ARIZONA DEPARTMENT OF TRANSPORTATION

REPORT NUMBER: FHWA-AZ99-475(1)

THE VALUE OF ARIZONA'S STATE HIGHWAY SYSTEM: A CORPORATE-STYLE FINANCIAL ANALYSIS

Final Report

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September 1999

Prepared for:
Arizona Department of Transportation
206 South 17th Avenue
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in cooperation with
U.S. Department of Transportation
Federal Highway Administration

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-AZ-99-475(1)		

4. Title and Subtitle	5. Report Date
The Value of Arizona's State Highway System: A Corporate-Style Financial Analysis	September 1999
	6. Performing Organization Code
7. Authors	8. Performing Organization Report No.
Nadia Mansour and John Semmens	
9. Performing Organization Name and Address	10. Work Unit No.
Nadia Mansour, #411, 819 Hamilton St., Vancouver, BC Canada V6B 6M2 John Semmens, Arizona Transportation Research Center, 206 S. 17 Ave., mail drop 075R, Phoenix, AZ 85007	11. Contract or Grant No. SPR-PL-1-(55) 475
12. Sponsoring Agency Name and Address **ARIZONA DEPARTMENT OF TRANSPORTATION** **206 S. 17TH AVENUE** **PHOENIX, ARIZONA 85007** Project Manager: John Semmens	13.Type of Report & Period Covered
	14. Sponsoring Agency Code

15. Supplementary Notes

Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration

16. Abstract

Government agencies and private sector corporations tend to approach financial reporting in different ways. Presenting government agency financial information using corporate-style reporting would accomplish two specific goals. First, it might provide a more economically sound picture of the financial status of governmental undertakings. The private sector approaches issues of subsidization, revenue generation, depreciation, inflation, etc. in a different way than governments generally do. Using private sector techniques will therefore, present a different perspective on the financial status of the state highway system than is currently reported by the Arizona Department of Transportation. Secondly, because legislators, the media and the general public are more familiar with private sector financial reporting, presenting government data in a similar fashion may improve communication between government agencies and these groups.

The basic findings of this research can be summarized as follows:

- Under corporate style accounting, Arizona's state highways are a "break-even" proposition.
- A "break-even" position does not allow for contingencies or traffic growth.
- State highway users have paid taxes sufficient to cover 97% of the amount spent on the system.
- The value of these highways is in excess of 30 cents per vehicle mile of travel.
- The amount paid to support the construction and maintenance of these highways is only 4 cents per vehicle mile of travel.
- Highway user fees could go considerably higher without significantly depressing usage.
- Differential pricing through electronic tolling would provide the most economically and socially efficient method for implementing fully compensatory highway user fees.

Phase II of this project will attempt a similar financial analysis of the Maricopa freeway system.

17. Key Words	18. Distribution Statement	23. Registrant's Seal
transportation finance, value of highways	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161	

19. Security Classification	20. Security Classification	21. No. of Pages	22. Price
Unclassified	Unclassified	58	

METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	0.3048	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	6.452	centimeters squared	cm^2
ft^2	square feet	0.0929	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
mi^2	square miles	2.59	kilometers squared	km^2
ac	acres	0.395	hectares	ha
		MASS (weight)		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.0328	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3

Note: Volumes greater than 1000 L shall be shown in m^3.

		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
yd	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
yd^2	kilometers squared	0.39	square miles	mi^2
ha	hectares (10,000 m^2)	2.53	acres	ac
		MASS (weight)		
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1000 kg)	1.103	short tons	T
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3

		TEMPERATURE (exact)		
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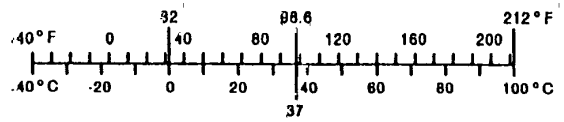
These factors conform to the requirement of FHWA Order 5190.1A

*SI is the symbol for the International System of Measurements



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Summary of Key Findings

- There is a need to improve communication of financial information from DOTs to policy-making entities in government and to voters/taxpayers.

- Corporate style financial reports may improve the communication of financial information from DOTs to policy-making entities in government and to voters/taxpayers.

- A corporate style financial report for the Arizona State Highway System reveals that these roads are in a precarious financial position.

  - For the period 1988 through 1997, the State Highway System had a return of only 2.5% on assets when considering all sources of funds available.

  - When only earned revenue (i.e., funds generated by traffic on the system) is counted, the state highway system had a –0.5% return on assets for the 1988 to 1997 period.

  - When we adjust for inflation, the earned revenue rate of return on investment drops to –1.3% for the 1988 to 1997 period.

  - These rates of return may be barely adequate to keep the system afloat, but they provide no margin for unforeseen contingencies or for growth in traffic.

- Over the 1988 to 1997 period, users of the state highway system paid taxes sufficient to cover 97% of the amounts spent on the system.

- Analysis of what highway users pay in the way of total costs to own and operate vehicles on Arizona's roadways implies a minimum value of around 30 cents per vehicle mile of travel. The amount of this payment that is paid to support the construction and maintenance of highways is around 4 cents per vehicle mile of travel.

- Since highway vehicles and the amounts spent on them would be virtually worthless without the highway infrastructure, the amount of additional user fees that could be collected is probably significantly larger than what is currently the case.

- The most economically and socially efficient method of collecting highway user fees would be to implement differential pricing so that users demanding high cost service (like peak hour capacity) could be charged truly compensatory fees. Electronic tolling offers the technology to achieve this economic and social efficiency.

I. Introduction

Government agencies and private sector corporations tend to approach financial reporting in different ways. The private sector approaches issues of subsidization, revenue generation, depreciation, inflation, etc. in a different way than governments generally do. The use of private sector approaches to financial accounting could shed an interesting light on some of the issues facing transportation departments. In particular, the analysis of government agency financial information using a corporate-style reporting technique is expected to accomplish two specific goals. First, it would provide a more economically sound picture of the financial status of governmental undertakings by focusing on the sources of state highway revenue and the rate of return on investment. Using private sector techniques will present a different perspective on the financial status of the state highway system than is currently reported by the Arizona Department of Transportation. Secondly, because legislators, the media and the general public are more familiar with private sector financial reporting, presenting government data in a similar fashion may improve communication between government agencies and these groups.

The purposes of this report are in general two-fold. One goal is to discuss some of the differences between corporate-style financial analyses and traditional governmental analyses and to apply a private sector approach to the Arizona State Highway System. The other major goal of this project is to compare the value of the highway system with what users actually pay for highway services. Numerous studies (many of which will be discussed here) have shown that the true value of the transportation systems is quite high while what people are actually paying in terms of fees and taxes to use the roads is quite small. Using private sector accounting procedures may help to more accurately compare and contrast the value of state highways with the net profits and return on investment currently being generated by these resources. This type of analysis may also help to determine a more efficient and equitable fee/taxation level for users of the highway system and improve the general financial management of state highway resources.

II. Why Use Private Sector Style Financial Analyses

In today's economic and political environment, public funds are limited and the number of interests competing for these funds is growing. This scarcity of funds means that decision-makers need to receive complete and impartial information regarding different investment opportunities. Providing this type of information will be extremely helpful not only in terms of deciding how to allocate public funds but in terms of justifying these expenditures.

Financial statements and annual reports are one of the ways that private sector organizations provide investors with information. These statements provide a snapshot of the financial status of companies. This information allows potential investors to assess the risks and returns associated with investing in a particular company or project. These types of statements are crucial to the proper and efficient functioning of the private sector. The principles and procedures used to develop financial statements for businesses can also be used very effectively in the public sector.

Deciding how to allocate resources is a difficult task. The purpose of a financial statement is "to provide information useful in making economic decisions that result in an efficient allocation of resources" (Sorter, 1974). Organizing information on the costs and revenues of a public project in a consistent and financially sound manner will help to promote economic efficiency. It will also allow decision-makers to allocate public funds to programs that meet public needs while at the same time maximizing return on investment. Decision-makers can use financial statements developed for public institutions to rationalize and justify investment decisions. Looking at government projects in terms of their financial viability will ultimately allow for better investment decisions to be made and it may improve the public's confidence in the decision making process.

The financial condition of highway systems across the country is precarious. On an aggregate basis, it appears that highways may not be receiving sufficient resources to maintain the investment (Semmens, 1993). Investing in highway projects is a high-risk activity. Once resources are used in the construction of a roadway it is essentially impossible to retrieve them should the revenues generated by the project not cover the costs. A highway cannot be disassembled and the pieces sold off in order to recover losses (Semmens, 1994). Given the amount of risk involved in these types of projects it is crucial that construction and maintenance decisions, as well as pricing and revenue generation decisions be made based on solid economic information. The organization of transportation system revenue and cost data in the form of a financial statement may help in making economically sound decisions.

In the future, it will be financially difficult for public agencies to subsidize projects that do not pay for themselves. There is little economic rationale for *not* subjecting public works projects to the same fiscal standards as private investment projects. Comparing the actual revenues and costs generated by various road networks will allow funds to be used to maintain and improve those roads that are creating an economic surplus and to alter the way that roads operating in the red are managed. Preliminary studies on the "profitability" of segments of the Arizona State Highway System show that certain portions of the system are able to cover their costs of construction and maintenance while others are not (Semmens, 1982). Developing an impartial way to compare investment opportunities within the state highway system will allow Arizona decision-makers to maximize the total benefits of the system for taxpayers.

Some people will argue that a strict financial analysis cannot fully capture the benefits or costs of a transportation network. There are a number of indirect impacts that arise from highway construction and maintenance. Many traditional cost-benefit analyses of transportation projects attempt to capture and quantify these impacts. The spin-off effects of economic development and job creation may be counted as a benefit of these types of projects and increased levels of air pollution or traffic congestion may be counted as additional costs.[1] There is a great deal of difficulty in attaching a monetary value to these types of indirect costs and benefits. It is unfair for these externalities to be explicitly figured into public sector project appraisals when they are largely considered irrelevant in terms of private sector project analyses. That is not to say that these impacts should not be considered in the decision making process. It is just that their

[1] Development and job creation that stems from increased access and mobility are often counted as a project benefit. Highway construction jobs are a cost of highway development, not a benefit.

incorporation into the financial analysis should be limited. Addressing externalities in the written portions of the annual report is preferable to including them directly in the financial analysis.

At a time when government agencies are struggling to practice fiscal responsibility it is necessary that the revenue agencies generate is sufficient to meet their current expenditures and to maintain their assets. Transportation agencies are no exception. It is of paramount importance in terms of ensuring that reliable and efficient transportation services are provided well into the future. The adoption of more "business-like" techniques can serve an important role in achieving this end.

One of the important steps that will be taken toward this end in terms of this study, is the inclusion of a depreciation charge for the highway system. The financial commitments of a private corporation include an amount to replace depreciating assets. This is also a necessary consideration for transportation providers. As previously constructed roadways wear out or become obsolete, additional investments will be needed in order to maintain current levels of highway infrastructure and performance in order to sustain the road system as an "ongoing business." This depreciation charge must be incorporated into current financial analyses to ensure that enough revenues are being generated to maintain highway system function.

The need to account for depreciation has been recognized by others in the transportation field. Williams and Howard (1994) found that a significant additional investment is required in the highway system to maintain U.S. highway performance levels. The authors found that "to maintain the 1991 level of support for the highway system and to provide the increase in funding needed to actually maintain the current level of performance, the current level of funding--$74.5 billion--will need to increase annually to keep up with inflation, and an additional $19.1 billion in real dollars is needed every year to raise the annual expenditure to the level needed to prevent further deterioration in system performance." This level of additional investment will require transportation agencies to find additional sources of revenues, and will require them to adopt a more long-term financial perspective.

Application of Corporate-Style Financial Analysis to Arizona State Highways

There are a number of financial analyses that are already being carried out using information related to the state highway system. Many of these analyses are extremely comprehensive and detailed. The organization of Arizona highway financial data in a form more reminiscent of corporate annual reports and financial statements is not meant to replace these other reporting forms. It is simply meant to present the information in a more simplified and standardized format.

The currently published *Receipts and Expenditures Annual Report* and *Comprehensive Annual Financial Report* present similar information to that which would be included in a corporate style financial report. One of the main benefits of adopting a corporate type analysis is that it is a format which many people in the government, as well as in the public, are familiar with. The simplification of financial analyses is important if the information is going to be used to justify transportation related decisions. Because the public is so directly impacted by changes in the provision and pricing of transportation services, making the financial justification for these changes explicitly clear is crucial.

There will be one major difference between this corporate style financial analysis and the traditional government accounting that has been carried out in the past. The corporate style financial analysis of transportation will focus on calculating revenues based on user fees. Revenues that come from subsidies will be shown as separate line items. For the purposes of this report, subsidies will be defined as revenues from sources other than fees and taxes (and interest earned from deposited fees and taxes) paid by highway users. If transportation decisions are going to be made based on the principles of economic efficiency and sustainability, then the costs of construction, operation, maintenance and administration should be met using revenues generated directly from the use of highways. An analysis of this type should reveal whether or not the costs of highway provision are being adequately borne by highway users. If this is not the case, then decisions will have to be made as to how to best rectify the situation.

To reiterate, the ultimate purpose of this analysis is to ascertain the value of the state highway system to the people of Arizona. Therefore, the analysis will also be broken down in such a manner as to compare transportation related costs and revenues according to vehicle miles traveled. Several years of revenue and expenditure data will be incorporated into an annual report in order carry out a comparative analysis. A historical data analysis will also be undertaken in order to derive an appropriate depreciation rate for fixed capital assets. This analysis will provide a more complete picture of the value of Arizona highways and the degree of economic efficiency with which they are managed.

The Organization of Corporate Annual Reports and Financial Statements

If a private sector style financial analysis is going to be used to analyze a public agency it is important to describe what goes into this type of analysis. Understanding the organization of these types of reports can help to justify their application to public institutions. This portion of the analysis will focus on explaining the basic structure and organization of corporate annual reports and financial statements.

Corporate annual reports and financial statements are organized in a standard fashion. This continuity allows for the comparison of financial information across different companies. In general, only a rudimentary knowledge of accounting is necessary in order to see general patterns in the financial data and the bulk of the written commentary is used to explain the numbers. The presentation of data related to the Arizona State Highway System in this standardized format might also be more attractive to legislators, the media and the public-at-large. Presenting the financial status of the highway system in a more familiar and more digestible manner would be beneficial in terms of providing sound fiscal justification for investment and pricing decisions. Organizing the financial information of the state highway system in a consistent manner will also help to facilitate the comparison of economic data over time.

A full corporate annual report includes a number of different sections. The letter from the chairman or director of the corporation usually acts as the introduction to the report. This letter includes a description of the corporation's major undertakings during the past year and the goals that have been achieved (as well as those that have not). The Chairman’s statement generally provides a review of what has been happening with the organization since the last report. The company's mission statement should also be presented and discussed in this portion of the report.

This is included in current governmental accounting reports, but could be refined to be more user-friendly to the average layperson.

Many of the most highly rated annual reports provide a ten-year summary of financial data near the beginning of the report. This provides a good picture of the long-term financial status of the company. The presentation of historical data should be done in as simple manner as possible without glossing over important information. This section can serve as the primary source of financial information for those readers who are unfamiliar with analyzing annual reports or those who simply want to see the major trends without all the detail.

The consolidated financial statements are presented next. The actual numerical comparison of assets and liabilities and revenues and expenditures is the focus of this portion of the report. The balance sheet and the income statement are the two major tables presented in the financial statement portion of the annual report. The balance sheet reflects the overall financial status of an organization. The income statement provides information as to whether a company or organization made a profit or incurred a loss over a specific time period. This particular application of private-sector style financial reporting to the Arizona State Highway System will focus on the development an income statement rather than a balance sheet.

In addition to the balance sheet and the income statement tables, a good financial statement includes written notes. The notes section is a very important part of the financial statement and can provide a lot of information which may otherwise get "lost in the numbers". The methods used for calculating various portions of the balance sheet and income statement should be discussed in the notes. The written commentary is also helpful in terms of more fully identifying the sources of revenues and expenditures. When analyzing a financial statement, the written notes should be examined closely.

Many companies chose to discuss and analyze the company's financial status before actually showing the balance sheet, income statement and their accompanying notes. In the discussion section, the corporation's management will explain, in depth, the trends that are evident in the financial statements. This analysis and discussion should focus not only the current year's financial data but should discuss trends over the past two years. Placing the discussion before the numerical tables may help to direct readers to the important information and may also help to “play down” the negative results and “play up” the positive ones.

A list of company directors and where to contact them is included at the end of the report. Naming the people who are ultimately responsible for the report and the accuracy of the information contained therein helps to promote accountability. Most corporate reports also include some stockholder information at the end of their annual reports. The end of the annual report might be an appropriate place to describe how the current and changing financial status of the public agency will affect taxpayers. When a public agency is being examined, taxpayers are the nominal "stockholders." In the case of the transportation department, there is a duty to ensure that taxpayers are receiving a good return on the portion of their tax dollars that are invested in highways.

