The Value of the RARF Freeway System: A Corporate-Style Financial Analysis

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16. Abstract

This report uses foundation and format developed in phase I of SPR 475—*The Value of Arizona's State Highway System: A Corporate-Style Financial Analysis*, report # FHWA-AZ-99-475(1)—and adapts it to measure the financial performance of the Maricopa County freeways funded by the Regional Area Road Fund.

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

- Under the assumptions of corporate-style accounting, the RARF freeway system has operated at a substantial loss over the past 12 years.
- These losses are projected to continue through the MAG system life cycle build-out in 2007.
- The average returns earned by the RARF Freeway System over the last five years lag those of other transportation and capital-intensive industries.
- The value of the regional freeway system exceeds 30 cents per vehicle mile of travel.
- Revenues generated by users of the RARF freeway system have averaged less than 4 cents per mile of travel.
- Highway user fees could be increased without significantly reducing use of the roadways.
- An electronic tolling system would be the most efficient means of ensuring that highway users pay fees commensurate with their use of the highway system. The RARF Freeway System would be the most effective part of the state highway system on which to implement such a program.

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

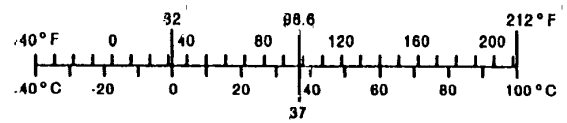
Note: Volumes greater than 1000 L shall be shown in m^3.

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)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

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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Glossary of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ADOT	Arizona Department of Transportation
ADVMT	Average daily vehicle miles of travel
BFO	Board Funding Obligations
FHWA	Federal Highway Administration
GAN	General Anticipation Note
HPMS	Highway Performance Monitoring System
HURF	Highway User Revenue Fund
ISTEA	Intermodal Surface Transportation Efficiency Act
MAG	Maricopa Association of Governments
RARF	Regional Area Road Fund (Maricopa County)
ROA	Return on assets
SIB	State Infrastructure Bank
SR	State Route
VLT	Vehicle license tax
VMT	Vehicle miles of travel

I. Introduction

Government agencies and private sector corporations tend to approach financial reporting of issues such as subsidization, revenue generation, depreciation and inflation in different ways. 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 RARF Freeway 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. The first goal is to apply a private sector approach to the Regional Freeway System in Maricopa County.[1] The other major goal of this project is to compare the value of the RARF freeway system with what users actually pay for highway services. Various studies 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.

Importance of the RARF Freeway System

The RARF Freeway System is a network of state and US highways in Maricopa County, Arizona. The system is overseen by the Arizona Department of Transportation, in conjunction with a long range transportation plan developed by the Maricopa Association of Governments (MAG), a consortium of county and municipal entities. In 1985, MAG completed an update of the Regional Freeway Plan that greatly expanded the miles of planned freeways in Maricopa County. The original plan called for over 230 miles of controlled-access freeways (ADOT, 1988). However, a funding shortfall developed between 1985 and 1994, as system costs increased while a downturn in the local economy resulted in lower system revenues.

The MAG Freeway Plan was scaled back in 1995 in order to comply with balanced funding requirements mandated by the Intermodal Surface Transportation Efficiency Act (ISTEA). Some planned freeway corridors were eliminated, while others underwent design changes such as lane reductions. The current RARF Freeway System, also referred to as the MAG Freeway System, is expected to comprise 155 miles of roadway throughout the

[1] In the first phase of this project, some of the differences between corporate-style financial analyses and traditional governmental analyses were discussed. This discussion is included in Appendix E.

metropolitan area (MAG, 1997). The system covered in this report includes the following routes:

- State Route (SR) 51: Squaw Peak Parkway
- SR 101: Agua Fria, Price and Pima Freeways
- SR 143 and 153: Hohokam and Sky Harbor Expressways
- SR 202: Red Mountain and Santan Freeways, South Mountain Parkway

Also included, based on plan revisions in 1997, are sections of Grand Avenue (US 60) from 27th Avenue to 43rd Avenue. Grand Avenue was included for upgrades as a "parkway" in the original MAG plan, subsequently dropped from the plan in 1995, and then reinstated in a limited capacity in 1997. Currently, funding exists for construction of two overpasses on Grand Avenue at Thomas Road and Camelback Road. Although Grand Avenue continues to be evaluated for potential re-addition to the plan, only the segment for which capital projects have been called out in the MAG Freeway Plan have been included in this report.

The RARF Freeway System is unique among state highway routes in Arizona for several reasons. First, the network has relied on external funding sources that are not tied to usage of the highway system for a majority of its revenues. The RARF Freeway System is primarily funded by the RARF transportation excise tax. This tax was approved by Maricopa County voters in 1985, and consists of a $^1/_2$ cent impost on every dollar of sales for sixteen components of economic activity in the county. Revenues from the transportation excise tax are collected in the Regional Area Road Fund (RARF), administered by the Arizona Department of Transportation. These revenues are dedicated by statute to the design, purchase of right-of-way and construction of the controlled-access highways in the MAG system plan. The RARF excise tax is a subsidy of the RARF freeway system, and is not a tax paid for use of the highways. Thus the excise tax does not represent the value of the system to highway users. Inclusion of such a subsidy in evaluations of system performance distorts the picture of the financial health of the MAG system.

Second, construction on the RARF Freeway System has accounted for a very large share of total state spending on highway construction, approximately 35 percent of capital expenditures on state highways from 1994 to 1999. This figure is particularly important in light of the varying returns on investment generated by different segments of the state highway system. A recent study of traffic and expenditures on the state highway system found that state highways in Maricopa County were generating less revenues relative to the cost of those highways than many other routes on the state system (Matranga and Semmens, 2000). However, Matranga and Semmens also discovered very different revenue to expenditure ratios for state highway system routes *within* Maricopa County. The influence of the RARF Freeway System was found to play a significant role in these differential returns.

Finally, unlike most routes on the state highway system, the RARF freeway system is *new*. Virtually all construction on the routes examined in this report did not begin until late 1985. The financial picture of the state highway system examined in the first phase of this research (Mansour and Semmens, 1999) is not subject to the revenue constraints imposed by construction of a completely new highway system. Construction of highways is a time-consuming and capital intensive endeavor. Not only is the process expensive, but immediate

returns on the investment can not be realized. A highway that takes three years to build is not likely to carry a significant amount of traffic during construction. The returns generated by the investment are thus deferred until the new route is opened to traffic. For this reason, returns on investment for the early years of capital-intensive projects will be abnormally low.

This report differs from the corporate-style analysis of the value of all Arizona state system highways (Mansour and Semmens, 1999) in one important aspect. Whereas the previous analysis focused on the past ten years for which data were readily available (1988 to 1997), this analysis will also include forecast returns for fiscal 1998 to 2007. Results are split by ten year period so that the RARF Freeway System can be compared to the state highway system. However, it should be noted that the limited capacity for revenue generation on the RARF system will create somewhat different results.

Whereas total traffic volume in the statewide analysis can be captured during periods of heavy construction on one route through the measurement of traffic on an alternate route, many of the highways that represent alternate routes for the MAG system are not included in the MAG system. For example, alternate routes in Maricopa County such as Interstate 10 and US 360, are likely to absorb the traffic that would ordinarily occupy the RARF freeway system. Because these routes are not included in the MAG system, user revenues are shifted out of the analysis and are not recaptured. Similarly, revenues generated on city arterial routes have not been included. These routes provide another alternative to highway traffic, but act primarily as a "compliment" to the RARF system highways. Whereas local arterials (i.e. surface streets) can be conceived of as providing immediate access to residential areas and businesses, the RARF system acts as an alternate route for those who wish to connect more distant locations without the impact of local traffic (e.g. driveways and traffic lights). In other words, local streets and regional freeways provide complimentary services between which some revenues can shift according to demand, but which can also be evaluated as distinct systems. Exclusion of local streets has the same effect on revenue capture as exclusion of non-RARF state highways. A twenty year period of analysis has been used in an effort to mitigate some of the overall impact of this shift in user revenues. As larger portions of the RARF freeway system are completed, the share of total statewide traffic on the MAG system approach the intended capacity for a forward analysis. Traffic volumes in later years may be used as a more reasonable indicator of the extent to which the RARF freeway system will be able to generate user revenues and make up for deferred returns in earlier periods.

The future test of the RARF freeway system will be its capacity to generate highway user revenues that replace the transportation excise tax. As will be seen in the following analysis, the elimination of the RARF excise tax revenues at the end of 2005 will have a dramatic impact on the total revenue available for the MAG system. The extent to which the RARF freeways can be completed and traveled to capacity will determine the future financial health of the regional freeway system.

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 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 highly risky activity (Semmens, 1994). Once resources are used 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. 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.[2] 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 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, additional investments will be needed in order to maintain current levels of highway infrastructure and performance. 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.

[2] 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.

Application of Corporate-Style Financial Analysis to the RARF Freeway System

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

This is especially true of the RARF Freeway System, for which most of the revenues have been derived from a regional excise tax. Because the majority of voters in the region elected to pay an additional fee that is not directly tied to their use of the MAG highway system, the performance of the MAG system becomes an issue of broader significance. In other words, it is conceivable that a poor return on investment for the MAG system could impact individuals who are not direct consumers of highway services in the region. The 1994 defeat of Proposition 400, which sought to extend and increase the RARF transportation excise tax, is indicative of public concern for obtaining a suitable return on investment in the MAG system.

There will be one major difference between the corporate style financial analysis and those 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 RARF freeway 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 on 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 MAG system highways and the degree of economic efficiency with which they are managed.

III. Data and Sources

A number of sources were used to compile revenue and expenditure data for the RARF Freeway System. An effort was made to maintain consistency through the use of as few data sources as possible. The principal source for both revenues and expenditures was the *Maricopa Freeway System Cash Flow Analysis Report*, prepared by the Arizona Department of Transportation Financial Management Services Group. The cash flow analysis report contains actual and projected revenues and expenditures on the RARF Freeway System from fiscal 1994 to 2016. Data for earlier periods was collected from a variety of reports. MAG system expenditures for fiscal 1985 to 1990 were collected from the *Maricopa County Transportation Excise Tax Review: 1986 to 1990* (ADOT, 1990), and expenditures from fiscal 1991 to 1993 were taken from *Traffic and Expenditures on Arizona Highways* (Matranga and Semmens, 2000). Revenue data from fiscal 1986 to 1993 were obtained from the *Arizona Department of Transportation Comprehensive Annual Financial Report* (ADOT FMS, 1999), the *Highway User Revenue Fund Year-End Report* (ADOT, 1999) and the *MAG Freeway Plan Update: Revenue Sources Analysis* (ADOT, 1990).

Complete information on Arizona state-administered highways revenues and expenditures was compiled for a ten year period (1988 to 1997). Additionally, a forecast for the following ten year period (1998 to 2007) was prepared. 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 are 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. Total administrative and service fees for the state highway system were prorated for MAG system highways according to share of state system traffic reported on the MAG system (see "Adjustment for Travel on the MAG System" below). 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 was not included as a cost of the highway system since it was not considered as a source of revenue in this analysis.

A construction recovery charge was also included as a cost of the RARF freeway system. This construction recovery charge captures the costs of the capital outlays of the state highway system. Information on actual and projected capital outlays was collected for the period 1969 to 2007 in order to allow for a depreciation charge for capital outlays to be developed.[3] 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 expense 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

[3] Note that construction on the principal controlled-access corridors of the MAG system began in 1986. Expenditure data for prior years includes spending on the sections of Grand Avenue (US 60) included in the most recent MAG system plan. These expenditures (1969 to 1985) comprise about one percent of the total spending on the MAG system for the period examined in this analysis.

possible remedy to this problem will be discussed in greater detail in an upcoming section of the report which deals with inflation adjustments.

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 to the MAG system 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, MAG system highway user fees are defined as those highway user revenues generated by travelers on the RARF freeway system, including earned revenues from the Federal Highway Administration.

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 revenues category captures the various fuel taxes, license taxes and registration fees which are paid by users of the roadways. As in the case of system administration and service expenditures, earned highway user revenues are derived from the share of state highway system traffic measured (forecast) on the RARF system. 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. The MAG system share of HURF funds which are transferred to the General State Fund (i.e. the portion of vehicle license taxes not dedicated for use in highways) 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 MAG highway systems come from the RARF excise tax, as well as other county, state and municipal funds. 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.

Adjustment for Travel on the RARF Freeway System

The share of state expenditures for maintenance, overhead and other administrative costs (collectively referred to as "administrative expenses") for maintaining the state highway system are not reported in conventional analyses of the RARF freeway system. However, because administrative expenses apply to travel on all state-system highways, including those on the MAG system, a prorated share of these expenditures was assigned to the RARF freeway system according to the share of total state highway system traffic reported (or forecast) on the MAG system highways in a given year.

Average daily vehicle miles of travel (ADVMT) on the RARF Freeway System were divided by total state system ADVMT to yield a share of travel on state system highways

applicable to the MAG system. This share of traffic was used to distribute maintenance and overhead costs, as well as most highway user revenues. Although the amount of gas and use fuel (diesel) sold in Maricopa County, and the number of vehicles registered in Maricopa County are tracked separately, these figures do not accurately represent the revenues generated by the MAG Freeway System. It is often the case that vehicles registered in other counties will use the MAG system highways, or that motorists will buy fuel in the metropolitan area prior to a long trip into other counties. Additionally, the MAG system does not include such high-traffic thoroughfares as Interstate 10 and Interstate 17. For these reasons, highway user revenues are allocated to the RARF Freeway System according to the share of traffic that the system generates. An additional adjustment is made for the distribution of certain highway user revenues. Because certain revenues are exclusive (or almost exclusive) to specific vehicles, these revenues are allocated according to *type* of traffic. Gasoline taxes are allocated to passenger vehicles, since these vehicles virtually all run on gasoline. In the same manner, use fuel and motor carrier taxes are allocated to commercial trucks. The share of total state system traffic on MAG highways, as well as passenger versus commercial traffic, are shown in Table 1.

Note that the traffic volumes shown in Table 1 do not include traffic on local routes that are not administered by the state. This is true both for RARF system traffic and all traffic on state highways. As in the analysis of all state highways (Mansour and Semmens, 1999), the revenues attributable to state routes have been factored downward from total highway user revenues according to the share of statewide VMT that does not occur on the state highway system (see discussion of revenues in the following section). The ADOT Transportation Planning Division estimates non-state system traffic (e.g. travel on local streets) at 50 percent of total VMT statewide.

When viewed as a business, the RARF system provides a means of expediting traffic flow for customers that choose not to follow local routes from point A to point B. As such, the RARF system is a complimentary route network that is fed by traffic on local streets. While the RARF system may provide spin-off benefits to travelers on local routes (e.g. traffic reductions) and to the economy as a whole (e.g. more efficient transport of goods and services), the *business* of the RARF system must be evaluated based on the income generated directly from its customers. Just as spending on local "feeder" routes is not included as a cost of the RARF system, traffic and traffic-generated revenues on local "feeder" routes are not included in the RARF system analysis.

Table 1: Vehicle Miles of Travel on State System Highways

Year	ADVMT Estimates[1.]		MAG System Share of State System VMT[2.]		
	State System Highways	MAG System	Passenger Vehicles	Commercial Vehicles	All Vehicles
1988	34,911,154	138,620	0.4%	0.1%	0.4%
1989	38,713,512	301,088	0.9%	0.4%	0.8%
1990	36,506,685	454,532	1.4%	0.6%	1.2%
1991	37,121,381	474,567	1.4%	0.7%	1.3%
1992	38,321,681	626,690	1.8%	0.7%	1.6%
1993	43,636,430	1,773,326	4.5%	2.0%	4.1%
1994	46,080,149	1,859,361	4.5%	2.0%	4.0%
1995	48,203,704	2,164,376	5.0%	2.2%	4.5%
1996	51,773,427	2,766,319	5.9%	2.6%	5.3%
1997	53,491,878	2,856,274	5.9%	2.6%	5.3%
1998	58,621,000	4,036,354	8.1%	2.7%	6.9%
1999	60,709,665	4,998,730	9.7%	3.3%	8.2%
2000	62,872,750	6,411,624	11.9%	4.2%	10.2%
2001	65,112,905	7,115,038	12.8%	4.4%	10.9%
2002	67,432,877	7,916,823	13.8%	4.8%	11.7%
2003	69,835,510	8,831,432	14.8%	5.1%	12.6%
2004	72,323,748	9,875,479	16.0%	5.5%	13.7%
2005	74,900,642	11,068,062	17.3%	5.9%	14.8%
2006	77,569,351	11,496,265	17.4%	5.9%	14.8%
2007	80,333,146	11,953,602	17.5%	5.9%	14.9%

(1.) State system DVMT from ADOT VMT database, 1976-1997 and Arizona Statewide Vehicle Travel Statistics, 1976-1998, Mark Catchpole, TPD Data Team, 1999. MAG system VMT 1988-1997 from Traffic and Expenditures on Arizona State Highways, Matranga and Semmens, 2000. MAG Traffic Forecasts provided by Maricopa Association of Governments for 1998, 2000, 2005 and 2010. Annualized growth rates used for interim year projections. (2.) Truck versus non-truck VMT for MAG system derived from Matranga and Semmens, 2000. State system truck VMT estimated at 15.6% for 1992 and 19.6% for 1997 (Catchpole, 1998). State system truck VMT forecast at 24.6% for 2000 (Carey, 2000).

