost benefit derived.

The calculated speed for each segment was then related to the vehicle miles traveled to develop a total travel time estimate for each analysis data point. Again, the total time was compared for both the build and no-build conditions and an incremental change in delay estimated. This was related to the cost per minute derived with the aid of the 1977 document published by AASHTO entitled, "A Manual on User Benefit Analysis of Highway and Bus-Transit Improvements." The values presented in that publication were

Figure 1
Effect of Traffic Volume/Capacity on Travel Speed



* capacity
** v/c ratio based on 2000 pcphpl valid only for -60 and 70-MPH design speeds

Speed flow relationship under ideal conditions

Source: Highway Capacity Manual, Special Report 209, 1985

adjusted to reflect current income levels in the corridor as well as current estimates of household worker hours.

Specifically, the value of the weighted cost per minute was derived in several stages. First, an estimate of median household income was derived, weighted to reflect Turnpike usage of the Portland suburban area, Massachusetts and New Hampshire, based on traffic studies done by WSA in 1981. This figure was adjusted from 1986 to February 1988 by means of the Consumer Price Index. Secondly, median household income was divided by an assumed number of average annual household worker hours. AASHTO suggests 2,080 hours per worker per year, which implies only one worker per household. It was assumed the average was actually higher due to the trend of a second worker per household and an average of 2,380 hours was used which yielded a raw cost per minute of $0.201.

The raw cost per minute was then weighted by three trip purpose categories: To/From Work, During Work and Other, which includes Social/Recreational and Shopping Trips. For each trip purpose category, the raw cost was multiplied by two weighting factors; the percentage of trips in those categories and a factor reflecting studies of motorists' perceptions of route choice when free and tolled alternatives are offered. The final weighted cost per minute resulted in a value of $0.115.

The next calculation was to relate the V/C ratio developed earlier to the accident rates corresponding to those V/C ratios. The rates used were based on the Transportation Research Record 931 which presents accident rates for freeways by type of accident (fatal accidents, non-fatal injury accidents and property-damage-only [PDO] accidents) and V/C ratio. A summary of the rates used by accident type and V/C ratio is presented in Table 1. As shown, as the V/C ratio increases, rate of the fatal and injury accidents grow through a V/C ratio of 1.0. The PDO accident rate peaks at a V/C ratio of approximately 0.7 and then drops as the V/C ratio approaches 1.0. This reflects lower speeds and less opportunity for lane changes and conflicts.

The relative number of accidents was then calculated by applying the accident rates to the estimated vehicle miles traveled on each segment. These were related to accident costs by type. The accident costs used were based on those currently being used by the Maine Department of Transportation.

Each of these calculations was summed for each hour by segment, by direction for each typical day of the month. Then, each of the daily totals was expanded by approximately 4.34 to reflect the average number of any day in the average month. The monthly totals were summed to get a yearly total, and estimates of benefits for operating costs, delay impacts and accident impacts were developed. Annual user benefits during intermediate years were developed through interpolation.

By using the above approach, it was possible to determine annual benefits and user impacts by recognizing typical annual, monthly, daily and hourly variation patterns. This iterative approach did not, however, easily permit recognition of certain isolated

Table 1

Freeway Accident Rates

Volume/ Capacity Ratio	Type of Accident		
	Property Damage Only	Injury	Fatal
	(----------accidents/100 MVM----------)		
0.4	106.0	18.0	0.50
0.5	115.0	25.0	0.66
0.6	120.0	32.0	0.85
0.7	124.0	43.0	1.16
0.8	122.0	62.0	1.60
0.9	120.0	82.0	2.10
1.0	115.0	104.0	2.68

Source: Transportation Research Record 931:
Transportation and Land Use Planning
Transportation Research Board 1983

peak conditions, such as holiday weekends, when congestion levels exceed the theoretical values computed by the model. As such, the results of the user impact analysis may be considered somewhat conservative, but reasonable, recognizing the purpose for which they are intended.

Operating Condition Impacts

The analysis not only resulted in net user benefits, but some other relationships which indicate operating advantages that the widening would realize. These are summarized and discussed below.

Total Annual Unaccommodated Vehicles - In Table 2, a summary of the total number of vehicles that would be unaccommodated for each mainline segment was summarized by analysis year. This was done for the no-build condition as well as the build condition and the net change or benefit derived from widening the Turnpike is indicated. As shown, in 1987 there would have been no vehicles unaccommodated under either the build or no-build condition.