Another essential part of a corporate annual report is the auditor's statement. This statement is intended to verify that the financial information contained in the report is accurate and meets generally accepted standards for accounting and financial reporting. There are typically three issues covered in the Auditor's Statement. These three areas are organized into an introductory paragraph, scope paragraph and opinion paragraph (Mellman, 1995). The introductory paragraph states that the financial statements have been examined by an independent accounting firm, but that the factuality of the information contained in the statements is the responsibility of the corporation's management. The scope paragraph reiterates that the auditor has used generally accepted auditing standards (GAAS) during the course of their work. During the scope portion of the Auditor's statement it should be made clear that the purpose of the audit is to assure that the financial statements are free of material errors and fraudulent claims. If the results of the audit show that the financial statements included in the annual report accurately and fairly represent the financial status of the organization, a statement to this fact is made in the opinion paragraph. If an audit finds any irregularities in the financial information included in the annual report it should be explicitly stated in this portion of the annual report.

What is an Income Statement?

The ultimate goal of the income or profit/loss statement is to calculate net income or profit levels and show how they have been derived. Along with the current year's income statement, two previous years worth of data typically are presented for comparison (Mellman, 1995). For private sector firms, profits are calculated in two ways. First, gross profits are calculated. Gross profits are simply total revenues minus total costs. The net profit statement takes into account the amount owed in taxes.

Revenues include all monies generated directly through sales, investments and other means. The cost section of the income statement includes the direct costs of providing services, administrative costs, interest payments and depreciation costs. Using a depreciation charge spreads the costs of equipment and other large capital purchases over the equipment's useful life rather than having all the costs imposed in the time period when the purchase was actually made (Bukics, 1991). Since the benefits of using the equipment accrue over time, the costs of purchasing the equipment should also be spread over time. A straight-line method of calculating depreciation is most often used. This method simply allocates the same proportion of an asset's cost to each period (Bandler, 1994). It may be important to differentiate between revenues and costs which are deemed normal in that they arise on a regular basis and extraordinary or incidental revenues or costs which occur on a irregular basis (Bukics, 1991). These differences should be outlined in the written portions of the report.

There are a number of ratios that can be calculated from the information presented in the balance sheet and income statement. These ratios help to further quantify the financial health of the organization. One of the traditional ratios, which may be of interest in analyzing state highway financial data, is the return on assets ratio. Return on assets is defined as net income divided by total assets (Dun and Bradstreet Inc., 1993). This ratio represents the ability of the organization to use their assets to generate income. The return on asset ratio is a fairly flexible measure of profitability. Different measures of income and assets can be placed in the numerator and denominator of the ratio to get different pictures of profitability (Friedlob and Plewa, 1996).

The ratio could be manipulated to represent the earning potential of specific portions or areas of the state highway system. The net income portion of the ratio could also be calculated using only revenue generated directly through user fees excluding any transfers or subsidies. This would give some indication of the self-sufficiency of the highway system.

A sample corporate style annual report for the Arizona State Highway System is included in Appendix A. The annual report includes an income statement that covers the period 1995 through 1997. A discussion of the ten-year perspective of the state highway system is included in the next section of the report.

III. Data and Sources

The source of much of the information used in the financial analyses of the Arizona State Highway System is the Federal Highway Administration's *Highway Statistics* report. In particular expenditure data from Table SF-4 on Disbursements for State-Administered Highways was used in this analysis. The Federal Highway Administration reports were used as the primary source of information for consistency reasons. The "Highway Statistics" report has maintained a consistent classification system for the reporting of state and expenditures, which allows for accurate comparisons of revenues and costs over time. Revenue data was obtained from the Arizona Department of Transportation's Financial Management Services Group.

Complete information on Arizona state-administered highways revenues and expenditures was collected for a 10-year period (1988-1997). All of the costs associated with maintaining the roadways and the traffic services on the roadways as well as providing for law enforcement and safety is included in total costs. Various administrative fees, including the costs associated with collecting fees and taxes were taken into account in determining the total cost of supplying the roadways. The money used to pay off the interest on bonds was also included as a cost of the highway system. The costs of paying off the principal of bonds is not included as a cost of the highway system since borrowed funds are not considered a source of revenue, but a shifting of capital from one time period to another.

A construction recovery or depreciation charge was also included as a cost of the state highway system. This construction recovery charge captures the costs of the capital outlays of the state highway system. Information on capital outlays was collected for the period 1969-1997 in order to allow for a depreciation charge for capital outlays to be developed. The calculation of a depreciation charge is necessary to spread the costs of large capital outlays over the total life of the asset. Because the benefits of using the highway system accrue over time, the costs of building the system should also be spread over time. A straight-line method of depreciation was used in this analysis. The expenses associated with capital outlays were allocated over a 20-year period, so depreciation was calculated at 5% per annum. This straight-line method of calculating depreciation may not be entirely adequate in terms of capturing the full costs of rebuilding and refurbishing existing roadways. The implications of this and a possible remedy to this problem will be discussed in greater detail in an upcoming section of this report that deals with inflation adjustments.

A lot of cogitation went into the decision to use a 20-year depreciation schedule. It certainly is true that roads may last beyond 20 years. In fact, it is often true that many of the assets used by businesses last longer than the depreciation schedule. Shorter depreciation periods are typically used in order to be more fiscally prudent. Since the normal "design life" of a highway is 20 years, we felt it wise to use an accounting approach that would look to earn back the original cost over that 20 years. This doesn't mean that the roadway would be discarded after 20 years, but merely that by recovering its initial cost we are better positioned financially. It would give the "business" of running a highway system more financial flexibility to cope with contingencies that may not have been forecast in the original design. Roads may need to be redesigned, realigned, and reconstructed before they are physically worn out. For instance, the Maricopa Freeway (I-10) went through major redesign and reconstruction in the Broadway curve area in less than a 20-year period from its original construction. The Superstition Freeway (US-60) was just widened a few years ago, now there is talk about the need to further widen it to 12 lanes in the next few years. So, we think a 20-year depreciation schedule is a reasonable and prudent length of time for recovery of the capital invested in a highway.

Several categories of revenue were defined for use in this analysis. This was done in an attempt to differentiate between revenue generated directly by highway users and that which was transferred into the DOT from other sources. A private corporation is expected to cover its expenditures using the revenue it generates through the sale of its products and/or services. If the state highway system is going to be evaluated from a private sector perspective, then it is necessary to exclude transfer payments, which are in effect, subsidies. The determination of the benefit of highways to society should be made by including only those payments made by consumers of the highways. In this case, state highway user fees are defined as those highway user revenues generated by travelers on the state highways.

A fairly extensive number of sources of revenue were included in the determination of net profits/losses. The revenues generated by the state highway system were divided into three general categories: highway user revenues, federal aid and inter-governmental transfers. The highway user fund revenue category captures the various fuel taxes, license taxes and registration fees that are paid by users of the roadways. A distinction is made between gross highway user revenues and net state highway user revenues. Gross highway user revenues include all of the taxes and fees paid by highway users into the Highway User Revenue Fund. The transfers out of the Highway User Revenue Fund are taken into account in the determination of net highway user revenues. Funds which are transferred to city and county governments and transfers to the General State Fund are subtracted from gross highway user revenues to determine net state highway user revenues. The category of federal aid encompasses all monies given to the state transportation department including funds from the Federal Highway Administration and other federal organizations. Inter-governmental transfers to the state highway systems come from the State General Fund as well as county and municipal governments. These transfers are in effect a subsidy to the state highway system, as they do not reflect income earned from the actual users of the roadways.

In determining net profits, a distinction was made in the types of revenues that were considered. In one determination of net profit/loss, all of the revenues including net state highway user revenue, total federal aid and total inter-governmental transfers were used. The

other type of revenue considered in this analysis was earned revenue. Earned revenue encompasses only that revenue that was generated by users of the state highway system and excludes all subsidies made to the state highway system. Earned revenue includes 50% of gross highway user revenues plus earned federal aid. Half of the gross highway user fund revenue is used in the calculation of earned revenue because approximately 50% of the total traffic on Arizona's roads occurs on the state highways themselves. In this way, only the income generated by users of the state highway system is included as state highway earned revenue. The earned federal aid portion of total earned revenue is equal to the total amount of federal aid divided by the apportionment ratio and multiplied by 50% (the ratio representing the amount of total traffic in Arizona which travels on state highways). This gives an indication of the amount of federal aid actually earned by the state highway system. An apportionment ratio greater than one indicates that the state government received more federal aid than they paid into the federal highway trust fund. The average ten-year apportionment ratio for Arizona between 1988 and 1997 indicates that more was paid into the federal system by the state than was received back from the federal government.

Figure 1 illustrates the net profit/loss for the Arizona State Highway System over the period 1988 through 1997. In general, the net profits generated by the state highways declined until 1993 when they began to rise once again. For the most part, when all sources of revenue were considered, the state highway system had a net profit. When only earned revenue was considered, the picture was much different. There were only four years out of ten when the state highway system generated a profit. This indicates that the state highway system did not generate enough revenue directly from the users of the system to cover the costs of providing the state highways during this period. The earned revenues eliminate all forms of subsidization from people who do not use the state highway system and all cross subsidies which may exist from motorists using roadways not included in the state system but who are paying fees which are being used to finance the state highways.

Both revenues and costs fluctuated over the ten-year period. Total costs rose more significantly than did revenues during the period of 1988 through 1993. After this time, the yearly change in revenues was generally higher than the change in costs. This pattern in revenues and costs helps to explain the general decline in net profits from 1988 through 1993 and the general upswing in net profits after 1993. Over the ten-year period, highway user revenues increased steadily despite the fact that gasoline and use fuel tax rates did not increase over the period. Inter-governmental transfers to state highways increased fairly steadily after 1993, as did the level of federal aid received by the state, both of which may help to explain the increase in overall net profits. Table 1 provides a more complete breakdown of the ten-year financial status of the Arizona State Highway System. The notes that follow the table provide a detailed line item explanation of each of the categories of expenditures and revenues.

For each of the years included in this analysis the residual value of state highway capital assets was calculated. This figure provides information on the depreciated value of the infrastructure of the highway system. As was previously mentioned, the effective life of the capital assets was set at 20 years which translates into a depreciation charge of 5% per year. In 1997 for example, capital outlays made in 1979 retain only 5% of their original value. Capital outlays made in 1997 however, retain 95% of their original value. In 1997, all capital outlays

made before 1979 have depreciated completely. The residual value of assets figure simply represents the sum of the depreciated value of the previous 20 years of capital outlays. This figure provides a more accurate representation of the assets held by the state highway system and is more in line with private sector approaches to the valuation of assets. A complete explanation of the calculations used in determining the residual value of assets for all of the years included in this study appears in Appendix B.

In sum, from a "going business" perspective, the state highway system is in precarious financial condition. The total return on assets for the 1988 to 1997 period was an anemic 2.5%. The earned return on assets for this time period was a negative 0.5%. This low rate of return on investment severely limits the DOT's ability to ensure the adequacy of the State highway system for future traffic needs. That is, a "break-even" or low rate of return on assets might be tolerable in a stagnant, no-growth environment, but is inadequate if robust growth in population and traffic is forecast.

From an equity standpoint, the State highway system earned about 97% of the costs incurred in providing these highways over the 1988 to 1997 period. Over this period, highway users in Arizona paid about $2.4 billion in vehicle license taxes that were transferred to the state's general fund. In turn, the State highway system received about $1.5 billion in non-user sales taxes. Consequently, the oft-heard contention that highway users are heavily subsidized by non-highway users via the Maricopa County freeway sales tax is not supported by the financial data. A similar equity conclusion was reached in a recent highway cost allocation study update (Carey, 1999). In that study, for a period spanning 1988 to 2003, highway users, as a group, were projected to have paid user taxes sufficient to have covered 98% of the cost of all roads in the state. Vehicles under 8,000 lbs. (a group that includes passenger cars, pick-up trucks, vans and sport utility vehicles) had tax payments equal to 105% of their share of the cost of all roads in Arizona.

Figure 1: Ten Year Trend in the Net Profits of the Arizona State Highway System

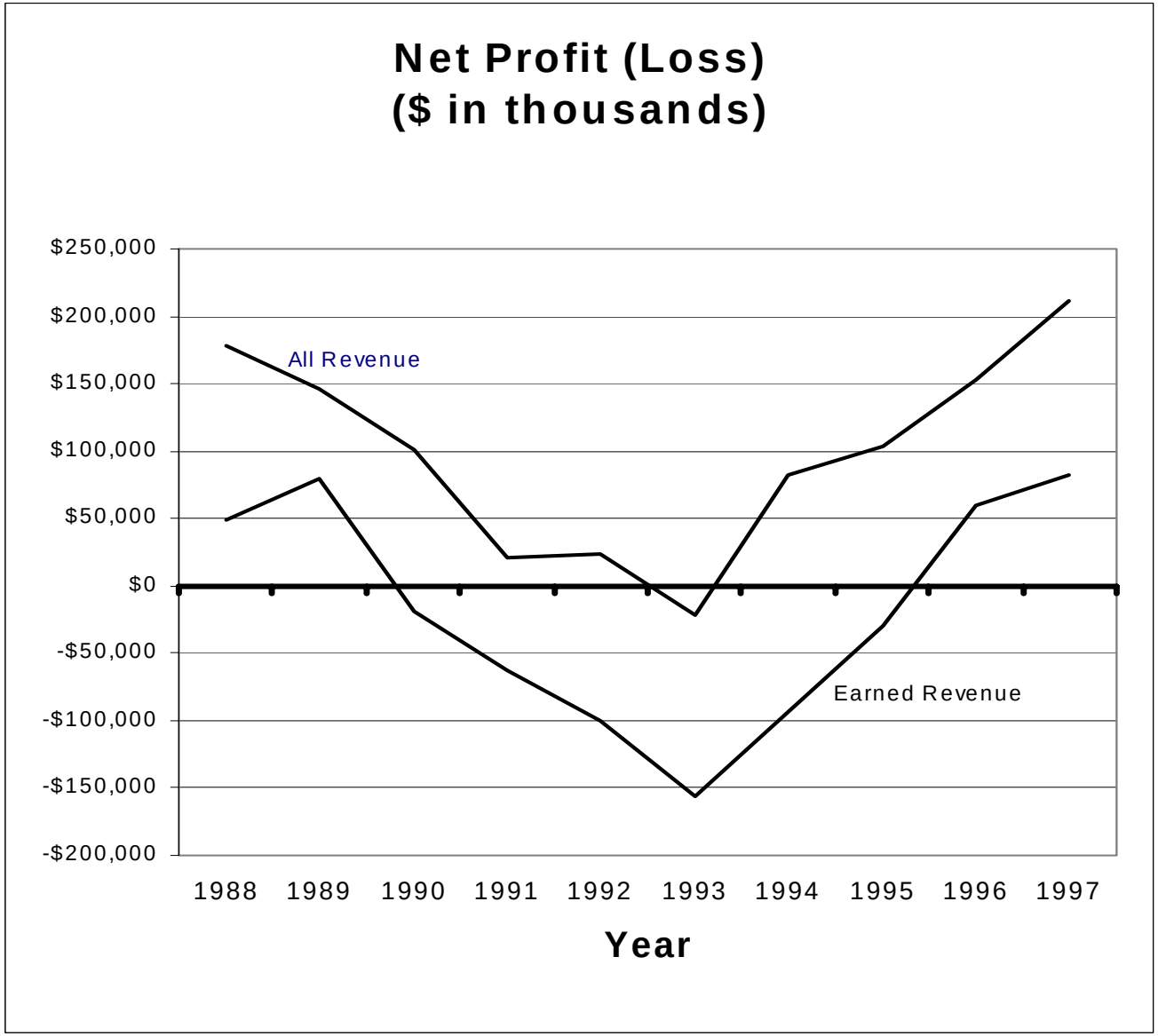

Table 1: Ten Year Income Statement for Arizona's State-Administered Highways ($ in thousands)

Costs/Expenditures	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Maintenance and Traffic Services[a]	$51,421	$53,815	$60,767	$65,265	$68,907	$74,471	$71,724	$76,205	$85,150	$70,109	$677,834
Administration and Miscellaneous[b]	$39,050	$44,292	$45,334	$61,934	$46,570	$54,606	$61,154	$45,872	$55,137	$38,118	$492,067
Highway Law Enforcement and Safety[c]	$52,780	$50,700	$53,064	$52,896	$50,045	$58,897	$61,554	$59,904	$75,638	$59,525	$575,003
Bond Interest[d]	$55,610	$57,621	$89,072	$93,171	$109,328	$146,745	$137,703	$88,230	$99,645	$81,548	$958,673
Fee and Tax Collection Costs[e]	$12,021	$25,919	$29,175	$26,243	$28,590	$27,516	$24,312	$33,081	$23,153	$59,252	$289,262
Construction Recovery Costs (Depreciation)[f]	$212,252	$234,921	$273,798	$299,419	$318,616	$336,734	$355,533	$370,547	$393,066	$412,043	$3,206,927
Total Costs/Expenditures[g]	$423,134	$467,268	$551,210	$598,928	$622,056	$698,969	$711,980	$673,839	$731,789	$720,595	$6,199,766