Calculating Net Profits and Losses on RARF System Highways

In determining net profits, a distinction was made in the types of revenues which were considered. In one determination of net profit/loss, all of the revenues including net receipts from the state Highway User Revenue Fund, total federal aid to the MAG system 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 which was generated by users of the MAG highway system and excludes all subsidies made to the 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 total traffic (including all state, county and municipal roads) occurs on the state highways themselves. In this way, only the income generated by users of the state highway system are 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 state highway users. 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 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 RARF freeway system over the period 1988 through 1997. In general, the returns on the MAG system highways varied dramatically according to which sources of revenues were considered. When all sources of revenue were considered, the MAG system highways ran a profit in every year from 1988 to 1997, and were forecast to be profitable in all years but 2007. The net profits from all revenue sources declined substantially from 1988 to 1990, due to the confluence of increased construction spending and slower growth in RARF receipts than anticipated. Net profits began increasing in 1992, but did not return to 1988 levels until 1997. Forecast profits from all revenue sources are expected to continue until 2007. The elimination of the RARF excise tax revenues at year-end 2005 has a dramatic effect on total MAG system revenues. Returns for fiscal 2006 include six months of RARF receipts, but system-wide profits fall by 75 percent that year. The following year, fiscal 2007, is the first full year of revenues without the excise tax receipts, and the MAG system is forecast to operate at a loss that year.

Both revenues and costs fluctuated over the ten year period. Total costs are rose more significantly than did total revenues during the period of 1988 through 1997, with an average year-over-year growth rate of 13.2 percent. Total revenues increased by an average of 6.7 percent over the same period, though fluctuations in excise tax receipts were observed in the early 1990s. Over the ten year period, the average annual growth in earned highway user revenues on the MAG system was greater than 50 percent. However, this rate of increase is primarily due to the limited scope of the system in earlier years, and the increase in traffic as new segments were opened for the first time. Table 1 provides a more complete breakdown of the ten year financial status of the RARF highway system from 1988 to 1997. The notes which follow the table provide a detailed line item explanation of each of the categories of expenditures and revenues.

Financial results for the MAG system from 1998 to 2007 are forecast in Table 2. Perhaps most notable in the forecast results are the convergence of Total Revenues and Earned Revenues in later years. While construction costs are forecast to continue to advance at slightly more than 5 percent annually, a decreasing growth rate is observed for total revenues over the 1998 to 2007 period. In contrast, the continued increase in traffic forecast for the MAG system results in a relatively high rate of growth in forecast highway user revenues, averaging 15.2 percent for the ten year forecast. These results indicate that the MAG system could be profitable at some point in the future, as decreasing construction costs are offset by higher earned revenues. However, this outcome is not observed for any of the twenty years examined in the tables below.

For each of the years included in this analysis the residual value of RARF freeway capital assets was calculated. This figure provides information on the depreciated value of the infrastructure of the freeway 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 1986 retain only 40% of their original value. Capital outlays made in 1997 however, retain 95% of their original value. Capital outlays made twenty years ago or more have depreciated completely and no longer have any monetary value. 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. Appendix B also includes a sample of the straight line depreciation technique.

Figure 1: Trend in the Net Profits of the RARF Freeway System, 1988 to 2007

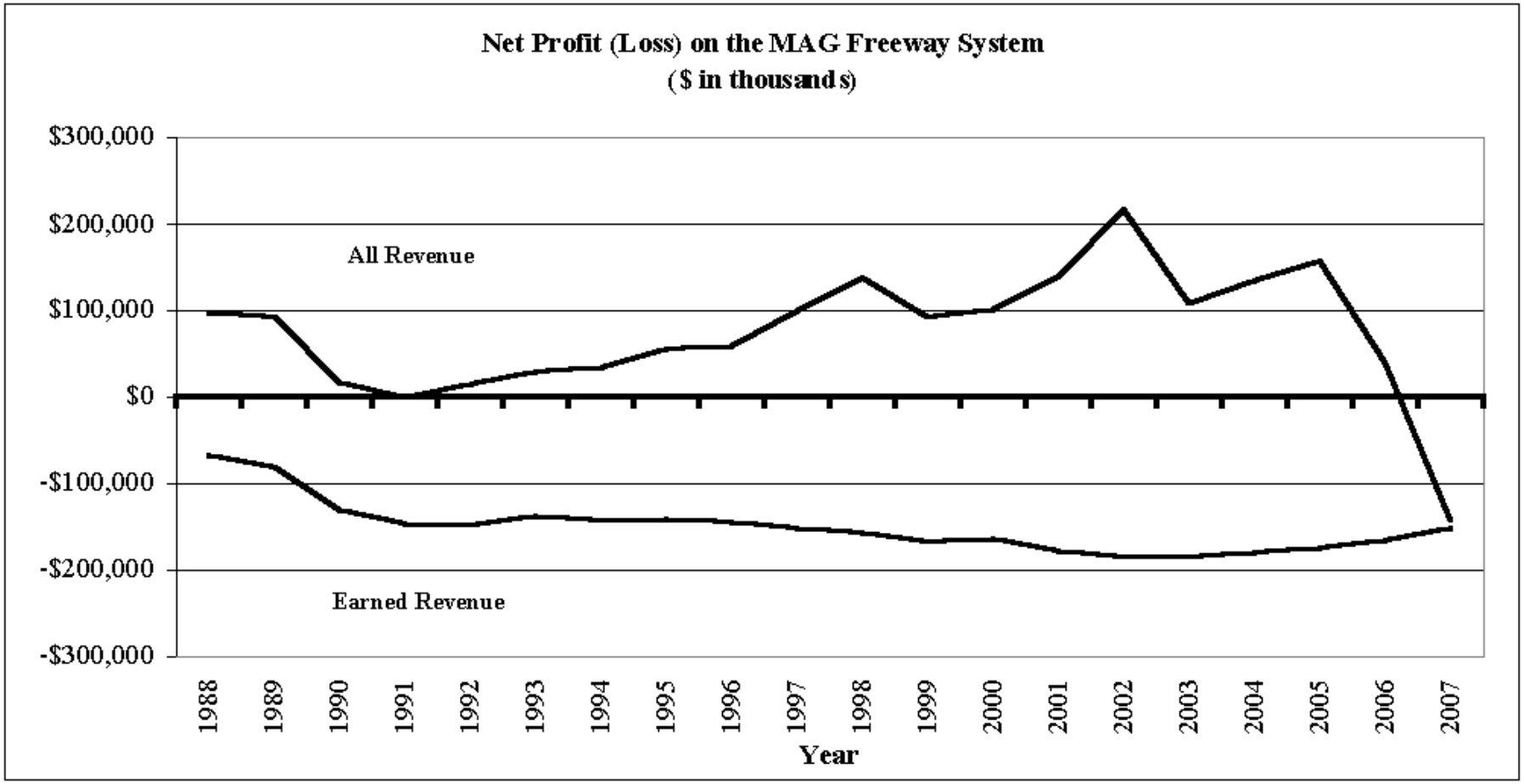


Table 2: Ten Year Income Statement for the Maricopa Freeway System, 1988 to 1997

Costs/Expenditures	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Maintenance and Traffic Services[a]	$204	$419	$757	$834	$1,127	$3,027	$2,894	$3,422	$4,550	$3,744	$20,976
Administration and Miscellaneous[b]	$155	$345	$564	$792	$761	$2,219	$2,468	$2,060	$2,946	$2,036	$14,345
Highway Law Enforcement and Safety[c]	$210	$394	$661	$676	$818	$2,394	$2,484	$2,690	$4,041	$3,179	$17,546
Bond Interest[d]	$36,542	$40,410	$66,001	$69,324	$67,343	$58,559	$61,338	$58,775	$61,797	$59,549	$579,637
Other Debt Service[e]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fee and Tax Collection Costs[f]	$48	$202	$363	$335	$467	$1,118	$981	$1,485	$1,237	$3,164	$9,401
Construction Recovery Costs (Depreciation)[g]	$30,918	$42,653	$67,443	$79,625	$84,807	$89,632	$95,210	$99,858	$109,318	$119,040	$818,505
Total Costs/Expenditures[h]	$68,077	$84,423	$135,789	$151,586	$155,324	$156,949	$165,374	$168,289	$183,888	$190,712	$1,460,410

Revenues	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Highway User Revenues											
Gasoline Taxes[1]	$1,192	$2,432	$3,887	$4,120	$5,557	$14,232	$14,979	$17,053	$21,312	$21,593	$106,358
Use Fuel Taxes[2]	$62	$196	$336	$448	$445	$1,434	$1,764	$2,421	$2,999	$3,256	$13,360
Motor Carrier Taxes[3]	$129	$403	$664	$746	$787	$2,395	$2,379	$2,049	$2,232	$2,354	$14,139
Vehicle License Taxes[4]	$999	$1,979	$3,612	$3,766	$4,990	$13,550	$14,602	$18,753	$27,164	$29,710	$119,124
Registration Fees[5]	$314	$625	$1,102	$967	$1,213	$3,280	$3,382	$3,869	$5,215	$5,422	$25,389
Other[6]	$91	$182	$317	$307	$417	$982	$1,499	$1,762	$2,279	$2,205	$10,042
Gross Earned User Revenue on MAG System Highways[7]	$1,394	$2,908	$4,959	$5,177	$6,704	$17,937	$19,303	$22,953	$30,600	$32,270	$144,206
Transfers to General Fund[8]	$342	$678	$1,237	$1,290	$1,709	$4,641	$5,001	$6,423	$9,304	$10,176	$40,800
Net Earned User Revenue on MAG System Highways[9]	$1,052	$2,231	$3,722	$3,887	$4,995	$13,296	$14,302	$16,530	$21,297	$22,094	$103,406
MAG System Receipts from HURF[10]	$36,726	$38,179	$39,190	$39,225	$38,111	$39,846	$43,219	$44,820	$48,415	$59,999	$427,730
Federal Aid to State System											
Federal Highway Administration[11]	$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[12]	$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 to State System[13]	$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[14]	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 State Highway System[15]	$88,167	$147,482	$108,015	$103,939	$79,495	$69,986	$106,330	$100,666	$187,011	$163,774	$1,154,865
Earned Federal User Revenue MAG Highway System[16]	$350	$1,147	$1,345	$1,328	$1,300	$2,844	$4,290	$4,520	$9,992	$8,746	$35,862
Direct Federal Aid to MAG System[17]	$3,954	$3,954	$3,745	$0	$17,017	$19,510	$5,034	$16,231	$10,629	$33,951	$114,025
Inter-Government Transfers to the MAG Highway System											
Appropriations from General Funds[18]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
From Counties and Townships[19]	$99,190	$106,250	$110,801	$113,335	$116,496	$127,273	$142,846	$160,318	$184,788	$192,257	$1,353,554
From Municipalities[20]	$28,400	$29,600	$0	$0	$0	$0	$9,529	$3,724	$186	$4,757	$76,196
Total Inter-Governmental Transfers to MAG Highways[21]	$127,590	$135,850	$110,801	$113,335	$116,496	$127,273	$152,375	$164,042	$184,974	$197,014	$1,429,750
Total MAG Highway System Earned Revenue[22]	$1,744	$4,056	$6,304	$6,505	$8,004	$20,781	$23,593	$27,473	$40,592	$41,015	$180,068
Subsidies from Non-Highway Users[23]	$127,590	$135,850	$110,801	$113,335	$116,496	$127,273	$152,375	$164,042	$184,974	$197,014	$1,429,750
Cross Subsidies from Other Highway Users[24]	$39,278	$38,755	$37,868	$34,009	$48,833	$43,216	$29,661	$40,001	$27,755	$63,110	$402,486
Total Resources from all Local, State and Federal Sources[25]	$168,270	$177,983	$153,736	$152,560	$171,624	$186,629	$200,628	$225,093	$244,018	$290,964	$1,971,504

Net Profit/Loss	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Net Profit/Loss (All Revenue Sources)[i]	$100,193	$93,560	$17,947	$974	$16,300	$29,681	$35,254	$56,804	$60,130	$100,252	$511,094
Return on Investment (All Revenue Sources)[ii]	18.0%	12.5%	1.5%	0.1%	1.2%	2.2%	2.5%	4.1%	4.1%	6.5%	4.2%
Net Profit/Loss (Earned Revenue)[iii]	-$66,333	-$80,367	-$129,485	-$145,080	-$147,320	-$136,167	-$141,781	-$140,816	-$143,296	-$149,696	-$1,280,342
Return on Investment (Earned Revenue)[iv]	-11.9%	-10.7%	-11.0%	-10.8%	-10.8%	-10.0%	-10.3%	-10.2%	-9.8%	-9.8%	-10.4%
Residual Value of Assets[v]	$556,226	$748,273	$1,176,629	$1,340,668	$1,359,557	$1,366,428	$1,382,762	$1,375,978	$1,455,859	$1,534,321	$1,229,670

Table 3: Ten Year Income Statement for the Maricopa Freeway System, 1998 to 2007

Costs/Expenditures	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-07
Maintenance and Traffic Services[a]	$5,868	$7,393	$9,296	$10,249	$11,287	$12,607	$14,117	$15,782	$16,351	$16,958	$119,907
Administration and Miscellaneous[b]	$4,260	$5,367	$6,748	$7,441	$8,194	$9,152	$10,248	$11,456	$11,870	$12,310	$87,045
Highway Law Enforcement and Safety[c]	$4,978	$6,271	$7,885	$8,695	$9,574	$10,694	$11,976	$13,387	$13,870	$14,385	$101,716
Bond Interest[d]	$54,798	$61,064	$52,903	$45,385	$51,785	$45,840	$39,598	$23,564	$9,032	$7,804	$391,773
Other Debt Service[e]	$0	$0	$0	$6,000	$5,638	$4,019	$0	$11,250	$14,834	$18,345	$60,086
Fee and Tax Collection Costs[f]	$2,504	$3,155	$3,967	$4,374	$4,817	$5,380	$6,025	$6,735	$6,978	$7,237	$51,170
Construction Recovery Costs (Depreciation)[g]	$130,019	$147,401	$163,252	$183,826	$194,343	$210,409	$224,761	$237,071	$244,830	$236,292	$1,972,205
Total Costs/Expenditures[h]	$202,426	$230,651	$244,052	$265,969	$285,637	$298,102	$306,725	$319,245	$317,765	$313,331	$2,783,902

