Measuring the Success of a Transportation Project -

Loop 202 (Red Mountain Freeway) Case Study

By

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ABSTRACT

Measuring the success of a transportation project as it is envisioned in the Regional Transportation Plan (RTP) and is detailed in an Environmental Impact Statement (EIS) is not part of any current planning process, for a post construction analysis may have political consequences for the project participants, would incur additional costs, and may be difficult to define in terms of scope. With local, state and federal budgets shrinking, funding sources are demanding that the performance of a project be evaluated and project stakeholders be held accountable. The Transportation Research Board (TRB) developed a framework that allows transportation agencies to customize their reporting so that a project's performance can be measured. In the case of the Red Mountain Freeway, the selected performance measure allows for comparing the population forecasts, the traffic volumes, and the project costs defined in the final EIS to actual population growth, actual average annual daily traffic (ADT), and actual project costs obtained from census data, the City of Mesa, and contractor bids, respectively.

The results show that population projections for both Maricopa County and the City of Mesa are within less than half a percent of the actual annual population growth. The traffic analysis proved more difficult due to inconsistencies within the EIS documents, variations in the local arterials used to produce traffic volume, and in the projection time-spans. The comparison for the total increase in traffic volume generated a difference of 11.34 percent and 89.30 percent. An adjusted traffic volume equal to all local arterials and US 60 resulted in a difference of 40 percent between the projected and actual ADT values. As for the project cost comparison, not only were the costs within the individual

documents inconsistent, but they were underestimated by as much as 75 percent.

Evaluating the goals as described in an EIS document using the performance measure guidelines provided by the TRB may provide the tool that can help promote conflict resolution for political issues that arise, streamline the planning process, and measure the performance of the transportation system, so that lessons learned can be applied to future projects.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADOT	Arizona Department of Transportation
ADT	Average Daily Traffic
ARRA	American Recovery and Reinvestment Act of 2009
ATM	Advanced Traffic Management
ATR	Automatic Traffic Recorders
Caltrans	California Department of Transportation
CIF	Cumulative Inflation Factor
DCR	Design Concept Report
DOT	Department of Transportation
EA	Environmental Assessment
EG	Exponential Growth
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FONSI	Finding No Significant Impact
FTA	Federal Transit Administration
GDP	Gross Domestic Product
HOT	High-occupancy/Toll Lane
HOV	High-occupancy Vehicle Lane
IRM	Intelligent Ramp Metering
ISTEA	Intermodal Transportation Efficiency Act of 1991
ITS	Intelligent Transportation Systems
Loop 202	Red Mountain Freeway (Loop 202)
LOS	Level-of-Service
LRSTP	Long-Range Statewide Transportation Plan
LRTP	Long-Range Transportation Plan

MAG	Maricopa Association of Governments
MAGTPO	Maricopa Association of Governments Transportation Planning Office
MIS	Major Investment Study
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
PPP	Public Private Partnership
PC	Overall Growth in Percent
ROD	Record of Decision
RTP	Regional Transportation Plan
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHRP 2	Strategic Highway Research Program Report 2
STIP	Statewide Transportation Improvement Program
TEA-21	Transportation Equity Act for the 21st Century
TI	Traffic Interchange
TIP	Transportation Improvement Program
TMS	Traffic Monitoring System
TRB	Transportation Research Board
UPWP	Unified Planning Work Program
USGAO	United States Government Accountability Office
VMT	Vehicle Miles of Travel
TMS	Traffic Monitoring System
TRB	Transportation Research Board
UPWP	Unified Planning Work Program
URA	Uniform Relocation Assistance
USGAO	United States Government Accountability Office
VMT	Vehicle Miles of Travel

1 INTRODUCTION

1.1 Overview

Measuring the success of a transportation project as the project is envisioned in the Regional Transportation Plan (RTP) and is specified in detail in an Environmental Impact Statement (EIS) is not part of any current planning process or may be information not made public, for a post construction analysis may have political consequences for the project participants and stakeholders, would incur additional costs to the project, and may be difficult to define in terms of scope. However, with local, state and federal budgets shrinking, the search to fund public projects using private moneys is becoming reality through the use of Public Private Partnerships (PPPs) whose profit motives demand that evaluating the project's performance be a critical component in transportation decision-making. Federal initiatives such as the American Recovery and Reinvestment Act of 2009 (ARRA), have also increased the demand for public projects accountability and make use of the United States Government Accountability Office (USGAO) to evaluate the impact the $787 billion has on state and local transportation improvements. The Transportation Research Board (TRB) under the Strategic Highway Research Program (SHRP 2), Report S2-C02-RR, authorized by the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU), developed a framework that allows transportation agencies and/or other public agencies the flexibility to customize their reporting so that both the agencies and the stakeholders can focus on an individual project as it contributes to a larger transportation system, and provides a means to measure a transportation project's performance.

It is my intent to use the Red Mountain Freeway (Loop 202) as a case study and document the process of evaluating its performance. The SHRP 2 Report will serve as a guide to measure the performance of Loop 202 as it relates to political issues, the overall planning process, and transportation system operation. The overall aim of using performance measures to resolve political issues is to find a means to improve the availability and accuracy of information, which in turn will improve collaboration, and hence, promote conflict resolution to minimize costs in completing the project. A timeline for Loop 202 will aid to better understand the complexities of the planning process, note when key documents were created, and document when segments of the freeway were opened and the traffic volumes these segments generated were included in the traffic analysis. The system operational performance will include comparing the population forecasts, the traffic volumes, and the project costs defined in the EIS to the actual population projections, traffic volumes and project costs using the performance measurement framework provided by the TRB. It is in the transportation system operation context to which my research analysis will apply. The following questions will be answered:

- Are the population and traffic volume projections and the forecast project costs consistent amongst the EIS documents and their contributing studies?
- Are the population and traffic volume forecasts accurate, that is, how do the actual population growth numbers provided by the census and the actual traffic volume numbers provided by the City of Mesa compare to the projected population and traffic volume numbers?

- Are the estimated cost projections for the Loop 202 segments accurate when compared to actual project costs?
- Did the Loop 202 project meet the goals defined in the EIS documents?
- Would the cost for the Loop 202 be justified among potential investors and tax payers?

Ultimately, this thesis may provide some insight into the dynamics of a transportation project. As federal and local governments establish Traffic Monitoring System (TMS) requirements for every day reporting and facility management, data gathered will be used to support studies for subsequent transportation projects and to allocate federal funds for design and construction of new transportation projects. With billions of dollars being invested into new and existing freeways in the name of economic development, is the taxpayer's money allocated appropriately?

1.2 Motivation

Accountability in planning is a new frontier as the many demands on federal and local funds have dried up the well. Funding public projects has spilled into the private, capital oriented sector, where the profit motif is demanding new tools that will measure the successes and/or the failures of these public projects so that lessons learned can be applied to future projects. Leading this effort is the TRB, who, with the publication of the SHRP 2, Report S2-C02-RR, has made the frustration of sitting in traffic a priority. The four "customer-oriented, high-priority" areas of focus include research in reliability, renewal, capacity and safety, areas in which

- commuter travel time **reliability** will be improved through the use of "data collection, highway design features, operational strategies, travel information, incident management, transportation systems operations and management, and corridor and long-range planning";
- the highway system will be **renewed**, "enabling faster, minimally disruptive, and longer-lasting improvements";
- engineering solutions address the environment, and stakeholder and community issues, "bringing greater **collaboration** to road building"; and
- research that will continue to **improve** our roadways, "identifying the behaviors that cause and avert collisions". (TRB, 2010, pp. 1-6)

A conference sponsored by the California Department of Transportation (Caltrans) held in Sacramento in October, 1997, revealed that performance measures will be an integral part in the "ongoing planning, management, resource allocation, and policy-making process for transportation in California", and that they will help "allocate scarce resources with the benefit of more clearly defined objectives that can then be used to hold agencies accountable for clearly defined outcomes". (Schwartz, 1998, pp. 9-10)

Measuring the performance of a transportation infrastructure is no easy task, for political issues complicate matters of consensus and funding, the planning process requires all agencies and stakeholders to collaborate, and the performance of the completed project may be disappointing. Loop 202 was selected for this case study for it provides all the political, planning process and performance measure elements for analysis, and, the project happens to affect my life a great deal.

This freeway incorporates all the ingredients typical of a transportation project, including:

- A 20-year plus timeframe from design concept to construction completion;
- Several RTP Updates;
- A final EIS document as required by the *National Environmental Policy Act* (NEPA);
- Incremental project phasing;
- A multitude of associated studies; and
- Plenty of public involvement opportunities and objections.

To benchmark this project, the purpose and need as defined in the EIS for Loop 202 will be examined, which will yield the required data and allow for evaluating whether the project goals have been met.

1.3 Thesis Structure

This document will use Loop 202 as a case study to answer the thesis questions posed. Policy, process and performance as they apply to the Loop 202 will be discussed in the following chapters:

- **Chapter 2 – Literature Review**: This chapter explores existing research as it applies to the politics issues, the planning process, and performance measures of a transportation system in terms of consequences and efficiency. It defines the current status, provides background information, and suggests improvements that could be applied to Loop 202;
- **Chapter 3 – Red Mountain Freeway (Loop 202) Defined**: This chapter describes and provides the benchmark for the analysis, that is, the goals and objectives of Loop 202 as defined in the "Purpose and Need" section

of an EIS and the data as defined in the Final Environmental Impact Statement (FEIS) documents, and provides a comprehensive timeline for reference.

- **Chapter 4 – Methodology**: This chapter lays out the methods used to compare the projected population and traffic volume numbers to the actual census and City of Mesa data. A brief discussion regarding the comparison of projected and actual costs is also included.
- **Chapter 5 – Project Analysis**: The heart of this document will provide results as Average Daily Traffic (ADT) volumes and population projections are compared to actual data. These results are then discussed as they apply to the political arena, the planning process, and the performance measurement framework. Results of the comparison of the actual and projected costs for Loop 202 will also be discussed.
- **Chapter 6 – Conclusions**: This chapter will conclude this thesis with reflective comments, additional traffic volume analyses, and answers to the research questions posed in the introduction.

Background information and definitions will be provided as the concepts are introduced throughout the document.

2 LITERATURE REVIEW

While we are caught in the crossfire between the consequences of urban sprawl and the new concepts of SMART growth, the SHRP 2 Report S2-C02-RR offers a performance measurement framework built to better enable the decision process during transportation "system planning, corridor studies, programming, environmental review, design, and permitting." (TRB, 2009, p. 1) Understanding the political environment, the planning process, and the intent of selected performance measures used to evaluate a transportation system is a tedious task. As this chapter will reveal that challenges in the political arena are difficult to overcome, efficient progress in the planning process will require collaboration and leadership, and efficiency in our transportation infrastructure may be difficult to maintain but is critical for sustainable economic growth. The following discussion seeks to define the current status, provide background information, and perhaps, suggest improvements in the areas of policy, process or performance.

2.1 Defining the Current Transportation Planning Status

The politics of transportation planning is a balance between the needs to maintain economic growth and the availability of funding. To fulfill the objectives of transportation planning, coordination between the state and the major metropolitan areas is essential, for the transportation system affects an area's quality of life and economic health. The federal government ensures its best planning practices through legal requirements, such as NEPA, and funding application requirements. The House subcommittee has allocated $27.7 billion and the Senate committee another $41.1 billion for the fiscal year (FY) 2012 for highways alone. Last year, the federal highway budget was $41.8 billion, which ended September 30, 2011. (Jordan, 2011) Federal monies amount to about 30 percent of total state and local government spending on transportation infrastructure, and these monies exert enormous political influence. (Levy, 2009, p. 89)

2.1.1 The Current Challenges

Research on the effects of transportation improvements on the local economy has long shown a positive correlation. Local transportation studies presented in the 94th Arizona Town Hall, *From Here to There: Transportation Opportunities for Arizona* focus on investment strategies that will balance the estimated demand for transportation infrastructure with the estimated supply. (94th Arizona Town Hall, 2009, p. 11) A report from Smart Growth America found that $16 billion spent on a highway project generated 139,000 jobs based on October 2009 data. (APA, 2010, p. 5) Increasing the efficiency with which transportation system planning, implementation, and maintenance is performed, may not only increase the number of jobs the highway project generates, but may also improve the life-cycle of the project by striving to be conscious of sustainable economic, environmental, and social goals. This suggests that strategies to continue and/or increase federal highway grants are vital to states and localities that wish to maintain a vibrant job market.

On the other hand, resource conservation and global warming issues find that motor fuel taxes, which are used to fund transportation projects, are being undermined by more fuel-efficient vehicles and clean fuels, and therefore undermine the accumulation of transportation funding. Although the cost of gasoline keeps rising, the taxes collected per gallon remain at 41.5 cents. (94th Arizona Town Hall, 2009, p. 17) And, in a recent report by the Federal Highway

Administration (FHWA), both rural and urban traffic volume trends in terms of vehicle-miles traveled in Arizona have decrease by 2% between 2011 and 2012, further decreasing local monies available for transportation. (FHWA, Traffic Volume Trends, 2012, pp. 4-5)

2.1.2 Possible Solutions

Care must be taken so that transportation investments have the greatest positive effect and yield the greatest benefits for the least cost. The USGAO, in 2004, initiated a study that will identify federal requirements for transportation planning and decision-making, benefit-cost analysis, and other evaluation criteria. (USGAO, 2004, p. 3) Concluding observations reference ISTEA and TEA-21 legislation for they provide a systematic approach for making transportation investment decisions and allow local MPOs (Metropolitan Planning Organization) and states “considerable discretion in choosing the analytical methods and tools that will be used to evaluate and select projects”. (USGAO, 2004, p. 39)

To address the lack of funding, financial resources include state and federal revenues, government bonds, or private financing. PPPs usually are established with an incentive to perform the work efficiently and manage the project’s risks. PPPs have also been viewed as “the savior of desperate state and local governments looking for transportation funding, but require a safeguard in the name of public interest”, simply because of the dollar amounts involved and the possible political influences exerted. (McCarron, 2010, p. 18) James Dunn suggests that the goal of a project-based PPP often is not about transportation, but about urban development, and provides examples of how PPPs often promote their agenda or manipulate transportation projects to protect other PPP investments. (Dunn, 1999, p. 92) In general, a report by the USGAO suggests that a National Commission be established to oversee and investigate future revenue sources for the Highway Trust Fund. (USGAO, 2009, p. 1)

No matter where the funding comes from, lack of funding is what drives the transportation policy, planning, and performance evaluation process to a new level of efficiency and accountability.