Revenues	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Highway User Revenues											
Gasoline Taxes[1]	$267,318	$286,101	$286,240	$296,816	$307,879	$315,227	$334,643	$342,299	$358,961	$363,953	$3,159,437
Use Fuel Taxes[2]	$47,610	$50,797	$52,876	$65,202	$61,910	$72,008	$87,913	$108,790	$114,780	$124,748	$786,634
Motor Carrier Taxes[3]	$98,707	$104,709	$104,343	$108,655	$109,573	$120,303	$118,530	$92,103	$85,433	$90,186	$1,032,542
Vehicle License Taxes[4]	$251,556	$254,365	$290,127	$294,686	$305,225	$333,419	$361,873	$417,657	$508,397	$556,359	$3,573,663
Registration Fees[5]	$79,090	$80,338	$88,536	$75,657	$74,180	$80,717	$83,826	$86,159	$97,601	$101,528	$847,632
Other[6]	$22,996	$23,402	$25,474	$24,033	$25,507	$24,161	$37,161	$39,238	$42,654	$41,294	$305,920
Gross Highway User Revenue[7]	$767,277	$799,712	$847,596	$865,049	$884,274	$945,835	$1,023,946	$1,086,246	$1,207,826	$1,278,068	$9,705,828
Transfers to General Fund[8]	$172,316	$174,240	$198,737	$201,860	$209,079	$228,392	$247,883	$286,095	$348,252	$381,106	$2,447,959
Allocations to City Governments[9]	$197,472	$204,112	$209,767	$208,708	$201,394	$210,531	$228,606	$237,920	$256,988	$267,931	$2,223,429
Allocations to County Governments[10]	$117,144	$121,052	$124,092	$123,746	$119,068	$124,468	$135,157	$140,627	$151,762	$166,908	$1,324,024
Net State Highway User Revenue[11]	$280,345	$300,308	$315,000	$330,735	$354,733	$382,444	$412,300	$421,604	$450,824	$462,123	$3,710,416
Federal Aid											
Federal Highway Administration[12]	$194,485	$174,947	$180,886	$157,562	$156,437	$157,088	$224,378	$187,572	$244,468	$276,143	$1,953,966
Other Agencies[13]	$1,245	$7,931	$13,541	$6,661	$5,733	$2,479	$3,169	$3,694	$2,387	$2,272	$49,112
Total Federal Aid[14]	$195,730	$182,878	$194,427	$164,223	$162,170	$159,567	$227,547	$191,266	$246,855	$278,415	$2,003,078
Apportionment Ratio[15]	1.11	0.62	0.90	0.79	1.02	1.14	1.07	0.95	0.66	0.85	0.87
Earned Federal User Revenue on State Highway System[16]	$88,167	$147,482	$108,015	$103,939	$79,495	$69,986	$106,330	$100,666	$187,011	$163,774	$1,154,865
Inter-Government Transfers to the State Highway System											
Appropriations from General Funds[17]	$45,435	$31,350	$30,932	$6,450	$2,483	$4,357	$547	$4,113	$7,739	$583	$133,989
From Counties and Townships[18]	$79,853	$96,746	$109,355	$110,005	$126,632	$130,589	$154,186	$160,230	$179,400	$190,973	$1,337,969
From Municipalities[19]	$0	$2,287	$2,303	$7,973	$0	$0	$0	$0	$0	$0	$12,563
Total Inter-Governmental Transfers to State Highways[20]	$125,288	$130,383	$142,590	$124,428	$129,115	$134,946	$154,733	$164,343	$187,139	$191,556	$1,484,521
Total State Highway System Earned Revenue[21]	$471,805	$547,338	$531,813	$536,463	$521,632	$542,903	$618,303	$643,789	$790,924	$802,807	$6,007,779
Subsidies from Non-Highway Users[22]	$125,288	$130,383	$142,590	$124,428	$129,115	$134,946	$154,733	$164,343	$187,139	$191,556	$1,484,521
Cross Subsidies from Other Highway Users[23]	$107,563	$35,396	$86,412	$60,284	$82,675	$89,581	$121,217	$90,600	$59,844	$114,641	$848,213
Total Resources from all Local, State and Federal Sources[24]	$601,363	$613,569	$652,017	$619,386	$646,018	$676,957	$794,580	$777,213	$884,818	$932,094	$7,198,015

Net Profit/Loss	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Net Profit/Loss (All Revenue Sources)[i]	$178,229	$146,301	$100,808	$20,458	$23,962	-$22,012	$82,600	$103,374	$153,029	$211,499	$998,249
Return on Investment (All Revenue Sources)[ii]	6.4%	4.7%	2.7%	0.5%	0.6%	-0.5%	1.9%	2.3%	3.3%	4.5%	2.5%
Net Profit/Loss (Earned Revenue)[iii]	$48,671	$80,071	-$19,397	-$62,465	-$100,424	-$156,066	-$93,676	-$30,049	$59,135	$82,213	-$191,987
Return on Investment (Earned Revenue)[iv]	1.7%	2.6%	-0.5%	-1.6%	-2.4%	-3.6%	-2.1%	-0.7%	1.3%	1.7%	-0.5%
Residual Value of Assets[v]	$2,790,091	$3,083,258	$3,681,396	$3,996,509	$4,166,167	$4,284,068	$4,397,122	$4,457,180	$4,626,501	$4,730,777	$4,021,307

Ten Year Income Statement Notes

The following notes are based on the Federal Highway Administration's *Guide to Reporting Highway Statistics*, specifically Chapter 8 (*Reports Identifying Receipts and Expenditures of State Highway Agencies)*. This publication provides the guidelines for state DOT's to use when reporting financial information to the FHWA for inclusion in the *Highway Statistics* report.

Expenditures

a. *Maintenance and Traffic Services*: This includes the cost of all the materials, supplies, and equipment involved in maintaining the highway system. This also includes all administrative and engineering costs that are directly linked to maintenance projects. The Maintenance and Traffic Services category is simply the sum of all the above mentioned categories.

b. *Administration and Miscellaneous*: This category includes all the expenses involved in the administration of the state Department of Transportation including salaries, general office expenses, the costs of construction and maintenance of DOT administrative buildings, insurance on these buildings, payment of damage claims and litigation. Highway planning and research costs are also included in this category.

c. *Highway Law Enforcement and Safety*: The costs of traffic supervision and enforcement of state highway laws, including vehicle size and weight restrictions, are accounted for in this category. The costs of safety and motor vehicle inspection programs are also included. The costs incurred in collecting motor vehicle taxes and fees are not included in this figure. The collection costs were netted out by ADOT before this information was submitted to the FHWA for inclusion in their data tables.

d. *Bond Interest*: The interest paid on bonds used for state highway construction is included as an expense. Re-payment of bond principal is not counted as an expense since the inflow of money when the bonds were first sold is not counted as revenue.

e. *Fee and Tax Collection Costs:* The administrative costs associated with collecting motor vehicle taxes and fees.

f. *Construction Recovery Costs (Depreciation)*: The state highway system is a fixed asset that depreciates over time. The life of state-highway capital outlays was set at 20 years and therefore, the value of capital outlays was depreciated at a steady rate of 5% per year. This procedure was undertaken to reflect the fact that construction costs incurred in one year are intended to provide a facility that will last a given number of years into the future. This entry reflects the expenditure that would be necessary to maintain the value of the state highway system. It is calculated by summing the 5% annual depreciation charge for each year's capital outlays over the previous 20-year period.

g. *Total Costs/Expenditures*: The sum of the Maintenance and Traffic Services, Administration and Miscellaneous, Highway Enforcement and Safety, Bond Interest, Fee and Tax Collection Costs, and Construction Recovery Costs (Depreciation) categories.

Revenues

1. *Gasoline Taxes*: The revenue raised by state taxation of gasoline.

2. *Use Fuel Taxes*: The revenue raised by state taxation of diesel fuel.

3. *Motor Carrier Taxes*: Sometimes referred to as the "weight-distance tax," this includes revenue generated through state taxes levied on commercial vehicles. The tax is based on registered gross weight and reported vehicle miles of travel within the state not on the ownership and operation of motor vehicles.

4. *Vehicle License Taxes*: These are *ad valorem* taxes levied on vehicles. The tax rate is based upon a depreciated original market value of the vehicle. This tax is currently being phased out by the state legislature and therefore this cannot be counted on as a future source of revenue for the state highway system.

5. *Registration Fees*: These are set fees levied upon vehicles registered in the state. Fees for commercial vehicles are based on registered gross weight and may be prorated for vehicles that operate in Arizona, but are registered in another state. A registration fee is a flat fee and does not reflect actual road usage.

6. *Other*: This category includes revenue from a variety of fees and taxes including (1)title fees, (2)driver licenses, (3)permits and penalties, (4)inquiry fees, (5)use fuel permits and penalties, (6)investment interest, (7)special plates, and (8)miscellaneous fees.

7. *Gross Highway User Revenue*: This is the sum of all previously listed taxes and fees. These revenues are generated directly by those people who use the highways and do not involve any transfers of revenue generated by non-users.

8. *Transfers to the General Fund*: This consists of the portion of vehicle license taxes (68.5% for the 1988 to 1997 period) that were transferred to the General Fund for non-highway expenditures. This is a subsidy from highway users to non-highway spending by government.

9. *Allocations to City Governments*: This is the portion of highway user revenue apportioned to cities within Arizona for use in building and maintaining city streets.

10. *Allocations to County Governments*: This is the portion of highway user revenue apportioned to counties within Arizona for use in building and maintaining county roads.

11. *Net State Highway User Revenue*: This is the residual of gross highway user revenue left after transfers to the general fund and allocations to city and county governments.

12. *Federal Highway Administration*: The actual cash payments made to the state DOT by the Federal Highway Administration. This figure does not reflect the obligations that the FWHA may have made to the DOT, only the actual payments that have been made to date. The entire allocation of revenue from the FHWA is meant to be used for highway purposes.

13. *Other Agencies*: Other agencies that may contribute revenue for state administered highways include the Federal Transit Administration and the National Highway Traffic Safety Administration. The original source of this money is from federal highway user taxes.

14. *Total Federal Aid*: This is the sum of revenues from the Federal Highway Administration and other agencies.

15. *Apportionment Ratio*: A ratio which compares the apportionments and allocations from the federal highway trust fund to state payments into the fund. A ratio greater than one indicates that the state received more money from the federal highway trust fund than they paid into it.

16. *Earned Federal User Revenue on the State Highway System*: This figure is determined by taking the total Federal Aid revenue (see note #14) dividing it by the apportionment ratio in order to reflect revenues generated by traffic in Arizona, and multiplying it by 50% (the estimate of highway user revenues generated by traffic on state highways as opposed to city and county roads). This reflects the amount of federal transfer payments that are actually earned or generated by users of the state highway system.

17. *Appropriations from General Funds*: Resources transferred to the DOT from the State General Fund. Includes the monies paid to the state DOT by other state agencies for roadwork when the ultimate source of those monies is the State General Fund.

18. *From Counties and Townships*: Revenue generated primarily through a ½ cent sales tax in Maricopa county.

19. *From Municipalities*: This records occasional revenues provided by municipalities for work on state highways.

20. *Total Inter-Governmental Transfers to State Highways:* The sum of the appropriations from general funds as well as the transfers from counties, townships, and municipalities. This reflects income that is not earned directly from highway users. It is a transfer of income from one branch of government to another and is in effect, a subsidy to the state highway system by non-users of the highway system.

21. *Total State Highway System Earned Revenue:* The portion of state highway revenues generated by users of the state highway system. It is estimated that 50% of total state highway user revenues are generated by travel on the state highway roads as opposed to county and municipal roads. Total state highway system earned revenue is equal to 50% of Gross Highway User Revenues plus the Earned Federal User Revenue on the State highway system.

22. *Subsidies from Non-Highway Users:* Equal to the Total Inter-Governmental Transfers to State Highways. This is revenue which is transferred to the state highway system but which is not generated by users of the state highway system.

23. *Cross Subsidies from Other Highway Users:* The cross subsidy is equal to Total Federal Aid minus Earned Federal User Revenue on State Highway Systems. This revenue is being generated by users of highway systems other than the Arizona State Highway System, but is being used for the maintenance and development of the Arizona state system. Since more money is transferred from other highway users in Arizona than is generated by highway users on the state highway system, this is a subsidy to the state system.

24. *Total Resources from all Local, State and Federal Sources:* The sum of the Net State Highway User Revenues, Total Federal Aid and Total Inter-Governmental Transfers to the State Highway. This indicates all of the revenue that is available to the state highway system regardless of whether it was earned by users of the state highway system or is a subsidy.

Net Profit/Loss

i. *Net Profit/Loss (All Revenue Sources)*: Total revenues as reported in the Total Resources from all Local, State and Federal Sources category net of Total Costs/Expenditures.

ii. *Return on Investment (All Revenue Sources):* Net Profit/Loss (All Revenue Sources) divided by the Residual Value of Assets (see Note v.). This represents the ability of the state highway system to use its assets to generate income from both users and non-users of the highway system.

iii. *Net Profit/Loss (Earned Revenue):* Total revenues as reported in the Total State Highway System Earned Revenue category net of Total Costs/Expenditures.

iv. *Return on Investment (Earned Revenue)*: Net Profit/Loss (Earned Revenue) divided by the Residual Value of Assets (See Note v.). This represents the ability of the state highway system to use its assets to generate income from users of the highway system.

v. *Residual Value of Assets*: A residual value of assets calculation was made for each of the years being considered. This provides an estimate of the depreciated value of the entire highway system at a given point in time. Depreciation was calculated at 5% per year, which corresponded to a 20-year life span for highway system capital outlays. For example, in terms of their value in 1997, capital outlays made in 1979 retain only 5% of their original value while capital outlays made in 1997 retain 95% of their value. By 1997, all capital outlays made before 1979 have depreciated completely.

Inflation Adjusted Depreciation

While the information on revenues for state administered highways has been reported in the current year's dollar, the information on capital outlays or construction recovery costs has been reported in nominal terms. The historical costs of various capital outlays however, are not representative of the expenditures incurred today to pay off these obligations. Therefore, calculating some form of inflation adjusted depreciation cost may be in order to ensure that an appropriate comparison of revenues and expenditures is being made. The inflation index used for this analysis was the Composite Price Index for Federal-Aid Highway Construction (FHWA, 1997).

This adjustment for inflation not only brings into better alignment the costs and revenues associated with the state highway system but also gives a more accurate representation of the costs involved in rebuilding or refurbishing the roadways. For the purposes of this analysis, the effective life of the roadways is estimated to be 20 years. After this time, most roads will likely need considerable upgrading. Adjusting the capital outlay costs by an inflation index will more adequately reflect the costs of maintaining the state highway system.

To calculate the inflation adjusted depreciation value of capital outlays in this analysis, historical capital outlay costs were amortized over a 20 year period and then adjusted to reflect their real dollar value for the ten year period of interest. The construction costs for each year were then calculated by summing over the current year plus the previous 19 years. For example, the cost of the capital outlays in 1970 were converted into 1988 dollars according the following formula:

$$5\%\ \text{of 1970 capital outlays} \cdot \left(\frac{\text{1988 composite price index}}{\text{1970 composite price index}} \right)$$

This calculation was carried out for all the capital outlays between 1969 and 1997 and for all the years between 1988 and 1997. A more complete discussion of the calculations that were done in order to convert the historical capital outlay costs to current dollars is included in Appendix C. Appendix C also includesw the procedures used to calculate straight line depreciation.

The adjustment of capital outlay depreciation for inflation worsened the financial situation of the state highway system. Table 2 outlines the inflation adjusted ten-year income statement for the state highway system and Figure 2 illustrates the effect of the inflation adjustment on the net profit/loss of the highway system. From the perspective of total revenues, the adjustment for inflation resulted in two years of net losses. When earned income was considered, there were only three years out of ten when the state highway system turned a net profit. Adjusting the capital outlays by an inflation factor increased these costs rather significantly. Table 3 compares the depreciation values for capital outlays before and after they were adjusted for inflation.