Revenues	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-07
Highway User Revenues											
Gasoline Taxes[1]	$27,108	$35,072	$45,061	$48,730	$54,305	$60,231	$67,410	$74,681	$77,148	$79,746	$569,491
Use Fuel Taxes[2]	$5,655	$7,841	$10,417	$11,016	$12,085	$13,381	$14,846	$16,555	$17,074	$17,614	$126,484
Motor Carrier Taxes[3]	$2,540	$1,670	$2,121	$2,279	$2,462	$2,690	$2,953	$3,256	$3,328	$3,394	$26,692
Vehicle License Taxes[4]	$28,509	$42,408	$56,096	$63,455	$72,984	$85,214	$99,968	$117,206	$127,716	$139,992	$833,549
Registration Fees[5]	$7,005	$10,866	$13,563	$14,566	$15,884	$17,540	$19,445	$21,663	$22,469	$23,198	$166,198
Other[6]	$2,508	$3,193	$4,038	$4,655	$5,236	$5,906	$6,677	$7,536	$7,900	$8,273	$55,922
Gross Earned User Revenue on MAG System Highways[7]	$36,663	$50,525	$65,648	$72,350	$81,478	$92,481	$105,650	$120,449	$127,817	$136,108	$889,168
Transfers to General Fund[8]	$9,764	$12,141	$16,060	$18,167	$20,895	$24,397	$28,621	$33,556	$36,565	$40,080	$240,247
Net Earned User Revenue on MAG System Highways[9]	$26,898	$38,383	$49,588	$54,183	$60,583	$68,084	$77,029	$86,893	$91,252	$96,029	$648,921
MAG System Receipts from HURF[10]	$107,343	$54,893	$58,075	$58,835	$71,692	$64,358	$97,409	$87,291	$73,610	$77,162	$750,668
Federal Aid to State System											
Federal Highway Administration[11]	$255,872	$296,188	$300,816	$306,647	$312,124	$318,270	$318,270	$324,635	$331,128	$337,751	$3,101,701
Other Agencies[12]	$0	$9,397	$5,800	$0	$10,000	$0	$0	$0	$0	$0	$25,197
Total Federal Aid to State System[13]	$255,872	$305,585	$306,616	$306,647	$322,124	$318,270	$318,270	$324,635	$331,128	$337,751	$3,126,898
Apportionment Ratio[14]	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Earned Federal User Revenue State Highway System[15]	$134,669	$160,834	$161,377	$161,393	$169,539	$167,511	$167,511	$170,861	$174,278	$177,764	$1,645,736
Earned Federal User Revenue MAG Highway System[16]	$9,273	$13,243	$16,457	$17,635	$19,904	$21,183	$22,874	$25,248	$25,830	$26,451	$198,099
Direct Federal Aid to MAG System[17]	$13,628	$26,984	$32,540	$31,601	$88,532	$25,180	$45,650	$18,786	$34,100	$34,100	$351,101
Inter-Government Transfers to the MAG Highway System											
Appropriations from General Funds[18]	$0	$0	$0	$0	$0	$30,000	$0	$50,000	$50,000	$60,000	$190,000
From Counties and Townships[19]	$209,322	$229,470	$246,650	$253,990	$271,240	$284,620	$299,140	$320,820	$200,630	$0	$2,315,882
From Municipalities[20]	$11,793	$13,607	$8,657	$63,265	$72,396	$2,240	$0	$0	$0	$0	$171,958
Total Inter-Governmental Transfers to MAG Highways[21]	$221,115	$243,077	$255,307	$317,255	$343,636	$316,860	$299,140	$370,820	$250,630	$60,000	$2,677,840
Total MAG Highway System Earned Revenue[22]	$45,936	$63,768	$82,105	$89,986	$101,382	$113,664	$128,523	$145,697	$153,646	$162,560	$1,087,267
Subsidies from Non-Highway Users[23]	$221,115	$243,077	$255,307	$317,255	$343,636	$316,860	$299,140	$370,820	$250,630	$60,000	$2,677,840
Cross Subsidies from Other Highway Users[24]	$84,799	$30,251	$24,570	$18,618	$79,737	$270	$43,157	-$6,064	-$9,371	-$11,218	$254,749
Total Resources from all Local, State and Federal Sources[25]	$342,086	$324,954	$345,922	$407,691	$503,860	$406,398	$442,199	$476,897	$358,340	$171,262	$3,779,609

Net Profit/Loss	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-07
Net Profit/Loss (All Revenue Sources)[i]	$139,660	$94,303	$101,870	$141,722	$218,223	$108,296	$135,474	$157,652	$40,575	-$142,069	$995,707
Return on Investment (All Revenue Sources)[ii]	8.6%	5.2%	5.1%	6.4%	9.8%	4.6%	5.6%	6.4%	1.7%	-6.2%	4.6%
Net Profit/Loss (Earned Revenue)[iii]	-$156,490	-$166,883	-$161,946	-$175,983	-$184,255	-$184,438	-$178,202	-$173,548	-$164,118	-$150,771	-$1,696,635
Return on Investment (Earned Revenue)[iv]	-9.6%	-9.1%	-8.2%	-8.0%	-8.3%	-7.9%	-7.4%	-7.1%	-6.7%	-6.6%	-7.8%
Residual Value of Assets[v]	$1,629,248	$1,829,851	$1,983,622	$2,211,262	$2,227,261	$2,338,188	$2,401,439	$2,445,080	$2,447,726	$2,279,776	$2,179,345

Income Statement Notes

The following notes are based on the Federal Highway Administration's *Guide to Reporting Highway Statistics*. 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. Revenues and expenditures have been organized in the format used in Phase 1: *The Value of Arizona's State Highway System* (Mansour and Semmens, 1999). However, as explained in Section III: Data and Sources, these figures have been adjusted according to the share of travel on MAG system highways when applicable. The following notes provide a description of each set of data, as well as a notation of any methods used to dis-aggregate state level data for allocation to the MAG highway system.

Expenditures

a. *Maintenance and Traffic Services*: The cost of all the materials, supplies, and equipment involved in preserving 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. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

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. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

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. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

d. *Bond Interest*: The interest paid on bonds used for state highway construction is included as an expense. Repayment of bond principal is not counted as an expense since the inflow of money from the bond undertaking is not counted as revenue. The principal bond issues used for construction on the MAG system are Highway User Revenue Fund (HURF) bonds and Regional Area Road Fund (RARF) bonds. HURF bonds are used for construction on *all* state highway system routes. The MAG system has therefore been assigned a share of HURF bond interest according to the ratio of MAG system capital expenditures to total state highway expenditures for each year. RARF bonds are dedicated for construction of the

MAG system. Interest on RARF bonds is therefore allocated in its entirety as a MAG system expense.

e. *Other Debt Service*: Interest on short-term obligations from the state general fund and local government loans are included as part of the alternative financing strategies for fiscal years 2000 to 2007. As in the case of HURF and RARF bonds (d.), repayment of the principal on these obligations is not included as an expense. However, interest on these obligations (e.g. State Infrastructure Bank (SIB) loans, Grant Anticipation Notes (GANs) and Board Funding Obligations (BFOs)) is not broken out separately on an annual basis due to their short-term repayment schedules. Interest has been booked to the earliest year(s) of the repayment schedule for each issue.

f. *Fee and Tax Collection Costs:* The administrative costs associated with collecting motor vehicle taxes and fees. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

g. *Construction Recovery Costs (Depreciation)*: The RARF highway system is a fixed asset that depreciates over time. The life of MAG-system 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 MAG highway system. It is calculated by summing the 5% annual depreciation charge for each year's capital outlays over the previous 20-year period.

h. *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. In Arizona, the average gasoline tax rate for the period 1988-1997 was approximately 18 cents per gallon. These revenues have been prorated according to the share of total *passenger automobile* traffic measured on the RARF Freeway System for each year of the analysis.

2. *Use Fuel Taxes*: The revenue raised by state taxation of diesel fuel. In Arizona, the average diesel fuel tax for the period 1988-1997 was approximately 18 cents per gallon with a 8 cent surcharge which made the effective tax rate on diesel fuel 26 cents per gallon. These revenues have been prorated according to the share of total *commercial truck* traffic measured on the RARF Freeway System for each year of the analysis.

3. *Motor Carrier Taxes*: Sometimes referred to as the "weight-distance tax," this includes revenue generated through state taxes levied on commercial vehicles. From 1988 to 1997, the tax was based on registered gross weight and reported vehicle miles of travel within the state not on the ownership and operation of motor vehicles. For the heaviest vehicles, this tax

amounted to approximately $0.06/mile. In 1998, the tax was changed to a flat fee assessed at the time of registration according to the gross registered weight of the vehicle. These revenues have been prorated according to the share of total *commercial truck* traffic measured on the RARF Freeway System for each year of the analysis.

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. Forecast revenues reflect the current reduction in vehicle license tax collections. These revenues have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

5. *Registration Fees*: These are set fees levied upon vehicles registered in the state. As in the case of the motor carrier tax, 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. These revenues have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

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. These revenues have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System for each year of the analysis.

7. *Gross MAG Highway System Earned User Revenue*: This is the sum of all previously listed taxes and fees multiplied by 50%. Previously listed revenue sources have been adjusted for the share of state highway system traffic occurring on MAG highways, but not for the share of total state traffic that occurs on state highways. 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. 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 share of vehicle license taxes that are transferred to the General Fund for non-highway expenditures. For fiscal years 1988 to 1998, 68.5% of the vehicle license tax was transferred to the general fund. Current forecasts for fiscal 1999 to 2007 estimate that 57.3% of the vehicle license tax will be transferred to the general fund.

9. *Net MAG Highway System Earned User Revenue*: This is the residual of gross highway user revenue left after transfers to the general fund.

10. *Gross MAG System Receipts from HURF*: This category consists of the actual amount of HURF receipts dedicated to the MAG system, representing 75% of the "controlled access" funds distributed to regional freeway systems in Maricopa and Pima counties. In addition to

these funds, the MAG system receipts also include state HURF discretionary transfers to the MAG system. The amount of controlled access funds distributed to the MAG system is dedicated by statute, not by amount of traffic on the system. These funds can therefore be greater or less than the amount of user revenues earned on the MAG system. If MAG system receipts (10.) exceed gross earned revenues (7.), the MAG system highways are being subsidized by other highway users. In the opposite scenario, MAG system highway users are providing a subsidy to other highways on the state system.

11. *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.

12. *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.

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

14. *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.

15. *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.

16. *Earned Federal User Revenue on the MAG Highway System*: The MAG highway system has been allocated a share of total earned federal user revenues on the state highway system (15.) according to the share of traffic on state system highways measured on the MAG system.

17. *Direct Federal Aid to the MAG System Highways*: This is the actual amount of federal funds received for construction of highways on the MAG freeway system. As in the case of highway user revenue receipts (10.), the federal funding received for MAG system highways can be greater or less than the earned federal revenues for these highways. If direct federal aid (17.) exceeds earned federal user revenue (16.), drivers on non-MAG highways are providing a subsidy to the RARF freeway system. If direct federal aid is less than federal revenue earned on the MAG system, drivers on RARF Freeways are subsidizing travel on non-MAG highways.

18. *Appropriations from General Funds*: Resources transferred from the State General Fund to the DOT for specific use on the RARF Freeway System. Includes dedicated highway transfers for funding of the MAG system after 2003.

19. *From Counties and Townships*: Revenue generated primarily through a ½ cent sales tax in Maricopa county. These funds are earmarked for use on the RARF Freeway System, and are therefore assigned to the MAG system in their entirety. Also includes transfers of Maricopa County highway revenues that have not been earmarked for the MAG system.

20. *From Municipalities*: This records occasional revenues provided by municipalities for specific sections of the RARF Freeway System, including direct construction expenditures made by a municipality on State Route 51 (1988-89).

21. *Total Inter-Governmental Transfers to RARF 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.

22. *Total RARF Freeway System Earned Revenue:* The portion of state highway revenues generated by users of the RARF highway system. Total RARF highway system earned revenue is equal the Gross MAG Highway System Earned User Revenues (7.) plus the Earned Federal User Revenue (16.) on the MAG System.

23. *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.

24. *Cross Subsidies from Other Highway Users:* The cross subsidy is equal to MAG System Receipts from the HURF (10.) and Direct Federal Aid to the MAG System (17.) minus Earned State (7.) and Federal (16.) User Revenue on the MAG Highway System. This revenue is being generated by users of highway systems other than the RARF Freeway System but is being used for the maintenance and development of the MAG system. Since more money is transferred to the RARF Freeway System than is generated by the users of MAG highways, this excess is in effect, a subsidy.

25. *Total Resources from all Local, State and Federal Sources:* The sum of the MAG System Receipts from the HURF, Direct Federal Aid to the MAG System and Total Inter-Governmental Transfers to MAG Highways. This indicates all of the revenue that is available to the RARF highway system regardless of whether it was earned by users of the 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 MAG 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 RARF Freeway 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 MAG 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 MAG 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 and no longer have any appreciable monetary value.

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 Urban Construction Price Index for Federal-Aid Highway Construction (FHWA, 2000). A copy of this index is included in Appendix C.

This adjustment for inflation not only brings into better alignment the costs and revenues associated with the RARF 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, the roads will likely need considerable upgrading. Adjusting the capital outlay costs by an inflation index will more adequately reflect the costs of maintaining the MAG 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:

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

This calculation was carried out for all the capital outlays between 1969 and 2007 and for all the years between 1988 and 2007. 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.

In general, the adjustment of capital outlay depreciation for inflation worsened the financial situation of the MAG highway system. Table 2 outlines the inflation adjusted ten year income statement for the MAG 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 reduced the return on system assets by one half. When earned income was considered, the total net loss for the entire forecast period increased by $660 million. Adjusting the capital outlays by an inflation factor increased these costs rather significantly. Table 6 compares the depreciation values for capital outlays before and after they were adjusted for inflation.

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

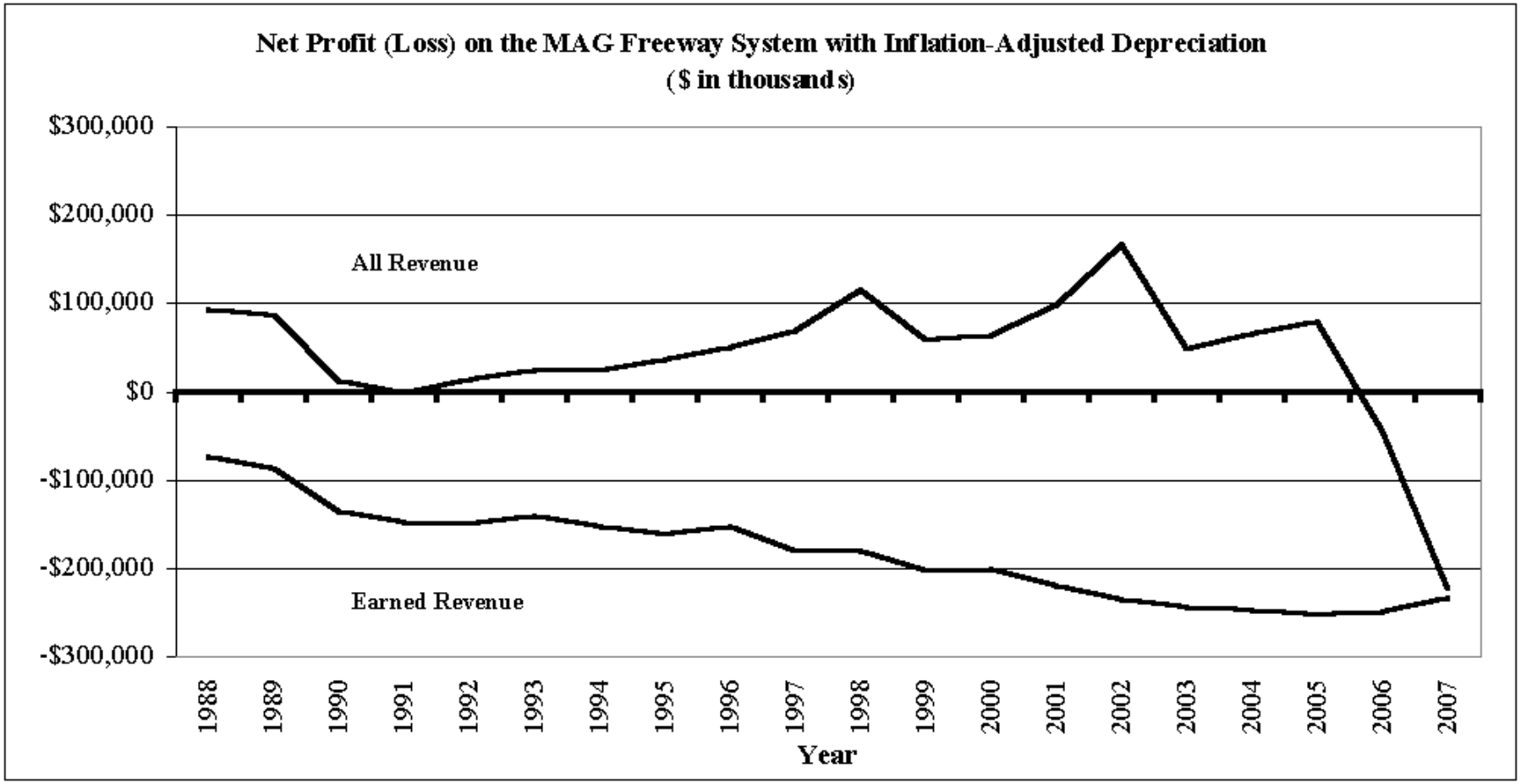


Table 4: Ten Year Income Statement for the Maricopa Freeway System with Inflation Adjusted Depreciation, 1988 to 1997