By 1992, with no widening assumed, each link shows some unaccommodated vehicles. If the Turnpike was widened, all vehicles would be accommodated. In all, a net benefit of over 80,000 unaccommodated vehicles between interchanges 1 and 1A could be anticipated in 1992.

By the horizon year, 2000, the number of unaccommodated annual vehicles increases dramatically. For example, on the mainline segment between Interchanges 6 and 6A on the Turnpike a net change of over 1.6 million in the number of vehicles which would not be accommodated is shown. To gain some perspective on this, that section of roadway is estimated to carry approximately 33 million vehicles annually in the year 2000. If the Turnpike is not widened, about 5 percent of those vehicles could not be accommodated.

Speed Threshold Summary - A second comparison was made of the number of hours annually where the average speed fell below a particular threshold level. For purposes of this analysis, a 45 mph and 50 mph threshold were investigated. The results are shown in Table 3.

For the no-build condition, the number of hours with speeds falling below the first threshold level of 45 mph is shown to vary between 30 hours at opening year levels to over 2,700 hours in the year 2000 for various mainline segments. It should be noted that this reflects the number of hours in either direction, and if a facility was operating under 45 mph in both directions it would be counted as two hours under the threshold level.

The build condition under the same threshold would have no hours where the speeds would fall below the 45 mph target in 1987. However, by the year 2000, it is estimated that even with the widening, about 380 hours per year would have operating conditions

Table 2

Total Annual Unaccommodated Vehicles

Year	Between Interchanges	Unaccommodated Vehicles No-Build Condition	Build Condition	Net Change
1987	1-1A	0	0	0
	1A-2	0	0	0
	2-3	0	0	0
	3-4	0	0	0
	4-5	0	0	0
	5-6	0	0	0
	6-6A	0	0	0
1992	1-1A	82,600	0	82,600
	1A-2	83,500	0	83,500
	2-3	29,500	0	29,500
	3-4	20,400	0	20,400
	4-5	37,600	0	37,600
	5-6	44,300	0	44,300
	6-6A	43,500	0	43,500
1997	1-1A	366,100	32,400	333,700
	1A-2	377,800	34,900	342,900
	2-3	217,800	4,700	213,100
	3-4	200,900	3,700	197,200
	4-5	456,600	14,300	442,300
	5-6	639,800	13,000	626,800
	6-6A	633,600	12,500	621,100
2000	1-1A	676,800	106,000	570,800
	1A-2	704,600	112,900	591,700
	2-3	489,200	44,300	444,900
	3-4	496,700	34,700	462,000
	4-5	1,216,900	76,900	1,140,000
	5-6	1,767,900	113,700	1,654,200
	6-6A	1,755,000	111,300	1,643,700

Table 3

Annual Hours With Speeds Less Than 45 and 50 MPH

Year	Between Interchanges	No-Build Condition Less Than 45 MPH	No-Build Condition Less Than 50 MPH	Build Condition Less Than 45 MPH	Build Condition Less Than 50 MPH	NET BENEFITS Savings Less Than 45 MPH	NET BENEFITS Savings Less Than 50 MPH
		(HOURS)					
1987	1-1A	30	70	0	0	30	70
	1A-2	30	70	0	0	30	70
	2-3	0	20	0	0	0	20
	3-4	0	20	0	0	0	20
	4-5	0	10	0	0	0	10
	5-6	0	10	0	0	0	10
	6-6A	0	10	0	0	0	10
1992	1-1A	210	300	0	30	210	270
	1A-2	220	300	0	30	220	270
	2-3	120	190	0	0	120	190
	3-4	110	180	0	0	110	180
	4-5	180	390	0	10	180	380
	5-6	280	510	0	0	280	510
	6-6A	280	510	0	0	280	510
1997	1-1A	500	720	90	140	410	580
	1A-2	510	730	90	150	420	580
	2-3	430	660	40	90	390	570
	3-4	450	750	30	80	420	670
	4-5	1,090	1,690	60	140	1,030	1,550
	5-6	1,610	2,180	90	230	1,520	1,950
	6-6A	1,590	2,170	90	230	1,500	1,940
2000	1-1A	870	1,190	190	260	680	930
	1A-2	910	1,220	200	280	710	940
	2-3	890	1,310	120	190	770	1,120
	3-4	1,020	1,460	110	190	910	1,270
	4-5	2,110	2,730	260	470	1,850	2,260
	5-6	2,730	3,680	380	660	2,350	3,020
	6-6A	2,730	3,650	380	660	2,350	2,990

consisting of average travel speeds under 45 mph on the worst link. This, however, is a significant reduction from the no-build condition in that year.