Figure 2: Ten Year Trend in Inflation Adjusted Net Profits of the Arizona State Highway System

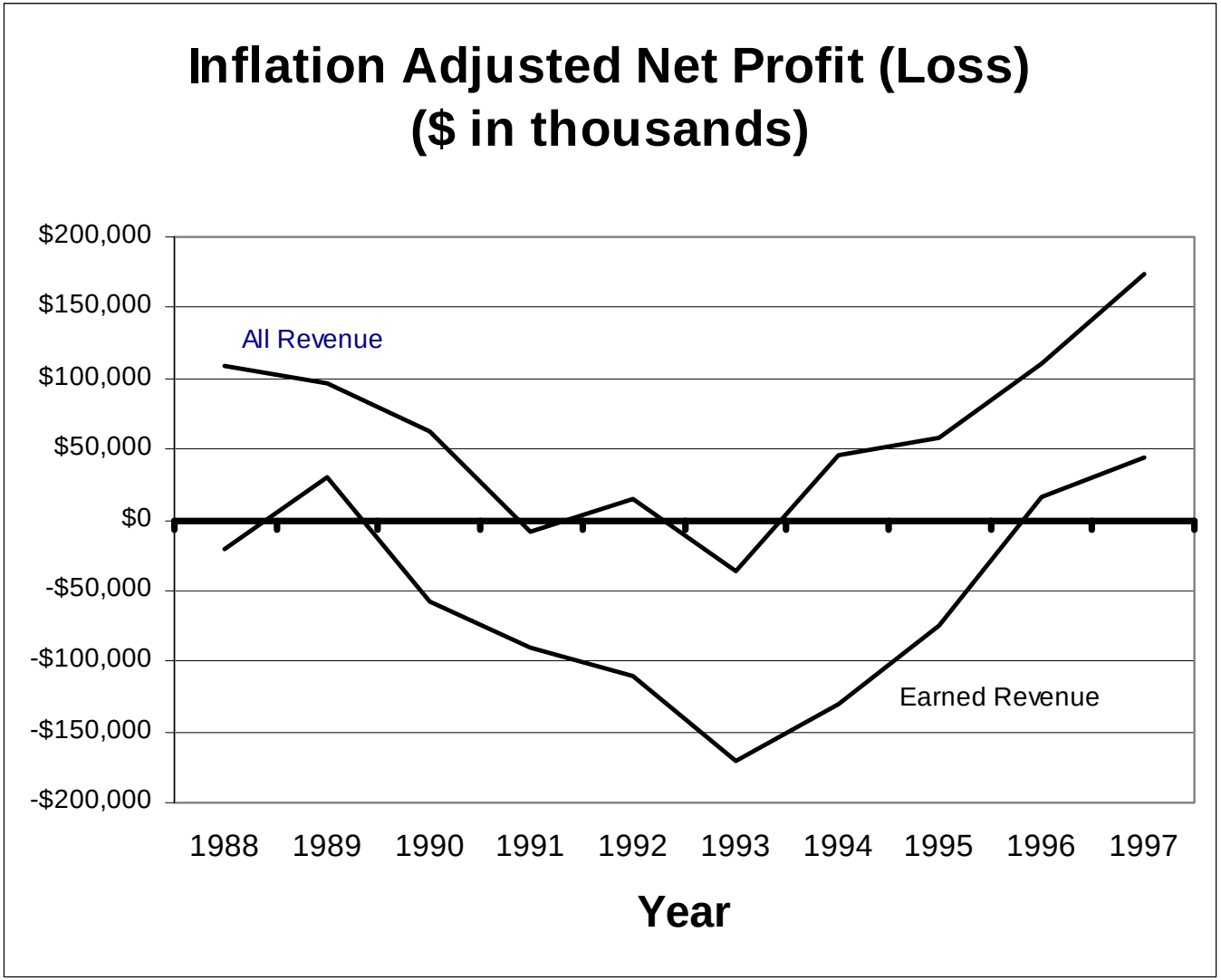

Table 2: Ten Year Income Statement for Arizona's State-Administered Highways with Inflation Adjusted Depreciation ($ in 1000s)

Costs/Expenditures	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Maintenance and Traffic Services[a]	$51,421	$53,815	$60,767	$65,265	$68,907	$74,471	$71,724	$76,205	$85,150	$70,109	$677,834
Administration and Miscellaneous[b]	$39,050	$44,292	$45,334	$61,934	$46,570	$54,606	$61,154	$45,872	$55,137	$38,118	$492,067
Highway Law Enforcement and Safety[c]	$52,780	$50,700	$53,064	$52,896	$50,045	$58,897	$61,554	$59,904	$75,638	$59,525	$575,003
Bond Interest[d]	$55,610	$57,621	$89,072	$93,171	$109,328	$146,745	$137,703	$88,230	$99,645	$81,548	$958,673
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Construction Recovery Costs (Depreciation)[f]	$293,291	$310,343	$341,530	$354,196	$356,497	$378,326	$416,305	$448,758	$458,664	$509,228	$3,867,138
Total Costs/Expenditures[g]	$492,152	$516,771	$589,767	$627,462	$631,347	$713,045	$748,440	$718,969	$774,234	$758,528	$6,570,715

Revenues	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Highway User Revenues											
Gasoline Taxes[1]	$267,318	$286,101	$286,240	$296,816	$307,879	$315,227	$334,643	$342,299	$358,961	$363,953	$3,159,437
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Registration Fees[5]	$79,090	$80,338	$88,536	$75,657	$74,180	$80,717	$83,826	$86,159	$97,601	$101,528	$847,632
Other[6]	$22,996	$23,402	$25,474	$24,033	$25,507	$24,161	$37,161	$39,238	$42,654	$41,294	$305,920
Gross Highway User Revenue[7]	$767,277	$799,712	$847,596	$865,049	$884,274	$945,835	$1,023,946	$1,086,246	$1,207,826	$1,278,068	$9,705,828
Transfers to General Fund[8]	$172,316	$174,240	$198,737	$201,860	$209,079	$228,392	$247,883	$286,095	$348,252	$381,106	$2,447,959
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Net State Highway User Revenue[11]	$280,345	$300,308	$315,000	$330,735	$354,733	$382,444	$412,300	$421,604	$450,824	$462,123	$3,710,416
Federal Aid											
Federal Highway Administration[12]	$194,485	$174,947	$180,886	$157,562	$156,437	$157,088	$224,378	$187,572	$244,468	$276,143	$1,953,966
Other Agencies[13]	$1,245	$7,931	$13,541	$6,661	$5,733	$2,479	$3,169	$3,694	$2,387	$2,272	$49,112
Total Federal Aid[14]	$195,730	$182,878	$194,427	$164,223	$162,170	$159,567	$227,547	$191,266	$246,855	$278,415	$2,003,078
Apportionment Ratio[15]	1.11	0.62	0.90	0.79	1.02	1.14	1.07	0.95	0.66	0.85	0.87
Earned Federal User Revenue on State Highway System[16]	$88,167	$147,482	$108,015	$103,939	$79,495	$69,986	$106,330	$100,666	$187,011	$163,774	$1,154,865
Inter-Government Transfers to the State Highway System											
Appropriations from General Funds[17]	$45,435	$31,350	$30,932	$6,450	$2,483	$4,357	$547	$4,113	$7,739	$583	$133,989
From Counties and Townships[18]	$79,853	$96,746	$109,355	$110,005	$126,632	$130,589	$154,186	$160,230	$179,400	$190,973	$1,337,969
From Municipalities[19]	$0	$2,287	$2,303	$7,973	$0	$0	$0	$0	$0	$0	$12,563
Total Inter-Governmental Transfers to State Highways[20]	$125,288	$130,383	$142,590	$124,428	$129,115	$134,946	$154,733	$164,343	$187,139	$191,556	$1,484,521
Total State Highway System Earned Revenue[21]	$471,805	$547,338	$531,813	$536,463	$521,632	$542,903	$618,303	$643,789	$790,924	$802,807	$6,007,779
Subsidies from Non-Highway Users[22]	$125,288	$130,383	$142,590	$124,428	$129,115	$134,946	$154,733	$164,343	$187,139	$191,556	$1,484,521
Cross Subsidies from Other Highway Users[23]	$107,563	$35,396	$86,412	$60,284	$82,675	$89,581	$121,217	$90,600	$59,844	$114,641	$848,213
Total Resources from all Local, State and Federal Sources[24]	$601,363	$613,569	$652,017	$619,386	$646,018	$676,957	$794,580	$777,213	$884,818	$932,094	$7,198,015

Net Profit/Loss	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Net Profit/Loss (All Revenue Sources)[i]	$109,211	$96,798	$62,250	-$8,076	$14,671	-$36,088	$46,140	$58,244	$110,584	$173,566	$627,300
Return on Investment (All Revenue Sources) [ii]	3.4%	2.8%	1.5%	-0.2%	0.3%	-0.8%	1.0%	1.1%	2.2%	3.1%	1.4%
Net Profit/Loss (Earned Revenue)[iii]	-$20,347	$30,567	-$57,954	-$90,999	-$109,715	-$170,142	-$130,137	-$75,180	$16,690	$44,280	-$562,936
Return on Investment (Earned Revenue) [iv]	-0.6%	0.9%	-1.4%	-2.1%	-2.6%	-3.8%	-2.7%	-1.5%	0.3%	0.8%	-1.3%
Residual Value of Assets[v]	$3,226,754	$3,477,795	$4,034,034	$4,257,191	$4,293,923	$4,500,969	$4,835,861	$5,103,405	$5,135,957	$5,587,424	$4,445,331

Table 3: Depreciation of Capital Outlays With and Without Inflation Adjustment
(thousands of dollars)

Year	Depreciation	Inflation Adjusted Depreciation
1988	212,252	293,291
1989	234,921	310,343
1990	273,798	341,530
1991	299,419	354,196
1992	318,616	356,497
1993	336,734	378,326
1994	355,533	416,305
1995	370,547	448,758
1996	393,066	458,664
1997	412,043	509,228

Standard financial accounting procedures do not typically take inflation into account. However, adopting this procedure may help to more accurately reflect the financial situation of the highway systems. Adjusting capital costs for inflation more accurately represents the financial obligations associated with the state highway system as well as more accurately reflecting the value of the assets held within the state highway system.

The spreadsheet codes which were used in the calculation of both the regular and inflation adjusted ten-year income statements are presented in Appendix D. These codes provide the guidelines for applying these financial analysis techniques to other data sets.

Return on Investment

Another major indicator of financial status is return on investment. The rate of return on investment represents the ability of the state highway system to use its assets to generate profits. The rate of return on investment for each of the years included in the analysis is presented in both Table 1 and Table 2. This figure was calculated by taking the net profit/loss in a given year and dividing it by the corresponding residual value of assets.

There was a significant difference in the rate of return on investment when all sources of revenue were considered and when only earned revenues were considered. The ten-year average rate of return on investment, when all revenue was considered was 2.5 %. When only earned revenue was considered, the ten-year average rate of return on investment was -0.5 %. The rate of return on investment was also adversely impacted by taking into account inflationary adjustment. When the residual value of assets is adjusted for inflation and all sources of revenue are considered, the average rate of return on return on investment falls to 1.4 % and when only earned revenue is considered, the rate falls to -1.3 %.

In order to assess the competitiveness of the return on investment for the state highway system, the rate of return from the highways was compared with other corporations involved in the transportation industry. A variety of trucking companies were chosen for comparison purposes and information was collected from recent annual and quarterly reports (1996-1999) filed by the companies. The average rate of return on investment (assets) was approximately 5.7%. The average rate of return investment for the state highway system was 2.5% for the ten-year period and was 3.4% for the three years from 1995 through 1997. There does appear to be some room for the state highway system to improve in terms of using their assets to generate additional income. When only earned revenue is taken into consideration, the comparison between the state highway system and private sector transportation companies is even worse. The three year average rate of return on investment for earned revenue from the state highways was 0.77%. Since the rate of return for private sector transportation providers considers only income that they have earned, comparing the return from earned income of the highways is more appropriate. This indicates that the state highway system is vastly under-pricing their services and not meeting their full potential in terms of generating revenue from their assets.

IV. The Value of the Highway System

The value of the highway transportation network is considerable, given its extensive use in transporting both freight and passengers. The costs incurred in constructing and maintaining the system are also quite considerable. The future solvency and efficiency of the state highway transportation network is going to be dependent on charging the correct price for the portion of transportation services provided by the state. Ensuring that the state highway network generates enough revenue to cover the current costs of construction, maintenance and administration as well the additional monies needed to replace its depreciating assets should be a goal of transportation agencies.

Promoting economic efficiency in all government activities, including the provision of highway services will also be an important goal for the future. "Getting prices right" is one way that this will be achieved. In the case of roadways, however, the situation is complicated by the fact that consumers do not always pay directly for what they consume. Consequently, the taxes and fees paid by users of the highway system do not accurately represent the roads' true value.

Private corporations must ensure that the prices they charge for their goods and services are sufficient to cover the costs of providing these services. Government agencies should operate under no less fiscally sound standards. If government agencies operated according to the economic principles of private corporations, net profits would have to be positive and sufficient to replace depreciating assets, and there would be a positive and significant rate of return on assets.

A number of studies have attempted to quantify the value of highways and assess the economic efficiency with which highway infrastructure and services are provided. The amount of literature in this area is, however, minimal. This study will attempt to add to this body of literature by comparing the value of owning and operating a motor vehicle with the amount that highway users pay in terms of taxes and fees for highway construction, maintenance and

administration. This study will also compare the amount of revenue generated through highway user charges with the costs of highway provision.

If the price paid for a good or service represents the minimum value placed on that good or service, then transportation consumers place considerable value on roadways and private transportation. Over the past few decades, the amount that consumers spent to own and operate an automobile increased considerably (Table 4). The amount that consumers spent in order to own and operate an automobile increased by far more than the resources available to construct and maintain highways. For example, between 1980 and 1990 the amount consumers spent to own and operate cars increased by almost 90%. During the same period, highway user fees and taxes (federal and state) increased by 53% and total government (federal, state and local) expenditures on highways increased by 46% (Wilson, 1998).

Table 4: Consumer Expenditures on Private Automobile Transportation
(millions of dollars)

	1960	**1970**	**1980**	**1990**	**1997**[1]
New and used cars	20,406	32,139	73,266	165,500	189,200
Other motor vehicles	606	2,883	10,060	50,300	77,100
Tires, tubes, accessories	2,924	7,135	22,234	25,444	43,111
Gasoline and oil	15,964	29,892	99,724	120,444	140,556
Tolls	365	767	1,141	2,222	3,869
Insurance less claims paid	2,387	4,414	11,465	20,111	32,556
Interest on debt	2,777	4,662	17,548	35,535	38,222
Auto registration fees	863	1,669	2,892	6,054	7,220
Operators' permit fees	119	222	370	638	848
Repair/greasing/washing/ parking/storage/rental	5,959	13,214	37,999	91,778	154,900
Total	**52,370**	**96,997**	**276,699**	**518,026**	**687,581**

[1] Preliminary estimate

Source: Transportation in America: Statistical Analysis of Transportation in the United States Sixteenth Edition (Wilson, 1998)

The amount of money consumers spend to own an automobile can act as a proxy for the value of transportation networks. After all, without roads on which to drive, an automobile would be practically worthless. It is important therefore, for transportation agencies to adequately fund highway construction and maintenance and to plan for the future. These historical statistics on automobile expenditures indicate that the demand for highway transportation services is likely to increase well into the future.

Rowell, Buonincontri, and Semmens (March 1999), give us a clue for estimating the value of the Arizona state roadways. They examined the average per mile cost of owning and operating both commercial and non-commercial motor vehicles. The average value associated with operating a commercial vehicle, in 1998 dollars, was approximately 44 cents per vehicle mile. This value was calculated by dividing the revenue generated by the trucking industry and dividing by the total number of vehicle miles traveled. Determining the value of roadways for

non-commercial vehicles was a more complicated undertaking since they do not generate measurable revenues. The value of roads to non-commercial vehicles was estimated using the costs of vehicle depreciation, insurance, vehicle registration fees and taxes, gasoline purchases, and vehicle maintenance and repair. Based on these categories, the average cost of operating a non-commercial vehicle in 1996 was 27.5 cents per vehicle mile. This average cost was weighted based on different classes of automobiles. For a complete discussion of the methodology and results of this analysis see Appendix E. As stated earlier, economic theory dictates that this price is a proxy for the minimum value that consumers of automobile-based transportation systems place on this service.

A similar analysis was also done at the national level (FHWA, 1998). This study found the average cost of owning and operating a vehicle fell in the range of 30-50 cents per mile (Table 5), somewhat higher than the results obtained by Rowell *et al.* The methodologies used in the two studies appeared to be similar in terms of the specific costs of ownership and operation that were incorporated (depreciation, insurance, registration fees, gasoline, etc). The differences in results may be attributed to the fact that the FHWA only considers the first five years of life of a vehicle while the Rowell report focused on vehicles actually in use on Arizona's roads. Given its mild climate, cars last longer in Arizona and consequently, the fixed costs are spread over more years and miles of driving. This lowers the average cost per vehicle mile of travel in Arizona.