Costs/Expenditures	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Maintenance and Traffic Services[a]	$204	$419	$757	$834	$1,127	$3,027	$2,894	$3,422	$4,550	$3,744	$20,976
Administration and Miscellaneous[b]	$155	$345	$564	$792	$761	$2,219	$2,468	$2,060	$2,946	$2,036	$14,345
Highway Law Enforcement and Safety[c]	$210	$394	$661	$676	$818	$2,394	$2,484	$2,690	$4,041	$3,179	$17,546
Bond Interest[d]	$36,542	$40,410	$66,001	$69,324	$67,343	$58,559	$61,338	$58,775	$61,797	$59,549	$579,637
Other Debt Service[e]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fee and Tax Collection Costs[f]	$48	$202	$363	$335	$467	$1,118	$981	$1,485	$1,237	$3,164	$9,401
Construction Recovery Costs (Depreciation)[g]	$36,082	$48,305	$72,289	$81,484	$86,160	$93,576	$105,659	$120,986	$119,599	$149,816	$913,955
Total Costs/Expenditures[h]	$73,241	$90,074	$140,634	$153,445	$156,677	$160,892	$175,823	$189,417	$194,170	$221,487	$1,555,860

Revenues	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Highway User Revenues											
Gasoline Taxes[1]	$1,192	$2,432	$3,887	$4,120	$5,557	$14,232	$14,979	$17,053	$21,312	$21,593	$106,358
Use Fuel Taxes[2]	$62	$196	$336	$448	$445	$1,434	$1,764	$2,421	$2,999	$3,256	$13,360
Motor Carrier Taxes[3]	$129	$403	$664	$746	$787	$2,395	$2,379	$2,049	$2,232	$2,354	$14,139
Vehicle License Taxes[4]	$999	$1,979	$3,612	$3,766	$4,990	$13,550	$14,602	$18,753	$27,164	$29,710	$119,124
Registration Fees[5]	$314	$625	$1,102	$967	$1,213	$3,280	$3,382	$3,869	$5,215	$5,422	$25,389
Other[6]	$91	$182	$317	$307	$417	$982	$1,499	$1,762	$2,279	$2,205	$10,042
Gross Earned User Revenue on MAG System Highways[7]	$1,394	$2,908	$4,959	$5,177	$6,704	$17,937	$19,303	$22,953	$30,600	$32,270	$144,206
Transfers to General Fund[8]	$342	$678	$1,237	$1,290	$1,709	$4,641	$5,001	$6,423	$9,304	$10,176	$40,800
Net Earned User Revenue on MAG System Highways[9]	$1,052	$2,231	$3,722	$3,887	$4,995	$13,296	$14,302	$16,530	$21,297	$22,094	$103,406
MAG System Receipts from HURF[10]	$36,726	$38,179	$39,190	$39,225	$38,111	$39,846	$43,219	$44,820	$48,415	$59,999	$427,730
Federal Aid to State System											
Federal Highway Administration[11]	$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[12]	$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 to State System[13]	$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[14]	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 State Highway System[15]	$88,167	$147,482	$108,015	$103,939	$79,495	$69,986	$106,330	$100,666	$187,011	$163,774	$1,154,865
Earned Federal User Revenue MAG Highway System[16]	$350	$1,147	$1,345	$1,328	$1,300	$2,844	$4,290	$4,520	$9,992	$8,746	$35,862
Direct Federal Aid to MAG System[17]	$3,954	$3,954	$3,745	$0	$17,017	$19,510	$5,034	$16,231	$10,629	$33,951	$114,025
Inter-Government Transfers to the MAG Highway System											
Appropriations from General Funds[18]	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
From Counties and Townships[19]	$99,190	$106,250	$110,801	$113,335	$116,496	$127,273	$142,846	$160,318	$184,788	$192,257	$1,353,554
From Municipalities[20]	$28,400	$29,600	$0	$0	$0	$0	$9,529	$3,724	$186	$4,757	$76,196
Total Inter-Governmental Transfers to MAG Highways[21]	$127,590	$135,850	$110,801	$113,335	$116,496	$127,273	$152,375	$164,042	$184,974	$197,014	$1,429,750
Total MAG Highway System Earned Revenue[22]	$1,744	$4,056	$6,304	$6,505	$8,004	$20,781	$23,593	$27,473	$40,592	$41,015	$180,068
Subsidies from Non-Highway Users[23]	$127,590	$135,850	$110,801	$113,335	$116,496	$127,273	$152,375	$164,042	$184,974	$197,014	$1,429,750
Cross Subsidies from Other Highway Users[24]	$39,278	$38,755	$37,868	$34,009	$48,833	$43,216	$29,661	$40,001	$27,755	$63,110	$402,486
Total Resources from all Local, State and Federal Sources[25]	$168,270	$177,983	$153,736	$152,560	$171,624	$186,629	$200,628	$225,093	$244,018	$290,964	$1,971,504

Net Profit/Loss	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1988-97
Net Profit/Loss (All Revenue Sources)[i]	$95,029	$87,909	$13,101	-$885	$14,947	$25,737	$24,805	$35,676	$49,848	$69,477	$415,645
Return on Investment (All Revenue Sources) [ii]	16.4%	11.3%	1.1%	-0.1%	1.1%	1.9%	1.7%	2.2%	3.3%	3.8%	3.2%
Net Profit/Loss (Earned Revenue)[iii]	-$71,497	-$86,019	-$134,330	-$146,939	-$148,673	-$140,111	-$152,230	-$161,944	-$153,578	-$180,472	-$1,375,792
Return on Investment (Earned Revenue) [iv]	-12.3%	-11.0%	-11.2%	-11.2%	-11.2%	-10.2%	-10.3%	-10.1%	-10.0%	-9.8%	-10.6%
Residual Value of Assets[v]	$579,580	$778,478	$1,196,910	$1,312,897	$1,325,553	$1,371,621	$1,476,392	$1,601,655	$1,531,195	$1,847,823	$1,302,211

Table 5: Ten Year Income Statement for the Maricopa Freeway System with Inflation Adjusted Depreciation, 1998 to 2007

Costs/Expenditures	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1998-07
Maintenance and Traffic Services[a]	$5,868	$7,393	$9,296	$10,249	$11,287	$12,607	$14,117	$15,782	$16,351	$16,958	$119,907
Administration and Miscellaneous[b]	$4,260	$5,367	$6,748	$7,441	$8,194	$9,152	$10,248	$11,456	$11,870	$12,310	$87,045
Highway Law Enforcement and Safety[c]	$4,978	$6,271	$7,885	$8,695	$9,574	$10,694	$11,976	$13,387	$13,870	$14,385	$101,716
Bond Interest[d]	$54,798	$61,064	$52,903	$45,385	$51,785	$45,840	$39,598	$23,564	$9,032	$7,804	$391,773
Other Debt Service[e]	$0	$0	$0	$6,000	$5,638	$4,019	$0	$11,250	$14,834	$18,345	$60,086
Fee and Tax Collection Costs[f]	$2,504	$3,155	$3,967	$4,374	$4,817	$5,380	$6,025	$6,735	$6,978	$7,237	$51,170
Construction Recovery Costs (Depreciation)[g]	$152,800	$181,612	$201,474	$227,173	$245,042	$270,002	$294,286	$315,478	$330,276	$317,799	$2,535,942
Total Costs/Expenditures[h]	$225,207	$264,862	$282,274	$309,316	$336,336	$357,694	$376,250	$397,652	$403,211	$394,838	$3,347,640
Revenues	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**1998-07**
Highway User Revenues											
Gasoline Taxes[1]	$27,108	$35,072	$45,061	$48,730	$54,305	$60,231	$67,410	$74,681	$77,148	$79,746	$569,491
Use Fuel Taxes[2]	$5,655	$7,841	$10,417	$11,016	$12,085	$13,381	$14,846	$16,555	$17,074	$17,614	$126,484
Motor Carrier Taxes[3]	$2,540	$1,670	$2,121	$2,279	$2,462	$2,690	$2,953	$3,256	$3,328	$3,394	$26,692
Vehicle License Taxes[4]	$28,509	$42,408	$56,096	$63,455	$72,984	$85,214	$99,968	$117,206	$127,716	$139,992	$833,549
Registration Fees[5]	$7,005	$10,866	$13,563	$14,566	$15,884	$17,540	$19,445	$21,663	$22,469	$23,198	$166,198
Other[6]	$2,508	$3,193	$4,038	$4,655	$5,236	$5,906	$6,677	$7,536	$7,900	$8,273	$55,922
Gross Earned User Revenue on MAG System Highways[7]	$36,663	$50,525	$65,648	$72,350	$81,478	$92,481	$105,650	$120,449	$127,817	$136,108	$889,168
Transfers to General Fund[8]	$9,764	$14,525	$19,213	$21,733	$24,997	$29,186	$34,239	$40,143	$43,743	$47,947	$285,490
Net Earned User Revenue on MAG System Highways[9]	$26,898	$36,000	$46,435	$50,617	$56,481	$63,295	$71,410	$80,306	$84,074	$88,161	$603,678
MAG System Receipts from HURF[10]	$107,343	$54,893	$58,075	$58,835	$71,692	$64,358	$97,409	$87,291	$73,610	$77,162	$750,668
Federal Aid to State System											
Federal Highway Administration[11]	$255,872	$296,188	$300,816	$306,647	$312,124	$318,270	$318,270	$324,635	$331,128	$337,751	$3,101,701
Other Agencies[12]	$0	$9,397	$5,800	$0	$10,000	$0	$0	$0	$0	$0	$25,197
Total Federal Aid to State System[13]	$255,872	$305,585	$306,616	$306,647	$322,124	$318,270	$318,270	$324,635	$331,128	$337,751	$3,126,898
Apportionment Ratio[14]	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Earned Federal User Revenue State Highway System[15]	$134,669	$160,834	$161,377	$161,393	$169,539	$167,511	$167,511	$170,861	$174,278	$177,764	$1,645,736
Earned Federal User Revenue MAG Highway System[16]	$9,273	$13,243	$16,457	$17,635	$19,904	$21,183	$22,874	$25,248	$25,830	$26,451	$198,099
Direct Federal Aid to MAG System[17]	$13,628	$26,984	$32,540	$31,601	$88,532	$25,180	$45,650	$18,786	$34,100	$34,100	$351,101
Inter-Government Transfers to the MAG Highway System											
Appropriations from General Funds[18]	$0	$0	$0	$0	$0	$30,000	$0	$50,000	$50,000	$60,000	$190,000
From Counties and Townships[19]	$209,322	$229,470	$246,650	$253,990	$271,240	$284,620	$299,140	$320,820	$200,630	$0	$2,315,882
From Municipalities[20]	$11,793	$13,607	$8,657	$63,265	$72,396	$2,240	$0	$0	$0	$0	$171,958
Total Inter-Governmental Transfers to MAG Highways[21]	$221,115	$243,077	$255,307	$317,255	$343,636	$316,860	$299,140	$370,820	$250,630	$60,000	$2,677,840
Total MAG Highway System Earned Revenue[22]	$45,936	$63,768	$82,105	$89,986	$101,382	$113,664	$128,523	$145,697	$153,646	$162,560	$1,087,267
Subsidies from Non-Highway Users[23]	$221,115	$243,077	$255,307	$317,255	$343,636	$316,860	$299,140	$370,820	$250,630	$60,000	$2,677,840
Cross Subsidies from Other Highway Users[24]	$84,799	$32,634	$27,723	$22,184	$83,839	$5,059	$48,775	$523	-$2,194	-$3,350	$299,992
Total Resources from all Local, State and Federal Sources[25]	$342,086	$324,954	$345,922	$407,691	$503,860	$406,398	$442,199	$476,897	$358,340	$171,262	$3,779,609
Net Profit/Loss	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**1998-07**
Net Profit/Loss (All Revenue Sources)[i]	$116,879	$60,092	$63,648	$98,375	$167,524	$48,704	$65,949	$79,245	-$44,871	-$223,576	$431,969
Return on Investment (All Revenue Sources) [ii]	6.4%	2.8%	2.8%	3.9%	6.4%	1.8%	2.3%	2.7%	-1.5%	-8.0%	1.7%
Net Profit/Loss (Earned Revenue)[iii]	-$179,271	-$201,094	-$200,168	-$219,331	-$234,954	-$244,030	-$247,727	-$251,955	-$249,565	-$232,278	-$2,260,373
Return on Investment (Earned Revenue) [iv]	-9.8%	-9.4%	-8.7%	-8.6%	-9.0%	-8.9%	-8.7%	-8.6%	-8.5%	-8.3%	-8.8%
Residual Value of Assets[v]	$1,828,034	$2,135,517	$2,302,545	$2,549,832	$2,602,212	$2,752,719	$2,852,976	$2,919,462	$2,922,814	$2,787,984	$2,565,409

Table 6: Depreciation of Capital Outlays With and Without Inflation Adjustment
(thousands of dollars)

Year	Depreciation	Inflation Adjusted Depreciation
1988	$30,918	$36,082
1989	$42,653	$48,305
1990	$67,443	$72,289
1991	$79,625	$81,484
1992	$84,807	$86,160
1993	$89,632	$93,576
1994	$95,210	$105,659
1995	$99,858	$120,986
1996	$109,318	$119,599
1997	$119,040	$149,816
1998	$130,019	$152,800
1999	$147,401	$181,612
2000	$163,252	$201,474
2001	$183,826	$227,173
2002	$194,343	$245,042
2003	$210,409	$270,002
2004	$224,761	$294,286
2005	$237,071	$315,478
2006	$244,830	$330,276
2007	$236,292	$317,799

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 system. Adjusting capital costs for inflation more accurately represents the financial obligations associated with the RARF freeway system as well as more accurately reflecting the value of the assets held within the RARF freeway 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 C. 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 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 Table 1 and Table 2. These results are adjusted for inflation in Table 3 and Table 4. The rate of return on investment was calculated by taking the net profit/loss in a given year and dividing through 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. For the 1988 to 1997 period, the ten year average rate of return on investment for MAG system highways was 4.1% when all sources of revenue were considered. When only earned revenue was considered, the ten year average rate of return on investment was -10.4 %. 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 from 1988 to 1997 falls to 3.1 % and when only earned revenue is considered, the rate falls to -10.6 %.

Increased traffic volumes (and hence, increased highway user revenues) on the MAG Freeway System are expected to improve the return on investment from 1998 to 2007. Over the forecast period, the estimated ten year average rate of return on the MAG system highways is 4.6% when all revenues are considered. The estimated ten year return on investment for earned revenues is -7.8%. As above, inclusion of an inflation adjustment in the forecast results has an adverse impact on the rate of return. This impact is heightened by rises in the index of urban construction costs in recent periods. After adjusting the residual value of assets for inflation, the forecast ten year rate of return including all sources of revenue is 1.7% from 1998 to 2007. The ten year average forecast rate of return for earned revenues on the MAG system falls to -8.8% when adjusted for inflation.

In order to assess the competitiveness of the return on investment for the RARF freeway system, the rate of return on assets for the MAG highways was compared several other industries. Whereas the state highway system analysis focused on trucking firms as a proxy for possible returns on highway system investments, this report compares the MAG system to a variety of industries that are either involved in transportation (trucking and railroads) or that have a highly capital-intensive business model that is comparable to the fixed costs associated with freeway construction. Using the latter rationale, electric utilities, telephone service providers and cable television companies have been included for comparison. The capital costs associated with these three industries are similar to the requirements of highway construction, with the need for lines or pipes requiring large fixed outlays and deferral of revenues until construction of a segment is complete. These industries and their average five-year return on assets are shown in Table 7.