Under the second threshold level of 50 mph, similar relationships exist. In the first year analyzed, 1987, a minimal impact of about 70 hours would be realized where the average travel speed would be under 50 mph for the no-build condition, but none for the build condition. In the year 2000, over 3,600 hours are estimated to have average speeds of less than 50 mph under the no-build condition on the worst segment. This would be reduced dramatically to just 660 hours is the Turnpike was widened.

Operating Cost Impacts

The first benefit calculated relating to a cost-benefit impact was the annual vehicle miles traveled under the no-build and build conditions and the operating cost impacts related to this. The results are shown in Table 4.

Shown on this table are the annual vehicle miles traveled under the no-build and build conditions, the net change in these, and the operating cost impacts associated with this. While a benefit of slightly reduced number of vehicle miles is indicated for the build condition, a small net operating cost increase is shown. The increased miles are directly related to the number of unaccommodated vehicles under each scenario. Any vehicles which would not be accommodated by the theoretical capacity were assigned an additional one mile in trip length for the arterial routing. The additional one mile was selected as a typical additional mileage after investigating the probably by-pass routing for each mainline segment. It was determined that this was a reasonable, though slightly conservative assumption. As shown, the impact in the number of miles traveled annually grows to over 6.5 million by the horizon year, 2000.

The estimates of the operating cost impacts were based on the average travel speeds. The analysis to develop the operating costs based on the average speeds indicated that peak vehicle efficiency (the lowest operating cost) was indicated at average travel speeds in the 35 to 40 mph range. The impact is shown to be in the magnitude of $100,000 in 1987 to almost $600,000 in 1997. As will be seen in the next section, this operating cost impact disbenefit will be greatly overshadowed by the savings associated with reductions in delay that the widening will have.

Annual Delay Savings

The annual vehicle hours traveled and the savings associated with the reduction of delay to the users of the Turnpike are presented in Table 5. As shown, in 1987, the total number of vehicle hours saved due to the widening is just over 100,000. This relates to a savings due to reduced annual delay of almost $900,000 in that first year. This increases dramatically to over 5.4 million vehicle hours of travel saved by the year 2000, relating to an annual savings of over $40 million in annual user delay cost.

Table 4

Annual Vehicle Miles Traveled and Operating Cost Impacts

Annual Vehicle Miles Traveled

Year	No-Build Condition	Build Condition	Net Savings	Operating Cost Savings
	(----------Thousands----------)			
1987	433,379	433,379	0	$(104)
1988	464,071	464,019	52	(142)
1989	496,936	496,825	111	(194)
1990	532,129	531,951	178	(265)
1991	569,815	569,559	256	(361)
1992	610,161	609,818	343	(493)
1993	644,849	644,108	741	(507)
1994	681,508	680,326	1,182	(522)
1995	720,252	718,581	1,671	(537)
1996	761,198	758,987	2,211	(553)
1997	804,462	801,680	2,782	(569)
1998	846,463	842,550	3,913	(137)
1999	890,657	885,503	5,154	(33)
2000	937,145	930,635	6,510	(8)

Table 5

Annual Vehicle Hours Traveled and Delay Savings

Annual Vehicle Hours Traveled

Year	No-Build Condition	Build Condition	Net Savings	Annual Delay Savings
	(----------Thousands----------)			
1987	7,511	7,392	119	$ 885
1988	8,150	7,934	216	1,607
1989	8,844	8,515	329	2,448
1990	9,597	9,139	458	3,408
1991	10,414	9,808	606	4,509
1992	11,300	10,527	773	5,751
1993	12,306	11,195	1,111	8,266
1994	13,402	11,906	1,496	11,130
1995	14,595	12,662	1,933	14,382
1996	15,894	13,466	2,428	18,064
1997	17,309	14,321	2,988	22,231
1998	18,972	15,276	3,696	27,498
1999	20,796	16,295	4,501	33,487
2000	22,794	17,382	5,412	40,265

Annual Accident Savings

The number of fatal, non-fatal injury and PDO accidents was calculated for the no-build and build conditions. Then, the total accident cost under each scenario was tallied using a value of approximately $1.3 million for each fatality, $13,000 for each injury accident and $1,800 for each PDO accident. Again, these costs reflect those currently used by the Maine Department of Transportation for their accident cost analyses.