Table 5: Cost of Owning and Operating An Automobile –1996
(Cents Per Mile)[1]

Size	Cost[2]
Subcompact	32.0
Compact	25.8
Intermediate	44.3
Full-Size Vehicle	46.3
Compact Pickup	31.3
Full-Size Pickup	39.9
Compact Utility	40.7
Full-Size Utility	45.4
Mini-Van	40.0
Full-Size Van	48.9

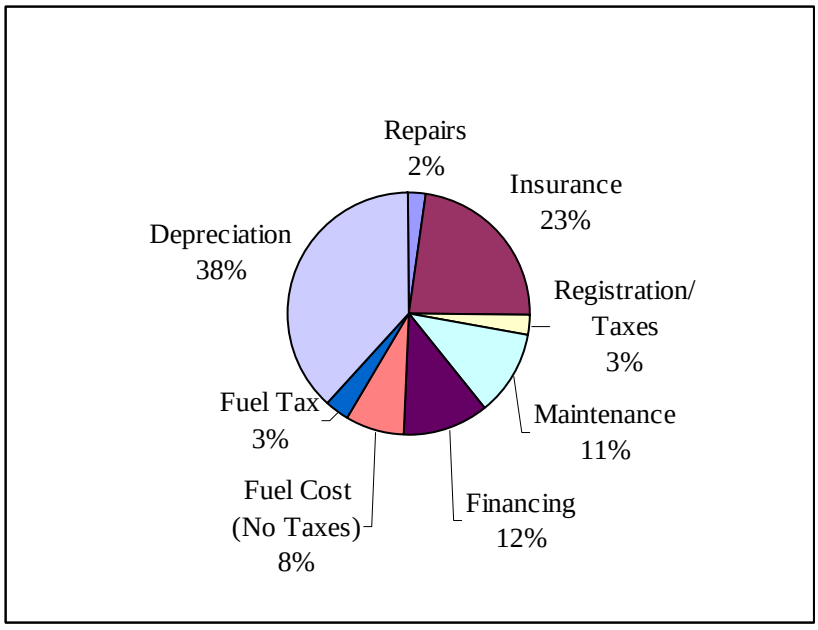
[1]Includes depreciation, financing, insurance, registration fees, taxes, fuel, maintenance and repairs.
[2] Total costs over 5 years, based on 70,000 miles.

Source: Our Nation's Highways: Selected Facts and Figures (Federal Highway Administration, 1998)

The percentage of the total cost of owning a vehicle that is attributable to registration fees and taxes (3%) and fuel taxes (3%) (the main source of revenue for highways) is minor (see Figure 3). An intermediate size vehicle, with an average cost of 44.3 cents per mile, would pay about 1.2 cents per mile in registration fees and taxes and 1.4 cents per mile in fuel taxes (FHWA, 1998). Respectively, these charges account for 2.7% and 3.2% of the total costs of

owning and operating an automobile. Yet, a vehicle would be essentially worthless without proper roads on which to drive it. The amount that people are willing to pay to have the freedom and convenience of travelling by automobile or shipping by truck is quite high, but the amount of this value that is being captured by the agencies that provide transportation infrastructure is quite low. This may be an indication that highways and roadways in general are being under-valued and therefore, under-priced.

Figure 3: Ownership and Operating Costs By Category for an Intermediate Size Vehicle (1996)



Note: Based on an average cost of 44.3 cents per mile.
Source: Our Nation's Highways: Selected Facts and Figures (Federal Highway Administration, 1998)

Winston and Shirley (1998) conducted a study examining the value and efficiency of urban transportation systems. The authors found evidence of inefficiency in urban transportation systems. In particular, they found that too many resources were being invested in public transportation at the expense of urban highways. The authors calculated a net loss of $6 billion for U.S. public transportation systems while urban highways generated a net benefit of more than $200 billion per year. They recommended the privatization of both the public transportation and urban highway systems in order to promote a more efficient allocation of resources. This study further bolsters the enormous value that is generated by highway systems and the need to manage this asset in an economically efficient manner.

Another study which looked at the relationship between highway user revenue and highway expenditures (Mallinckrodt, 1998) showed that the amount spent on highways in the United States was less than what was collected in highway user fees. Mallinckrodt defined highway user fees as “all those categories of government fees and taxation, paid by road users and only road users to all levels of government, irrespective of the use to which those funds may be put.” He included those fees which, although generated by highway or automobile users, were

not necessarily allocated to fund highway projects. Based on federal highway statistics for the year 1993, this study found that highway user fees exceeded government expenditures by approximately $49 billion.

A recent study done by AASHTO (1998) shows that investments made in the total highway system between 1980 and 1991, by all levels of governments, had an average net rate of return of 14.6%. This was higher than the average rate of return for many private sector investments. This is considerably higher than the rate of return calculated for the Arizona State Highway System. This is partially due to the fact that the social benefits of the highway system were included in the AASHTO study while this study focused only on the purely financial benefits of the highway system (such as would be considered by a private sector corporation).

A number of researchers are becoming interested in assessing the value of highway systems and reconciling the value of the system with the costs of provision. There are several reasons why this type of analysis is important. First, it is crucial in terms of deciding where to allocate limited government funds. If the highway system is seen to be valuable to those who use it and to the economy in general, then there will be a precedent for continued and increased investment in the system. Quantifying the value of highways is also important in terms of developing appropriate pricing policies. If the value of the highway system is seen to greatly outweigh the actual price paid for this service it may provide justification for increasing the amount charged to users of the system. This increase could take many different forms including increasing vehicle licensing fees, raising gasoline taxes or implementing a more direct form of user fees, for example, electronically tolled roads. However, before decisions regarding how best to capture excess consumer surplus (the difference between the value a person places on a good or service and what they actually have to pay), the actual amount of surplus must be estimated.

The Value of the Arizona State Highway System

Many of the previously cited studies determined the value of highways on a per mile of travel basis. Contrasting the value of travel per mile and the actual costs incurred for travel per mile can provide some valuable information as to whether or not highway user charges are adequately reflecting the true value that consumers place on the system. Between 1988 and 1997, the state highway system earned just over $6 billion from users of the state highway system (not including subsidies). During this same time, there were over 163 billion annual vehicle miles traveled on the state highway system (Arizona Highway Performance Monitoring System). Users of the highway system were charged approximately 3.6 cents per vehicle mile of travel that they engaged in over the period. This charge is considerably lower than the 27.5 cent per mile value that is attributed to non-commercial and the 44 cents per mile value that is attributed to commercial users of Arizona's roads in Rowell *et al*. (1999). This provides an indication that the services of the state highway system may be under valued and under priced.

In determining how to best capture the value of the state highway system it is important to balance both efficiency and equity. The price charged for the use of the highway must be set at an efficient level, but the costs must also be spread in an equitable manner across users. In general, there are two groups of users, commercial vehicles and non-commercial vehicles and the costs that these different types of vehicles impose on the roadways is quite different. It seems

therefore, only fair to impose different levels of charges on different types of vehicles. It is the case in Arizona that passenger cars and trucks pay more in taxes than they are responsible for in terms of their associated highway building and maintenance costs (Carey, 1999). Carey (1999) found that non-commercial vehicles pay more in taxes than they are responsible for in costs. These non-commercial vehicles are paying about 105% of their share of the costs of highway maintenance and expansion. Commercial vehicles including buses, single unit trucks, and combination trucks pay less in revenues than their cost responsibility. These categories of commercial vehicles, as a group, are paying about 86% of their share of the costs of highway maintenance and expansion. Correcting this inequity in cost responsibility should be one of the goals of transportation policy makers.

Using the information on actual costs and revenues and the goal of a 5% rate of return on investment an estimate of an efficient and equitable price for highway services can be made. In order to encourage self-sufficiency within the state highway system only earned revenue will be considered (all subsidies from non-users of the state highway system and transfers from other branches of government have been excluded). Based on 1997 figures, vehicles are currently paying about four cents per vehicle mile of travel on the state highway system. In order to generate a modest 5% return on the State highway system investment, highway users would need to pay an average of 5.2 cents per vehicle mile of travel. This would represent a 30% increase in the "price" of using the state highway system. This charge is based on the fact that an additional $235 million per year would need to be generated in highway user revenues to establish a net profit level sufficient to create a more competitive return on investment.

Increasing existing highway user taxes by about 30% would be one way of bolstering the financial condition of the state highway system. However, is not the only option that is available for increasing revenues. There are various more direct pricing mechanisms that could be used to replace the taxes and fees that are currently being used to generate revenues. Alternative pricing techniques like electronically tolled roads for example, would be a more efficient and equitable way to generate the revenues necessary to build and maintain the state highway system. This would enable the DOT to charge users of the state highway system directly and according to their actual use of the roads rather than through proxies of actual use such as gasoline consumption. This would be more equitable in that those vehicles using the roads more often, especially during periods of peak demand, and, therefore, imposing a higher cost on the roadway, would be responsible for paying their fair share. Electronic tolling might also be useful in terms of helping to regulate traffic patterns. Higher prices could be charged to vehicles using the roadways during peak periods. This might help to encourage people to change their driving patterns and help ease the social costs associated with congestion and urban pollution. This method of revenue generation would also bring the DOT more in line with private sector approaches to business. The DOT would be charging consumers directly for the use of their roads just as a business charges consumers directly for the products that they sell. Various studies have been done (Semmens, 1987; Semmens, 1987a; Semmens, 1993) which outline, in more detail, the some of the benefits associated with electronic pricing as well as the variety of electronic pricing strategies which are currently available.

V. Conclusions and Recommendations

The goal of this project was to analyze the financial condition of the state highway system using a private sector perspective and framework. The results of the private sector style analysis of Arizona's state highways produced somewhat mixed results. The more traditional approach to government financial accounting includes all sources of revenue regardless of whether they were earned by the highway system or were subsidies from other branches of government or non-highway users. When all sources of revenue for the state highway systems are considered, the highway system generated an overall level of positive net profits and a rate of return on investment equal to approximately 2.5%. This rate of return on investment however, was much lower than that found for other private sector companies operating in the transportation field.

The profitability of the state system was also analyzed from the perspective of earned revenues. This is more in line with the situation faced by private sector corporations where the ultimate ability of the corporation to generate a profit depends on their ability to generate revenues from those people that buy and use their products. When the financial viability of the state highway system is analyzed from the perspective of the revenue it is able to generate from users of the highway system, the overall profitability declines significantly. For the ten-year period considered in this analysis, there is a net loss for the highway system and the average rate of return on investment is -0.5%. Adjusting for inflation further worsens the return on investment, dropping it to –1.3%. This provides a strong indication that the state highway system is not generating sufficient revenues directly from the users of the highway system to pay for the administration and maintenance of the state highways.

The amount charged to consumers of the transportation system is low relative to the value provided by the highway system. On average, users are generating about four cents per vehicle mile in revenue for the state highway system, yet the study by Rowell *et al*. (1999) indicates that the minimum value they place on transportation is in the range of 30¢ per mile. There is obviously a great deal of room for the Arizona Department of Transportation to capture more of the value generated by the state highways and use this additional revenue to create new and better transportation routes and to improve on existing ones.

To promote economic efficiency, the DOT needs to ensure that it can generate enough revenue from its users to meet its expenditures on state highways. This is happening on average, when all sources of revenue are considered, but there is very little net profit being created. When only earned revenue is taken into account, the system proved to be operating at a net loss most of the time and making only a very marginal level of net profits in more recent years. Profits need to be improved to ensure that the future needs of the DOT and the transportation network are capable of being met. Maintaining a positive stream of net profits is required to ensure that investments can be made to replace deteriorating infrastructure and expand to meet growing demand. The DOT needs to increase the amount of revenue it generates from those people who benefit from the transportation system, the users themselves. Focusing on alternative pricing and fee collection strategies, like electronic tolling, which charge users directly for their use of the roads, is one possible way to achieve this goal in an efficient and equitable fashion.

The various studies cited here show that consumers place a high value on the road system. The amount that they have to pay for the roads, however, is very low. In order to ensure the long-term financial stability and self-sufficiency of the state highway system it will be necessary to increase revenues from customers. The price that consumers are paying to the DOT for the use of state highways in no real way reflects the value of those roadways. New pricing strategies must be developed in order to capture more of the true value of state highways. As the economy and population of Arizona continues to grow, there will be greater demands placed on state highways both in terms of moving goods and people. Additional revenues must be generated to ensure that this growth in demand can be met in an effective and efficient manner. Ensuring that the state highways earn a competitive rate of return on investment will help to create the additional resources that are needed to maintain the state highway system as a "going business" concern and to meet the demands of the future. Managing the state highway system while keeping in mind the principles and practices which govern private enterprises will help to promote the financial viability and economic efficiency of the system into the future. A private sector approach might also help to ensure that the financial returns of the state highway more closely reflect their true value.

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Appendix A: Sample Corporate-Style Annual Report for Arizona's State Administered Highways

The following section provides a sample corporate-style annual report for Arizona's highways. The formatting and approach discussed in Section II is applied to the governmental data on Arizona's highways. As previously stated, a typical private sector annual report includes a letter from the director, a ten year summary of financial information, current year consolidated financial statements and an auditor's statement.

Letter from the Director

The mission of the Arizona Department of Transportation is "to provide a safe and efficient transportation system, together with the means of revenue collection and licensing for Arizona. The activities of the department are conducted keeping in mind the following goals:

- To improve the movements of people and products throughout Arizona.
- To increase the quality, timeliness and cost effectiveness of our products and services.
- To develop and retain a high performing successful workforce.
- To optimize the use of all resources.
- To improve public and political support necessary to meet Arizona's transportation needs.

The Department has also developed several breakthrough strategies that emphasize the importance of efficiently allocating its resources as well as improving the performance of the highway system. In particular, the department has stressed the allocation of resources based on mandates, planned priorities, customer requirements and return on investment.

Arizona's Highway User Revenue Fund (HURF) has shown continued growth over the past few years (ADOT, 1997) and is the major source of revenue for the department. In FY 1997, HURF revenues were expected to total approximately $875 million (ADOT, 1997). HURF is distributed among a number of governmental agencies including the Department of Transportation, Arizona towns, cities and counties, the Department of Public Safety and the Economic Strength Project fund.

A Five-Year Highway Construction Program was initiated in 1997. Approximately $2.5 billion was allocated for highway construction projects between 1997 and 2001. This program includes funding for new construction and widening projects on the National Highway System, resurfacing on the national and statewide highway systems and minor projects throughout the state.

Over the past few years, the Department of Transportation has undertaken a number of important construction projects. Both urban and rural areas were targeted for construction and improvement projects. A number of urban freeway projects were completed in the Maricopa County area and in the Phoenix regional area in particular. For the 1997 fiscal year, construction expenditures for state highways (including staff costs) were approximately $478 million (ADOT,

1998). More than half of these expenditures ($282 million) was directed towards projects in Maricopa County. Pima County had the next highest allocation ($44 million).

A Ten Year Perspective of the Financial Status of Arizona's Highways

Over the past ten years, the state administered highway system has been marginally profitable. On average, total revenues have exceeded total costs. Between 1988 and 1997, there was a total net profit of approximately $998 million. Since 1993, there has been a general upward trend in net profits after a period of general decline in net profits between 1988 and 1993. The average ten-year rate of return on investment was relatively low at 2.5%. This is somewhat lower than the rate of return realized by other private sector corporations involved in the transportation industry, which averaged approximately 5.7%.

Current Financial Outlook for Arizona's State Administered Highways

The financial outlook for the state administered highway system has generally improved over the past three years. Total costs decreased in 1997 as compared to 1996 levels. This is a result of decreases in the costs associated with maintenance and traffic services, administration, law enforcement, and bond interest. The revenues generated from highway user fees, inter-governmental transfers and federal aid have all increased over the past three years. This lowering of costs and increase in revenues accounts for the increase in net profits since 1995. In fact, net profits in 1997 are more than double what they were in 1995, which is a significant improvement.

The rate of return on investment on state highway infrastructure has also improved over the past three years. In 1997 the rate of return on investment was 4.5%, the highest rate of return on investment realized by the state highway system since the late 1980s. Private sector corporations involved in the transportation industry have averaged a 5.7% return on investment in the past few years. The rate of return for the state-administered highway system is still lower than for other comparable business alternatives but it has greatly improved over the past three years and is in the general ballpark of other similar enterprises.

The following table outlines in greater detail the sources of costs and revenues for the state-administered highway system. The notes to the table form an integral part of the table and contribute detailed information on the types of revenues and costs that were factored into the income statement and how these various categories of information were calculated.