Table 7: Comparative Returns of Various Industries and the RARF Freeway System

Industry[1]	5-Year Return on Assets[2], All Revenue	5-Year Return on Assets[2], Earned Revenue
Trucking	N/A	6.4%
Railroads	N/A	3.7%
Electric Utilities	N/A	3.6%
Telecommunications Services	N/A	1.1%
Cable Television	N/A	(0.8%)
RARF Freeway System	5.9%	(9.2%)

1. Industry comparisons based on industry groups from Multex Investor Market Guide, 2000.
2. Five-year ROA through June 30, 2000.

The five-year rate of return for these industries ranged from 6.4 percent for trucking firms to a slight negative return for cable television operators. The 5-year (fiscal 1996 to 2000) return on investment for all revenue sources on the RARF freeway system was 5.9 percent, which exceeded the returns achieved by nearly all of the comparable industries over the same period. However, the returns for the MAG system are inflated considerably by the RARF excise tax receipts and other subsidies. When only earned revenues are considered, the RARF freeway system performed much worse than comparable industries.

From fiscal 1996 to 2000, the RARF freeway system earned less in user revenues than was spent, generating a net loss on highway system assets of -9.2 percent. This return on assets is far worse than even the results of cable television operators, who had a net loss on assets of 0.8 percent. Since the rate of return for private sector industries considers only income that they have earned, comparing the return from earned income of the highways is more appropriate. This indicates that the MAG highway system is vastly under-pricing its services and not meeting its full potential in terms of generating revenue from 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 updating and maintaining the system are also quite considerable. The future solvency and efficiency of the 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 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 stringent 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 8: 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 F. 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 Rowell report's focus 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.

Table 9: Cost of Owning and Operating An Automobile –1996
(Cents Per Mile)[1]

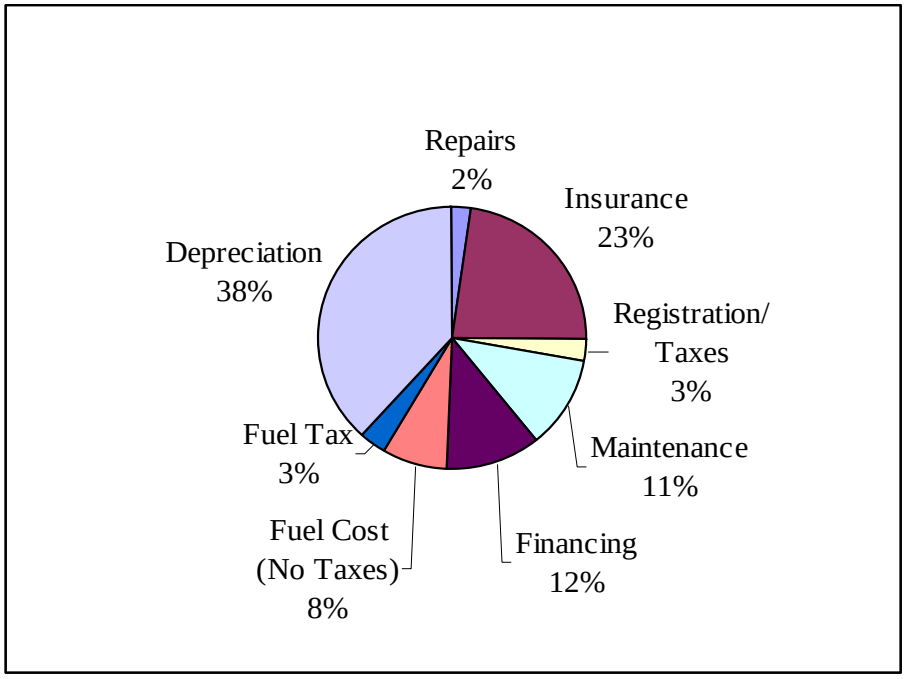
Size	Cost[2]
Subcompact	32.0
Compact	25.8
Intermediate	44.3
Full-Size Vehicle	46.3
Compact Pickup	31.3
Full-Size Pickup	39.9
Compact Utility	40.7
Full-Size Utility	45.4
Mini-Van	40.0
Full-Size Van	48.9

[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. By far, the majority of the costs incurred in owning and operating a vehicle are incurred through depreciation (38.5%) and insurance (22.8%). But, 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 traveling by automobile 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: Vehicle Ownership and Operating Costs By Category (1996)



Note: Based on an average cost of 44.3 cents per mile for an intermediate-size vehicle.
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 highway 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 highways in the United States are more than paid for by 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 costs were more than covered by user costs. In fact, for 1993, 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 RARF 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 what a person is willing to pay for a good or service and what they actually have to pay), the actual amount of surplus must be estimated.

The Value of the RARF 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 MAG highway system earned just over $180 million from users of the system (not including subsidies). During this same time, there were over 4.8 billion annual vehicle mile traveled on the MAG highway system (Arizona Highway Performance Monitoring System). Users of the MAG highway system were charged approximately 3.7 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 users of the state highway system in Rowell et al. (1999). This provides an indication that the services of the MAG highway system may be under valued and under priced.

In determining how to best capture the value of the RARF freeway 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, 2000). Carey (2000) found that the highway user taxes paid by automobiles, pick-up trucks and sport utility vehicles covered 102% of the cost responsibility that these vehicles imposed on the highway system.

Commercial vehicles including buses, single unit trucks, and combination trucks pay significantly less in revenues than their costs responsibility. These categories of commercial vehicles are each paying less than 95% of their share of the costs of highway maintenance and expansion. Correcting this inequity in cost responsibility should be one of the goals of the department of transportation.

To estimate the more appropriate charge for the use of the roadways, earned revenues for the twenty year period of analysis were increased to the level necessary to generate a 5% rate of return on investment.[4] Information on the cost responsibility of commercial versus non-commercial vehicles and the breakdown in proportion of commercial and non-commercial traffic on the MAG highway system was also used to develop an appropriate charge for different classes of vehicles.

Using the information on actual and forecast 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 Maricopa regional highway system, only earned revenue will be considered (all subsidies from non-users of the MAG highway system and transfers from other branches of government have been ignored). Based on forecast travel and expenditures from 1988 to 2007, non-commercial vehicles would need to be charged 12.0 cents per vehicle mile and commercial vehicles would need to be charged 12.9 cents per vehicle mile in order to generate a 5% rate of return on MAG highway system investments. This charge is based on the allocation of cost responsibility in urbanized areas according only to the need for highway capacity. As developed in the Arizona Simplified Model for Highway Cost Allocation, total vehicle miles of travel are used to estimate the degree to which different vehicles are responsible for capacity-related construction such as urban freeway systems (Carey, 2000). The average shares of RARF system traffic for passenger and commercial vehicles have been weighted according to the aggregated forecast of over- or under-payment of cost responsibility by these vehicle types from 1988 to 2004 (102 percent and 95 percent respectively). The weighted shares of RARF system traffic are then used to estimate the charges for the two classes of highway user. These user fees would generate the additional $4.3 billion in highway user revenues needed over the twenty year period to establish a net profit level sufficient to create a more competitive return on investment.

The above calculation is based on the equitable distribution of fees/taxes according to the costs imposed by the different vehicle classes. If a flat per vehicle mile rate was applied to all vehicles regardless of class, a charge of approximately 12.2 cents per vehicle mile would accomplish the goals of an increased rate of return based purely on user fees. However, the ten year average charge per vehicle mile from 1988 to 1997 was estimated to be 3.7 cents. In order to recoup the shortfall from the previous ten year period and achieve a 5% rate of return, the average charge per vehicle mile on the MAG highway system from 1998 to 2007 would have to be increased to 14.2 cents. The increase in user revenues which would be necessary to boost the

[4] Because essentially all construction on the RARF Freeway System began in 1986, many highway segments have only been open for traffic for a few years. As new segments have opened, the growth in traffic on the MAG system has been very rapid (over 2,000% from 1988 to 1997). However, capital expenditures in earlier years have necessarily been offset by increased traffic in later years. While state system highways may be reasonably assessed for any given year, the large changes in traffic on the MAG system create distortions in single-year assessments of adequate user fees. For this reason, the entire twenty year period has been used.

rate of return on investment appears quite substantial on an absolute and a vehicle mile basis. However, this charge still represents less than half of the cost of operating a motor vehicle. Furthermore, the requisite charge per vehicle mile could be expected to decline substantially as the Maricopa Freeway System approaches completion.

There are several possible alternatives for generating additional revenues for the state highway system. Raising use taxes such as the gasoline tax and use fuel tax is one possible way to increase revenue from users of the roadways. An additional surcharge on gasoline and use fuel sales in Maricopa County is one possible measure for consideration. As an example, , an additional surcharge of 10¢ per gallon on gasoline and 13¢ per gallon of use fuel sales would achieve a break-even return on investment for the RARF Freeway System and eliminate the need for non-user subsidies. Increasing fuel taxes is a more direct method of capturing revenues from users of the state highway system than registration fees or other flat fees as it generates revenue from people who use the roadways most frequently. Those who use the roadways most also pay the most for their use. There are however, some problems associated with further increases in gasoline taxes as a way to generate additional revenue. As fuel costs increase, drivers are encouraged to conserve fuel and as a result tax revenues may fall short of forecast amounts (Semmens, 1993). Using taxation as a method of generating highway revenues also does little to address some of the problems associated with road congestion. Finally, taxing all fuel sales in the county would not isolate users of the regional freeway system.

Increasing fuel taxes is not the only option that is available for increasing revenues. There are various more direct pricing mechanisms which could be used to replace the taxes and fees which 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 highway system. Placing tolls on the regional freeway system would enable the DOT to charge users of the MAG system directly and according to their actual use of the roads rather than through proxies to actual use such as gasoline consumption . This would be more equitable in that those vehicles using the roads more often, and therefore exacting a higher cost on the roadway, would be responsible for paying their fair share of the costs. 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, 1987; 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 and in use.

V. Conclusions and Recommendations

The goal of this project was to analyze the financial condition of the RARF highway system using a private sector perspective and framework. The results of the private sector style analysis of the MAG system highways produced 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 RARF highway system are considered, the MAG system generates an overall level of positive net profits and a rate of return on investment equal to approximately 4.4%. This rate of return on investment is comparable to that found for other private sector companies operating in the transportation field or under similar constraints. However, the RARF freeway system returns in this scenario are dependent of high levels of subsidization.

The profitability of the MAG highway 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 RARF 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 twenty year period considered in this analysis, there is a net loss for the highway system and the average rate of return on investment is -8.7%. This provides an indication that the MAG highway system is not generating sufficient revenues directly from the users of the highway system to pay for the construction of the MAG highways.

The negative return on investment for the RARF system highways should not be interpreted as an indication that the RARF system highways are not a worthwhile investment. Instead, the negative return on investment should be interpreted as an indication that highway user fees have not been sufficient to meet the cost of this investment. While establishing a relationship between regional economic growth and highway system expansion is not a part of this analysis, it is plausible that the RARF highway system has had spin-off effects on the rapid growth that has occurred in the urbanized area of Maricopa County in the past decade. However, any ancillary effects that accrue to society as a byproduct of the freeway system are both difficult to quantify and inappropriate for this analysis. This is not to say that these benefits are inconsequential, but rather to acknowledge that private businesses make project decisions based on their expectations of profit maximization. A financial analysis of the RARF system based on the private sector approach should focus on the revenues earned by the highway system, just as a business will focus on the profits made from selling a product or service. A negative return on investment suggests that more could be done to capture the value of the RARF highway system from the users of that system.

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 3.7 cents per vehicle mile in revenue for the MAG highway system, yet the study by Rowell et al. (1999) indicates that the minimum value they place on transportation is in the range of 27.5¢ per mile. The amount of user revenue being collected in Arizona per vehicle mile is also significantly less than the

national average. 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 on the MAG system in lieu of relying on subsidies such as the RARF excise tax. This research also shows that steps could be taken to improve the equity of highway user charges by tying the payment scales of different vehicle classes more directly to their cost responsibilities.

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 regional freeway system was shown to be operating at a net loss for the entire twenty year period. 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. The MAG system currently relies heavily on subsidies from non-highway users to maintain positive net profits. This is not a situation that can be expected to continue indefinitely. 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 RARF highway system it will be necessary to reduce the dependency on subsidies and increase revenues from consumers. The price that consumers are paying to the DOT for the use of MAG highways in no real way reflects the value of those roadways. New pricing strategies should be developed in order to capture more of the true value of these highways. As the economy and population of Maricopa County continues to grow, there will be greater demands placed on regional 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 on the RARF system earn a competitive rate of return on investment will help to create the additional resources that are needed to maintain and expand the highway system to meet the demands of the future. Managing the regional highway system keeping in mind the principles and practices which govern private enterprises will help to ensure 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 MAG system highways more closely reflect their true value.

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Appendix A: Sample Corporate-Style Annual Report for the RARF Freeway System

The following section provides a sample corporate-style annual report for the RARF Freeway System. The approach discussed in Section II is applied to the governmental data on the MAG system highways. 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 1999, HURF revenues were expected to total approximately $1,278 million (ADOT, 2000). The 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. The RARF Freeway System receives a predetermined share of HURF revenues on an annual basis. In recent years, the amount of these "15 percent" funds has been slightly greater than the share of highway user revenues generated on the MAG system.

The Maricopa Freeway System Life Cycle Construction Program was initiated in 1999. Estimated expenditures on the MAG system totaled $3.5 billion through 1999. The remainder of the Life Cycle Program calls for an additional $1.6 billion in capital expenditures between 1999 and 2007. This program includes funding for right-of-way and new construction to complete State Routes 51, 101, and 202. Additional funds are allocated to State Routes 143 and 153 for widening, interchanges and other improvements. Over the past few years, a number of urban freeway projects were completed in the Maricopa County area and in the Phoenix regional area in particular. For the 1998 fiscal year, construction expenditures for MAG system highways (including staff costs) were approximately $225 million (ADOT, 1999).

A Ten Year Perspective of the Financial Status of the RARF Freeway System

Over the past ten years, the RARF freeway system has been marginally profitable in terms of all revenues received by the highway system. On average, total revenues have exceeded total costs. Between 1988 and 1997, there was a total net profit of approximately $509 million. Since 1991, there has been a general upward trend in net profits after a period of general decline in net profits between 1988 and 1991. The average ten year rate of return on investment was 4.1%. 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%.

When only earned revenues generated by users of the RARF Freeway System are considered, the system has operated at a substantial loss. The total net loss on earned revenues from 1988 to 1997 was $1,208 million. The average rate of return on investment for this period was -10.4%. This performance, while unsatisfactory, is attributable largely to the lag time between expenditures for highway construction and the completion of that construction. As new facilities have been completed and opened for travel, the user revenues generated by traffic on the system have increased dramatically. Earned revenues on the RARF Freeway System have increased by more than 2,300% between 1988 and 1997. These revenues are expected to continue to increase, albeit more slowly, as additional lane miles are opened to traffic.

Current Financial Outlook for the RARF Freeway System

The financial outlook for the RARF freeway system has worsened slightly over the past three years. Total costs rose by 13.9 percent in 1999 as compared to 1998 levels. This is primarily a result of increases in the costs associated with accelerated construction on the MAG system. The earned revenues generated from highway user fees have increased at a faster rate than expenditures over the past three years. However, on average, these revenues make up only 18 percent of total revenues collected by the RARF Freeway System. Growth in total revenues, including inter-governmental transfers and federal aid have failed to keep pace with the cost of the highway system. Net profits from all revenue sources and from earned revenues in 1999 are lower than profits in the previous two years.

The rate of return on investment on RARF system infrastructure has fluctuated over the past three years. In 1998 the rate of return on investment from all sources of revenue was 8.6%, the highest rate of return on investment realized by the MAG 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. While the historical rate of return for the RARF freeway system is still lower than for other comparable business alternatives, it has generally improved over the past three years and is approaching the return on investment for other similar enterprises. The rate of return on investment for earned highway user revenues has improved steadily, from -9.7% to -9.1%, but remains far below break-even levels.