2.2 Background on the Transportation Planning Process

To ensure that transportation planning and project development "reflects the desires of communities", it must comply with the laws that cover "social, economic, and environmental concerns". (USEPA, 2010) Collaboration among stakeholders and consensus among the leadership of the stakeholders is vital if a project is to come to fruition. In general, potential stakeholders consist of elected officials, public transit operators, affected public agencies, representatives of transportation employees, freight shippers, providers of freight transportation services, private providers of transportation, business communities, community groups, environmental organizations, the traveling public, the general public, and the MPOs and state Departments of Transportation (DOTs) who conduct the process. The functions of the main stakeholders are:

- The FHWA and Federal Transit Administration (FTA) – approves the state's *Statewide Transportation Improvement Program*, approves the MPO and state planning process certification, and provides the regulatory requirements for projects that will receive federal funding;
- State DOTs – prepare and maintain the *Long-Range Statewide Transportation Plan*, develop the Statewide Transportation Improvement Program (STIP), and involve the public; and the

- MPOs – provide planning studies, future goals, investment strategies and transportation projects, the Metropolitan Long-Range Transportation Plan, and ensure that transportation projects are based on "a continuing, cooperative, and comprehensive (3-C) planning process". (FHWA, 2007, pp. 3-6)

Appendix A provides more information on the key planning products public agencies provide.

2.2.1 The Transportation Planning Process at the Federal Level

The transportation planning process, as defined by the FTA, Office of Planning and Environment, and implemented by the MPO and state DOT, includes the following steps:

- Monitoring existing conditions;
- Forecasting future population and employment growth, including assessing projected land uses in the region and identifying major growth corridors;
- Identifying current and projected future transportation problems and needs and analyzing, through detailed planning studies, various transportation improvement strategies to address those needs;
- Developing long-range plans and short-range programs of alternative capital improvement and operational strategies for moving people and goods;
- Estimating the impact of recommended future improvements to the transportation system on environmental features, including air quality; and

- Developing a financial plan for securing sufficient revenues to cover the costs of implementing these strategies.

Funding for transportation projects and plans will only be distributed after projects are approved and work is started. State DOTs are held accountable for complying with all federal laws.

2.2.1.1 The Federal Highway Administration

The primary function of the FHWA is to approve the state's Statewide Transportation Improvement Program that prioritizes projects at the federal level, as information is gathered and their purpose and need are investigated. To regulate how a transportation project might impact the environment, the project must address and comply with the laws specified by NEPA, including but not limited to:

- *Clean Air Act*;
- *National Ambient Air Quality Standards* (NAAQS);
- *National Environmental Policy Act of 1969* (NEPA);
- *Safe, Accountable, Flexible, Efficient transportation Equity Act: A Legacy for Users* (SAFETEA-LU);
- *Title VI of the Civil Rights Act of 1964*;
- *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* (URA);
- *Transportation Equity Act for the 21st Century* (TEA-21); and the *Department of Transportation Act of 1966* special provision Section 4(f). (FHWA, Planning, Environment, & Realty, 2011)

2.2.1.2 The Environmental Impact Statement Process

The EIS process comes into play at the Project Development stage (see Appendix B). It is a decision-making process in which project alternatives are reviewed, the decision to proceed with the implementation of the project is made, and the public is given the opportunity to comment on the project. Following the public review period, a FEIS is prepared and the FHWA issues a Record of Decision (ROD) that states the proposed build alternative, environmental findings, mitigation requirements, responses to comments made during the public involvement period, and in what long-range plan the project was identified.

2.2.1.3 The Environmental Impact Statement (EIS)

An EIS must comply with both the federal and the local mandates. On the federal level, it is a NEPA requirement under [42 U.S.C. 4321 et seq.] which was signed into law on January 1, 1970. Each federal action that will significantly affect the environment, including transportation projects, requires an EIS. There are three levels of analysis within the NEPA process:

- **Level 1 = Categorical Exclusions** which may be used on projects that meet the federal agency criteria of having no significant impact on the environment.
- **Level 2 = Environmental Assessment** (EA) or Finding No Significant Impact (FONSI) which are documents prepared for the federal agencies and include measures that will mitigate potential environmental impacts. It usually determines if an EIS is needed.
- **Level 3 = Environmental Impact Statement** which determines the environmental impacts of the project, including all the proposed alternatives and actions considered during project development.

At the state level, the public has an important role in the NEPA process, in that the EIS document can be reviewed and comments can be submitted to the lead agency, usually the state DOT in association with federal agencies such as the Federal Aviation Administration (FAA), where all issues must be considered and addressed. (USEPA, 2010, p. 4)

2.2.2 The Transportation Planning Process at the State and MPO Level

Many statewide plans have their own legal requirements that ensure that local government plans and actions do not contradict state mandates.

Specific to the Arizona Department of Transportation (ADOT), the *Completion Guidelines and Format of an EIS* must address:

- the **natural environment** such as threatened and endangered species, tribal lands, invasive species, wetlands and riparian areas, Section 4(f), visual impacts, sole source aquifers, and coast guard permits (along the Colorado River);
- the **physical environment** such as noise, air quality, construction related impacts, utilities, and hazardous materials; socioeconomic issues such as residential and commercial development, temporary and permanent access, and environmental justice; and
- the **cultural resources** such as archaeological and historical sites and historic preservation. (ADOT, Categorical Exclusion and Environmental Determination - Completion Guidelines and Format, 2006)

Federal and state legislation in 2002 also adopted into law a new set of guidelines on the development of long-range plans under the House Bill 2660. This requires state DOT's to use performance-based planning as specified by the TRB. The *Move AZ – Long Range Transportation Plan* published by ADOT is an example of a document that is based on this new law. It conducts “in-depth analysis of actual projects and programs using performance-based planning techniques”, including the performance factors listed below:

- System preservation
- Congestion relief, mobility
- Accessibility
- Integration and connectivity with other modes
- Economic benefits
- Safety
- Air quality and other environmental impacts
- Cost effectiveness of a project or service
- Operational efficiency
- Project readiness

It is the mission of the TRB with this bill to save lives, reduce congestion, and improve the quality of life (ADOT, 2004, pp. 1-1, 3-2). This House Bill is also the first step by federal agencies to improve coordination and collaboration among stakeholders, providing performance based guidance that can be used to evaluate a transportation project.

2.2.3 Challenges in the Transportation Planning Process

A breakdown in the transportation planning process will have economic consequences to an area and may have politically damaging effect for elected officials. While numerous studies have concluded that replacing the entire Tappan Zee Bridge is vital to keeping the I-287 corridor active, $83 million were spent on producing a draft EIS, only to have New York and New Jersey officials cancel the project because the $16 billion budget no longer covered the construction costs of the proposed build alternative supported by the general public. The planning process took over a decade, starting in 1999, but in this case, failed to produce a project due to lack of consensus. (Paschalis, 2010, p. 4)

Federal and state legislation has also made the timeframe of 20 years the norm for a transportation project. Newly elected officials may not agree on the importance of the transportation project of their predecessor, and/or may require supporting studies to be revisited. In the extreme case of the Maryland Intercounty Connector highway project, Neil Pedersen, the administrator of the Maryland State Highway Administration, had a “60-year history” before the project began construction in 2007. (TRB, 2009, p. 3) Efficient progress in the transportation planning process must be priority to avoid losing vital transportation improvement and construction projects, and avoid the possible disastrous consequences that not completing the project may have.

Estimating the cost of a freeway has and will remain one the most difficult problems a transportation project will face. The TRB’s guidance in the SHRP 2 is minimal and for reference only, stating that tracking cost performance should be performed early and often to “maintain accountability”, should use standardized coding to “track the causes of cost overruns”, and should link performance with paying the contractors. (TRB, 2009, p. 60) Explaining why costs are consistently underestimated proves difficult as well, for if the cost estimate is wrong, so, unfortunately, will be the risk analysis. Flyvbjerg insists that environmental, economic, psychological and technical factors can be part of the risk analysis and be included in the cost estimate of the project, but is not, because the project would never get off the ground. (Flyvbjerg, Holm, & Buhl, 2002, p. 290)

2.2.4 Possible Solutions to the Transportation Planning Process

In an effort to manage all federal and state transportation improvement projects, a project must be identified within a RTP. It must also make its way through the environmental review process. This environmental review process is required by NEPA whose policy it is to protect, maintain, and enhance the environment "under which man and nature can exist in productive harmony". (NEPA, 2011, pp. 1-2) Often, however, this process is viewed as a hindrance and at times, is not completed until the plan is already published. An EIS is "intended to be used in the information-gathering stage of the planning process, not after the plan has been formulated." Public outrage on the $78 million expansion plan for the Jack Murphy Stadium in Los Angeles could have been avoided, had the project been advanced using the EIS process. (Schreibman, 2010, p. 40) In the case of the Tappan Zee Bridge, it has taken twelve years to produce a draft EIS, a process viewed by George Paschalis, a transportation planner and public involvement specialist for Howard/Stein-Hudson Associates, Inc., as a "crushing federal process". The project failed and was removed from the Federal Registry in the summer of 2011. (Paschalis, 2010, p. 5)

Knowing that an EIS, mandated by the federal government on projects that are large in scope, use federal funding, and cannot be implemented with a categorical exclusion or an environmental assessment, is a required document without which the project cannot be built. Why not use the EIS as a planning tool? All issues related to a project come to light during the NEPA process, items that will be included in one or several of the chapters of an EIS, regulated to include:

- Discussions of the purpose and need for the project;
- Alternatives considered for the project;
- The affected environment;
- The environmental consequences of the proposed project;
- Lists of preparers, agencies, organizations and persons to whom the statement is sent; and
- An index. (NEPA, 2011, p. 3)

Knowing that the public will have the opportunity to contribute to the project adds a consensus building tool into the EIS process and enables the public to hold the planners accountable for their project forecasting and cost estimating. The public can participate in the project related hearings and meetings by submitting comments during the review process, comments that are required to be addressed by the lead agency. Surprises will be avoided. Impacts will be mitigated if they cannot be avoided. Political issues will be resolved and consensus among the stakeholders should be well established by the time an EIS Record of Decision is filed.

The challenge for transportation planning, then, is to find the "most economically efficient and politically acceptable arrangements for coordinating public and private efforts to improve mobility and to apportion costs and benefits among the many stakeholders." (Dunn, 1999, p. 92) A clearly defined project must be agreed upon and adhered to by all agencies and stakeholders, in order for the project to move ahead. An engineering solution to a transportation problem is no longer the best solution if it cannot generate consensus among the stakeholders. Some of the most common issues that hold the planning process hostage politically include:

- Working reactively rather than proactively on a project;
- Lack of collaboration between stakeholders such as community activists and local businesses, federal regulatory agencies, state and local agencies, and private environmental and wildlife advocacy groups; and
- Utility issues that cause delays in both the design and highway construction phases. (TRB, 2009)

Studies also suggest, that due to the political pressures competing for project funding invoke, planners are forced to systematically underestimate the costs of transportation infrastructure and provide biased forecasts to secure "the go-ahead for construction". (Flyvbjerg, Holm, & Buhl, 2005, p. 142) Flyvbjerg proposes accountability as the medicine with which the planner's strategic misrepresentation in forecasting can be cured.

2.3 Suggested Improvements to Transportation Performance

In this regard, the TRB leads the research and development to improve the efficiency of our transportation network. Efficiency relates mostly to highway capacity and ways in which the capacity can be managed, increased or decreased. The term "efficient" specifically occurs under the Mobility factor in the SHRP 2 *Performance Measurement Framework for Highway Capacity Decision Making Report*. The goal to improve mobility is to "provide for efficient movement of people and goods". (TRB, 2009, p. 19) The TRB identifies the average daily traffic (ADT) and the level-of-service (LOS), among many others, as measures for recurring delay; that is, it compares the actual time a motorist takes to travel a roadway segment during peak hours of operation to the time a motorist takes to travel that same distance at the designated speed limit. (TRB, 2009, p. 34) Mobility refers to the ability to “facilitate efficient movement of people and goods.” (TRB, 2009, p. 33) Mobility performance measures highlight the extent of congestion and identify the objectives to reduce recurring congestion and traffic volume.

Categories in which the efficiency of transportation networks can be improved include, but certainly are not limited to, increase in capacity, standardization of transportation data collection, and improvements in technology. The following are examples that highlight some of the more unusual methods of dealing with congestion, none of which, however, address demand management through comprehensive planning efforts such as mixed-use development.

2.3.1 Efficiency in Highway Capacity

Transportation networks are complex and so are the reasons why there is highway congestion. There are those who believe that congestion is due to inadequate highway capacity. They often lobby for specific construction projects, environmental support, and congestion pricing initiatives such as tolls and High occupancy/toll (HOT) lanes. Then, there are those who believe that no matter the capacity of the highway, “induced demand” will reroute and increase the use of the highway to again reach the point of congestion. (94th Arizona Town Hall, 2009, p. 12) Chen defines congestion as “the inefficient operation of highways during periods of high demand.” (Chen, Jia, & Pravin, 2001, p. 26)

Solutions to congestion problems abound. For example, to make a highway efficient during peak hours, Chen proposes the use of Intelligent Ramp Metering (IRM), saving some 280,000 vehicle-hours along selected sections of highway in

Los Angeles. He views a highway as “capital equipment”, vehicle-hours traveled as input and vehicle-miles traveled as the product. This allows Chen to calculate the efficiency of a highway network for any duration and to apply mathematical modeling to minimize congestion. He optimizes the IRM system so that vehicles will enter the freeway causing minimal slowing to the existing traffic. I do question the effect waiting to get onto the freeway during peak hours will have on the efficiency of the local arterial network, as traffic backs up. (Chen, Jia, & Pravin, 2001, p. 26)

Another idea in improving capacity during peak hours is suggested by the Texas Transportation Institute. This report explores the implications of using right and left shoulder lanes as travel lanes to “increase the efficient use of highway capacity.” (USDOT, 2010, p. 1) Three European countries, Netherlands, Germany, and Great Britain, were selected as they currently use shoulders part-time to manage congestion. The study concluded that buses on shoulders “benefited the transit trip time reliability”, but, a larger investment into Advanced Traffic Management (ATM) technology and resources is required to manage these lanes, and clearing a highway incident takes longer when the shoulders are not available.

Bartlett comments on the futility of increasing highway capacity. Increasing highway capacity by widening the highway seems illogical when the widening project will not relieve congestion. In the case of I-25 in Colorado, the governor pushed to increase the highway from 6 to 8 lanes, a capacity increase of 33 percent. The project was estimated to be completed in 7 to 12 years. With an annual population growth of over 2 percent, 12 years would project an increase in traffic of about 33 percent, filling up the added capacity of the highway by the time it is built. The dilemma is; do you widen the highway, knowing that capacity will increase as quickly as it is being built? At a construction cost of roughly $10 million per lane mile, to add one lane each direction for 20 miles will cost $400 million. If one lane can accommodate 2000 cars per lane each hour and rush hour lasts approximately 2.5 hours, then the additional 2 lanes built will accommodate 10,000 cars during rush hours, assuming that both directions are used at capacity. Spending $400 million to accommodate 10,000 additional cars during rush hour means, tax payers paid $40,000 per car. With an average of 1.2 persons per car, that is $33,000 per commuter. This cost may seem excessive. However, at 52 weeks per year, 5 days per week, with a facility life-span of 20 years, this would result in 5200 days or $6.35 per day per commuter. Bartlett concludes that population growth is the root of all problems, but offers no solution. I would say that widening the highway to increase capacity is money well spent when you consider the cost of congestion.