Three Year Income Statement for Arizona's State-Administered Highways
(millions of dollars)

Costs/Expenditures	**1995**	**1996**	**1997**
Maintenance and Traffic Services[a]	$76.2	$85.2	$70.1
Administration and Miscellaneous[b]	$45.9	$55.1	$38.1
Highway Law Enforcement and Safety[c]	$59.9	$75.6	$59.5
Bond Interest[d]	$88.2	$99.6	$81.5
Fee and Tax Collection Costs[e]	$33.1	$23.2	$59.3
Construction Recovery Costs (Depreciation)[f]	$370.5	$393.1	$412.0
Total Costs/Expenditures[g]	$673.8	$731.8	$720.6
Revenues	**1995**	**1996**	**1997**
Gross State Highway User Revenue[1]	$1,086.2	$1,207.8	$1,278.1
Transfers to General Fund[2]	($286.1)	($348.3)	($381.1)
Allocations to City Governments[3]	($237.9)	($257.0)	($267.9)
Allocations to County Governments[4]	($140.6)	($151.8)	($166.9)
Net State Highway User Revenue[5]	$421.6	$450.8	$462.1
Total Federal Aid[6]	$191.3	$246.9	$278.4
Inter-Government Transfers to the State Highway System			
Appropriations from General Funds[7]	$4.1	$7.7	$0.6
From Counties and Townships[8]	$160.2	$179.4	$191.0
Total Inter-Governmental Transfers to State Highways[9]	$164.3	$187.1	$191.6
Total Revenues from all Local, State and Federal Sources[10]	$777.2	$884.8	$932.1
Net Profit/Loss	**1995**	**1996**	**1997**
Net Profit/Loss [i]	$103.4	$153.0	$211.5
Return on Investment [ii]	2.3%	3.3%	4.5%
Residual Value of Assets [iii]	$4,457.2	$4,626.5	$4,730.8

Income Statement Notes

The following notes are based on the Federal Highway Administration's *Guide to Reporting Highway Statistics*, specifically Chapter 8 (*Reports Identifying Receipts and Expenditures of State Highway Agencies)*. This publication provides the guidelines for state DOT's to use when reporting financial information to the FHWA for inclusion in the *Federal Highway Statistics* report.

Expenditures

a. *Maintenance and Traffic Services*: This includes the cost of all the materials, supplies, and equipment involved in maintaining the highway system. This also includes all administrative and engineering costs that are directly linked to maintenance projects. The Maintenance and Traffic Services category is simply the sum of all the above mentioned categories.

b. *Administration and Miscellaneous*: This category includes all the expenses involved in the administration of the state Department of Transportation including salaries, general office expenses, the costs of construction and maintenance of DOT administrative buildings, insurance on these buildings, payment of damage claims and litigation. Highway planning and research costs are also included in this category.

c. *Highway Law Enforcement and Safety*: The costs of traffic supervision and enforcement of state highway laws, including vehicle size and weight restrictions, are accounted for in this category. The costs of safety and motor vehicle inspection programs are also included. The costs incurred in collecting motor vehicle taxes and fees are not included in this figure. The collection costs were netted out by ADOT before this information was submitted to the FHWA for inclusion in their data tables.

d. *Bond Interest*: The interest paid on bonds used for state highway construction is included as an expense. Re-payment of bond principal is not counted as an expense since the inflow of money when the bonds were first sold is not counted as revenue.

e. *Fee and Tax Collection Costs:* The administrative costs associated with collecting motor vehicle taxes and fees.

f. *Construction Recovery Costs (Depreciation)*: The state highway system is a fixed asset that depreciates over time. The life of state-highway capital outlays was set at 20 years and therefore, the value of capital outlays was depreciated at a steady rate of 5% per year. This procedure was undertaken to reflect the fact that construction costs incurred in one year are intended to provide a facility that will last a given number of years into the future. This entry reflects the expenditure that would be necessary to maintain the value of the state highway system. It is calculated by summing the 5% annual depreciation charge for each year's capital outlays over the previous 20-year period.

g. *Total Costs/Expenditures*: The sum of the Maintenance and Traffic Services, Administration and Miscellaneous, Highway Enforcement and Safety, Bond Interest, Fee and Tax Collection Costs, and Construction Recovery Costs (Depreciation) categories.

Revenues

1. *Gross Highway User Revenue*: Gross highway user revenues include all monies collected through the gasoline tax, use fuel tax, motor carrier tax, vehicle license tax, registration fees and other miscellaneous charges. These revenues are generated directly by those people who use the highways and do not involve any transfers of revenue generated by non-users.

2. *Transfers to the General Fund*: This consists of the 68.5% of vehicle license taxes that were transferred to non-highway expenditures.

3. *Allocations to City Governments*: This is the portion of highway user revenue apportioned to cities within Arizona for use in building and maintaining city streets.

4. *Allocations to County Governments*: This is the portion of highway user revenue apportioned to counties within Arizona for use in building and maintaining county roads.

5. *Net State Highway User Revenue*: This is the residual of gross highway user revenue left after transfers to the general fund and allocations to city and county governments.

6. *Total Federal Aid*: This is the sum of revenues transferred to the state department of transportation from the Federal Highway Administration and other agencies such as the Federal Transit Administration and the National Highway Traffic Safety Administration. This revenue is intended to be used for highway purposes. The source of this revenue is federal highway user taxes.

7. *Appropriations from General Funds*: Resources transferred to the DOT from the State General Fund. Includes the monies paid to the State DOT by other State agencies for roadwork when the ultimate source of those monies is the State General Fund.

8. *From Counties and Townships*: Revenue generated primarily through a ½ cent sales tax in Maricopa county.

9. *Total Inter-Governmental Transfers to State Highways:* The sum of the appropriations from general funds as well as the transfers from counties and townships. This reflects income that is not earned directly from highway users. It is a transfer of income from one branch of government to another and is in effect, a subsidy to the state highway system by non-users of the highway system.

10. *Total Resources from all Local, State and Federal Sources:* The sum of the Net State Highway User Revenues, Total Federal Aid and Total Inter-Governmental Transfers to the State Highway. This indicates all of the revenue that is available to the state highway system regardless of whether it was earned by users of the state highway system or is a subsidy.

Net Profit/Loss

i. *Net Profit/Loss*: Total revenues as reported in the Total Resources from all Local, State and Federal Sources category net of Total Costs/Expenditures.

ii. *Return on Investment:* Net Profit/Loss divided by the Residual Value of Assets (see note iii). This represents the ability of the state highway system to use its assets to generate income from both users and non-users of the highway system.

iii. *Residual Value of Assets*: A residual value of assets calculation was made for each of the years being considered. This provides an estimate of the depreciated value of the entire highway system at a given point in time. Depreciation was calculated at 5% per year, which corresponded to a 20-year life span for highway system capital outlays. For example, in terms of their value in 1997, capital outlays made in 1979 retain only 5% of their original value while capital outlays made in 1997 retain 95% of their value. In terms of their value in 1997, all capital outlays made before 1979 have depreciated completely and no longer have any appreciable monetary value.

Auditor's Statement

Typically the financial accounting procedures used in a corporate annual report would be audited by an outside party. As this report was meant only to serve as a preliminary sample of how to organize government financial data using private sector accounting techniques, no outside auditing was done. Standard accounting techniques were used to carry out the financial accounting and any errors are the sole responsibility of the authors.

Appendix B: Calculation of the Residual Value of Assets

The following pages illustrate how the residual value of assets was calculated. Performing this calculation is actually a multi-step process. To start, a separate table was constructed to deal with each year of the analysis (1988 – 1997). Information on capital outlays was collected back to 1969 so that there would be 20 years worth of past data available to construct the residual value of assets for the first year considered in this analysis, 1988. The following list outlines the various steps that were taken in order to calculate the residual value of assets.

1. Actual Capital Outlays: In this column, the actual capital outlays for construction as reported in the Federal Highway Statistics report were entered.

2. Amortized Construction: Each year's actual capital outlays were divided by 20 and entered into the corresponding row in this column. This column simply represents the fact that capital outlays allocated to one particular year are actually paid for over time. A 20-year time frame was chosen for this analysis.

3. 19** Value of Assets: In this column, the residual value of the previous 20 years of capital outlays is calculated. In order to calculate the total residual value of assets, the value in the actual capital outlays column is multiplied by its remaining value at the end of the year for which the value is being calculated. For example, at the end of 1997, the actual capital outlays for 1997 are worth only 95%of their original value therefore the number in the 1997 value of assets is equal to 0.95*Actual Capital Outlays (1997). Actual capital outlays made in 1979 are only worth 5% of their original value therefore the 1997 value of assets from 1979 is equal to 0.05*Actual Capital Outlays (1979). The 1997 value of assets created in 1980 would be 10%of the actual capital outlays made in 1980, the 1997 value of assets created in 1981 would be 15% of the actual capital outlays made in 1981, and so on. To get the total residual value of assets for each year simply sum up the value of assets for the previous 20 years.

4. Construction Cost Index: This index shows the increase in prices for the highway construction. It is taken from *Highway Statistics* (Federal Highway Administration, 1997) "Price Trends for Federal –Aid Highway Construction" table.

5. Value of Assets (Inflation Adjusted): A simple formula was used to transform the value of a particular year's assets into another year's dollar value. For example to convert the residual value of assets in 1979 into their 1997 dollar value you would apply the following formula:

$$1997\ \text{Value of Assets} * \left(\frac{1997\ \text{Construction Cost Index}}{1979\ \text{Construction Cost Index}} \right)$$

Calculation of Residual Value of Assets (thousands of dollars)

Year	Capital Outlays	Amortized Construction[a]	1997 Value of Assets[b]	Construction Cost Index[c]	1997 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$0	42.5	$0
1974	$92,606	$4,630	$0	57.9	$0
1975	$130,324	$6,516	$0	58.1	$0
1976	$111,995	$5,600	$0	56.3	$0
1977	$136,788	$6,839	$0	59.8	$0
1978	$147,222	$7,361	$0	70.7	$0
1979	$184,060	$9,203	$9,203	85.5	$14,057
1980	$181,641	$9,082	$18,164	97.2	$24,406
1981	$181,640	$9,082	$27,246	94.2	$37,774
1982	$150,159	$7,508	$30,032	88.5	$44,318
1983	$170,831	$8,542	$42,708	87.6	$63,672
1984	$244,255	$12,213	$73,277	92.6	$103,347
1985	$351,297	$17,565	$122,954	102.0	$157,429
1986	$435,215	$21,761	$174,086	101.1	$224,883
1987	$596,757	$29,838	$268,541	100.0	$350,714
1988	$662,419	$33,121	$331,210	106.6	$405,778
1989	$528,087	$26,404	$290,448	107.7	$352,205
1990	$871,936	$43,597	$523,162	108.5	$629,723
1991	$614,532	$30,727	$399,446	107.5	$485,280
1992	$488,274	$24,414	$341,792	105.1	$424,719
1993	$454,634	$22,732	$340,976	108.3	$411,186
1994	$468,587	$23,429	$374,870	115.1	$425,352
1995	$430,605	$21,530	$366,014	121.9	$392,137
1996	$562,387	$28,119	$506,148	120.2	$549,941
1997	$516,319	$25,816	$490,503	130.6	$490,503
			$4,730,777		$5,587,424

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1997 Value of Assets = the residual undepreciated assets at the end of 1997
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1997 Value of Assets (inflation adjusted) = residual value converted into 1997 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Capital Outlays	Amortized Construction[a]	1996 Value of Assets[b]	Construction Cost Index[c]	1996 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$0	42.5	$0
1974	$92,606	$4,630	$0	57.9	$0
1975	$130,324	$6,516	$0	58.1	$0
1976	$111,995	$5,600	$0	56.3	$0
1977	$136,788	$6,839	$0	59.8	$0
1978	$147,222	$7,361	$7,361	70.7	$12,515
1979	$184,060	$9,203	$18,406	85.5	$25,876
1980	$181,641	$9,082	$27,246	97.2	$33,693
1981	$181,640	$9,082	$36,328	94.2	$46,355
1982	$150,159	$7,508	$37,540	88.5	$50,986
1983	$170,831	$8,542	$51,249	87.6	$70,322
1984	$244,255	$12,213	$85,489	92.6	$110,970
1985	$351,297	$17,565	$140,519	102.0	$165,592
1986	$435,215	$21,761	$195,847	101.1	$232,846
1987	$596,757	$29,838	$298,379	100.0	$358,651
1988	$662,419	$33,121	$364,330	106.6	$410,812
1989	$528,087	$26,404	$316,852	107.7	$353,627
1990	$871,936	$43,597	$566,758	108.5	$627,874
1991	$614,532	$30,727	$430,172	107.5	$480,993
1992	$488,274	$24,414	$366,206	105.1	$418,819
1993	$454,634	$22,732	$363,707	108.3	$403,671
1994	$468,587	$23,429	$398,299	115.1	$415,947
1995	$430,605	$21,530	$387,545	121.9	$382,140
1996	$562,387	$28,119	$534,268	120.2	$534,268
			$4,626,501		$5,135,957

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)

b - 1996 Value of Assets = the residual undepreciated assets at the end of 1996

c - Construction Cost Index = a measure of inflation's affects on construction costs

d - 1996 Value of Assets (inflation adjusted) = residual value converted into 1996 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1995 Value of Assets[b]	Construction Cost Index[c]	1995 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$0	42.5	$0
1974	$92,606	$4,630	$0	57.9	$0
1975	$130,324	$6,516	$0	58.1	$0
1976	$111,995	$5,600	$0	56.3	$0
1977	$136,788	$6,839	$6,839	59.8	$13,942
1978	$147,222	$7,361	$14,722	70.7	$25,384
1979	$184,060	$9,203	$27,609	85.5	$39,363
1980	$181,641	$9,082	$36,328	97.2	$45,560
1981	$181,640	$9,082	$45,410	94.2	$58,763
1982	$150,159	$7,508	$45,048	88.5	$62,049
1983	$170,831	$8,542	$59,791	87.6	$83,202
1984	$244,255	$12,213	$97,702	92.6	$128,616
1985	$351,297	$17,565	$158,084	102.0	$188,925
1986	$435,215	$21,761	$217,608	101.1	$262,377
1987	$596,757	$29,838	$328,216	100.0	$400,096
1988	$662,419	$33,121	$397,451	106.6	$454,496
1989	$528,087	$26,404	$343,257	107.7	$388,514
1990	$871,936	$43,597	$610,355	108.5	$685,735
1991	$614,532	$30,727	$460,899	107.5	$522,638
1992	$488,274	$24,414	$390,619	105.1	$453,059
1993	$454,634	$22,732	$386,439	108.3	$434,967
1994	$468,587	$23,429	$421,728	115.1	$446,644
1995	$430,605	$21,530	$409,075	121.9	$409,075
			$4,457,180		$5,103,405

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1995 Value of Assets = the residual undepreciated assets at the end of 1995
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1995 Value of Assets (inflation adjusted) = residual value converted into 1995 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1994 Value of Assets[b]	Construction Cost Index[c]	1994 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$0	42.5	$0
1974	$92,606	$4,630	$0	57.9	$0
1975	$130,324	$6,516	$0	58.1	$0
1976	$111,995	$5,600	$5,600	56.3	$11,448
1977	$136,788	$6,839	$13,679	59.8	$26,328
1978	$147,222	$7,361	$22,083	70.7	$35,952
1979	$184,060	$9,203	$36,812	85.5	$49,556
1980	$181,641	$9,082	$45,410	97.2	$53,773
1981	$181,640	$9,082	$54,492	94.2	$66,582
1982	$150,159	$7,508	$52,556	88.5	$68,352
1983	$170,831	$8,542	$68,332	87.6	$89,784
1984	$244,255	$12,213	$109,915	92.6	$136,622
1985	$351,297	$17,565	$175,649	102.0	$198,207
1986	$435,215	$21,761	$239,368	101.1	$272,515
1987	$596,757	$29,838	$358,054	100.0	$412,120
1988	$662,419	$33,121	$430,572	106.6	$464,905
1989	$528,087	$26,404	$369,661	107.7	$395,060
1990	$871,936	$43,597	$653,952	108.5	$693,732
1991	$614,532	$30,727	$491,626	107.5	$526,382
1992	$488,274	$24,414	$415,033	105.1	$454,522
1993	$454,634	$22,732	$409,171	108.3	$434,862
1994	$468,587	$23,429	$445,158	115.1	$445,158
			$4,397,122		$4,835,861