The following table outlines in greater detail the sources of costs and revenues for the state-administered highways on the RARF 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 RARF Freeway System
(millions of dollars)

Costs/Expenditures	**1997**	**1998**	**1999**
Maintenance and Traffic Services[a]	$3.7	$5.9	$7.4
Administration and Miscellaneous[b]	$2.0	$4.3	$5.4
Highway Law Enforcement and Safety[c]	$3.2	$5.0	$6.3
Bond Interest[d]	$59.5	$54.8	$61.1
Fee and Tax Collection Costs[e]	$3.2	$2.5	$3.2
Construction Recovery Costs (Depreciation)[f]	$119.0	$130.0	$147.4
Total Costs/Expenditures[g]	$190.7	$202.4	$230.7
Revenues	**1997**	**1998**	**1999**
Gross Earned User Revenue on MAG Highways[1]	$32.3	$36.7	$50.5
Transfers to General Fund[2]	($10.2)	($9.8)	($12.1)
Net Earned User Revenue on MAG Highways[3]	$22.1	$26.9	$38.4
Gross MAG System Receipts from HURF[4]	$60.0	$107.3	$54.9
Earned Federal User Revenue on the MAG System[5]	$8.7	$9.3	$13.2
Total Federal Aid to the MAG System[6]	$34.0	$13.6	$27.0
Inter-Government Transfers to the MAG Freeway System			
Appropriations from State General Funds[7]	$0.0	$0.0	$0.0
From Counties and Townships[8]	$192.3	$209.3	$229.5
From Municipalities[9]	$4.8	$11.8	$13.6
Total Inter-Governmental Transfers to State Highways[10]	$197.0	$221.1	$243.1
Total MAG Highway System Earned Revenue[11]	$41.0	$45.9	$63.8
Total Revenues from all Local, State and Federal Sources[12]	$291.0	$342.1	$325.0
Net Profit/Loss	**1997**	**1998**	**1999**
Net Profit/Loss (All Revenue Sources) [i]	$100.3	$139.7	$94.3
Return on Investment (All Revenue Sources) [ii]	6.5%	8.6%	5.2%
Net Profit/Loss (Earned Revenues) [iii]	($149.7)	($156.5)	($166.9)
Return on Investment (Earned Revenues) [iv]	-9.8%	-9.6%	-9.1%
Residual Value of Assets [v]	$1,534.3	$1,629.2	$1,829.9

Income Statement Notes

The following notes are based on the Federal Highway Administration's *Guide to Reporting Highway Statistics*. 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. Revenues and expenditures have been organized in the format used in Phase 1: *The Value of Arizona's State Highway System* (Mansour and Semmens, 1999), and have been adjusted according to the share of travel on MAG system highways when applicable. The following notes provide a description of each set of data, as well as a notation of any methods used to dis-aggregate state level data for allocation to the MAG highway system

Expenditures

a. *Maintenance and Traffic Services*: The cost of all the materials, supplies, and equipment involved in preserving 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. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System.

b. *Administration and Miscellaneous*: This category includes all the expenses involved in the administration of the 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. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System.

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. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System.

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 from the bond undertaking is not counted as revenue. The principal bond issues used for construction on the MAG system are Highway User Revenue Fund (HURF) bonds and Regional Area Road Fund (RARF) bonds. HURF bonds are used for construction on *all* state highway system routes. The MAG system has therefore been assigned a share of HURF bond interest according to the ratio of MAG system capital expenditures to total state highway expenditures for each year. RARF bonds are dedicated for construction of the MAG system. Interest on RARF bonds is therefore allocated in its entirety as a MAG system expense. Interest on short-term obligations from the state general fund and local government

loans are included as part of the alternative financing strategies for fiscal years 2000 to 2007. As in the case of HURF and RARF bonds, repayment of the principal on these obligations is not included as an expense. However, interest on these obligations (e.g. State Infrastructure Bank (SIB) loans, Grant Anticipation Notes (GANs) and Board Funding Obligations (BFOs)) is not broken out separately on an annual basis due to their short-term repayment schedules. Interest has been booked to the earliest year(s) of the repayment schedule for each issue.

e. *Fee and Tax Collection Costs:* The administrative costs associated with collecting motor vehicle taxes and fees. These expenses have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System.

f. *Construction Recovery Costs (Depreciation)*: The highway system is a fixed asset that depreciates over time. The life of MAG-system 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 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 Earned User Revenues*: 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. These revenues have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System.

2. *Transfers to State Funds*: This consists of the share of vehicle license taxes that are transferred to the state general fund for non-highway expenditures. These revenues have been prorated according to the share of total state highway system traffic measured on the RARF Freeway System.

3. *Net Earned User Revenues*: This is the residual of gross highway user revenue left after transfers to the general fund and allocations to city and county governments.

4. *Gross MAG System Receipts from HURF*: This category consists of the actual amount of HURF receipts dedicated to the MAG system, representing 75% of the "controlled access" funds distributed to regional freeway systems in Maricopa and Pima counties. In addition to these funds, the MAG system receipts also include state HURF discretionary transfers to the MAG system. The amount of controlled access funds distributed to the MAG system is

dedicated by statute, not by amount of traffic on the system. These funds can therefore be greater or less than the amount of user revenues earned on the MAG system. If MAG system receipts exceed gross earned revenues, the MAG system highways are being subsidized by other highway users. In the opposite scenario, MAG system highway users are providing a subsidy to other highways on the state system.

5. *Earned Federal User Revenue on the MAG Highway System*: The MAG highway system has been allocated a share of total earned federal user revenues on the state highway system according to the share of traffic on state system highways measured on the MAG system.

6. *Direct Federal Aid to the MAG System Highways*: This is the actual amount of federal funds received for construction of highways on the MAG freeway system. As in the case of highway user revenue receipts, the federal funding received for MAG system highways can be greater or less than the earned federal revenues for these highways. If direct federal aid exceeds earned federal user revenue, drivers on non-MAG highways are providing a subsidy to the RARF freeway system. If direct federal aid is less than federal revenue earned on the MAG system, drivers on RARF freeways are subsidizing travel on non-MAG highways.

7. *Appropriations from General Funds*: Resources transferred from the State General Fund to the DOT for specific use on the RARF Freeway System. Includes dedicated highway transfers for funding of the MAG system after 2003.

8. *From Counties and Townships*: Revenue generated primarily through a ½ cent sales tax in Maricopa county. These funds are earmarked for use on the RARF Freeway System, and are therefore assigned to the MAG system in their entirety. Also includes transfers of Maricopa County highway revenues received from the HURF that have not been earmarked for the MAG system.

9. *From Municipalities*: This records occasional revenues provided by municipalities for specific sections of the RARF Freeway System.

10. *Total Inter-Governmental Transfers to State Highways:* The sum of the appropriations from general funds as well as the transfers from counties and townships and municipalities. With the exception of excess exchanges from the HURF, 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.

11. *Total MAG Highway System Earned Revenues*: The portion of state highway revenues generated by users of the RARF highway system. Total RARF highway system earned revenue is equal the Gross MAG Highway System Earned User Revenues plus the Earned Federal User Revenue on the MAG System.

12. *Total Resources from all Local, State and Federal Sources:* The sum of the MAG System Receipts from the HURF, Direct Federal Aid to MAG System Highways and Total Inter-Governmental Transfers to the MAG system. This indicates all of the revenue that is

available to the RARF Freeway system regardless of whether it was earned by users of the 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 on all revenues divided by the Residual Value of Assets (see note v). This represents the ability of the MAG highway system to use its assets to generate income from both users and non-users of the highway system.

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

iv. *Return on Investment (All Revenue Sources):* Net Profit/Loss on earned revenues divided by the Residual Value of Assets (see note v). This represents the ability of the MAG highway system to use its assets to generate income specifically from users of the 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 2007, capital outlays made in 1989 retain only 5% of their original value while capital outlays made in 2007 retain 95% of their value. In terms of their value in 2007, all capital outlays made before 1989 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 problem. To start, a matrix of expenditures was created to handle the various years of the analysis. Virtually all construction began on the highways in the Maricopa freeway system in 1986, but because expenditures on specific segments of Grand Avenue (US 60) are included in the MAG Freeway System Life Cycle Plan, an effort was made to approximate expenditures on these segments of Grand Avenue back to 1969. These additional capital outlays were compiled so that there would be 20 years of expenditure data with which to calculate 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 expenditures database and Obligation Program 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 1986 are only worth 40% of their original value. Therefore the 1997 value of assets from 1986 is equal to 0.40*Actual Capital Outlays (1986). 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 19** 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 *Price Trends for Federal-Aid Highway Construction* (Federal Highway Administration, 2000) table.

5. 19** Value of Assets (Inflation Adjusted): A simple formula was used to transform the value of a particular years assets into another year's dollar value. For example to convert the residual value of assets in 1986 into their 1997 dollar value you would apply the following formula:

$$\text{1997 Value of Assets} * \left(\frac{\text{1997 Construction Cost Index}}{\text{1986 Construction Cost Index}} \right)$$

Calculation of Residual Value of Assets (thousands of dollars)

Year	Actual Capital Outlays	Amortized Construction[a]	1988 Value of Assets[b]	1989 Value of Assets[b]	1990 Value of Assets[b]	1991 Value of Assets[b]	1992 Value of Assets[b]	1993 Value of Assets[b]	1994 Value of Assets[b]	1995 Value of Assets[b]	1996 Value of Assets[b]	1997 Value of Assets[b]
1969	$0	$0										
1970	$0	$0	$0									
1971	$27	$1	$3	$1								
1972	$56	$3	$8	$6	$3							
1973	$0	$0	$0	$0	$0	$0						
1974	$0	$0	$0	$0	$0	$0	$0					
1975	$109	$5	$33	$27	$22	$16	$11	$5				
1976	$0	$0	$0	$0	$0	$0	$0	$0	$0			
1977	$3,046	$152	$1,218	$1,066	$914	$762	$609	$457	$305	$152		
1978	$5,370	$269	$2,417	$2,148	$1,880	$1,611	$1,343	$1,074	$806	$537	$269	
1979	$368	$18	$184	$166	$147	$129	$110	$92	$74	$55	$37	$18
1980	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1981	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1982	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1983	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1984	$980	$49	$735	$686	$637	$588	$539	$490	$441	$392	$343	$294
1985	$34,510	$1,726	$27,608	$25,883	$24,157	$22,432	$20,706	$18,981	$17,255	$15,530	$13,804	$12,079

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

Year	Actual Capital Outlays	Amortized Construction[a]	1998 Value of Assets[b]	1999 Value of Assets[b]	2000 Value of Assets[b]	2001 Value of Assets[b]	2002 Value of Assets[b]	2003 Value of Assets[b]	2004 Value of Assets[b]	2005 Value of Assets[b]	2006 Value of Assets[b]	2007 Value of Assets[b]
1969	$0	$0										
1970	$0	$0										
1971	$27	$1										
1972	$56	$3										
1973	$0	$0										
1974	$0	$0										
1975	$109	$5										
1976	$0	$0										
1977	$3,046	$152										
1978	$5,370	$269										
1979	$368	$18										
1980	$0	$0	$0									
1981	$0	$0	$0	$0								
1982	$0	$0	$0	$0	$0							
1983	$0	$0	$0	$0	$0	$0						
1984	$980	$49	$245	$196	$147	$98	$49					
1985	$34,510	$1,726	$10,353	$8,628	$6,902	$5,177	$3,451	$1,726				

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

Year	Construction Cost Index[c]	Actual Capital Outlays	Amort. Constrn[a]	1988 Value of Assets (inflation adjusted)[d]	1989 Value of Assets (inflation adjusted)[d]	1990 Value of Assets (inflation adjusted)[d]	1991 Value of Assets (inflation adjusted)[d]	1992 Value of Assets (inflation adjusted)[d]	1993 Value of Assets (inflation adjusted)[d]	1994 Value of Assets (inflation adjusted)[d]	1995 Value of Assets (inflation adjusted)[d]	1996 Value of Assets (inflation adjusted)[d]	1997 Value of Assets (inflation adjusted)[d]
1969	43.0	$0	$0										
1970	43.0	$0	$0	$0									
1971	43.0	$27	$1	$8	$4								
1972	43.0	$56	$3	$23	$16	$8							
1973	46.8	$0	$0	$0	$0	$0	$0						
1974	64.8	$0	$0	$0	$0	$0	$0	$0					
1975	65.2	$109	$5	$60	$50	$40	$29	$19	$10				
1976	61.8	$0	$0	$0	$0	$0	$0	$0	$0	$0			
1977	65.4	$3,046	$152	$2,202	$1,956	$1,659	$1,325	$1,054	$814	$580	$320		
1978	75.9	$5,370	$269	$3,763	$3,396	$2,939	$2,415	$2,000	$1,648	$1,322	$971	$442	
1979	94.0	$368	$18	$231	$211	$186	$156	$133	$114	$98	$81	$49	$29
1980	104.6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1981	98.1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1982	92.1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1983	94.5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1984	100.6	$980	$49	$864	$818	$752	$665	$606	$567	$546	$535	$426	$428
1985	112.0	$34,510	$1,726	$29,136	$27,731	$25,602	$22,792	$20,909	$19,743	$19,196	$19,024	$15,394	$15,799

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

Year	Construction Cost Index[c]	Actual Capital Outlays	Amort. Constrn[a]	1998 Value of Assets (inflation adjusted)[d]	1999 Value of Assets (inflation adjusted)[d]	2000 Value of Assets (inflation adjusted)[d]	2001 Value of Assets (inflation adjusted)[d]	2002 Value of Assets (inflation adjusted)[d]	2003 Value of Assets (inflation adjusted)[d]	2004 Value of Assets (inflation adjusted)[d]	2005 Value of Assets (inflation adjusted)[d]	2006 Value of Assets (inflation adjusted)[d]	2007 Value of Assets (inflation adjusted)[d]
1969	43.0	$0	$0										
1970	43.0	$0	$0										
1971	43.0	$27	$1										
1972	43.0	$56	$3										
1973	46.8	$0	$0										
1974	64.8	$0	$0										
1975	65.2	$109	$5										
1976	61.8	$0	$0										
1977	65.4	$3,046	$152										
1978	75.9	$5,370	$269										
1979	94.0	$368	$18										
1980	104.6	$0	$0	$0									
1981	98.1	$0	$0	$0	$0								
1982	92.1	$0	$0	$0	$0	$0							
1983	94.5	$0	$0	$0	$0	$0	$0						
1984	100.6	$980	$49	$338	$291	$223	$152	$79					
1985	112.0	$34,510	$1,726	$12,840	$11,501	$9,404	$7,232	$4,978	$2,579				

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

Year	Actual Capital Outlays	Amortized Construction[a]	1988 Value of Assets[b]	1989 Value of Assets[b]	1990 Value of Assets[b]	1991 Value of Assets[b]	1992 Value of Assets[b]	1993 Value of Assets[b]	1994 Value of Assets[b]	1995 Value of Assets[b]	1996 Value of Assets[b]	1997 Value of Assets[b]
1986	$92,300	$4,615	$78,455	$73,840	$69,225	$64,610	$59,995	$55,380	$50,765	$46,150	$41,535	$36,920
1987	$239,100	$11,955	$215,190	$203,235	$191,280	$179,325	$167,370	$155,415	$143,460	$131,505	$119,550	$107,595
1988	$242,500	$12,125	$230,375	$218,250	$206,125	$194,000	$181,875	$169,750	$157,625	$145,500	$133,375	$121,250
1989	$234,700	$11,735		$222,965	$211,230	$199,495	$187,760	$176,025	$164,290	$152,555	$140,820	$129,085
1990	$495,800	$24,790			$471,010	$446,220	$421,430	$396,640	$371,850	$347,060	$322,270	$297,480
1991	$243,664	$12,183				$231,481	$219,298	$207,115	$194,932	$182,748	$170,565	$158,382
1992	$103,696	$5,185					$98,511	$93,326	$88,142	$82,957	$77,772	$72,587
1993	$96,504	$4,825						$91,678	$86,853	$82,028	$77,203	$72,378
1994	$111,543	$5,577							$105,966	$100,389	$94,812	$89,234
1995	$93,074	$4,654								$88,420	$83,767	$79,113
1996	$189,198	$9,460									$179,738	$170,278
1997	$197,503	$9,875										$187,628
1998	$224,946	$11,247										
1999	$348,004	$17,400										
2000	$317,024	$15,851										
2001	$411,465	$20,573										
2002	$210,342	$10,517										
2003	$321,336	$16,067										
2004	$288,012	$14,401										
2005	$280,713	$14,036										
2006	$247,476	$12,374										
2007	$68,342	$3,417										
	Total Residual Value:		$556,226	$748,273	$1,176,629	$1,340,668	$1,359,557	$1,366,428	$1,382,762	$1,375,978	$1,455,859	$1,534,321