Cervero and Hansen argue that the futility of increasing highway capacity is a product of both induced demand and induced investment. Induced demand triggers drivers to “shift their routes, times of travel, and modes in order to exploit the new capacity”, while induced investment provides the means for development, generating new traffic. (Cervero & Hansen, 2002, p. 470) “Halting new freeway construction is often seen as a tool for advancing SMART growth agendas”, but seems an unreasonable solution when population growth and economic factors are considered. (Cervero, 2003, p. 146) It has been proven that “every project that increases the traffic capacity of an urban street or highway generates sufficient new traffic to fill completely and quickly the new added highway capacity”. (Bartlett, 2000, p. 2)

2.3.2 Efficiency in Highway Data Collection

Neuman, perhaps, provides the clearest picture of the intent of the TRB's performance measures. "Performance measures should be identified in response to goals and objectives…When monitored in the field, data on attained performance can be compared with objectives to show an agency how well the transportation system is performing now and over time. These comparisons can indicate the implications of current policies and programs and suggest updates in the future". (Neumann, 2004, pp. 157-158) Among the advantages of performance based planning, greater accountability, increased organizational efficiency, and greater effectiveness in achieving meaningful objectives top the list.

Meyer and Schuman suggest that in order to improve the performance of our transportation system, we need to increase our effort to collect data properly, that is, limit issues such as data gaps and problematic data quality, and improve efforts to share data. This will enable transportation planners to analyze performance measures including system reliability, safety, the average time of delay, traveler costs, and the actual physical condition of the road, among others. Benefits from this effort include using

- adaptive traffic signals to reduce vehicle delays;
- metering of highway ramps to increase highway speed and reduce crashes;
- automatic vehicle location to improve bus performance and reduce fleet size; and
- Weather monitoring data to reduce crashes.

"Collection of data and the development of performance measures are vital to ensure the effective management and operation of the transportation system of the future." (Meyer & Schuman, 2002, p. 49)

2.3.3 Improvements in Technology

Benefits of using Intelligent Transportation Systems (ITS) range from informing travelers in advance about delays, accidents, weather or road repairs, or about the status of their transit, to using ITS to manage traffic control devices, collect toll and congestion pricing dollars, and enable communication between vehicles or between vehicles and the infrastructure. Although the United States lags behind in the use and investment of ITS, the variety of solutions proposed requires analysis and time. An incremental approach to implementing some of these solutions seems to lack commitment. However, steps are being taken through the use of performance measures, to ensure that comparisons of case study results can be made based on uniform standards.

Performance measures of a transportation network based on data gathered from ITS, then, are vital, if we are to conserve our resources. Current TRB research projects with regards to transportation infrastructure efficiency gains obtained through the use of ITS include:

- **Performance Measures for Transportation Planning and Operations for MPO**, Project Number 161004. This project's focus is to help guide MPO's to achieve a higher-level transportation goal through the use of performance measures, specifically, as the performance measures relate to agency practices, agency needs, strategic planning, setting goals and collecting data.

- **A Framework for Improving Travel Time Reliability**, Project Number L17. This study reviews seven factors that account for traffic delay so that reliability of the transportation network can be improved. These factors include traffic incidents, weather, work zones, fluctuation in demand, special events, traffic control devices and inadequate base capacity.
- **Drivers' Asynchronous Day-to-Day Route Choices with Information Provision**. This study seeks to simulate how drivers will decide and respond to different information provision schemes, such as new technologies in inter-vehicle communications.
- **Refining the Real-Timed Urban Mobility Report**. The Texas Transportation Institute responsible for the Urban Mobility Report which measures system delay, wasted fuel consumption, and the cost of congestion seeks to improve upon the methodology by which data are used to estimate congestion and its costs.

However, it should be noted that technology must be viewed as a tool, only. Studies in demand forecasting have found that "50% of road projects have a difference between actual and forecasted traffic of more than 20% +/-, road traffic forecasts were underestimated by an average of 8.7%, and statistical tests show there is no indication that traffic forecasts have become more accurate in the past 30 years." (Flyvbjerg, Holm, & Buhl, 2005, pp. 133-138) This last item must be considered as we spend tax dollars pursuing advancements in ITS in the name of improving demand forecasting.

2.4 Summary

In summary, this chapter has revealed

- the dichotomy of transportation improvements in the political arena when quality of life depends on economic development enhanced by efficient transportation networks and environmental conservation;
- that the challenge not only lies with funding the transportation project, but developing relationships among stakeholders that will overcome legislation, build consensus regarding the goals and the issues of the project, and can survive the time it takes for the project to become reality; and
- that performance measures are a tool, a standard that will enable improvements in data collection and analysis.

Potentially, an EIS is a single document that can combine the political, the process and the performance elements as they apply to a specific transportation project. The EIS builds on previous studies that evaluated proposed transportation improvements, and thus, should allow for easy access to information, and include the public as part of the decision making process. As suggested, an EIS can/should be used as a tool to unify the stakeholders of a transportation project, used as a tool to coordinate the many processes that are required to clear the project for construction, and used as a tool to measure the performance of a newly constructed transportation project, for the EIS provides

- The goals and objectives of a transportation project;
- The data that supports the purpose and need;
- Issues that have come to light during the EIS process and perhaps previous studies;

- Environmental and economic mitigation measures taken to minimize the impact on our resources; and
- The specific performance measures used for analysis.

Completing and EIS, then, is only a required step, but could be used to evaluate transportation performance, hence, adding value to future projects. Standardization is key.

3 RED MOUNTAIN FREEWAY (LOOP 202) DEFINED

At this time, it should be noted that Loop 202 has two EISs, one completed in 1994 and the other in 1999, and subsequently will be referred to as FEIS (1994) and FEIS (1999).

3.1 Project Description

The Red Mountain Freeway project is a 33-mile corridor that is part of a larger transportation facility that extends from Interstate 10 (I-10) to US 60, and is comprised of the Red Mountain, Santan, and South Mountain freeway corridors.

Multiple EIS's exist for the Red Mountain Freeway due to the phasing of the project. Overall, the Red Mountain Freeway portion of Loop 202 was designed and constructed in three main segments (ADOT, 2001, pp. 24-26);

- Segment 1 = SR 202L, Red Mountain – I-10/SR 51 Traffic Interchange (TI) to SR 101L (see Figure 3-1);
- Segment 2 = SR 202L, Red Mountain – SR 101L to SR 87 (see Figure 3-2); and
- Segment 3 = SR 202L, Red Mountain – SR 87 to US 60 (see Figure 3-3).