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1994 Value of Assets = the residual undepreciated assets at the end of 1994
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1994 Value of Assets (inflation adjusted) = residual value converted into 1994 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1993 Value of Assets[b]	Construction Cost Index[c]	1993 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$0	42.5	$0
1974	$92,606	$4,630	$0	57.9	$0
1975	$130,324	$6,516	$6,516	58.1	$12,146
1976	$111,995	$5,600	$11,200	56.3	$21,544
1977	$136,788	$6,839	$20,518	59.8	$37,159
1978	$147,222	$7,361	$29,444	70.7	$45,104
1979	$184,060	$9,203	$46,015	85.5	$58,286
1980	$181,641	$9,082	$54,492	97.2	$60,715
1981	$181,640	$9,082	$63,574	94.2	$73,090
1982	$150,159	$7,508	$60,064	88.5	$73,502
1983	$170,831	$8,542	$76,874	87.6	$95,039
1984	$244,255	$12,213	$122,128	92.6	$142,834
1985	$351,297	$17,565	$193,213	102.0	$205,147
1986	$435,215	$21,761	$261,129	101.1	$279,726
1987	$596,757	$29,838	$387,892	100.0	$420,087
1988	$662,419	$33,121	$463,693	106.6	$471,088
1989	$528,087	$26,404	$396,065	107.7	$398,272
1990	$871,936	$43,597	$697,549	108.5	$696,263
1991	$614,532	$30,727	$522,352	107.5	$526,239
1992	$488,274	$24,414	$439,447	105.1	$452,827
1993	$454,634	$22,732	$431,902	108.3	$431,902
			$4,284,068		$4,500,969

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1993 Value of Assets = the residual undepreciated assets at the end of 1993
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1993 Value of Assets (inflation adjusted) = residual value converted into 1993 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1992 Value of Assets[b]	Construction Cost Index[c]	1992 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$0	42.5	$0
1974	$92,606	$4,630	$4,630	57.9	$8,405
1975	$130,324	$6,516	$13,032	58.1	$23,575
1976	$111,995	$5,600	$16,799	56.3	$31,361
1977	$136,788	$6,839	$27,358	59.8	$48,082
1978	$147,222	$7,361	$36,806	70.7	$54,714
1979	$184,060	$9,203	$55,218	85.5	$67,876
1980	$181,641	$9,082	$63,574	97.2	$68,741
1981	$181,640	$9,082	$72,656	94.2	$81,063
1982	$150,159	$7,508	$67,572	88.5	$80,246
1983	$170,831	$8,542	$85,416	87.6	$102,479
1984	$244,255	$12,213	$134,340	92.6	$152,475
1985	$351,297	$17,565	$210,778	102.0	$217,184
1986	$435,215	$21,761	$282,890	101.1	$294,082
1987	$596,757	$29,838	$417,730	100.0	$439,034
1988	$662,419	$33,121	$496,814	106.6	$489,823
1989	$528,087	$26,404	$422,470	107.7	$412,271
1990	$871,936	$43,597	$741,146	108.5	$717,921
1991	$614,532	$30,727	$553,079	107.5	$540,731
1992	$488,274	$24,414	$463,860	105.1	$463,860
			$4,166,167		$4,293,923

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1992 Value of Assets = the residual undepreciated assets at the end of 1992
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1992 Value of Assets (inflation adjusted) = residual value converted into 1992 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1991 Value of Assets[b]	Construction Cost Index[c]	1991 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$0	38.6	$0
1973	$92,282	$4,614	$4,614	42.5	$11,671
1974	$92,606	$4,630	$9,261	57.9	$17,194
1975	$130,324	$6,516	$19,549	58.1	$36,170
1976	$111,995	$5,600	$22,399	56.3	$42,769
1977	$136,788	$6,839	$34,197	59.8	$61,475
1978	$147,222	$7,361	$44,167	70.7	$67,156
1979	$184,060	$9,203	$64,421	85.5	$80,997
1980	$181,641	$9,082	$72,656	97.2	$80,356
1981	$181,640	$9,082	$81,738	94.2	$93,279
1982	$150,159	$7,508	$75,080	88.5	$91,198
1983	$170,831	$8,542	$93,957	87.6	$115,301
1984	$244,255	$12,213	$146,553	92.6	$170,134
1985	$351,297	$17,565	$228,343	102.0	$240,656
1986	$435,215	$21,761	$304,651	101.1	$323,936
1987	$596,757	$29,838	$447,568	100.0	$481,135
1988	$662,419	$33,121	$529,935	106.6	$534,409
1989	$528,087	$26,404	$448,874	107.7	$448,040
1990	$871,936	$43,597	$784,742	108.5	$777,510
1991	$614,532	$30,727	$583,805	107.5	$583,805
			$3,996,509		$4,257,191

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1991 Value of Assets = the residual undepreciated assets at the end of 1991
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1991 Value of Assets (inflation adjusted) = residual value converted into 1991 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1990 Value of Assets[b]	Construction Cost Index[c]	1990 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$0	36.8	$0
1972	$104,335	$5,217	$5,217	38.6	$14,664
1973	$92,282	$4,614	$9,228	42.5	$23,559
1974	$92,606	$4,630	$13,891	57.9	$26,030
1975	$130,324	$6,516	$26,065	58.1	$48,675
1976	$111,995	$5,600	$27,999	56.3	$53,959
1977	$136,788	$6,839	$41,036	59.8	$74,456
1978	$147,222	$7,361	$51,528	70.7	$79,077
1979	$184,060	$9,203	$73,624	85.5	$93,429
1980	$181,641	$9,082	$81,738	97.2	$91,241
1981	$181,640	$9,082	$90,820	94.2	$104,607
1982	$150,159	$7,508	$82,587	88.5	$101,251
1983	$170,831	$8,542	$102,499	87.6	$126,953
1984	$244,255	$12,213	$158,766	92.6	$186,027
1985	$351,297	$17,565	$245,908	102.0	$261,579
1986	$435,215	$21,761	$326,411	101.1	$350,303
1987	$596,757	$29,838	$477,406	100.0	$517,985
1988	$662,419	$33,121	$563,056	106.6	$573,092
1989	$528,087	$26,404	$475,278	107.7	$478,809
1990	$871,936	$43,597	$828,339	108.5	$828,339
			$3,681,396		$4,034,034

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1990 Value of Assets = the residual undepreciated assets at the end of 1990
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1990 Value of Assets (inflation adjusted) = residual value converted into 1990 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1989 Value of Assets[b]	Construction Cost Index[c]	1989 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$0	34.8	$0
1971	$102,101	$5,105	$5,105	36.8	$14,941
1972	$104,335	$5,217	$10,434	38.6	$29,111
1973	$92,282	$4,614	$13,842	42.5	$35,078
1974	$92,606	$4,630	$18,521	57.9	$34,451
1975	$130,324	$6,516	$32,581	58.1	$60,395
1976	$111,995	$5,600	$33,599	56.3	$64,273
1977	$136,788	$6,839	$47,876	59.8	$86,224
1978	$147,222	$7,361	$58,889	70.7	$89,708
1979	$184,060	$9,203	$82,827	85.5	$104,333
1980	$181,641	$9,082	$90,821	97.2	$100,631
1981	$181,640	$9,082	$99,902	94.2	$114,219
1982	$150,159	$7,508	$90,095	88.5	$109,642
1983	$170,831	$8,542	$111,040	87.6	$136,519
1984	$244,255	$12,213	$170,979	92.6	$198,859
1985	$351,297	$17,565	$263,473	102.0	$278,196
1986	$435,215	$21,761	$348,172	101.1	$370,901
1987	$596,757	$29,838	$507,243	100.0	$546,301
1988	$662,419	$33,121	$596,177	106.6	$602,329
1989	$528,087	$26,404	$501,683	107.7	$501,683
			$3,083,258		$3,477,795

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1989 Value of Assets = the residual undepreciated assets at the end of 1989
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1989 Value of Assets (inflation adjusted) = residual value converted into 1989 dollars

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1988 Value of Assets[b]	Construction Cost Index[c]	1988 Value of Assets (inflation adjusted)[d]
1969	$74,709	$3,735	$0	32.5	$0
1970	$94,398	$4,720	$4,720	34.8	$14,458
1971	$102,101	$5,105	$10,210	36.8	$29,576
1972	$104,335	$5,217	$15,650	38.6	$43,221
1973	$92,282	$4,614	$18,456	42.5	$46,293
1974	$92,606	$4,630	$23,152	57.9	$42,624
1975	$130,324	$6,516	$39,097	58.1	$71,734
1976	$111,995	$5,600	$39,198	56.3	$74,219
1977	$136,788	$6,839	$54,715	59.8	$97,536
1978	$147,222	$7,361	$66,250	70.7	$99,890
1979	$184,060	$9,203	$92,030	85.5	$114,741
1980	$181,641	$9,082	$99,903	97.2	$109,564
1981	$181,640	$9,082	$108,984	94.2	$123,330
1982	$150,159	$7,508	$97,603	88.5	$117,565
1983	$170,831	$8,542	$119,582	87.6	$145,518
1984	$244,255	$12,213	$183,191	92.6	$210,888
1985	$351,297	$17,565	$281,038	102.0	$293,712
1986	$435,215	$21,761	$369,933	101.1	$390,058
1987	$596,757	$29,838	$537,081	100.0	$572,529
1988	$662,419	$33,121	$629,298	106.6	$629,298
			$2,790,091		$3,226,754

a - Amortized Construction = actual capital outlays/20 (5% depreciation per annum)
b - 1988 Value of Assets = the residual undepreciated assets at the end of 1988
c - Construction Cost Index = a measure of inflation's affects on construction costs
d - 1988 Value of Assets (inflation adjusted) = residual value converted into 1988 dollars

Appendix C: Procedures for Calculating Depreciation

Calculating Straight Line Depreciation

Year	Actual Capital Outlays	Current Year Construction[a]	Straight Line Depreciation[b]
1969	74,709	3,735	
1970	94,398	4,720	
1971	102,101	5,105	
1972	104,335	5,217	
1973	92,282	4,614	
1974	92,606	4,630	
1975	130,324	6,516	
1976	111,995	5,600	
1977	136,788	6,839	
1978	147,222	7,361	
1979	184,060	9,203	
1980	181,641	9,082	
1981	181,640	9,082	
1982	150,159	7,508	
1983	170,831	8,542	
1984	244,255	12,213	
1985	351,297	17,565	
1986	435,215	21,761	
1987	596,757	29,838	
1988	662,419	33,121	212,252
1989	528,087	26,404	234,921
1990	871,936	43,597	273,798
1991	614,532	30,727	299,419
1992	488,274	24,414	318,616
1993	454,634	22,732	336,734
1994	468,587	23,429	355,533
1995	430,605	21,530	370,547
1996	562,387	28,119	393,066
1997	516,319	25,816	412,043

a – Current Year Construction = actual capital outlays/20 (5% depreciation per annum)
b – Straight Line Depreciation = sum of the previous 20 years current year construction figure

Calculating Inflation Adjusted Depreciation

Year	Composite Index[a]	Current Year Construction[b]	1988$[c]	1989$	1990$	1991$	1992$	1993$	1994$	1995$	1996$	1997$	Inflation Adjusted Depreciation[d]
1969	32.5	3,735	12,252	12,379	12,471	12,356	12,080	12,448	13,229	14,011	13,815	15,011	
1970	34.8	4,720	14,458	14,607	14,716	14,580	14,255	14,689	15,611	16,533	16,303	17,713	
1971	36.8	5,105	14,788	14,941	15,052	14,913	14,580	15,024	15,967	16,910	16,675	18,117	
1972	38.6	5,217	14,407	14,556	14,664	14,529	14,204	14,637	15,556	16,475	16,245	17,650	
1973	42.5	4,614	11,573	11,693	11,780	11,671	11,410	11,758	12,496	13,234	13,050	14,179	
1974	57.9	4,630	8,525	8,613	8,677	8,597	8,405	8,661	9,205	9,748	9,612	10,444	
1975	58.1	6,516	11,956	12,079	12,169	12,057	11,787	12,146	12,909	13,672	13,481	14,647	
1976	56.3	5,600	10,603	10,712	10,792	10,692	10,454	10,772	11,448	12,125	11,955	12,990	
1977	59.8	6,839	12,192	12,318	12,409	12,295	12,020	12,386	13,164	13,942	13,747	14,937	
1978	70.7	7,361	11,099	11,213	11,297	11,193	10,943	11,276	11,984	12,692	12,515	13,598	
1979	85.5	9,203	11,474	11,593	11,679	11,571	11,313	11,657	12,389	13,121	12,938	14,057	
1980	97.2	9,082	9,960	10,063	10,138	10,044	9,820	10,119	10,755	11,390	11,231	12,203	
1981	94.2	9,082	10,278	10,384	10,461	10,364	10,133	10,441	11,097	11,753	11,589	12,591	
1982	88.5	7,508	9,043	9,137	9,205	9,120	8,916	9,188	9,765	10,341	10,197	11,080	
1983	87.6	8,542	10,394	10,501	10,579	10,482	10,248	10,560	11,223	11,886	11,720	12,734	
1984	92.6	12,213	14,059	14,204	14,310	14,178	13,861	14,283	15,180	16,077	15,853	17,224	
1985	102	17,565	18,357	18,546	18,684	18,512	18,099	18,650	19,821	20,992	20,699	22,490	
1986	101.1	21,761	22,945	23,181	23,354	23,138	22,622	23,310	24,774	26,238	25,872	28,110	
1987	100	29,838	31,807	32,135	32,374	32,076	31,360	32,314	34,343	36,372	35,865	38,968	
1988	106.6	33,121	33,121	33,463	33,711	33,401	32,655	33,649	35,762	37,875	37,347	40,578	293,291
1989	107.7	26,404	26,135	26,404	26,600	26,355	25,767	26,551	28,219	29,886	29,469	32,019	310,343
1990	108.5	43,597	42,833	43,275	43,597	43,195	42,231	43,516	46,249	48,981	48,298	52,477	341,530
1991	107.5	30,727	30,469	30,784	31,012	30,727	30,041	30,955	32,899	34,843	34,357	37,329	354,196
1992	105.1	24,414	24,762	25,018	25,203	24,971	24,414	25,157	26,737	28,316	27,921	30,337	356,497
1993	108.3	22,732	22,375	22,606	22,774	22,564	22,060	22,732	24,159	25,586	25,229	27,412	378,326
1994	115.1	23,429	21,699	21,923	22,086	21,882	21,394	22,045	23,429	24,814	24,467	26,584	416,305
1995	121.9	21,530	18,828	19,022	19,164	18,987	18,563	19,128	20,329	21,530	21,230	23,067	448,758
1996	120.2	28,119	24,938	25,195	25,382	25,148	24,587	25,335	26,926	28,517	28,119	30,552	458,664
1997	130.6	25,816	21,072	21,289	21,447	21,250	20,775	21,408	22,752	24,096	23,760	25,816	509,228
		20 year totals	293,291 (1969-1988)	310,343 (1970-1989)	341,530 (1971-1990)	354,196 (1972-1991)	356,497 (1973-1992)	378,326 (1974-1993)	416,305 (1975-1994)	448,758 (1976-1995)	458,664 (1977-1996)	509,228 (1978-1997)	

Note: Composite Index for 1969 has been estimated

a – Composite Index = a composite price index for construction projects (Federal Highway Administration, 1997)

b – Current Year Construction = actual capital outlays/20 (5% depreciation per annum)

c - Each year's construction value is translated into current year dollars for 1988 through 1997.
This is done according to the following formula (Current Year Construction)*(Composite Index for the Year of Interest/Composite Index for the Current Year)
ex) (Construction Value for 1969)* (Composite Index for 1988/Composite Index for 1969)

d – Inflation Adjusted Depreciation = the twenty year totals for 1988 through 1997

Appendix D: Cell Formulas for Calculating Ten Year Income Statement

Costs/Expenditures	1988	1989	1990	1991
Maintenance and Traffic Services[a]	51421	53815	60767	65265
Administration and Miscellaneous[b]	39050	44292	45334	61934
Highway Law Enforcement and Safety[c]	52780	50700	53064	52896
Bond Interest[d]	55610	57621	89072	93171
Fee and Tax Collection Costs[e]	12021	25919	29175	26243
Construction Recovery Costs (Depreciation)[f]	212251.7	234920.6	273797.5	299419.05
Total Costs/Expenditures[g]	=B2+B3+B4+B5+B6+B7	=C2+C3+C4+C5+C6+C7	=D2+D3+D4+D5+D6+D7	=E2+E3+E4+E5+E6+E7