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

Year	Actual Capital Outlays	Amortized Construction[a]	1998 Value of Assets[b]	1999 Value of Assets[b]	2000 Value of Assets[b]	2001 Value of Assets[b]	2002 Value of Assets[b]	2003 Value of Assets[b]	2004 Value of Assets[b]	2005 Value of Assets[b]	2006 Value of Assets[b]	2007 Value of Assets[b]
1986	$73,959	$3,698	$32,305	$27,690	$23,075	$18,460	$13,845	$9,230	$4,615			
1987	$335,958	$16,798	$95,640	$83,685	$71,730	$59,775	$47,820	$35,865	$23,910	$11,955		
1988	$232,590	$11,629	$109,125	$97,000	$84,875	$72,750	$60,625	$48,500	$36,375	$24,250	$12,125	
1989	$233,471	$11,674	$117,350	$105,615	$93,880	$82,145	$70,410	$58,675	$46,940	$35,205	$23,470	$11,735
1990	$490,136	$24,507	$272,690	$247,900	$223,110	$198,320	$173,530	$148,740	$123,950	$99,160	$74,370	$49,580
1991	$243,664	$12,183	$146,199	$134,015	$121,832	$109,649	$97,466	$85,283	$73,099	$60,916	$48,733	$36,550
1992	$103,696	$5,185	$67,402	$62,218	$57,033	$51,848	$46,663	$41,478	$36,294	$31,109	$25,924	$20,739
1993	$96,504	$4,825	$67,552	$62,727	$57,902	$53,077	$48,252	$43,427	$38,601	$33,776	$28,951	$24,126
1994	$110,592	$5,530	$83,657	$78,080	$72,503	$66,926	$61,349	$55,772	$50,194	$44,617	$39,040	$33,463
1995	$101,710	$5,085	$74,459	$69,806	$65,152	$60,498	$55,844	$51,191	$46,537	$41,883	$37,230	$32,576
1996	$192,575	$9,629	$160,818	$151,358	$141,899	$132,439	$122,979	$113,519	$104,059	$94,599	$85,139	$75,679
1997	$189,318	$9,466	$177,753	$167,878	$158,002	$148,127	$138,252	$128,377	$118,502	$108,627	$98,752	$88,876
1998	$228,335	$11,417	$213,699	$202,451	$191,204	$179,957	$168,710	$157,462	$146,215	$134,968	$123,720	$112,473
1999	$353,988	$17,699		$330,604	$313,204	$295,803	$278,403	$261,003	$243,603	$226,203	$208,802	$191,402
2000	$339,932	$16,997			$301,173	$285,322	$269,470	$253,619	$237,768	$221,917	$206,066	$190,214
2001	$292,956	$14,648				$390,892	$370,319	$349,745	$329,172	$308,599	$288,026	$267,452
2002	$368,430	$18,422					$199,825	$189,308	$178,791	$168,274	$157,757	$147,239
2003	$230,436	$11,522						$305,269	$289,202	$273,136	$257,069	$241,002
2004	$383,493	$19,175							$273,611	$259,211	$244,810	$230,410
2005	$90,521	$4,526								$266,677	$252,642	$238,606
2006	$57,056	$2,853									$235,102	$222,728
2007	$182,494	$9,125										$64,925
	Total Residual Value:		$1,629,248	$1,829,851	$1,983,622	$2,211,262	$2,227,261	$2,338,188	$2,401,439	$2,445,080	$2,447,726	$2,279,776

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

Year	Construction Cost Index[c]	Actual Capital Outlays	Amort. Constrn[a]	1988 Value of Assets (inflation adjusted)[d]	1989 Value of Assets (inflation adjusted)[d]	1990 Value of Assets (inflation adjusted)[d]	1991 Value of Assets (inflation adjusted)[d]	1992 Value of Assets (inflation adjusted)[d]	1993 Value of Assets (inflation adjusted)[d]	1994 Value of Assets (inflation adjusted)[d]	1995 Value of Assets (inflation adjusted)[d]	1996 Value of Assets (inflation adjusted)[d]	1997 Value of Assets (inflation adjusted)[d]
1986	110.7	$73,959	$3,698	$83,770	$80,043	$74,228	$66,419	$61,296	$58,282	$57,139	$57,198	$46,863	$48,860
1987	111.0	$335,958	$16,798	$229,148	$219,714	$204,549	$183,849	$170,536	$163,116	$161,037	$162,545	$134,521	$142,006
1988	118.2	$232,590	$11,629	$230,375	$221,574	$206,997	$186,778	$174,028	$167,309	$166,160	$168,888	$140,935	$150,280
1989	120.0	$233,471	$11,674		$222,965	$208,942	$189,188	$176,964	$170,891	$170,588	$174,421	$146,570	$157,591
1990	118.7	$490,136	$24,507			$471,010	$427,800	$401,548	$389,289	$390,333	$401,151	$339,103	$367,151
1991	113.8	$243,664	$12,183				$231,481	$217,949	$212,029	$213,431	$220,326	$187,202	$203,892
1992	113.1	$103,696	$5,185					$98,511	$96,132	$97,104	$100,634	$85,886	$94,023
1993	116.5	$96,504	$4,825						$91,678	$92,892	$96,603	$82,769	$91,016
1994	124.6	$110,592	$5,530							$105,966	$110,540	$95,040	$104,918
1995	137.2	$101,710	$5,085								$88,420	$76,257	$84,476
1996	124.9	$192,575	$9,629									$179,738	$199,726
1997	146.5	$189,318	$9,466										$187,628
1998	138.9	$228,335	$11,417										
1999	149.3	$353,988	$17,699										
2000	152.6	$339,932	$16,997										
2001	156.5	$292,956	$14,648										
2002	161.5	$368,430	$18,422										
2003	167.4	$230,436	$11,522										
2004	173.6	$383,493	$19,175										
2005	179.4	$90,521	$4,526										
2006	184.3	$57,056	$2,853										
2007	191.6	$182,494	$9,125										
	Total Residual Value:			$579,580	$778,478	$1,196,910	$1,312,897	$1,325,553	$1,371,621	$1,476,392	$1,601,655	$1,531,195	$1,847,823

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

Year	Construction Cost Index[c]	Actual Capital Outlays	Amort. Constrn[a]	1998 Value of Assets (inflation adjusted)[d]	1999 Value of Assets (inflation adjusted)[d]	2000 Value of Assets (inflation adjusted)[d]	2001 Value of Assets (inflation adjusted)[d]	2002 Value of Assets (inflation adjusted)[d]	2003 Value of Assets (inflation adjusted)[d]	2004 Value of Assets (inflation adjusted)[d]	2005 Value of Assets (inflation adjusted)[d]	2006 Value of Assets (inflation adjusted)[d]	2007 Value of Assets (inflation adjusted)[d]
1986	110.7	$73,959	$3,698	$40,534	$37,345	$31,808	$26,094	$20,204	$13,958	$7,237			
1987	111.0	$335,958	$16,798	$119,679	$112,560	$98,611	$84,266	$69,595	$54,090	$37,391	$19,326		
1988	118.2	$232,590	$11,629	$128,236	$122,522	$109,575	$96,310	$82,856	$68,690	$53,420	$36,814	$18,908	
1989	120.0	$233,471	$11,674	$135,833	$131,403	$119,382	$107,117	$94,786	$81,855	$67,901	$52,643	$36,050	$18,740
1990	118.7	$490,136	$24,507	$319,096	$311,807	$286,824	$261,441	$236,163	$209,772	$181,264	$149,900	$115,483	$80,044
1991	113.8	$243,664	$12,183	$178,445	$175,822	$163,368	$150,772	$138,356	$125,455	$111,503	$96,052	$78,932	$61,548
1992	113.1	$103,696	$5,185	$82,778	$82,132	$76,950	$71,734	$66,650	$61,395	$55,704	$49,356	$42,249	$35,140
1993	116.5	$96,504	$4,825	$80,541	$80,388	$75,843	$71,291	$66,908	$62,402	$57,517	$52,024	$45,805	$39,685
1994	124.6	$110,592	$5,530	$93,258	$93,558	$88,794	$84,049	$79,538	$74,932	$69,928	$64,254	$57,752	$51,466
1995	137.2	$101,710	$5,085	$75,382	$75,962	$72,464	$68,999	$65,753	$62,461	$58,879	$54,778	$50,016	$45,500
1996	124.9	$192,575	$9,629	$178,844	$180,927	$173,366	$165,924	$159,058	$152,152	$144,621	$135,906	$125,643	$116,115
1997	146.5	$189,318	$9,466	$168,531	$171,086	$164,579	$158,218	$152,448	$146,697	$140,412	$133,050	$124,245	$116,258
1998	138.9	$228,335	$11,417	$213,699	$217,610	$210,060	$202,732	$196,212	$189,778	$182,728	$174,359	$164,176	$155,174
1999	149.3	$353,988	$17,699		$330,604	$320,121	$310,028	$301,234	$292,656	$283,230	$271,865	$257,779	$245,675
2000	152.6	$339,932	$16,997			$301,173	$292,580	$285,267	$278,231	$270,472	$260,951	$248,903	$238,874
2001	156.5	$292,956	$14,648				$390,892	$382,302	$374,167	$365,159	$353,877	$339,270	$327,538
2002	161.5	$368,430	$18,422					$199,825	$196,178	$192,120	$186,914	$179,999	$174,666
2003	167.4	$230,436	$11,522						$305,269	$299,879	$292,767	$283,041	$275,881
2004	173.6	$383,493	$19,175							$273,611	$267,949	$259,947	$254,365
2005	179.4	$90,521	$4,526								$266,677	$259,514	$254,823
2006	184.3	$57,056	$2,853									$235,102	$231,567
2007	191.6	$182,494	$9,125										$64,925
	Total Residual Value:			$1,828,034	$2,135,517	$2,302,545	$2,549,832	$2,602,212	$2,752,719	$2,852,976	$2,919,462	$2,922,814	$2,787,984

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

Appendix C: Procedures for Calculating Depreciation

Calculating Straight Line Depreciation

Year	Actual/ Obligated Capital Outlays	Current Year Construction[a]	Straight Line Depreciation[b]
1969	$0	$0	$0
1970	$0	$0	$0
1971	$27	$1	$1
1972	$56	$3	$4
1973	$0	$0	$4
1974	$0	$0	$4
1975	$109	$5	$10
1976	$0	$0	$10
1977	$3,046	$152	$162
1978	$5,370	$269	$430
1979	$368	$18	$449
1980	$0	$0	$449
1981	$0	$0	$449
1982	$0	$0	$449
1983	$0	$0	$449
1984	$980	$49	$498
1985	$34,510	$1,726	$2,223
1986	$92,300	$4,615	$6,838
1987	$239,100	$11,955	$18,793
1988	$242,500	$12,125	$30,918
1989	$234,700	$11,735	$42,653
1990	$495,800	$24,790	$67,443
1991	$243,664	$12,183	$79,625
1992	$103,696	$5,185	$84,807
1993	$96,504	$4,825	$89,632
1994	$111,543	$5,577	$95,210
1995	$93,074	$4,654	$99,858
1996	$189,198	$9,460	$109,318
1997	$197,503	$9,875	$119,040
1998	$224,946	$11,247	$130,019
1999	$348,004	$17,400	$147,401
2000	$317,024	$15,851	$163,252
2001	$411,465	$20,573	$183,826
2002	$210,342	$10,517	$194,343
2003	$321,336	$16,067	$210,409
2004	$288,012	$14,401	$224,761
2005	$280,713	$14,036	$237,071
2006	$247,476	$12,374	$244,830
2007	$68,342	$3,417	$236,292

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	43.0	$0	$0										
1970	43.0	$0	$0	$0									
1971	43.0	$1	$4	$4	$4								
1972	43.0	$3	$8	$8	$8	$7							
1973	46.8	$0	$0	$0	$0	$0	$0						
1974	64.8	$0	$0	$0	$0	$0	$0	$0					
1975	65.2	$5	$10	$10	$10	$10	$9	$10	$10				
1976	61.8	$0	$0	$0	$0	$0	$0	$0	$0	$0			
1977	65.4	$152	$275	$279	$276	$265	$263	$271	$290	$320	$291		
1978	75.9	$269	$418	$425	$420	$403	$400	$412	$441	$485	$442	$518	
1979	94.0	$18	$23	$23	$23	$22	$22	$23	$24	$27	$24	$29	
1980	104.6	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
1981	98.1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
1982	92.1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
1983	94.5	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
1984	100.6	$49	$58	$58	$58	$55	$55	$57	$61	$67	$61	$71	
1985	112.0	$1,726	$1,821	$1,849	$1,829	$1,753	$1,742	$1,795	$1,920	$2,114	$1,924	$2,257	

a – Composite Index = a composite price index for urban construction projects (Federal Highway Administration, 2000)
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 1986)* (Composite Index for 1988/Composite Index for 1986)
d – Inflation Adjusted Depreciation = the twenty year totals for 1988 through 1997

Year	Composite Index[a]	Current Year Construction[b]	1998$	1999$	2000$	2001$	2002$	2003$	2004$	2005$	2006$	2007$	Inflation Adjusted Depreciation[d]
1969	43.0	$0											
1970	43.0	$0											
1971	43.0	$1											
1972	43.0	$3											
1973	46.8	$0											
1974	64.8	$0											
1975	65.2	$5											
1976	61.8	$0											
1977	65.4	$152											
1978	75.9	$269											
1979	94.0	$18	$27										
1980	104.6	$0	$0	$0									
1981	98.1	$0	$0	$0	$0								
1982	92.1	$0	$0	$0	$0	$0							
1983	94.5	$0	$0	$0	$0	$0	$0						
1984	100.6	$49	$68	$73	$74	$76	$79	$82					
1985	112.0	$1,726	$2,140	$2,300	$2,351	$2,411	$2,489	$2,579	$2,674				

a – Composite Index = a composite price index for urban construction projects (Federal Highway Administration, 2000)
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 1986)* (Composite Index for 1988/Composite Index for 1986)
d – Inflation Adjusted Depreciation = the twenty year totals for 1988 through 1997

Year	Composite Index[a]	Current Year Construction[b]	1988$[c]	1989$	1990$	1991$	1992$	1993$	1994$	1995$	1996$	1997$	Inflation Adjusted Depreciation[d]
1986	110.7	$3,698	$3,949	$4,009	$3,965	$3,802	$3,778	$3,892	$4,162	$4,583	$4,172	$4,894	
1987	111.0	$16,798	$17,887	$18,160	$17,963	$17,222	$17,116	$17,630	$18,856	$20,763	$18,901	$22,170	
1988	118.2	$11,629	$11,629	$11,807	$11,679	$11,197	$11,128	$11,462	$12,259	$13,499	$12,289	$14,414	$36,082
1989	120.0	$11,674		$11,674	$11,547	$11,070	$11,002	$11,333	$12,121	$13,347	$12,150	$14,251	$48,305
1990	118.7	$24,507			$24,507	$23,495	$23,351	$24,053	$25,725	$28,326	$25,787	$30,246	$72,289
1991	113.8	$12,183				$12,183	$12,108	$12,472	$13,339	$14,688	$13,372	$15,684	$81,484
1992	113.1	$5,185					$5,185	$5,341	$5,712	$6,290	$5,726	$6,716	$86,160
1993	116.5	$4,825						$4,825	$5,161	$5,683	$5,173	$6,068	$93,576
1994	124.6	$5,577							$5,577	$6,141	$5,591	$6,557	$105,659
1995	137.2	$4,654								$4,654	$4,236	$4,969	$120,986
1996	124.9	$9,460									$9,460	$11,096	$119,599
1997	146.5	$9,875										$9,875	$149,816
1998	138.9	$11,247											
1999	149.3	$17,400											
2000	152.6	$15,851											
2001	156.5	$20,573											
2002	161.5	$10,517											
2003	167.4	$16,067											
2004	173.6	$14,401											
2005	179.4	$14,036											
2006	184.3	$12,374											
2007	191.6	$3,417											
		20 year totals	$36,082	$48,305	$72,289	$81,484	$86,160	$93,576	$105,659	$120,986	$119,599	$149,816	
			(1969-1988)	(1970-1989)	(1971-1990)	(1972-1991)	(1973-1992)	(1974-1993)	(1975-1994)	(1976-1995)	(1977-1996)	(1978-1997)	