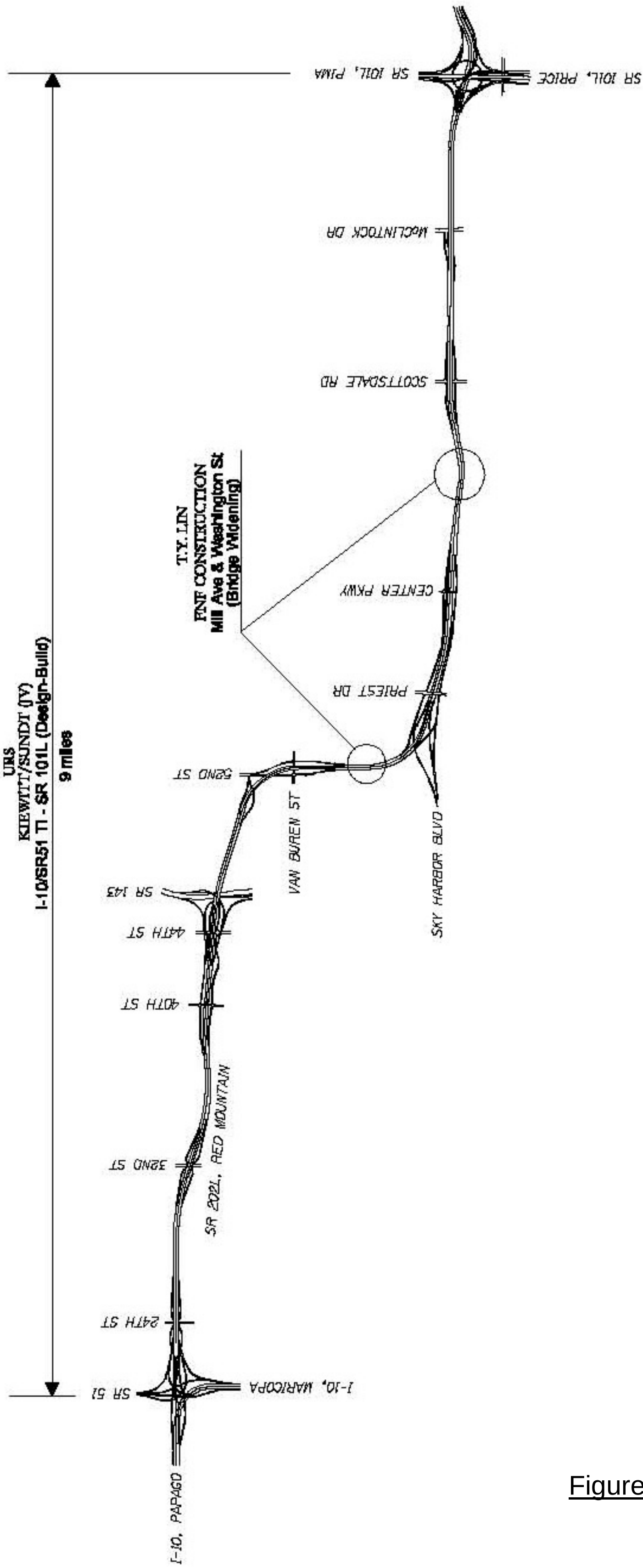


Figure 3-1: Segment 1

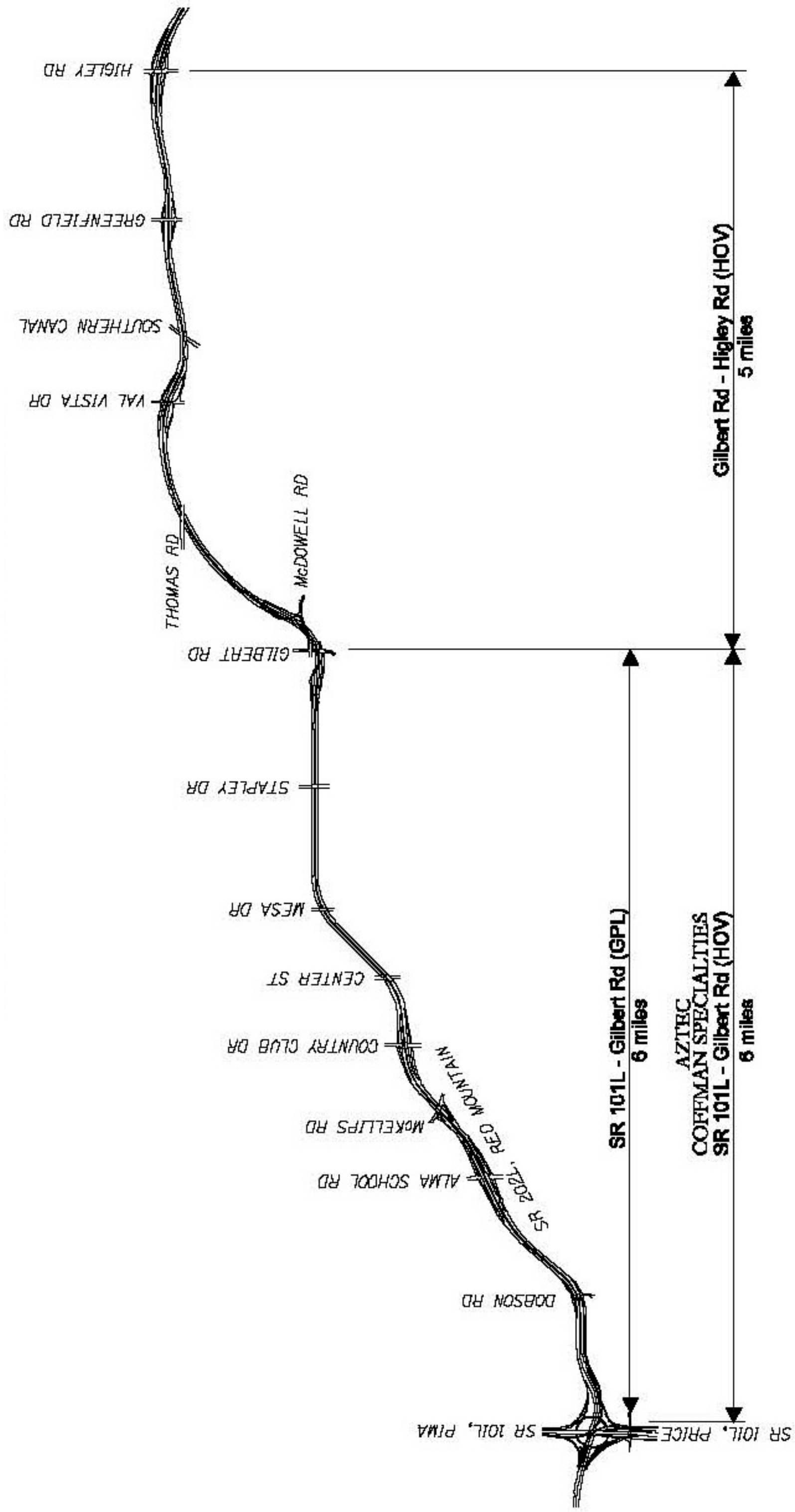


Figure 3-2: Segment 2

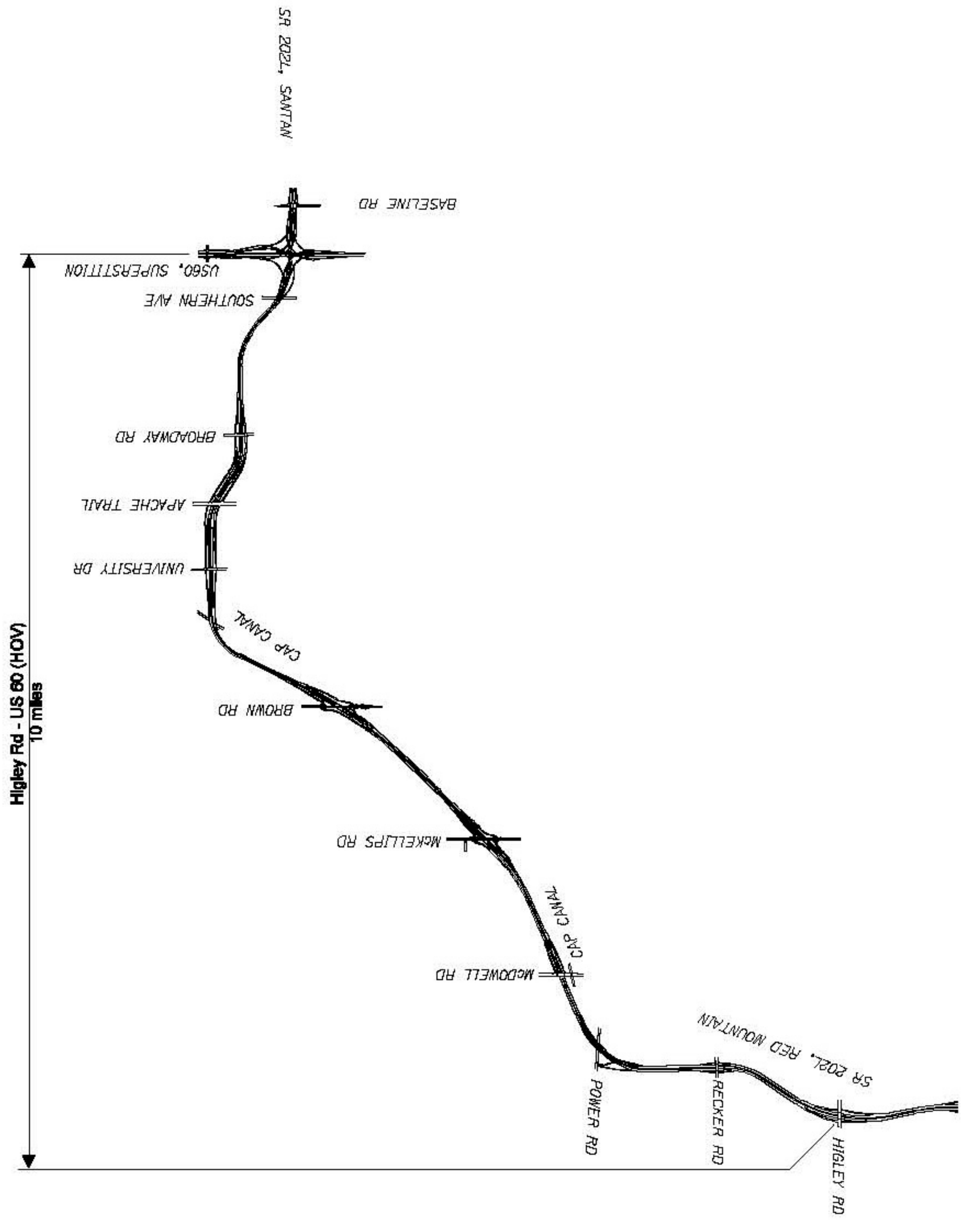


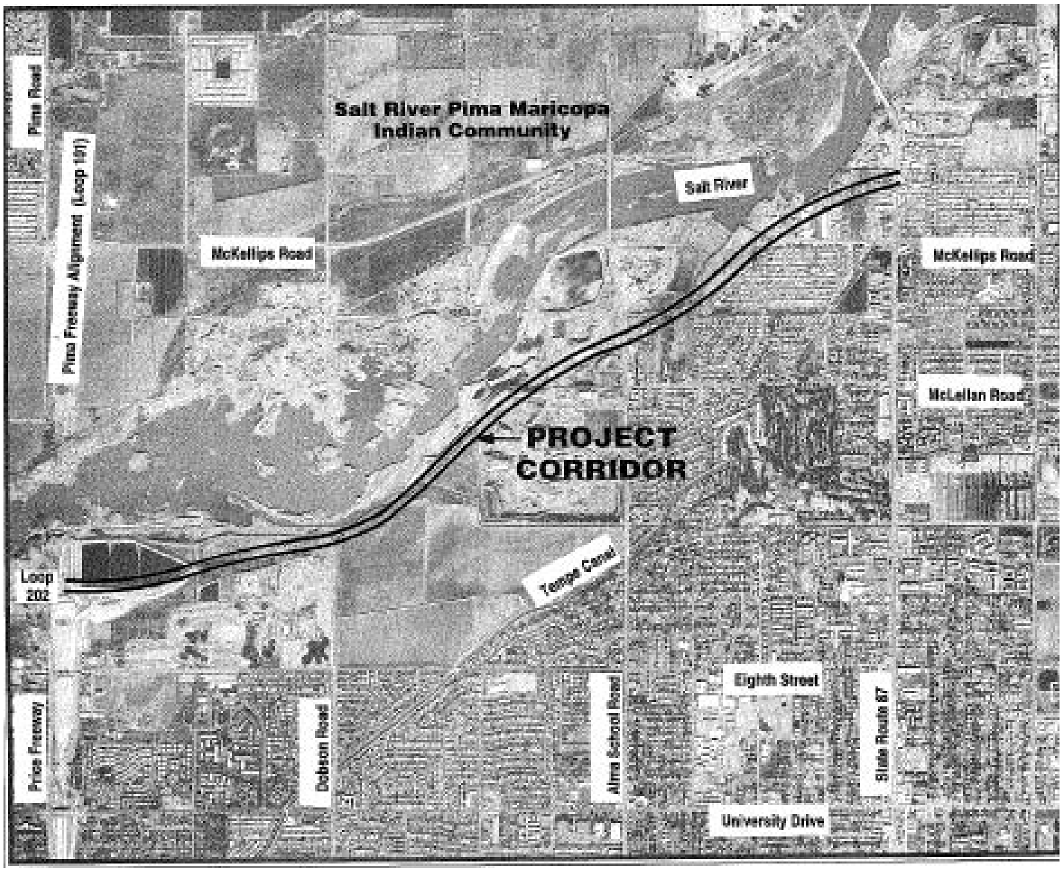
Figure 3-3: Segment 3

In 1989, segment 2 was further divided into two sections for study purposes, that is, the Dobson Road to Lindsay Road section and the Lindsay Road to Baseline Road section. All segments make up part of the original MAG Regional Freeway System as approved by voters in Proposition 300 in 1985. An EIS for segment 1, construction of which was completed in 1995, was not available, possibly due to the fact that this segment of Loop 202 already existed as part of the Papago Freeway and only needed to be redesigned, widened, and linked to segment 2 of Loop 202.

3.1.1 Project Description as Defined in the FEIS (1994)

The project location for the 6.5-mile Red Mountain Freeway (Loop 202) portion, as described in the FEIS (1994), is south of the Salt River between west of Price Freeway (Loop 101) and east of State Route 87 (SR 87) (see Figure 3-1). The project is within the Phoenix Metropolitan Area in Maricopa County, Arizona, and is part of both the Maricopa Association of Governments (MAG) regional and the Arizona statewide transportation plans. The project starts at the traffic interchange that connects Loop 101 and Loop 202 and ends at SR 87. The western terminus links Mesa, Apache Junction, Gilbert and Chandler to the regional transportation system, for Loop 101 combines the Price, the Pima and the Agua Fria corridors, while the eastern terminus that connects with SR 87 provides access to a major north-south Arizona State Highway System, connecting the Fort McDowell Indian Community and communities further north, such as Payson, to the valley.

Originally proposed as a parkway in the *Eastside and Central Transportation Studies* prepared by MAG in 1984, the predicted traffic volume required that the parkway be upgraded to a freeway in 1985, and the Red Mountain Corridor became part of the MAG Regional Freeway System. The final design of segment 2 is shown in Figure 3-4.



Source: (ADOT, Final Environmental Impact Statement, 1994, p. 1.3)

Figure 3-4: Segment 2 as Defined in FEIS (1994)

The boundary of the project was guided by factors that included:

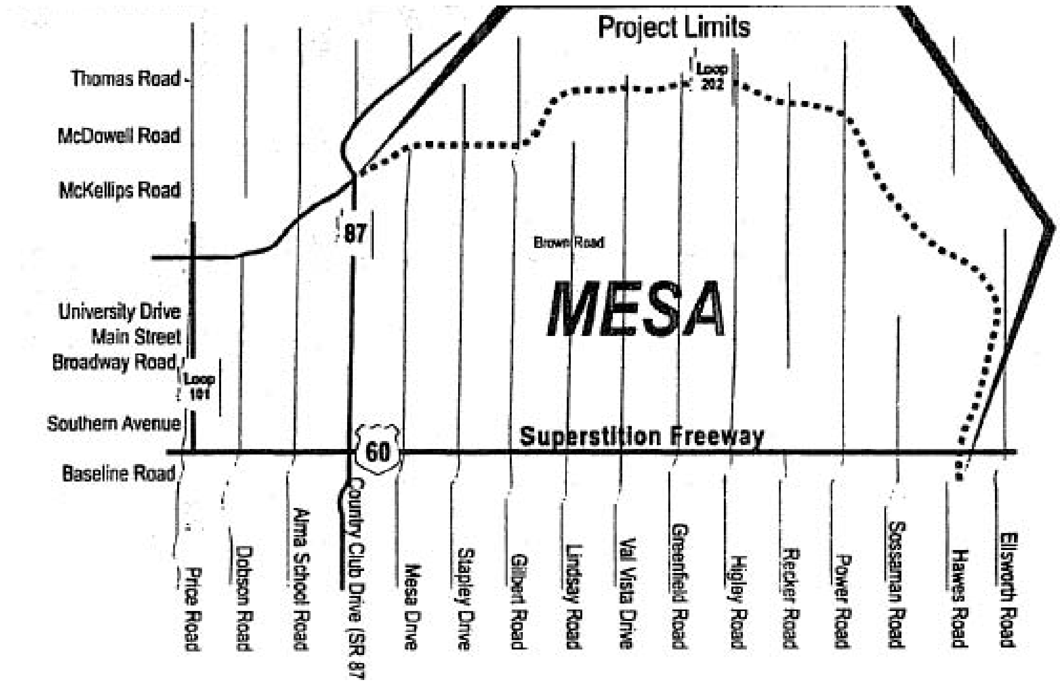
- **a logical termini** – providing connections to not only metropolitan locations, but also to destinations throughout the state;
- **independent utility** – improvements that will meet the demand of increased volumes of commuter traffic from SR 87, traffic that is generated by current and future urban development;
- **fiscal constraints** – priorities that were established by MAG and ADOT that balances the need with the available resources; and

- **priorities among components of the regional system** – priorities that were established by MAG and ADOT given the appropriate timing of constructing the individual segments of the system allowing for maximum flexibility for locating the future extensions of Loop 202 east of SR 87.

3.1.2 Project Description as Defined in the FEIS (1999)

The project location for the remaining 23.5-mile Red Mountain Freeway (Loop 202) portion, as described in the FEIS (1999), begins east of SR 87 and extends east to US 60, generally following the northern and eastern City of Mesa city limits (see Figure 3-5). The project remains within the Phoenix Metropolitan Area in Maricopa County, Arizona, and also remains as part of both the MAG regional and the Arizona statewide transportation plans. The project starts at the traffic interchange that connects SR 87 and Loop 202 and ends at the traffic interchange that connects US 60 and Loop 202. The western terminus connects with SR 87 and provides access to a major north-south Arizona State Highway System, providing access to the Fort McDowell Indian Community and communities of central and northern Arizona, while the eastern terminus links Loop 202 to the Santan Freeway and US 60.

The definition of the project limits within this FEIS was guided by factors that included logical termini, an independent utility, construction priorities provided by the MAG regional freeway system, and the projected future traffic needs.



Source: (ADOT, Red Mountain Freeway (Loop 202) - SR 87 to US 60 Final Environmental Impact Statement/Section 4(f) Evaluation, 1999, p. S.3)

Figure 3-5: Segment 3 as Defined in FEIS (1999)

Initially, ADOT divided the corridor into two sections, Dobson Road to Lindsay Road and Lindsay Road to Baseline Road, in preparation of the Design Concept Reports (DCR) and the State-Level EA, both of which were approved by ADOT in 1989. These two sections extend beyond the FEIS 1994 and 1999 project limits, but provided the background for both the FEIS's. The timeline illustrates the order of these documents with more detail. In 1985, the TRB placed the Red Mountain Freeway on the state highway system.

3.2 Project Timeline

The timeline of this project, as it pertains to the FEIS (1994) and FEIS (1999) only, is extensive due to the many reports that each document is based on. However, I felt that this exercise was necessary for the analysis. The following timeline breaks down what reports were generated when and by whom, and which report the FEISs referenced (see Table 3-1). All studies, reports, working papers, etc., are included in either the FEIS (1994) or the FEIS (1999), or both.

Table 3-1: FEIS 1994 and FEIS 1999 Project Timeline

Year	Source	Description	Related Transportation Studies
1982	City of Mesa	Mesa Transportation **Study**	
1983	ADOT	Proposed Red Mountain Parkway-**Working Paper** No.1-Selection of Recommended Alternatives	
1983	City of Mesa	Parkway Location **Study**	
1984	MAG	Eastside Transportation **Analysis**	
1984	MAG	Eastside Transportation **Plan**	
1984	MAG	Eastside and Central Area Transportation **Studies**	
1985	ADOT	Red Mountain Freeway-**Preliminary Engineering Final Report**	
1985	MAG	MAG Freeway/Expressway **Plan**	
1985	MAG	MAG **Regional Transportation Plan**	
1985	Voters approve **Proposition 300**		
1987	ADOT	Red Mountain Freeway-**Bush Highway to Baseline Road**-Location Study-**Working Paper**	
1987	ADOT	Mesa-Chandler-Gilbert North South Corridor **Study**	
1987	ADOT	**Final Environmental Assessment**, East **Papago Freeway**	
1988	ADOT	**Action Plan** of the Arizona Department of Transportation for State-Funded Highway Projects	
1988	ADOT	Red Mountain Freeway-**Lindsay Road to Baseline Road**-**Design Concept Report**	
1988	City of Mesa	Mesa Freeway Corridors **Study**	

Year	Source	Description	Related Transportation Studies
1989	ADOT	Red Mountain Freeway-**Lindsay Road to Dobson Road Design Concept Report**	• Mesa Transportation Study (City of Mesa, 1982) • Proposed Red Mountain Parkway-Working Paper No. 1-Selection of Recommended Alternatives (ADOT, 1983) • Parkway Location Study (City of Mesa, 1983) • Eastside Transportation Analysis (MAG, 1984) • Red Mountain Freeway-Preliminary Engineering Final Report (ADOT, 1985) • Red Mountain Freeway-**Bush Highway to Baseline Road-Location Study**-Working Paper (ADOT, 1987) • Red Mountain Freeway-**Lindsay Road to Baseline Road**-Design Concept Report (ADOT, 1988)
1989	ADOT, City of Mesa	Red Mountain Freeway **Environmental Assessment**, **Lindsay Roadway to Dobson Road**	
1990	ADOT	**Environmental Assessment**, **Pima Freeway** (Loop 101)	
1991	ADOT	Final Red Mountain Interchange **Environmental Assessment** (**Loop 101 and 202**)-Project 101LMA50H2412OID	• Regional Transportation Plan (MAG, July 1985) • Final Environmental Assessment, East **Papago Freeway** (State Route 217) (ADOT, August 1987) • Red Mountain Freeway Environmental Assessment, **Lindsay Road to Dobson Road** (ADOT. City of Mesa, November 1989) • Environmental Assessment, **Pima Freeway** (Loop 101), (Salt River Pima-Maricopa Indian Community, Maricopa County, Arizona, ADOT, July 1990)
1992	MAG	Regional Bicycle **Plan**	
1992	MAG	**Regional Transit Plan** for Maricopa County, Arizona (RPTA)	
1992	MAG	MAG Life-Cycle Program	
1994	ADOT	**Final Environmental Impact Statement (FHWA-AZ-EIS-93-02-D) for Red Mountain Freeway – Price Freeway to State Route 87**	• Mesa Transportation Study (City of Mesa, 1982) • Eastside and Central Area Transportation (Studies prepared by MAG, 1984) • Eastside Transportation Analysis (MAG, 1984) • Regional Transportation Plan (MAG, 1985) • Congestion Management Plan (MAG, October 1994) • Regional Transit Plan for Maricopa