In Table 6, a summary of the findings of this section of the analysis is shown. As can be seen, the reduction of PDO accidents would be minimal since high congestion levels actually reduce the rate of these types of accidents. However, the injury and fatality categories show significant impacts.

In the first year of the analysis, 1987, a reduction of approximately 15 injury accidents and a percent of the fatal accidents is indicated. The percentage points were carried to a tenth of a percent here to reflect smaller impacts on categories such as fatalities. Defining these numbers of accidents by the corresponding costs associated with them, respectively, a net benefit due to accident savings of over $700,000 is shown.

In the horizon year, 2000, the PDO accidents again show little difference between a build and a no-build condition. The injuries, however, decrease by over 40 percent while a reduction of five fatalities could be expected. This relates to a net benefit due to accident reduction of almost $10 million in that year.

Summary of User Benefits

Table 7 presents a summary of net user benefits associated with the widening project on the Maine Turnpike. As noted earlier, WSA has been advised that the first full year of operation under the widened Turnpike should be assumed to be 1992. Traffic forecasts for use in the analysis were provided by Mr. Mallar through the year 2000. Hence, net user benefits were calculated annually between 1992 and 2000.

As shown in Table 7, small increases in operating costs associated with the widening are greatly offset by a sizable reduction in annual delay and accident savings. In the opening year, total net user benefits are estimated at approximately $8.2 million, projected to increase to over $49 million by the year 2000.

In evaluating the economic justification for major transportation investments such as the proposed widening program, it is customary to determine the net present value of future benefits. In accordance with procedures suggested in the AASHTO Manual for such studies, future benefits were discounted at an annual rate of 5 percent per year to a 1987 base year level. In this way, the total net present value of benefits over the entire analysis period can be related to the uninflated 1987-level cost of the improvement in determining a benefit/cost ratio.

Table 6

Annual Accident Savings

Year	No-Build Condition				Build Condition				Accident Savings
	Property Damage Only	Injury	Fatal	Total Accident Cost	Property Damage Only	Injury	Fatal	Total Accident Cost	
1987	472.0	94.5	2.6	$ 5,465,400	461.6	80.0	2.2	$ 4,737,100	$ 728,300
1988	508.6	108.7	3.0	6,237,100	496.0	87.8	2.4	5,160,900	1,076,200
1989	548.1	125.0	3.4	7,041,100	533.0	96.4	2.6	5,599,800	1,441,300
1990	590.7	143.7	3.9	8,012,200	572.7	105.8	2.9	6,184,400	1,827,800
1991	636.5	165.3	4.6	9,287,700	615.4	116.1	3.2	6,786,100	2,501,600
1992	685.9	190.1	5.1	10,350,000	661.2	127.4	3.5	7,406,200	2,943,800
1993	727.8	216.0	5.8	11,674,100	701.8	141.4	3.9	8,182,500	3,491,600
1994	772.3	245.5	6.5	13,049,400	744.9	156.9	4.3	8,982,600	4,066,800
1995	819.4	279.0	7.4	14,742,200	790.6	174.1	4.7	9,809,400	4,932,800
1996	869.5	317.1	8.4	16,630,400	839.2	193.2	5.2	10,796,600	5,833,800
1997	922.6	360.4	9.5	18,721,800	890.7	214.4	5.8	11,946,600	6,775,200
1998	962.7	402.8	10.6	20,778,100	950.3	239.7	6.5	13,294,800	7,483,300
1999	1,004.5	450.2	11.8	23,032,700	1,013.8	268.0	7.2	14,688,800	8,343,900
2000	1,048.1	503.1	13.1	25,492,200	1,081.6	299.7	8.0	16,265,000	9,227,200