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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 1986)* (Composite Index for 1988/Composite Index for 1986)
d – Inflation Adjusted Depreciation = the twenty year totals for 1988 through 1997

Year	Composite Index[a]	Current Year Construction[b]	1998$[c]	1999$	2000$	2001$	2002$	2003$	2004$	2005$	2006$	2007$	Inflation Adjusted Depreciation[d]
1986	110.7	$3,698	$4,640	$4,987	$5,098	$5,227	$5,396	$5,592	$5,799	$5,994			
1987	111.0	$16,798	$21,020	$22,594	$23,093	$23,680	$24,447	$25,334	$26,269	$27,155	$27,894		
1988	118.2	$11,629	$13,666	$14,689	$15,014	$15,396	$15,894	$16,471	$17,079	$17,655	$18,135	$18,855	
1989	120.0	$11,674	$13,512	$14,524	$14,845	$15,222	$15,715	$16,285	$16,886	$17,456	$17,931	$18,642	
1990	118.7	$24,507	$28,677	$30,824	$31,505	$32,307	$33,352	$34,563	$35,839	$37,047	$38,055	$39,565	
1991	113.8	$12,183	$14,870	$15,984	$16,337	$16,752	$17,295	$17,922	$18,584	$19,210	$19,733	$20,516	
1992	113.1	$5,185	$6,368	$6,844	$6,995	$7,173	$7,406	$7,674	$7,958	$8,226	$8,450	$8,785	
1993	116.5	$4,825	$5,753	$6,184	$6,320	$6,481	$6,691	$6,934	$7,190	$7,432	$7,634	$7,937	
1994	124.6	$5,577	$6,217	$6,683	$6,830	$7,004	$7,231	$7,493	$7,770	$8,032	$8,250	$8,578	
1995	137.2	$4,654	$4,711	$5,064	$5,176	$5,308	$5,479	$5,678	$5,888	$6,086	$6,252	$6,500	
1996	124.9	$9,460	$10,520	$11,308	$11,558	$11,852	$12,235	$12,679	$13,147	$13,591	$13,960	$14,514	
1997	146.5	$9,875	$9,363	$10,064	$10,286	$10,548	$10,889	$11,284	$11,701	$12,095	$12,424	$12,918	
1998	138.9	$11,247	$11,247	$12,089	$12,356	$12,671	$13,081	$13,556	$14,056	$14,530	$14,925	$15,517	$152,800
1999	149.3	$17,400		$17,400	$17,785	$18,237	$18,827	$19,510	$20,231	$20,913	$21,482	$22,334	$181,612
2000	152.6	$15,851			$15,851	$16,254	$16,780	$17,389	$18,031	$18,639	$19,146	$19,906	$201,474
2001	156.5	$20,573				$20,573	$21,239	$22,010	$22,822	$23,592	$24,234	$25,195	$227,173
2002	161.5	$10,517					$10,517	$10,899	$11,301	$11,682	$12,000	$12,476	$245,042
2003	167.4	$16,067						$16,067	$16,660	$17,222	$17,690	$18,392	$270,002
2004	173.6	$14,401							$14,401	$14,886	$15,291	$15,898	$294,286
2005	179.4	$14,036								$14,036	$14,417	$14,990	$315,478
2006	184.3	$12,374									$12,374	$12,865	$330,276
2007	191.6	$3,417										$3,417	$317,799
		20 year totals	$152,800	$181,612	$201,474	$227,173	$245,042	$270,002	$294,286	$315,478	$330,276	$317,799	
			(1979-1998)	(1980-1999)	(1981-2000)	(1982-2001)	(1983-2002)	(1984-2003)	(1985-2004)	(1986-2005)	(1987-2006)	(1988-2007)	

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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 1986)* (Composite Index for 1988/Composite Index for 1986)
d – Inflation Adjusted Depreciation = the twenty year totals for 1988 through 1997

Appendix D: Procedures for Calculating Ten Year Income Statement

Ten Year Income Statement for Arizona's State-Administered Highways (thousands of dollars)

Costs/Expenditures	**1998**	**1999**	**2000**	**2001**	**2002**
Maintenance and Traffic Services[a]	=85212.51*0.06886	=89784.02*0.08234	=91152.24*0.10198	=93799.7*0.10927	=96139.27*0.1174
Administration and Miscellaneous[b]	=61859.19*0.06886	=65177.83*0.08234	=66171.08*0.10198	=68092.98*0.10927	=69791.37*0.1174
Highway Law Enforcement and Safety[c]	=72285.32*0.06886	=76163.31*0.08234	=77323.96*0.10198	=79569.79*0.10927	=81554.44*0.1174
HURF Bond Interest[d]	14285.9147091854	17813	16473	15051	13553
RARF Bond Interest[d]	40512	43251	36430	30334	38232
Other Debt Service[e]	0	0	0	6000	5638
Fee and Tax Collection Costs[f]	=36363.98*0.06886	=38314.84*0.08234	=38898.72*0.10198	=40028.52*0.10927	=41026.92*0.1174
Construction Recovery Costs (Depreciation)[g]	$130,019	$147,401	$163,252	$183,826	$194,343
Total Costs/Expenditures[h]	=SUM(M4:M11)	=SUM(N4:N11)	=SUM(O4:O11)	=SUM(P4:P11)	=SUM(Q4:Q11)
Revenues	**=B3**	**=C3**	**=D3**	**=E3**	**=F3**
Highway User Revenues					
Gasoline Taxes[1]	=0.07399*366376.609	=0.08824*397463.15	=0.109*413400	=0.11683*417100	=0.12556*432500
Use Fuel Taxes[2]	=0.03978*142166.607	=0.04891*160311.949	=0.06219*167500	=0.06644*165800	=0.07117*169800
Motor Carrier Taxes[3]	=0.03978*63845.891	=0.04891*34139.96	=0.06219*34100	=0.06644*34300	=0.07117*34600
Vehicle License Taxes[4]	=0.06886*176950.2/0.4274	=0.08234*220126.1/0.4274	=0.10198*550070.1918544	=0.10927*580720.6364062	=0.1174*621665.88675716
Registration Fees[5]	=0.06886*101721.852	=0.08234*131962.53	=0.10198*133000	=0.10927*133300	=0.1174*135300
Other[6]	=0.06886*36425.632	=0.08234*38775.123	=0.10198*39600	=0.10927*42600	=0.1174*44600
Gross MAG Highway System Earned User Revenue[7]	=SUM(M17:M22)*0.5	=SUM(N17:N22)*0.5	=SUM(O17:O22)*0.5	=SUM(P17:P22)*0.5	=SUM(Q17:Q22)*0.5
Transfers to General Fund[8]	=(M20*0.685)*0.5	=(N20*0.5726)*0.5	=(O20*0.5726)*0.5	=(P20*0.5726)*0.5	=(Q20*0.5726)*0.5
Net MAG Highway System Earned User Revenue[9]	=M23-M24	=N23-N24	=O23-O24	=P23-P24	=Q23-Q24
Gross MAG System Receipts from HURF[10]	=46112+61231+0	=54893+0+0	=58075+0+0	=58835+0+0	=61692+0+10000
Federal Aid to State System					
Federal Highway Administration[11]	255872	296188	300816	306647	312124
Other Agencies[12]	0	9397	5800	0	10000
Total Federal Aid to State System[13]	=(M29+M30)	=(N29+N30)	=(O29+O30)	=(P29+P30)	=(Q29+Q30)
Apportionment Ratio[14]	0.95	0.95	0.95	0.95	0.95
Earned Federal User Revenue State Highway System[15]	=(M31/M32)*(0.5)	=(N31/N32)*(0.5)	=(O31/O32)*(0.5)	=(P31/P32)*(0.5)	=(Q31/Q32)*(0.5)
Earned Federal User Revenue MAG Highway System[16]	=M33*0.06886	=N33*0.08234	=O33*0.10198	=P33*0.10927	=Q33*0.1174
Direct Federal Aid to MAG System[17]	13628	26984	32540	31601	88532
Inter-Government Transfers to the MAG Highway System					
Appropriations from State General Funds[18]	0	0	0	0	0
From Counties and Townships[19]	=209263+59	=229470	=246650	=253990	271240
From Municipalities[20]	11793	13607	8657	=2700+39705+20860	=4881+47361+20154
Total Inter-Governmental Transfers to MAG Highways[21]	=SUM(M38:M40)	=SUM(N38:N40)	=SUM(O38:O40)	=SUM(P38:P40)	=SUM(Q38:Q40)
Total MAG Highway System Earned Revenue[22]	=M23+M34	=N23+N34	=O23+O34	=P23+P34	=Q23+Q34
Subsidies from Non-Highway Users[23]	=M41	=N41	=O41	=P41	=Q41
Cross Subsidies from Other Highway Users[24]	=(M26-M25)+(M35-M34)	=(N26-N25)+(N35-N34)	=(O26-O25)+(O35-O34)	=(P26-P25)+(P35-P34)	=(Q26-Q25)+(Q35-Q34)
Total Resources from all Local, State and Federal Sources[25]	=M26+M35+M41	=N26+N35+N41	=O26+O35+O41	=P26+P35+P41	=Q26+Q35+Q41
Net Profit/Loss	**1998**	**1999**	**2000**	**2001**	**2002**
Net Profit/Loss (All Revenue Sources)[i]	=(M46-M13)	=(N46-N13)	=(O46-O13)	=(P46-P13)	=(Q46-Q13)
Return on Investment (All Revenue Sources)[ii]	=(M49/M54)	=(N49/N54)	=(O49/O54)	=(P49/P54)	=(Q49/Q54)
Net Profit/Loss (Earned Revenue)[iii]	=M43-M13	=N43-N13	=O43-O13	=P43-P13	=Q43-Q13
Return on Investment (Earned Revenue)[iv]	=(M51/M54)	=(N51/N54)	=(O51/O54)	=(P51/P54)	=(Q51/Q54)
Residual Value of Assets[v]	$1,629,248	$1,829,851	$1,983,622	$2,211,262	$2,227,261

2003	2004	2005	2006	2007	1998-07
=99691.78*0.12646	=103386.24*0.13655	=106797.99*0.14777	=110322.32*0.14821	=113962.96*0.1488	=SUM(M4:V4)
=72370.28*0.12646	=75052.24*(0.13655)	=77528.96*0.14777	=80087.42*0.14821	=82730.3*0.1488	=SUM(M5:V5)
=84568.01*0.12646	=87702*(0.13655)	=90596.17*0.14777	=93585.84*0.14821	=96674.17*0.1488	=SUM(M6:V6)
12675	11405	10186	9032	7804	=SUM(M7:V7)
33165	28193	13378	0	0	=SUM(M8:V8)
4019	0	11250	14834	18345	=SUM(M9:V9)
=42542.93*0.12646	=44119.52*(0.13655)	=45575.46*0.14777	=47079.45*0.14821	=48633.08*0.1488	=SUM(M10:V10)
$210,409	$224,761	$237,071	$244,830	$236,292	=SUM(M11:V11)
=SUM(R4:R11)	=SUM(S4:S11)	=SUM(T4:T11)	=SUM(U4:U11)	=SUM(V4:V11)	=SUM(W4:W11)

=G3	=H3	=I3	=J3	=K3	=L3
=0.13529*445200	=0.14613*461300	=0.15819*472100	=0.15874*486000	=0.15946*500100	=SUM(M17:V17)
=0.07642*175100	=0.08225*180500	=0.08872*186600	=0.08851*192900	=0.08838*199300	=SUM(M18:V18)
=0.07642*35200	=0.08225*35900	=0.08872*36700	=0.08851*37600	=0.08838*38400	=SUM(M19:V19)
=0.12646*673841.834347216	=0.13655*732101.076275152	=0.14777*793167.992512868	=0.14821*861722.040243332	=0.1488*940804.86663547	=SUM(M20:V20)
=0.12646*138700	=0.13655*142400	=0.14777*146600	=0.14821*151600	=0.1488*155900	=SUM(M21:V21)
=0.12646*46700	=0.13655*48900	=0.14777*51000	=0.14821*53300	=0.1488*55600	=SUM(M22:V22)
=SUM(R17:R22)*0.5	=SUM(S17:S22)*0.5	=SUM(T17:T22)*0.5	=SUM(U17:U22)*0.5	=SUM(V17:V22)*0.5	=SUM(M23:V23)
=(R20*0.5726)*0.5	=(S20*0.5726)*0.5	=(T20*0.5726)*0.5	=(U20*0.5726)*0.5	=(V20*0.5726)*0.5	=SUM(M24:V24)
=R23-R24	=S23-S24	=T23-T24	=U23-U24	=V23-V24	=SUM(M25:V25)
=64358+0+0	=67409+0+30000	=70291+0+17000	=73610+0+0	=77162+0+0	=SUM(M26:V26)
318270	318270	=1.02*S29	=1.02*T29	=1.02*U29	=SUM(M29:V29)
0	0	0	0	0	=SUM(M30:V30)
=(R29+R30)	=(S29+S30)	=(T29+T30)	=(U29+U30)	=(V29+V30)	=SUM(M31:V31)
0.95	0.95	0.95	0.95	0.95	=(0.5*W31)/(W33)
=(R31/R32)*(0.5)	=(S31/S32)*(0.5)	=(T31/T32)*(0.5)	=(U31/U32)*(0.5)	=(V31/V32)*(0.5)	=SUM(M33:V33)
=R33*0.12646	=S33*0.13655	=T33*0.14777	=U33*0.14821	=V33*0.1488	=SUM(M34:V34)
25180	45650	18786	34100	=U35	=SUM(M35:V35)
30000	0	50000	50000	60000	=SUM(M38:V38)
284620	299140	320820	200630	0	=SUM(M39:V39)
=1890+350	0	0	0	0	=SUM(M40:V40)
=SUM(R38:R40)	=SUM(S38:S40)	=SUM(T38:T40)	=SUM(U38:U40)	=SUM(V38:V40)	=SUM(W38:W40)
=R23+R34	=S23+S34	=T23+T34	=U23+U34	=V23+V34	=W23+W34
=R41	=S41	=T41	=U41	=V41	=W41
=(R26-R25)+(R35-R34)	=(S26-S25)+(S35-S34)	=(T26-T25)+(T35-T34)	=(U26-U25)+(U35-U34)	=(V26-V25)+(V35-V34)	=(W26-W25)+(W35-W34)
=R26+R35+R41	=S26+S35+S41	=T26+T35+T41	=U26+U35+U41	=V26+V35+V41	=W26+W35+W41

2003	2004	2005	2006	2007	1998-07
=(R46-R13)	=(S46-S13)	=(T46-T13)	=(U46-U13)	=(V46-V13)	=SUM(M49:V49)
=(R49/R54)	=(S49/S54)	=(T49/T54)	=(U49/U54)	=(V49/V54)	=W49/SUM(M54:V54)
=R43-R13	=S43-S13	=T43-T13	=U43-U13	=V43-V13	=W43-W13
=(R51/R54)	=(S51/S54)	=(T51/T54)	=(U51/U54)	=(V51/V54)	=W51/SUM(M54:V54)
$2,338,188	$2,401,439	$2,445,080	$2,447,726	$2,279,776	=SUM(M54:V54)/(10)

Appendix E: Introduction to Corporate Annual Reports and Income Statements

Excerpted from Mansour and Semmens (1999)

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.

Appendix F: *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*[5] 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 minimum 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.[6] 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

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[5] *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.

[6] *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.[7] 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.[8] 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[9] 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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[7] *Your Driving Costs* (American Automobile Association, 1000 AAA Dr., Heathrow, FL 32746-5063; phone 407-444-7000; 1997), pp. 4-5.
[8] *Ibid*.
[9] *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[10] 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.[11] 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%).

[10] *Your Driving Costs, op cit.*.
[11] 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**