Year	Source	Description	Related Transportation Studies
			County by RPTA (MAG, 1992) • MAG Life-Cycle Program (MAG, 1992)
1994	MAG	MAG Congestion Management System	
1994	MAG	Congestion Management **Plan**	
1996	City of Mesa	Mesa General Plan (City of Mesa)	
1996	MAG	Red Mountain and Santan Corridors, Major Investment **Study**	
1997	City of Mesa	Bicycle **Plan**, Fiscal Years 1996 to 1999 (City of Mesa)	
1997	MAG	MAG **Long Range Transportation Plan** (MAG)	
1997	MAG	Maricopa County Comprehensive **Plan**	
1998	**Red Mountain Freeway Segment opens from McKellips Road to CountryClub Drive (SR 87)**		
1999	ADOT	**Final Environmental Impact Statement (FHWA-AZ-EIS-96-01-F) for Red Mountain Freeway (Loop 202) – SR 87 to US 60**	• Mesa Transportation Study (City of Mesa, 1982) • Mesa-Chandler-Gilbert North – South Corridor Study (ADOT, 1987) • Action Plan of the Arizona State Department of Transportation for State-Funded Highway Projects (ADOT 1988) • Mesa Freeway Corridors Study (City of Mesa, 1988) • Red Mountain Freeway – **Lindsay Road to Baseline Road** – Design Concept Report (ADOT, 1988) • Red Mountain Freeway – **Lindsay Road to Baseline Road** – Environmental Assessment (ADOT, 1988) • Red Mountain Freeway – **Lindsay Road to Dobson Road** – Design Concept Report (ADOT, 1989) • Red Mountain Freeway – **Lindsay Road to Dobson Road** – Environmental Assessment (ADOT, 1989) • Statewide Transportation Plan (ADOT, 1993) • FEIS Red Mountain Freeway – **Price Freeway to State Route 87** (ADOT, 1994) • Mesa General Plan (City of Mesa, 1996) • Red Mountain and Santan Corridors – Major Investment Study (MAG, 1996)
1999	MAG	**Transportation Improvement Program** (MAG)	

Year	Source	Description	Related Transportation Studies
1999		**Environmental Impact Statement** approved for **Country Club Drive to Baseline Road**	
2001	ADOT	Final **Environmental Assessment-202L/US60 Traffic Interchange** (Federal Aid Number NH-202-BACG, TRACS Number 202L MA 028 H5686 01D	• **202L/US60 Traffic Interchange** Noise Technical Study (ADOT) • **202L/US60 Traffic Interchange** Final Alternatives Selection Report (ADOT, 2000) • **202L/US60 Traffic Interchange** Final Alternatives Selection Report Addendum – Service Interchange (ADOT, 2001) • Red Mountain Freeway-**SR 87 to US 60** Final Environmental Impact Statement (ADOT 1999) • Santan Freeway-Price Freeway to Baseline Road Final Environmental Assessment (ADOT 1999) • Mesa General Plan (City of Mesa, 1996) • Mesa Transportation Study (City of Mesa, 1982) • Mesa-Chandler-Gilbert North South Corridor Study (ADOT, 1987) • Mesa Freeway Corridor Study (City of Mesa, 1988, 1996) • City of Mesa Transportation Plan (City of Mesa, 2001)
2002	**Red Mountain Freeway segment opens from Country Club Drive (SR 87) to Gilbert Road**		
2003	**Red Mountain Freeway segment opens from Gilbert Road to Higley Road**		
2004	**Voters approved a 20 year extension of half-cent sales tax under Proposition 400 until December 31, 2025**		
2005	ADOT	Widening of Red Mountain Freeway-**Environmental Assessment-Lindsay Road to Dobson Road** (ADOT, City of Mesa)	• Mesa Transportation Study (City of Mesa, 1982) • Eastside Transportation Analysis (MAG, 1984) • Mesa-Chandler-Gilbert North-South Corridor Study (ADOT, 1987)
2005	**Red Mountain Freeway segment opens from Higley Road to Power Road**		

Year	Source	Description	Related Transportation Studies
2007	ADOT	Widening of Red Mountain Freeway-**Final Design Concept Report**-HOV Lanes from SR 101L to Gilbert Road (ADOT)-Project 202L MA 9 H7058SIL	• MAG Freeway and Expressway Plan Update: Priority Treatment for High Occupancy Vehicles (MAG 1990) • High Occupancy Vehicle Facilities Policy Guidelines for the MAG Freeway System (MAG 1994) • Park and Ride Lot Location Study (MAG 2001) • High Occupancy Lanes and Value Lanes Study (MAG 2003) • High Occupancy Transit Plan (MAG 2003) • Regional Transit System Study (Valley Metro 2003)
2008	**Red Mountain Freeway segment opens from Power Road to University Drive**		

4 METHODOLOGY

Here, methods used to compare the projected population and traffic volume numbers to the actual census and City of Mesa data are described. As a NEPA requirement, a discussion of the purpose and need for the project must be included in the EIS. The goals described in the purpose and need provide the standard with which the performance measures can be analyzed.

This chapter also provides definitions and methods used to calculate the traffic volumes and cost estimate comparisons.

4.1 Population and Traffic Volume Projection Calculations Defined

Both population and traffic volume projections are discussed for each FEIS separately, for each FEIS has a different time-span. To calculate the overall growth (PC) in population, traffic volume, and cost, the formula below is applied:

$$PC = \frac{(V_{Future} - V_{Present})}{V_{Present}}\ x\ 100$$

where PC = Percent Change
$V_{Present}$ = Present Value
V_{Future} = Future Value

To calculate the exponential growth (EG) for the population, the traffic volume, and the cost, the formula below is applied:

$$EG = e^{\left(\frac{\ln\left(V_{Future}/V_{Present}\right)}{(t_{Future} - t_{Present})}\right)}$$

where e = constant of 2.71828
$V_{Present}$ = Present Value
V_{Future} = Future Value
$t_{Present}$ = Present time
t_{Future} = Future time

4.2 Screenline Analysis Defined

Screenline analysis is a technique that allows for a broad assessment of the distribution of network travel demand. In screenline analysis, an imaginary line is drawn across all of the major roadway facilities in a given area of the network. Typically, screenlines are drawn across a series of either east/west or north/south roadways. A total screenline volume is obtained by adding up all the volumes on the individual roadways that cross the screenline. Thus, the screenline volume represents the total demand for travel in a given direction over a broad portion of the network. The traffic volume can be evaluated to determine how a proposed transportation facility can modify traffic patterns within a study area, and to measure how the facility would provide a benefit to the community.

4.3 Traffic Volume Data Defined

Since Loop 202 was constructed almost entirely within the City of Mesa, traffic volume data used for comparison was provided by the City of Mesa. Traffic volume data can be described as follows:

- Highway Traffic Data are used to “develop estimates of the amount of person or vehicular travel, vehicle usage, or vehicle characteristics associated with a system of highways or with a particular location on a highway”. Data collected includes traffic volume, vehicle classification, vehicle weight and vehicle occupancy. (ADOT, Multimodal Planning Division, 2010)
- The Average Daily Traffic (ADT) is the average 24-hour volume of vehicles at either a given point or segment of a roadway divided by the number of days in the year. The term is often also known as Traffic Count. ADOT collects traffic count data via the use of Automatic Traffic

Recorders (ATRs), equipped to record traffic volumes, speed, and classification of vehicles 24 hours a day, 365 days a year, for each lane of roadway. This data can also be used to estimate vehicle miles of travel (VMT). ADOT ensures that “at least some” data are collected for all roads that fall within the jurisdiction of the state highway authority. (ADOT, Multimodal Planning Division, 2010)

Traffic volume data as provided by the City of Mesa describes the average weekday volume per 24 hour period. The traffic volume maps show the counts taken during the previous year or provided by ADOT. Because counts were not taken in 2004, a map for 2005 was not produced. The link to these maps can be found in Appendix C. These maps can be found on the City of Mesa website (mesaaz.gov/transportation/trafficcounts.aspx).

For purposes of comparison, the actual traffic volume for any given year is the year for which the map was published.

4.4 Purpose and Need Defined

The analysis used to establish the purpose and need for an EIS follows guidance provided in the *FHWA Technical Advisory T6640.8a*, 1987. The guidance is not all-inclusive or applicable in every situation. As such, the following items serve only as a guide in developing the purpose and need for an EIS:

- **System Linkage** – is the proposed action a “connecting link” in the overall transportation system?
- **Capacity** - Is the capacity of the present facility sufficient to accommodate existing and future traffic? If not, what capacity is needed?

- **Transportation Demand** - Is the proposed action related to any statewide plan or adopted transportation plan? Are the proposed action's traffic forecasts consistent with the regional plan?
- **Legislation** - Is there a federal, state, or local governmental mandate for the action?
- **Social Demands or Economic Development** - What projected socioeconomic, demographic, and/or land use changes indicate the need to improve or add to the freeway capacity?
- **Modal Interrelationships** - How will the proposed action interface with and complement airports, rail and port facilities, mass transit services, etc.?
- **Roadway Deficiencies** - Is the proposed project necessary to correct existing roadway deficiencies (e.g., substandard structures, inadequate lane capacity, etc.)? If so, how will the proposed action improve it? (FHWA, Guidance for Preparing and Processing Environmental and Section 4(f) Documents, 1987)

The purpose and need of an EIS should address all of the above issues and answer all questions that apply.

4.4.1 Purpose and Need as Defined in the Final FEIS (1994)

The project purpose and need described in the FEIS (1994) is to **"construct a freeway facility … in order to serve the identified traffic needs in the area"**. (FHWA, ADOT, & USACE, 1994, p. 1.7) The new freeway will serve to:

1. Relieve traffic congestion on the existing east-west arterial roadways, where roadway improvements will not meet the projected traffic demands;

2. Relieve the increasing traffic congestion on US 60;
3. Connect north Mesa to the regional freeway system;
4. Connect the developing industrial area of north Mesa to the regional freeway system; and
5. Provide a more direct route for the Phoenix Metropolitan Area to the recreational river and lakes of east Mesa.

As noted in Section 3.1.1 of this thesis, the early *Mesa Transportation Study* conducted by the City of Mesa in 1982, identified the Red Mountain Freeway as a Parkway, providing at grade intersections. The Red Mountain Freeway was upgraded to a freeway in 1984 after MAG published the *Eastside Transportation Analysis*, in which the study concluded that the at-grade intersections would still cause long traffic delays and not meet project goals.

4.4.2 Purpose and Need as Defined in the Final FEIS (1999)

The project purpose and need described in the FEIS (1999) is to **"serve regional transportation-related needs and relieve congestion on local arterial streets throughout the City of Mesa and on US 60."** (FHWA, ADOT, & USACE, 1999, p. 1.2) In preparation for this FEIS, MAG prepared the *Red Mountain and Santan Corridor, Major Investment Study (MIS)* (MAG, 1996), which concluded that a freeway is the most appropriate investment strategy for the City of Mesa and the east valley. The MIS also recommended high occupancy vehicle (HOV) lanes to accommodate the ever increasing daily traffic volume that is projected to 2015.

Reasons for the need of a freeway include:

1. A population growth of 86 percent or 3.9 million by year 2015 for Maricopa County;

2. A population growth for the east valley, specifically for the City of Mesa, reaching a population of 562,000 by 2015;
3. An employment growth for the City of Mesa from 80,700 in 1987 to 183,300 by 2015;
4. The need to divert traffic from McKellips Road, University Drive, and other east-west local arterials to "reduce congestion, enhance access to the developing industrial areas near Falcon Field, and provide bypass for recreational traffic destined for the Salt River and various lakes to the east of Mesa; and
5. Loop 202 is a major component of the National Highway System for the Phoenix Metropolitan Area identified in the City of Mesa's *Mesa General Plan* (1996).

The *Mesa-Chandler-Gilbert North-South Corridor Study* by ADOT (1987) concluded that a six-lane freeway would be needed to reach a LOS C.

In 1965, an LOS report card was introduced in an effort to grade freeway quality and service using six letters, "A" through "F", with "A" being the best and "F" being the worst. In modern times, a planning-level LOS criteria for freeways based on Highway Capacity Software v5.3, would result in the following for a six-lane freeway:

Table 4-1: Level-of-Service Criteria for a Six-lane Freeway

Level-of-Service	**ADT Range (veh/day)**
A	< 35,000
B	35,000 – 56,000
C	56,000 – 81,000
D	81,000 – 103,000
E	103,000 – 118,000
F	> 118,000

Hence, a LOS C traffic volume for Loop 202 would mean that an average of 56,000 to 81,000 vehicles would travel the freeway every day. Traffic volume studies conducted by MAG in the form of ADT volumes concluded that only a freeway would reduce local arterial network traffic throughout the City of Mesa when compared to a No-Action condition.

4.5 Population Growth and Traffic Volume Projections

4.5.1 Population Projections as Defined in the FEIS (1994)

The growth in population in the FEIS (1994) is based on the population growth trend between 1960 and 1990, a trend that resulted in a population increase of 40.6 percent for Maricopa County and 89.0 percent for the City of Mesa. Allocating the population according to the 1990 Census Tracts produced the **86 percent population growth projection** for the study area **from 1990 to 2015** for Maricopa County. (ADOT, 1994, p. 1.14)

The cited methodology for obtaining future travel demand for 2015 in the FEIS (1994) is a "computerized travel forecasting model" from MAG. MAG assumed that the Price/Pima Freeway would be completed and that Main Street and Broadway Road would be widened from four to six lanes within the study area. (ADOT, 1994, p. 1.10) Indicators used for the travel forecasting model include "population, employment, miles of freeway, lane miles of arterials, daily vehicle trips, daily vehicle miles of travel, freeway vehicle miles of travel, percent of travel on freeways and congested intersections". The FEIS's (1994) **traffic volume increase projection from 1990 to 2015 is 81 percent** within the study area. (FHWA, ADOT, & USACE, 1994, pp. 1.13-1.14)

4.5.2 Population Projections as Defined in the FEIS (1999)

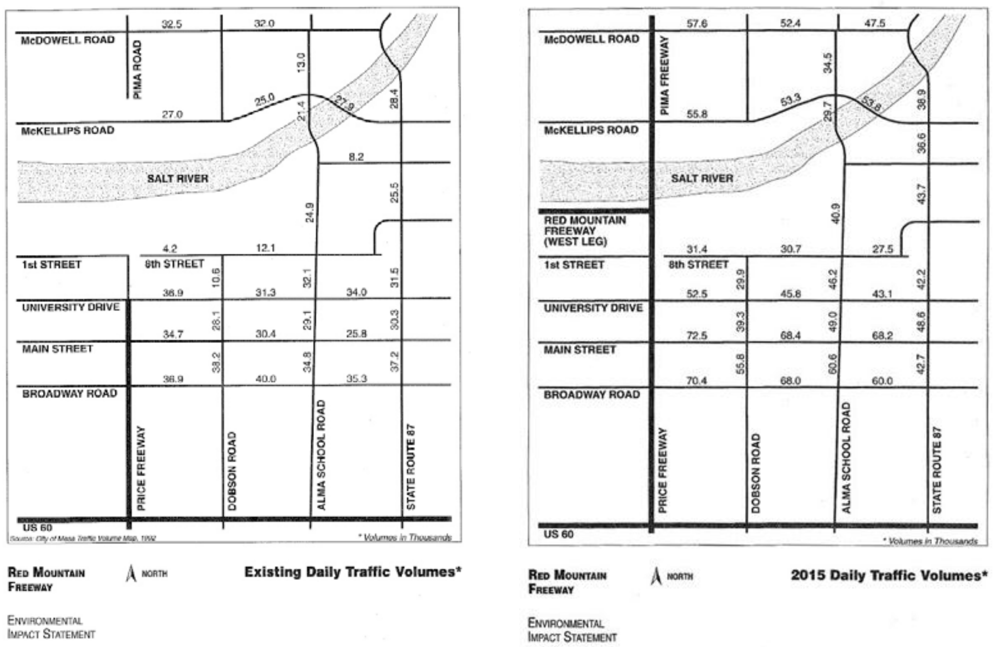
The FEIS (1999) projected the population for Maricopa County to increase to 3,900,000 by 2015, estimating an **86 percent growth in population from 1990 to 2015**. (FHWA, ADOT, & USACE, 1999, p. 1.3) This population growth was based on projections provided by the MAG Transportation Planning Office in 1996, estimating the population growth over a 20-year time-span. No methodology is specified within the FEIS (1999). The **City of Mesa** was estimated to have the largest population and experience the fastest employment growth in the east valley in comparison to the City of Chandler and the Town of Gilbert, and therefore, was expected to grow from 338,117 in 1995 to 562,000 by 2015, an overall **66.2 percent increase**.