Revenues	1988	1989	1990	1991
Highway User Revenues				
Gasoline Taxes[1]	267318	286101	286240	296816
Use Fuel Taxes[2]	47610	50797	52876	65202
Motor Carrier Taxes[3]	98707	104709	104343	108655
Vehicle License Taxes[4]	=(79240/0.315)	=(80125/0.315)	=(91390/0.315)	=(92826/0.315)
Registration Fees[5]	79090	80338	88536	75657
Other[6]	22996	23402	25474	24033
Gross Highway User Revenue[7]	=SUM(B13:B18)	=SUM(C13:C18)	=SUM(D13:D18)	=SUM(E13:E18)
Transfers to General Fund[8]	=(79240/0.315)*(0.685)	=(80125/0.315)*(0.685)	=(91390/0.315)*(0.685)	=(92826/0.315)*(0.685)
Allocations to City Governments[9]	197472	204112	209767	208708
Allocations to County Governments[10]	117144	121052	124092	123746
Net State Highway User Revenue[11]	=B19-B20-B21-B22	=C19-C20-C21-C22	=D19-D20-D21-D22	=E19-E20-E21-E22
Federal Aid				
Federal Highway Administration[12]	194485	174947	180886	157562
Other Agencies[13]	1245	7931	13541	6661
Total Federal Aid[14]	=(B26+B27)	=(C26+C27)	=(D26+D27)	=(E26+E27)
Apportionment Ratio[15]	1.11	0.62	0.9	0.79
Earned Federal User Revenue on State Highway System[16]	=(B28/B29)*(0.5)	=(C28/C29)*(0.5)	=(D28/D29)*(0.5)	=(E28/E29)*(0.5)
Inter-Government Transfers to the State Highway System				
Appropriations from General Funds[17]	45435	31350	30932	6450
From Counties and Townships[18]	79853	96746	109355	110005
From Municipalities[19]	0	2287	2303	7973
Total Inter-Governmental Transfers to State Highways[20]	=SUM(B33:B35)	=SUM(C33:C35)	=SUM(D33:D35)	=SUM(E33:E35)
Total State Highway System Earned Revenue[21]	=(B19*0.5)+(B30)	=(C19*0.5)+(C30)	=(D19*0.5)+(D30)	=(E19*0.5)+(E30)
Subsidies from Non-Highway Users[22]	=(B36)	=(C36)	=(D36)	=(E36)
Cross Subsidies from Other Highway Users[23]	=(B28-B30)	=(C28-C30)	=(D28-D30)	=(E28-E30)
Total Resources from all Local, State and Federal Sources[24]	=SUM(B23+B28+B36)	=SUM(C23+C28+C36)	=SUM(D23+D28+D36)	=SUM(E23+E28+E36)

Net Profit/Loss	1988	1989	1990	1991
Net Profit/Loss (All Revenue Sources)[i]	=(B41-B9)	=(C41-C9)	=(D41-D9)	=(E41-E9)
Return on Investment (All Revenue Sources)[ii]	=(B44/B49)	=(C44/C49)	=(D44/D49)	=(E44/E49)
Net Profit/Loss (Earned Revenue)[iii]	=B38-B9	=C38-C9	=D38-D9	=E38-E9
Return on Investment (Earned Revenue)[iv]	=(B46/B49)	=(C46/C49)	=(D46/D49)	=(E46/E49)
Residual Value of Assets[v]	2790091	3083258	3681396	3996509

1992	1993	1994	1995	1996	1997	1988-97
307879	315227	334643	342299	358961	363953	=SUM(B13:K13)
61910	72008	87913	108790	114780	124748	=SUM(B14:K14)
109573	120303	118530	92103	85433	90186	=SUM(B15:K15)
=(96146/0.315)	=(105027/0.315)	=(113990/0.315)	=(131562/0.315)	=(160145/0.315)	=(175253/0.315)	=SUM(B16:K16)
74180	80717	83826	86159	97601	101528	=SUM(B17:K17)
25507	24161	37161	39238	42654	41294	=SUM(B18:K18)
=SUM(F13:F18)	=SUM(G13:G18)	=SUM(H13:H18)	=SUM(I13:I18)	=SUM(J13:J18)	=SUM(K13:K18)	=SUM(B19:K19)
=(96146/0.315)*(0.685)	=(105027/0.315)*(0.685)	=(113990/0.315)*(0.685)	=(131562/0.315)*(0.685)	=(160145/0.315)*(0.685)	=(175253/0.315)*(0.685)	=SUM(B20:K20)
201394	210531	228606	237920	256988	267931	=SUM(B21:K21)
119068	124468	135157	140627	151762	166908	=SUM(B22:K22)
=F19-F20-F21-F22	=G19-G20-G21-G22	=H19-H20-H21-H22	=I19-I20-I21-I22	=J19-J20-J21-J22	=K19-K20-K21-K22	=SUM(B23:K23)
156437	157088	224378	187572	244468	276143	=SUM(B26:K26)
5733	2479	3169	3694	2387	2272	=SUM(B27:K27)
=(F26+F27)	=(G26+G27)	=(H26+H27)	=(I26+I27)	=(J26+J27)	=(K26+K27)	=SUM(B28:K28)
1.02	1.14	1.07	0.95	0.66	0.85	=(0.5*L28)/(L30)
=(F28/F29)*(0.5)	=(G28/G29)*(0.5)	=(H28/H29)*(0.5)	=(I28/I29)*(0.5)	=(J28/J29)*(0.5)	=(K28/K29)*(0.5)	=SUM(B30:K30)
2483	4357	547	4113	7739	583	=SUM(B33:K33)
126632	130589	154186	160230	179400	190973	=SUM(B34:K34)
0	0	0	0	0	0	=SUM(B35:K35)
=SUM(F33:F35)	=SUM(G33:G35)	=SUM(H33:H35)	=SUM(I33:I35)	=SUM(J33:J35)	=SUM(K33:K35)	=SUM(B36:K36)
=(F19*0.5)+(F30)	=(G19*0.5)+(G30)	=(H19*0.5)+(H30)	=(I19*0.5)+(I30)	=(J19*0.5)+(J30)	=(K19*0.5)+(K30)	=SUM(B38:K38)
=(F36)	=(G36)	=(H36)	=(I36)	=(J36)	=(K36)	=SUM(B39:K39)
=(F28-F30)	=(G28-G30)	=(H28-H30)	=(I28-I30)	=(J28-J30)	=(K28-K30)	=SUM(B40:K40)
=SUM(F23+F28+F36)	=SUM(G23+G28+G36)	=SUM(H23+H28+H36)	=SUM(I23+I28+I36)	=SUM(J23+J28+J36)	=SUM(K23+K28+K36)	=SUM(B41:K41)

1992	1993	1994	1995	1996	1997	1988-97
=(F41-F9)	=(G41-G9)	=(H41-H9)	=(I41-I9)	=(J41-J9)	=(K41-K9)	=SUM(B44:K44)
=(F44/F49)	=(G44/G49)	=(H44/H49)	=(I44/I49)	=(J44/J49)	=(K44/K49)	=L44/SUM(B49:K49)
=F38-F9	=G38-G9	=H38-H9	=I38-I9	=J38-J9	=K38-K9	=SUM(B46:K46)
=(F46/F49)	=(G46/G49)	=(H46/H49)	=(I46/I49)	=(J46/J49)	=(K46/K49)	=L46/SUM(B49:K49)
4166167	4284068	4397122	4457180	4626501	4730777	=SUM(B49:K49)/(10)

Appendix E: *The Value of Highways,* Excerpted from Rowell, Buoncontri and Semmens (1999)

In order to estimate the value of new highways for this project we used a "consumer choice" theory for determining value. This theory assumes that the amount of money consumers voluntarily pay to undertake the consumption or use of a product or service represents a minimum value for that good or service *as perceived by the consumer.* In most commercial transactions, the sales revenue obtained from customers serves as the best estimate of this minimum value. For highways, the situation is a little more complex. We lack direct sales revenue data. The tax collection data we do have is not, strictly speaking, sales revenue. It also, in our opinion, grossly understates the value customers would place on the roads they use.

To resolve these difficulties we opted to consider the complimentary package of services represented by the combined amounts paid by consumers for both the vehicle and the roadway. We justify this on the grounds that automobiles and trucks are essentially worthless (for the most part) without the availability of roadways. Consumers wouldn't be buying cars if there were no roads on which to drive them. Likewise, trucking businesses would have no revenues if there were no roads on which to carry out their business. Consequently, we obtained data on the combined costs of owning and operating cars and commercial trucking businesses as a means of estimating a minimum per vehicle mile value of the existence of the roadways in Arizona. The weighted average value is then used in the model to represent the benefits to highway users.

The estimate of the value per truck mile was simpler to calculate. A publication entitled *Freight Transportation in Arizona: Selected Data from Federal Sources*[2] provided trucking revenue totals for the state for the year 1992. This figure was $1,466,657,000. Since this revenue must cover all costs of operating a trucking business--including taxes paid to the highway agency--it represents a reasonable estimate of the mimimum value of using roadways for trucking. Truck vehicle miles of travel in Arizona for 1992 were 3,545,610,000. Dividing the revenues by the vehicle miles of travel produced a per vehicle mile value of 41 cents. To get a 1998 equivalent value, this 41 cent figure was inflated to dollars of 1998 purchasing power using the producer price index for motor freight.[3] The resulting value per vehicle mile for trucks in 1998 is then around 44 cents.

Estimating the value automobile use of roadways was a bit more complicated. The overwhelming majority of cars are not used to generate a revenue. So it was necessary to estimate values from Motor Vehicle Division and American Automobile Association data. We started with a listing of every vehicle registered in Arizona as of 1997 by model year. The following calculations were made.

A weighted average cost for each vehicle when new was calculated for each year. Data on numbers and gross values of vehicles in several vehicle classes for each year was provided by the ADOT Motor Vehicle Division. The vehicles included in this analysis were cars, pick-up

[2] *Freight Transportation in Arizona: Selected Data from Federal Sources* (Bureau of Transportation Statistics, US DOT; www.bts.gov; phone 202-366-3282; October 1996), p. 25.
[3] *Bureau of Labor Statistics* (http://stats.bls.gov/blshome.html).

trucks, sport utility vehicles, vans, and motorcycles. Summing the gross values and dividing by the number of total vehicles produced the weighted average cost for each vehicle.

Finance cost was estimated from American Automobile Association data.[4] In their booklet, the AAA estimates finance cost by assuming a loan for 80% of the value of the vehicle, a 9% interest charge and a four year term. The amounts shown are for interest paid on the loan. Vehicles older than four years are assumed to be fully paid off. This data could be refined further if we could obtain information on the percentage of new cars that are purchased for cash and the percentage of older cars that are financed. For now, the data here is offered as a reasonable aggregate estimate of finance costs.

Depreciation was estimated by applying a 20% per year depreciation of the residual value schedule. That is, a new vehicle will depreciate by 20% of its original value the first year, another 20% of the remaining value the second year, etc.

The vehicle license tax was estimated by using the statutory formula of 60% of the original vehicle cost for the first year times the $3.35 per $100 tax rate and decreasing the tax liability by 15% for each year thereafter.

The flat registration fee is $8 per vehicle.

The liability insurance estimate was taken from the AAA booklet. It is the estimated cost for a liability coverage of $100,000/$300,000/$50,000.[5] Some vehicles may carry more insurance, some less. Some locations may require higher rates for this level of coverage. Some may require lower rates. This figure is our current best estimate.

Collision insurance costs are based on a combination of AAA starting data and vehicle depreciation rates. The resulting rate was 1.75% of the residual undepreciated value per year. Newer, more costly vehicles will cost more to repair or replace than older vehicles. Consequently, the cost of collision insurance should fall with vehicle age. As vehicles age, many owners will drop collision coverage. So, this cost will diminish for older cars.

Comprehensive insurance costs are based on a combination of AAA starting data and vehicle depreciation rates. The resulting rate was 0.65% of the residual undepreciated value per year.

Gasoline costs were based on the average of 11,300 miles per vehicle per year at an average miles-per-gallon fuel consumption[6] and a price of $1.10 per gallon of gasoline. Newer cars get better gas mileage, but are driven more miles. Older cars drive fewer miles, but consume more gasoline per mile. The estimates used here could be further refined if data on vehicle miles of travel and miles per gallon for cars of various years of age were obtained.

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[4] *Your Driving Costs* (American Automobile Association, 1000 AAA Dr., Heathrow, FL 32746-5063; phone 407-444-7000; 1997), pp. 4-5.
[5] *Ibid*.
[6] *Highway Statistics 1996* (Federal Highway Administration), p. V-94.

Oil cost estimates were based on an assumed three oil changes per year at a cost of $25 each.

Tire cost estimates were based on an assumed new set of tires every other year at a cost of $200 per set.

Maintenance costs are taken directly from the AAA's 2.8 cents per mile[7] multiplied by an 11,300 miles per year per vehicle.

Total costs are the sum of each separate item in the table.

Cost per mile is the total cost divided by the average 11,300 miles per vehicle per year.

The percentage of fleet figure was obtained from ADOT's Motor Vehicle Division. This is just one "snapshot" of the vehicles registered in Arizona at a previous point in time. The precise combination of vehicles, of course, changes over time. Nevertheless, the changes are incremental in their impact on the total picture. While it is recommended that this data be updated periodically it seems unlikely that drastic changes in the mix will occur from one year to the next.

Weighted cost per mile is the product of the multiplication of the cost per mile times the percentage of the fleet figure for each year. The sum of this column of data is the weighted average cost per vehicle mile for non-commercial vehicles using the highways in Arizona. Using these data, we come up with an estimated weighted average cost per vehicle mile of around 27.5 cents.

One further amalgamation is required in order to obtain the value that will be entered into the model. We must estimate the relative percentages of trucks vs. cars in the traffic mix. Since this version of the model is focused on the potential use of bonding for an urban freeway system, the percentages used were 13% trucks and 87% cars.[8] The combined weighted average for all vehicles, then, is around 30 cents per vehicle mile (43.9 cents x 13% + 27.4 cents x 87%).

[7] *Your Driving Costs, op cit.*.
[8] Data supplied by ADOT's Travel and Facilities section.

Estimated Value Per Vehicle Mile for Autos																
Year	**Wtd Avg Cost/ Vehicle**	**Finance**	**Depr.**	**Veh. Lic. Tax**	**Regis-tra-tion**	**Liability Insurance**	**Collision Ins.**	**Comp Ins.**	**Gas**	**Oil**	**Tires**	**Maint.**	**Total**	**Cost/Mi.**	**% Of Fleet**	**Wtd. Cost/ Mi.**
1997	$19,753	$1,280	$3,951	$397	$8	$400	$346	$128	$584	$75	$100	$316	$7,585	$0.671	8.2%	$0.055
1996	$18,711	$909	$2,994	$382	$8	$400	$210	$78	$584	$75	$100	$316	$6,055	$0.536	7.1%	$0.038
1995	$17,985	$553	$2,302	$312	$8	$400	$161	$60	$584	$75	$100	$316	$4,871	$0.431	7.7%	$0.033
1994	$16,961	$191	$1,737	$250	$8	$400	$122	$45	$584	$75	$100	$316	$3,828	$0.339	6.9%	$0.023
1993	$16,176		$1,325	$203	$8	$400	$93	$34	$584	$75	$100	$316	$3,138	$0.278	6.1%	$0.017
1992	$16,020		$1,050	$171	$8	$400	$73	$27	$584	$75	$100	$316	$2,804	$0.248	5.2%	$0.013
1991	$14,742		$773	$133	$8	$400	$54	$20	$584	$75	$100	$316	$2,463	$0.218	5.3%	$0.012
1990	$14,431		$605	$111	$8	$400	$42	$16	$584	$75	$100	$316	$2,257	$0.200	5.0%	$0.010
1989	$13,544		$454	$89	$8	$400	$32	$12	$584	$75	$100	$316	$2,070	$0.183	5.5%	$0.010
1988	$12,914		$347	$72	$8	$400	$24	$9	$584	$75	$100	$316	$1,935	$0.171	5.1%	$0.009
1987	$12,151		$261	$57	$8	$400	$18	$7	$584	$75	$100	$316	$1,826	$0.162	4.8%	$0.008
1986	$10,931		$188	$44	$8	$400	$13	$5	$584	$75	$100	$316	$1,733	$0.153	5.0%	$0.008
1985	$10,878		$150	$37	$8	$400	$10	$4	$584	$75	$100	$316	$1,684	$0.149	4.4%	$0.007
1984	$10,674		$117	$31	$8	$400	$8	$3	$584	$75	$100	$316	$1,643	$0.145	3.6%	$0.005
1983	$10,340		$91	$26	$8	$400	$6	$2	$584	$75	$100	$316	$1,608	$0.142	2.2%	$0.003
1982	$9,734		$68	$20	$8	$400	$5	$2	$584	$75	$100	$316	$1,578	$0.140	1.8%	$0.002
1981	$8,647		$49	$15	$8	$400	$3	$1	$584	$75	$100	$316	$1,552	$0.137	1.6%	$0.002
1980	$7,562		$34	$11	$8	$400	$2	$1	$584	$75	$100	$316	$1,532	$0.136	1.3%	$0.002
1979	$7,261		$26	$10	$8	$400	$2	$1	$584	$75	$100	$316	$1,522	$0.135	1.9%	$0.003
1978	$4,518		$13	$10	$8	$400	$1	$0	$584	$75	$100	$316	$1,507	$0.133	11.3%	$0.015
														Weighted Average Cost Per Vehicle Mile of Travel		**$0.274**