Table 7

Summary of Net User Benefits

Year	Annual Vehicle Operating Savings	Annual Delay Savings	Annual Accident Savings	Total Annual Benefits	Present Value of Benefits[1]
			thousands		
1992	$(493)	$ 5,751	$2,944	$8,202	$ 6,426
1993	(507)	8,266	3,492	11,251	8,395
1994	(522)	11,130	4,067	14,675	10,430
1995	(537)	14,382	4,933	18,778	12,709
1996	(553)	18,064	5,834	23,345	15,048
1997	(569)	22,231	6,775	28,437	17,457
1998	(137)	27,498	7,483	34,844	20,373
1999	(33)	33,487	8,344	41,798	23,273
2000	(8)	40,265	9,227	49,484	26,241
				Next 11 years annually:	26,241
				20-year total:	$429,003

[1] Calculated at a discount rate of 5 percent per year to 1987 dollars.

Even after discounting to present value, net user benefits associated with the widening increase steadily through the year 2000. Over $26.2 million in discounted benefits are shown in that horizon year.

While traffic forecasts beyond the year 2000 were not available for use in the analysis, it is clear that the economic justification for major transportation investments should be evaluated over a longer design life than the nine years shown in Table 7. A 20-year evaluation period is considered more reasonable. A conservative estimate of net user benefits subsequent to the year 2000 was made by assuming the discounted level of benefits remains constant for the next 11 years annually. In effect, this assumes that increases in annual user benefits beyond the year 2000 occur at a rate equal to the 5 percent compounded annual discount rate.

The total discounted present value of net user benefits is estimated at $429,003,000. This is considered a generally conservative estimate for the following reasons:

- Net discounted benefits subsequent to the year 2000 are assumed to remain constant, in the face of an increasing pattern prior to the year 2000.

- The method used in computing annual benefits involved an iterative cycling throughout the year using typical hourly, daily and monthly variations. While this is considered a reasonable approach on an annualized basis, it understates potential benefits during uniquely high periods of congestion, such as peak summer holiday weekends.

- The lowest average speed at V/C ratios greater than 1.0 was assumed to be 20 mph; in practice, under periods of totally forced-flow, average travel speeds below this level may be quit common. In addition, the maximum average free-flow speeds were computed at approximately 58 mph, based on prior research; in practice, with the recently increased speed limits, maximum free-flow speeds may be somewhat higher.

APPENDIX K

CONSULTANT RESPONSIBILITIES

Governmental Services, Inc.

1. Review and examination of the Maine Turnpike Authority's "Capital Improvement Study" conducted by Howard, Needles, Tammen & Bergendoff, including:
   a. traffic projections;
   b. cost estimates;
   c. revenue projections.

2. Survey and interview community officials in the southerly corridor to help identify secondary impacts of Turnpike widening, interchange development and fare structure.

3. An examination of alternative fare structures to identify:
   a. rate structures which more closely allocate usage-caused-cost to charges;
   b. options that have potential for lessening off-corridor impacts;
   c. elements that may appropriately balance the cost and benefits to corridor communities of the economic impact of the toll highway; and
   d. the revenue generating potential of alternate structures.

4. A comprehensive review of the latest trends in highway planning, including:
   a. direction of federal highway policy;
   b. the various uses and applications of toll highway revenue;
   c. traffic engineering standards
   d. secondary impacts of road improvements;
   e. pricing structures and approaches to design;

5. The administration of the following sub-contractor responsibilities:
   a. Squaw Bay Corp.: Review of cost projections for construction projects on the Turnpike;
   b Perkins, Thompson, Hinckley and Keddy: Legal issues regarding fare structure and use of revenue;
   c. Pulse Unlimited: Public opinion survey.

Mallar Associates

1. Review and up-date traffic estimates.
2. Represent the Maine Turnpike Authority in the Westerly Connector and Northerly Corridor Studies, including the coordination of work with Howard, Needles, Tammen, & Bergendoff and Wilbur Smith Associates.
3. Coordinate and direct consulting and legal services required and represent the Authority in seeking appropriate permits from the Department of Environmental Protection and such other agencies as may be required.

Wilbur Smith Associates

1. Produce revised forecast of Turnpike traffic reflecting growth rates by interchange and vehicle class furnished by Mallar Associates.
2. Develop updated traffic and revenue forecast, to include the improvements proposed under the capital improvement program, again using information supplied by Mallar Associates.
3. A user benefits analysis in terms of impacts on travel time, operating cost and accidents on the Maine Turnpike.