The traffic projections in the FEIS (1999) are discussed in two ways:

1. As the basis for the need of the project, that is, a population increase that would generate a projected daily **traffic volume increase of 81 percent by 2015** referenced in the *Red Mountain and Santan Corridors, Major Investment Study* by MAG, 1996, the *Mesa Transportation Study* by the City of Mesa in 1982, and the *Eastside Transportation Analysis* by the City of Mesa in 1984. (FHWA, ADOT, & USACE, 1999, p. 1.3)
2. As a consequence of a no-build action. The *Eastside Transportation Analysis* used a Level-of-Service (LOS) analysis and **projected an LOS F by year 2015**, suggesting that the traffic conditions of major arterial streets will operate at high traffic volumes and under congested and overloaded conditions. (FHWA, ADOT, & USACE, 1999, pp. 1.3-1.4)

4.5.3 Traffic Volume Projections as Defined in the FEIS (1994)

At the time of the FEIS (1994), existing daily traffic volumes on the major arterials in the study area ranged from 10,600 vehicles on Dobson Road north of University Drive to 40,000 vehicles on Broadway Road between Dobson and Alma School Road (see Figure 4-1).



Source: (FHWA, ADOT, & USACE, 1994, pp. 1.9,1.11)

Figure 4-1: Traffic Volume Comparison in FEIS (1994)

The projected future traffic conditions obtained from MAG for the year 2015, would vary from 29,700 on Alma School Road south of McKellips Road to 72,500 on Main Street west of Dobson Road. The north-south screenline set between Alma School and Dobson Roads shows that the **existing total traffic volume of 158,700 vehicles will increase to 287,900 vehicles by 2015**, an **81 percent increase** (see Table 4-2).

Table 4-2: Existing and Future Traffic Volume as Defined in the FEIS (1994)

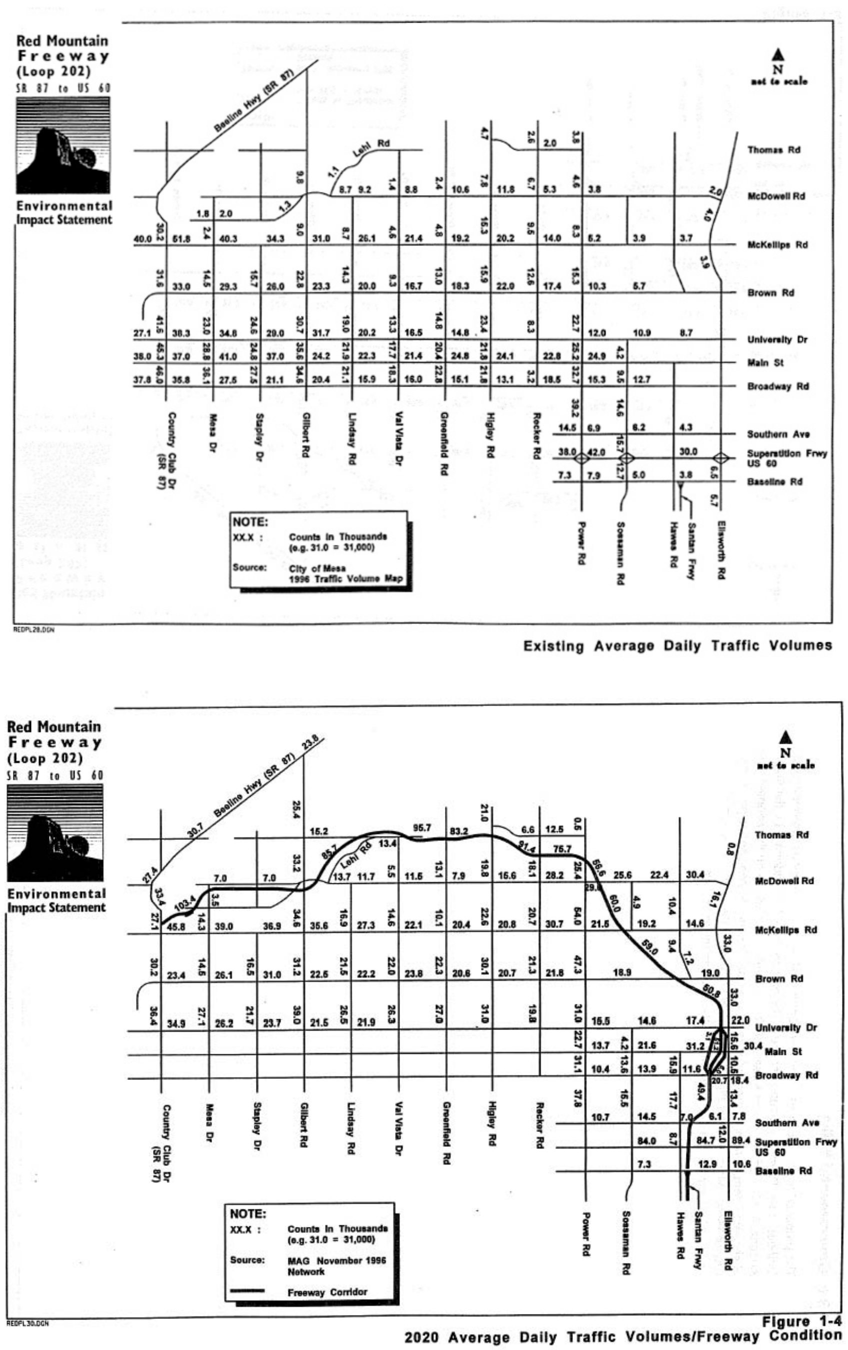
	Existing (1992) vehicles daily	**Future (2015) vehicles daily**
McDowell Road	32,000	52,400
McKellips Road	25,000	53,300
University Drive	31,300	45,800
Main Street	30,400	68,400
Broadway Road	40,000	68,000
Total	**158,700**	**287,900**

Source: (FHWA, ADOT, & USACE, 1994, p. 1.12)

4.5.4 Traffic Volume Projections as Defined in the FEIS (1999)

Traffic analysis conducted for this FEIS (1999) concludes that the Red Mountain Freeway facility will have to accommodate an **81 percent increase in daily traffic volume projected to 2015**. This conclusion was supported in the *Red Mountain and Santan Corridors, Major Investment Study* conducted by MAG in 1996 and remains as defined in the FEIS (1994). In reviewing the maps provided in the FEIS (1999) and as seen in Figure 4-3, however, one should note that the FEIS (1994) screenline between Dobson Road and Alma School Road is not shown. The “planning-level capacity analysis” conducted by MAG redefined the study area to be “bound by SR 87 on the west, Ellsworth Road on the east, Thomas Road on the north, and Baseline Road to the south”, and projected to the design year 2020. MAG’s traffic volume alanysis set the screenline to north-south between Mesa Drive and SR 87 and defined the major arterials east-west as McDowell Road, McKellips Road, Brown Road, and University Drive. (FHWA, ADOT, & USACE, 1999, p. 1.5)

In the FEIS (1999), the traffic analysis discussion also shifted in emphasis from screenline analysis to LOS. The 1987 *Mesa-Chandler-Gilbert North-South Corridor Study* conducted by ADOT concluded that the major intersections in the study area would operate under LOS F conditions during peak hours, projecting average daily traffic volumes of 260,000 to 290,000 on the City of Mesa street network (see Figure 4-2).



Source: (FHWA, ADOT, & USACE, 1999, pp. 1.7-1.8)

Figure 4-2: Traffic Volume Comparison in FEIS (1999)

The inconsistency of the time-span of forecasts and major arterial roads included in the screenline analysis become critical in chapter 5, where comparisons are made, for the projected traffic count shown in the maps (see Figure 4-3) is to the year 2020 but the ADT projections in the text of the document only go to year 2015, and the traffic volumes produced by Brown Road, Main Street and Broadway Road varied in their roles.

4.6 Cost Estimates

The TRB's SHRP 2 Report states that typically, cost is not a performance factor. However, in order for agencies to prioritize projects, it is important to project costs early and often. Potential influences on costs should be considered such as project delays and community outreach issues. (TRB, 2009, p. 60) In the NCHRP Report 574, year-of-construction costs are used to communicate to the stakeholders the actual cost of construction of the project in the year it will be built. (TRB, 2006, p. 135)

To calculate the year-of-construction cost, current dollar estimates should be adjusted by applying a cumulative inflation factor to the year of construction. Using inflation data, or the Gross Domestic Product (GDP) deflator for Arizona provided by the U.S. Department of Commerce, Bureau of Economic Analysis and compiled by the Morrison Institute for Public Policy, Table 4-3 shows the cumulative inflation factor for each segment of the Loop 202 as it is defined in the FEISs and the RTPs. For Arizona, the state specific inflation factor is based on the gross domestic product implicit price deflator. For more information, please visit http://arizonaindicators.org/content/inflation.

To calculate the Cumulative Inflation Factor (CIF), the following formula was used:

$$CIF = \sum_{Year\ of\ Cost\ Estimate}^{Year\ of\ Expenditure-1} Inflation\ measured\ by\ GDP\ Implicit\ Price\ Deflator$$

Table 4-3: Cumulative Inflation Factors

Red Mountain Freeway Segment	Year of Cost Estimate	Year of Expenditure	Cumulative Inflation Factor
FEIS (1994) Price Freeway to SR 87			
• Price Freeway to McKellips	1992	1996	7.5% (1)
• McKellips to SR 87	1992	1998	12.5% (1)
FEIS (1999) State Route 87 to US 60			
• SR 87 to Gilbert Road	1997	2002	4.1 %
• Gilbert Road to Higley Road	1997	2003	5.7 %
• Higley Road to Power Road	1997	2005	9.9 %
• Power Road to Baseline Road	1997	2007	16.3 %
RTP 2003			
• Price Freeway to Gilbert Road	2002	2002	0 %
• Gilbert Road to Higley Road	2002	2003	1.7%
• Higley Road to US 60 (4)	2002	2007	12.3%
RTP 2006 Update			
• Price Freeway to Gilbert Road	2006	2002	-9 %
• Gilbert Road to Higley Road	2006	2003	-7.3 %
• Higley Road to US 60	2006	2008	6.1 %

Source: (Arizona Indicators, 2011)

Notes: (1) Inflation rate for Arizona is only available from the years 1998 on up, therefore the inflation rate for the U.S. was used for the years 1997 and prior.

These cumulative inflation factors will be multiplied by the projected cost estimate to derive at the adjusted cost estimates listed in Table 5-6, or

$$Adjusted\ Cost\ Estimate = CIF * Projected\ Cost\ Estimate$$

The adjusted cost estimate is then compared to the actual cost and the difference calculated as shown below:

$$Cost\ Difference\ (percent) = \frac{Actual\ Cost\ Estimate - Adjusted\ Cost\ Estimate}{Adjusted\ Cost\ Estimate} * 100$$

5 PROJECT ANALYSIS

This chapter will provide the results as traffic volume projections and population forecasts are compared to actual data in respect to the political environment and the planning process, and will include a comparison of estimated and actual costs.

5.1 The Political Arena

The project timeline provides numerous insights into the politics associated with the Red Mountain Freeway (Loop 202), especially in the sequence of studies as described in both the NEPA regulations and the Regional Transportation Plan process.

5.1.1 Project Timeline

Often, it is assumed that a highway project begins with the RTP. Granted, the RTP actually identifies the project. However, studies and reports begin much earlier than an RTP as shown in the Red Mountain Freeway (Loop 202) project timeline (see Table 3-1). The *Mesa Transportation Study* completed by the City of Mesa in 1982 was the first report referenced in the FEIS (1994). As such, the Notice of Intent was issued by the FHWA in the Federal Register, Volume 57, No. 172, on September 3rd, 1992, and the FEIS document was cleared by the FHWA in the EIS Record of Decision 12 years later, in 1994. It took another eight years to construct Loop 202 to the project limit defined (SR 87) in the FEIS (1994).

Adding the FEIS (1999) into the mix increases the time from which the Red Mountain Freeway (Loop 202) began by another five years to 17 years. The Notice of Intent was published in the Federal Register on January 23rd, 1998 and the EIS Record of Decision in 1999. Construction for the remainder of Loop 202 was completed in 2008. Overall, the Red Mountain Freeway portion of Loop 202 defined in the FEISs (1994 and 1999) took 26 years from concept to completion.

Politically, the City of Mesa seems to be the lead agency in moving this project forward, although, by the time the FEIS 1999 was published, the project had a wider, more significant impact on the region. It also seems that the stakeholders, that is, the City of Mesa, MAG, ADOT, and the FHWA, among others, were all on board, for the project appeared in the RTP just three years after the *Mesa Transportation Study*. This suggests that coordination and leadership in solving issues among the stakeholders was not a problem. This is a commendable effort on all preparers and contributors involved, especially in publishing the FEIS (1999), for it took only one year to produce the document, conduct two public hearings, and address the multitude of comments received during the review process.

5.1.2 EIS Comment Resolution

Within the FEIS (1994), the biggest concern was the project location and its proximity to the Salt River. Identified as waters of the United States, encroaching on the Salt River floodplain brings a whole new set of regulations to the table. Eight studies published between 1982 and 1985 develop the alternatives for the location of the, then, parkway. Two more studies generated additional alternatives until the Design Concept Reports and the FEIS were developed. This may also provide the reasons why ADOT divided the Red Mountain Freeway (Loop 202) into two sections, Dobson Road to Lindsay Road and Lindsay Road to Baseline Road. Impacts to floodplains and the Salt River were mitigated by revising the corridor location and forcing "additions to Roosevelt Dam upstream". (FHWA, ADOT, & USACE, 1994, p. 7.9)

Funding the project was another concern. Voters approving Proposition 300 in 1985 and elected to extend the half-cent tax for another 20 years under Proposition 400, suggesting that they were willing to provide the local funding for most of the Red Mountain Freeway (Loop 202) segments detailed in the FEISs (1994 and 1999) and support the project.

Areas of concern included air quality and noise. The FEIS (1994) had to be revised in nine separate paragraphs/sections before all parties agreed on the language. Overall, concerns related to CO, particulate matters, dust control, and the investments and visual aesthetics for all noise walls.

One comment received by Mr. Belt I found of particular interest, for it questioned the need for the project. It states:

"The screenline analysis on page 2-33 describes that proposed Freeway Alternatives as being over capacity in the design year and thus unable to handle anticipated traffic volume. How will this excess traffic be accommodated?" (FHWA, ADOT, & USACE, 1994, p. 7.23)

The response was that "the facility will provide the needed service for several years prior to 2015…and that the median will be reserved for future addition of lanes as traffic volumes increase". Although, this response seems to admit that the Red Mountain Freeway was designed not to meet all of the future demand, it also introduces future projects . The timeline confirms this, for MAG began with the *Congestion Management Plan* in 1994 and ADOT published the *Widening of Red Mountain Freeway – Environmental Assessment* in 2005. This incremental project design and construction process is a true example of how efficiency in highway capacity is dealt with in the political arena. It also provides the proverbial "foot in the door" for subsequent project phasing and funding.

Section 7 in the FEIS (1994) managed to remain civil with 41 pages of comments and their responses. The number of stakeholders to which this FEIS (1994) was distributed includes eight federal agencies, 11 state agencies, and 26 local agencies. Comments received included two businesses and 14 individuals. Within the FEIS (1999), comments and their responses were bound into a separate Appendix K, a page count of 355. A draft version of this EIS was made available to the public on January 23, 1998. The alignment for this portion of the Red Mountain Freeway (Loop 202), again, seemed to be of major concern, although, the corridor is now past the Salt River area. Irrigation canals, flood retarding structures, retention basins, groundwater wells, and water treatment plants were among the culprits, of which the freeway overpass over Power Road and the Central Arizona Project canal caused the most concern. Neighbors in the area did not find a 20' noise wall 5' from the end of their street very attractive and were worried about their property value. Also, the Red Mountain District Park forced a re-alignment of part of the corridor. In this case, a group of neighbors fought for the park to remain, and won, but, most importantly, the project kept moving forward.

Overall, the FEIS (1999) stakeholders included 39 federal agencies, 33 state agencies, 16 county agencies, 36 city agencies, 11 Indian communities, and 339 businesses and individuals. Needless to say, efforts in community outreach, issue resolution and stakeholder collaboration were more intense than during the

FEIS (1994) comment resolution period just five years earlier, but concluded the planning process in record time.

5.1.3 Comments

The timeline represents the overall number of years it took for the Red Mountain Freeway to become part of our transportation network, 1982 to 2008. It also illustrates the effort put into the project. 26 years from concept to construction completion is exceptional in that I don't think that this can be repeated. I have been working on an EIS document for a 30-mile corridor for 10 years and it is still in the agency review process. In the Loop 202 case, the challenge to find the most economically efficient and politically acceptable arrangements was met. The project, although large in scope, was phased appropriately, continues to produce future work and generate income for the valley, positively affecting the quality of life for the East Valley.

5.2 The Planning Process

While I commend the efficiency of the Loop 202 political process, the question of whether the planning process for the Red Mountain Freeway was efficient remains. If the planning process must ensure compliance with laws that cover "social, economic, and environmental concerns", a process that brings to fruition a project from concept to an RTP in three years, then, perhaps the project development stage requires scrutiny. This stage is directly above construction and is indicated by a vague, large arrow (see Appendix B). Issues raised during the comment resolution in both FEISs (1994 and 1999) were issues of mitigating impacts on the water and air quality, issues that are administrative in nature, require adherence to regulations, and therefore are not issues due to public opposition. As Schreibman noted, “Policy makers often express an irrational fear of environmental reviews. Yet in all of 2009, the federal government produced only 187 final EISs.” (Schreibman, 2010, p. 40)

Perhaps, using performance measures that model potential impacts and “gauge whether proposed projects would pass environmental review and assess compliance with NEPA and other environmental laws and regulations” are useful tools. (TRB, 2009, p. 96) These performance measures for water related issues, for example, would include:

- Water Quality Parameters – measuring the potential chemical, biological and physical impacts of a project;
- Hydromodification Measures – measuring the potential impact on water quality and alteration of water bodies;
- Landscape and Ecosystem Data
- Species Data
- Road Impacts Data
- Wetland Losses Measures
- Wetland Replacement Measures

The TRB’s SHRP 2 report is filled with other performance measures as they relate to NEPA requirements. Making use of these tools would not only minimize the efforts expended on crafting the responses to 355 pages of comments, but they could be anticipated before they need to be addressed during comment review. Using the House Bill 2660 guidelines for developing long-range plans based on performance measures should provide an EIS with all of the base information. Using a proactive approach to complete an EIS as described above could reduce the number of years spent in the project development process, making the overall planning process more efficient.

As for the Red Mountain Freeway EIS documents, it is difficult to speculate whether the speed with which the project developed was executed is due to a conducive political environment or an efficient planning process. Flyvbjerg's suggestion of biased forecasts did not occur on this project where population and traffic volume is concerned, for a variant of less than plus or minus 3 percent in the population projection is not significant and the overestimate in the traffic volume in both FEIS documents can only be to the commuter's advantage. Traffic volume estimates seem to have too many variables and are unpredictable when you begin to incorporate the effects gas prices, home prices, wages, and the cost of living will have on the daily shifting traffic pattern.

5.3 Measuring the Performance of the Red Mountain Freeway

This section compares the actual data to the projections cited in both FEISs. It will answer whether the projections were over- or underestimated for both the population and the traffic volumes as they were discussed in the purpose and need for the Red Mountain Freeway (Loop 202) project.

5.3.1 Population Comparison as Defined in FEIS (1994)

The MAG Transportation Plan (Updated 1991) estimated that the **population of Maricopa County will increase from 2.1 million in 1990 to 3.9 million in 2015**, representing **an 86 percent overall increase** or an **exponential growth of 2.51**. Other projections for the period between 1992 and 2015 included in the FEIS (1994) indicate

- **An 82 percent increase in population for the City of Mesa** or an **exponential growth of 2.64**;
- An 88 percent increase in trips; and
- A 128 percent increase in vehicle miles traveled. (FHWA, ADOT, & USACE, 1994, p. 1.14)

The **actual increase in population for Maricopa County** between 1990 and 2010 was **80 percent** or an **exponential growth of 2.98** (see Figure 5-1).

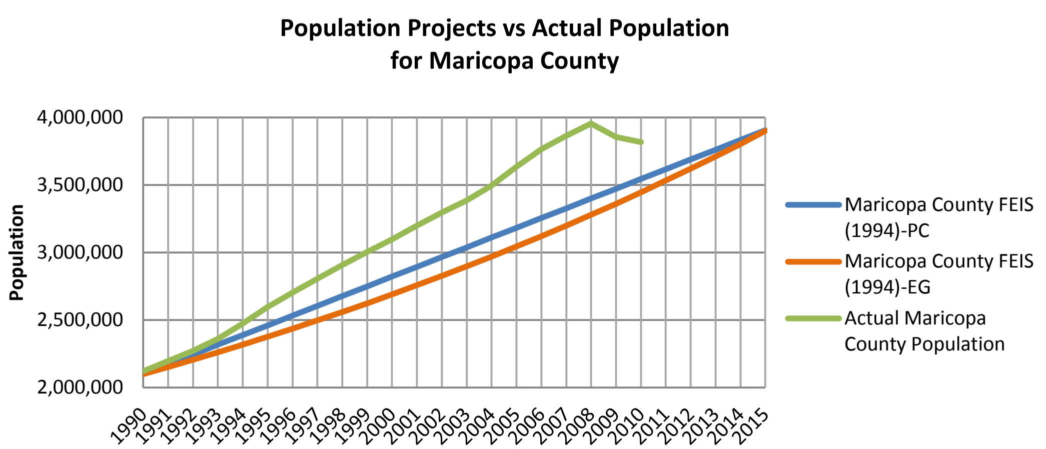


Figure 5-1: Population Growth Comparison for Maricopa County FEIS (1994)

Since the Red Mountain Freeway (Loop 202) is located almost entirely within the city limits of the City of Mesa, the population projection for the City of Mesa more accurately represents the population growth for the study area (see Figure 5-2).

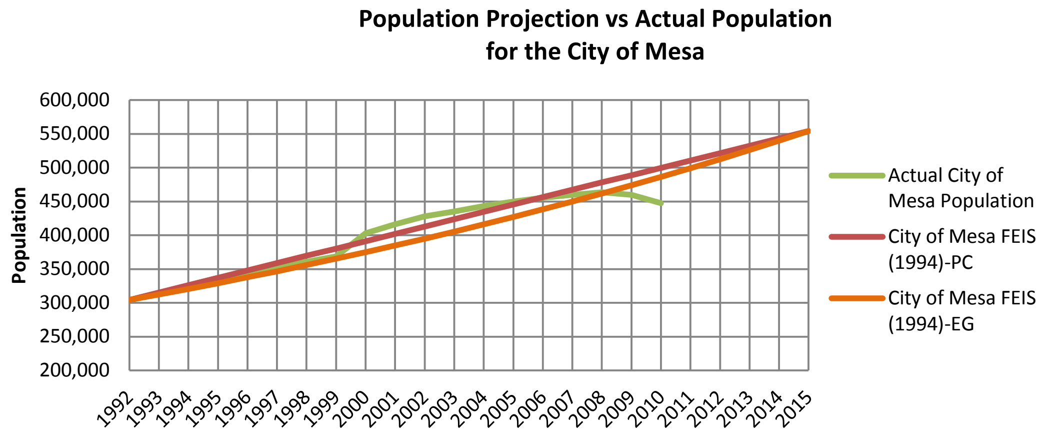


Figure 5-2: Population Growth Comparison for the City of Mesa FEIS (1994)

The **actual increase in population for the City of Mesa** between 1992 and 2010 was **47 percent** or an **exponential growth of 2.16**.

For both population estimates, the exponential growth was very close, that is, the projection for Maricopa County was underestimated by only 0.47 and the growth for the City of Mesa was overestimated by only 0.48 as shown in Table 5-1 below.

Table 5-1: Exponential Growth Comparison for FEIS (1994)

	Projected EG	**Actual EG**	**Difference**
Maricopa County	2.51	2.98	0.47
City of Mesa	2.64	2.16	-0.48

For the City of Mesa population comparison, the exponential growth curve consistently underestimates the actual population until 2008 (see Figures 5-1). When the actual population curve is compared to the linear projection, however, the distribution of under- and overestimation is more even, hence, implying that the population growth for the City of Mesa was more linear than exponential, until

2008. For Maricopa County, both the linear and the exponential growth were underestimated. In both cases, the actual population growth decline in 2008, more sharply for Maricopa County than for the City of Mesa (see Figures 5-1 and 5-2).

Assuming that the new freeway will lead to new development, an increase in employment, an increase in population and an increase in traffic, the fact that these projections parallel the actual overall growth is a testament to the planners and professionals who provided these numbers in the reference documents for the FEISs, for they not only accurately estimated the populations but also accurately forecast the impact the Red Mountain Freeway had on the City of Mesa.

5.3.2 Population Comparison as Defined in FEIS (1999)

This FEIS projected that the **county's population will reach 3.9 million by 2015**, an increase of **86 percent** or an **exponential growth of 2.51 over 25 years**, the same as in the FEIS (1994). The MAG Transportation Planning Office (MAGTPO) estimated that the **City of Mesa** with a permanent resident **population of 338,117 in 1995 will exceed 562,000 by 2015**, an increase of **66 percent** or an **exponential growth of 2.57 over 20 years**.

The **actual population increase for Maricopa County** between 1995 and 2010 was **47 percent** or an **exponential growth of 2.60 over 15 years**, reaching a population of 3,817,177 in 2010 (see Figure 5-3).

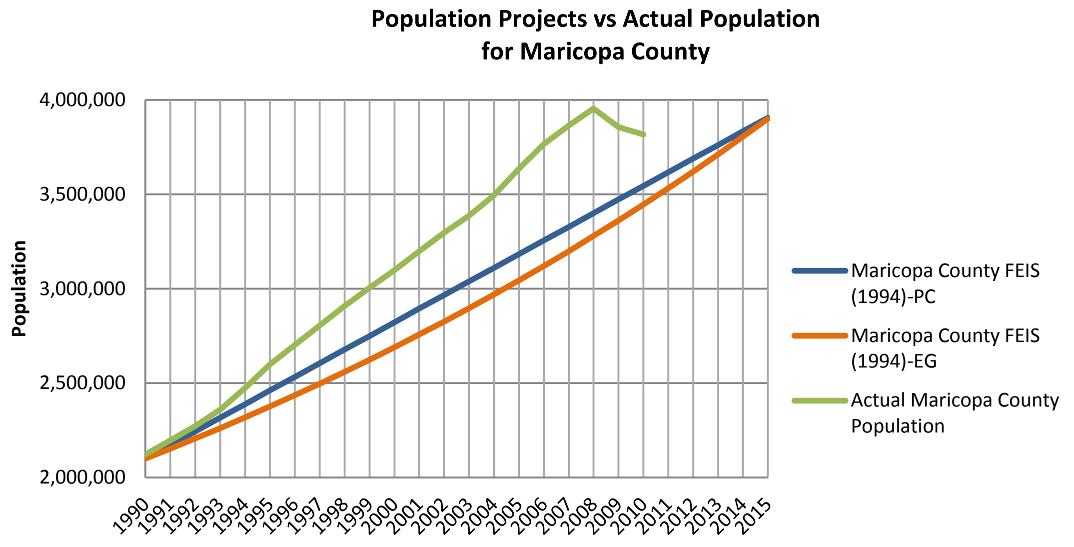


Figure 5-3: Population Growth Comparison for Maricopa County FEIS (1999)

The **actual increase in population for the City of Mesa** between 1995 and 2010 was **33 percent** or an **exponential growth of 2.87**, reaching a total population of 447,541 in 2010 (see Figure 5-4).

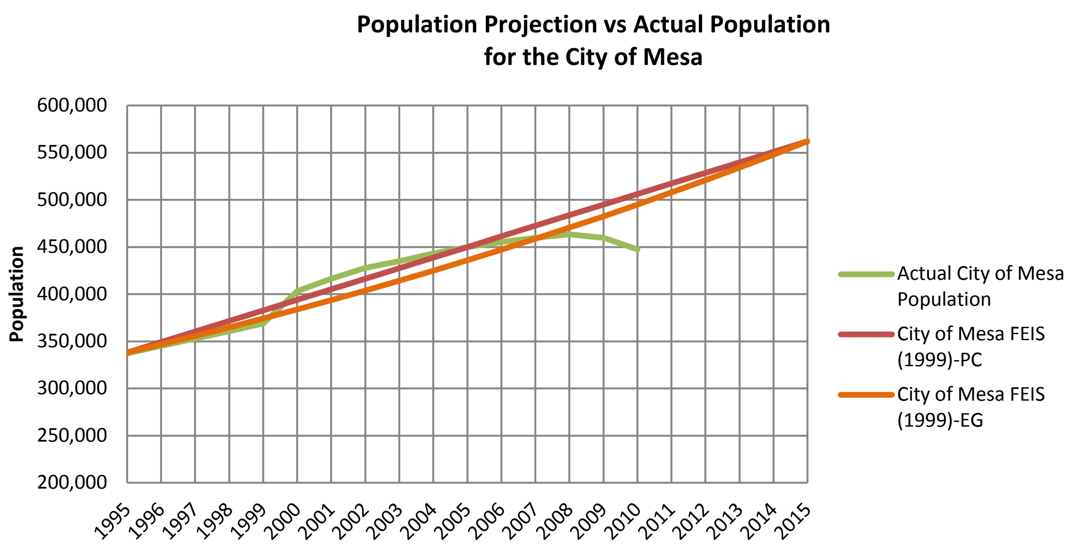


Figure 5-4: Population Growth Comparison for the City of Mesa FEIS (1999)

The population projections for Maricopa County were not adjusted for the FEIS (1999), even though, the actual population in 1995 was 2.598 million, not the projected 2.319 million (EG) or 2.461 million (PC). For the City of Mesa, although the estimated overall increase in population was reduced to 66 percent with a projected exponential growth of 2.57, the shorter timeframe of 15 years resulted in an actual exponential growth of 2.87. The actual population growth was overestimated, resulting in an overall population increase of only 33 percent. The difference between the projected and the actual exponential growth is less in the FEIS (1999), particularly for the Maricopa County estimate (see Table 5-2).

Table 5-2: Exponential Growth Comparison for FEIS (1999)

	Projected EG	**Actual EG**	**Difference**
Maricopa County	2.51	2.60	0.09
City of Mesa	2.57	2.87	0.30

It is evident that in all figures (Figures 5-1 through 5-4), the population growth comes to a halt in 2008, and actually declines. Vickner notes that "The downturn began in December 2007." (Vickner, 2009, p. 30) The fact that both, Maricopa County and the City of Mesa, continued to experience growth in population greater than expected is a good sign. The accuracy of the projected population growth, then, would validate the purpose and need for the Red Mountain Freeway project.

5.3.3 Traffic Volume Comparison as Defined in FEIS (1994)

The FEIS (1994) projected a total **traffic volume increase of 81 percent** between 1992 and 2015, starting with an existing total average traffic volume of 158,700 vehicles per day. The traffic analysis in the FEIS (1994) places the screenline north-south between Dobson and Alma School Roads. This yields the results shown in Table 5-3 below. This suggests that by 2015, 287,900 vehicles will cross over Country Club Drive on these arterial streets.

Table 5-3: Traffic Volume Comparison for FEIS (1994)

	FEIS (1994) Existing (1992) ADT	**FEIS (1994) Projected (2015) ADT**	**Actual ADT 2011**	**Actual ADT Increase from 1992 to 2011**
Red Mountain Freeway (Loop 202)	0	0	109,000	-
McDowell Road	32,000	52,400	0	-
McKellips Road	25,000	53,300	0	-
University Drive	31,300	45,800	19,700	-37.06%
Main Street	30,400	68,400	17,300	-43.09%
Broadway	40,000	68,000	30,700	-23.25%
Total	158,700	287,900	176,700	**11.34%**

McDowell Road and McKellips Road could not be calculated due to the zero values in the PC calculation. These roads were closed between Country Club Drive and Alma School Road in 1993, as the roadway became part of the right-of-way for the Red Mountain Freeway from Mesa Drive to Gilbert Road. It is also evident in Table 5-3, that the total traffic volume increase of 11.34 percent is due to Loop 202, for all arterials listed decreased in traffic volume by as much as 43 percent. In producing Table 5-3, however, I question why arterials such as Thomas Road, Brown Road, and Southern Avenue, and in particular, why US 60 was not included in the FEIS(1994) screenline analysis. Figure 5-5 below shows the location of the arterial roads, the screenline, and the ADT for both the existing traffic volume for 1992 and the projected traffic volume for 2015.

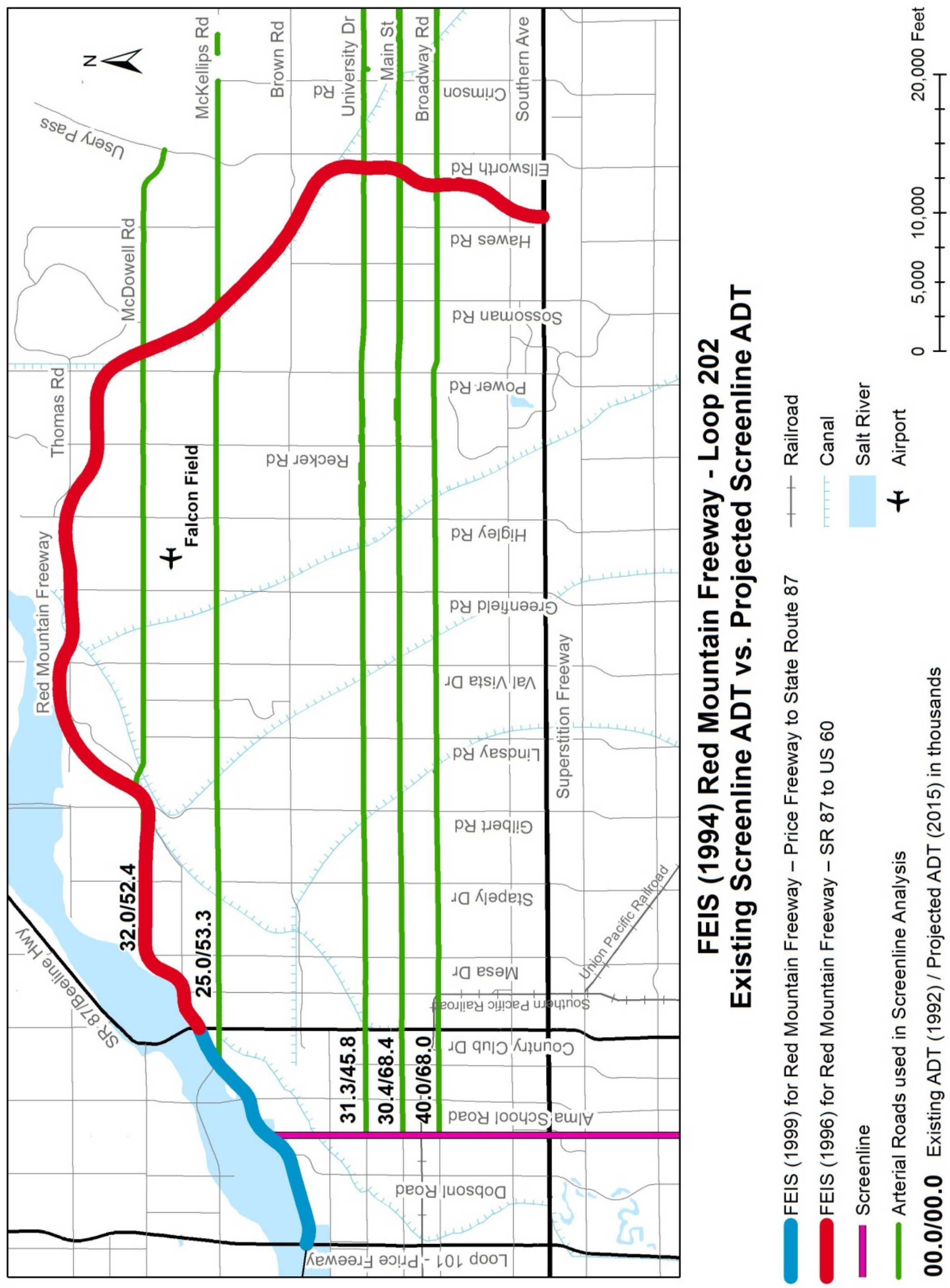


Figure 5-5: Traffic Volume Comparison for FEIS (1994)

To more clearly demonstrate the difference between the actual and the projected traffic volumes, the graph below shows a yearly comparison (see Figure 5-6).

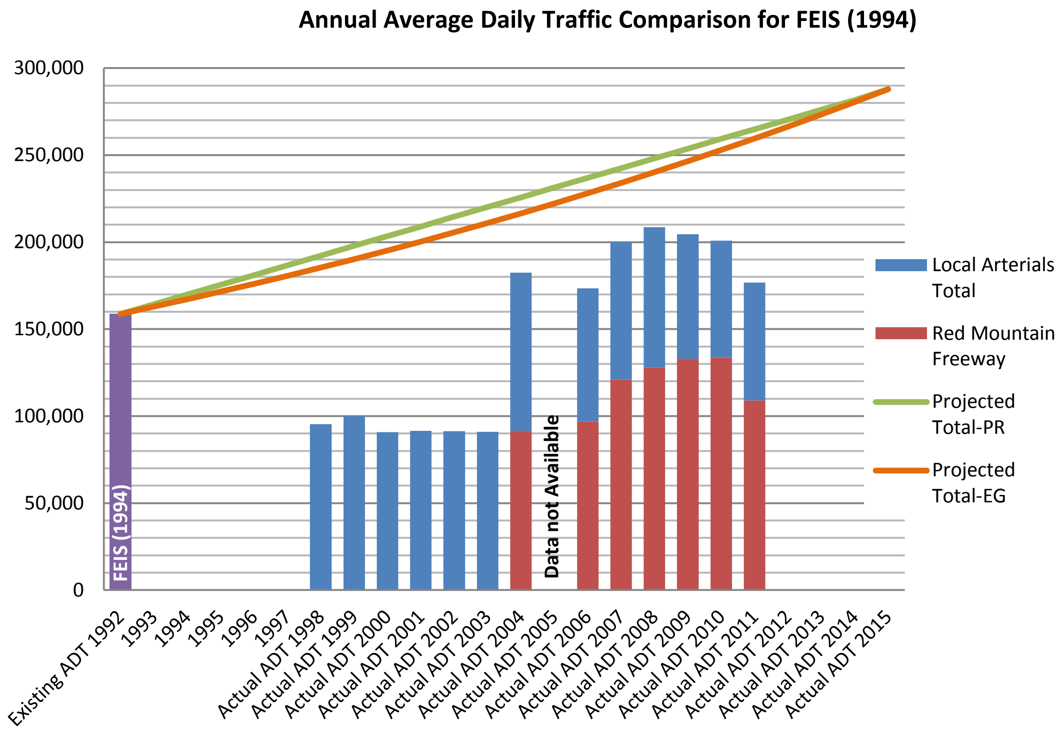


Figure 5-6: ADT Comparison for FEIS (1994)

The actual **increase in total traffic volume from 1992 to 2011 of 11.34 percent** is nowhere near the projected 81 percent. With that said, Figure 5-6 shows a marked increase in traffic volume across the screenline when the Red Mountain Freeway segment from Gilbert Road to Higley Road opened in 2003. In fact, Loop 202 in 2004 accounts for half of the total traffic volume (91,500 vehicles per day). The actual total local arterials traffic volume attained an ADT of 90,900 in 2004 and declined to 67,700 by year 2011. This decline, although affected by the opening of Loop 202, also reflects the decline in population, for the overall traffic volume begins to decrease, having peaked at an ADT of 208,500 in 2008.

5.3.4 Traffic Volume Comparison as Defined in FEIS (1999)

The traffic analysis presented in the FEIS (1999) shows traffic volume maps that extend to just past Country Club Drive (SR 87), and therefore do not include Dobson and Alma School Roads, the location of the screenline for the FEIS (1994). The screenline for this comparison is located between Mesa Drive and Country Club Drive (SR 87). In addition, the traffic volume projections in this FEIS (1999) are discussed in in level-of-service performance measures. The discussion below first covers the ADT, then the LOS.

1. The basis for the need of the project is the projected population increase and a projected **daily traffic volume increase of 81 percent by 2015** referenced in the *Red Mountain and Santan Corridors, Major Investment Study* by MAG, 1996, the *Mesa Transportation Study* by the City of Mesa in 1982, and the *Eastside Transportation Analysis* by the City of Mesa in 1984. Comparing the projected, freeway condition [Figure 1-4 in the FEIS (1999), p. 1-9] (knowing that the freeway was built) to the actual daily traffic volume produces the results show in Table 5-4, an actual increase of 89.30 percent.

Table 5-4: Traffic Volume Comparison for FEIS (1999)

	FEIS (1999) Existing (1996) ADT	**FEIS (1999) Projected (2020) ADT**	**Actual ADT 2011**	**Actual Increase**
Red Mountain Freeway (Loop 202)	0	103,400	109,000	-
McDowell Road	1,800	7,000	900	-50.00%
McKellips Road	40,000	45,800	33,300	-16.75%
University Drive	27,100	34,900	30,700	13.28%
Brown Road	33,000	23,400	19,000	-42.42%
Total	**101,900**	**214,500**	**192,900**	**89.30%**

The change in traffic volume for the Red Mountain Freeway (Loop 202) could not be computed due to a zero value in the PC calculation. The actual **increase in total traffic volume from 1996 to 2011 is 89.30 percent**, well above the projected 81 percent. All local arterials decreased in traffic volume by as much as 50 percent, except for University Drive, which increased its traffic volume by 13.28 percent.

2. The *Eastside Transportation Analysis* used a Level-of-Service (LOS) analysis and projected an LOS F by year 2015, suggesting that the traffic conditions of major arterial streets will operate at high traffic volumes and under congested and overloaded conditions. (FHWA, ADOT, & USACE, 1999, p. 1.3) Using a current Highway Capacity Software v5.3 for LOS planning, the criteria assume that:

    - 65 mph is free-flow speed;
    - 5% of traffic is heavy vehicles in peak hour;
    - 3% of traffic is buses/RV's in peak hour;
    - The terrain is level; and
    - There is a 60/40 directional split in peak hour.

For a six-lane highway, this would rate the level-of-service as shown in Table 5-5.

Table 5-5: Level-of-Service for a Six Lane Highway

Level-of-Service	ADT Range (veh/day)
A	< 35,000
B	35,000 – 56,000
C	56,000 – 81,000
D	81,000 – 103,000
E	103,000 – 118,000
F	> 118,000

As a planner, it is the goal to design a transportation facility that will operate at an LOS C. With an estimated average daily traffic volume of 103,400 by 2020, the Red Mountain Freeway was designed to operate at LOS E, suggesting that the average daily traffic volume during peak hours would exceed 103,000 vehicles per day. In fact, the traffic volume for the freeway reached LOS D, or 91,500 vehicles per day in 2004, the same year the segment from Gilbert Road to Higley Road opened. One should also note that at an actual ADT of 109,000 in 2011, Loop 202 is currently operating at an LOS E.

The screenline analysis presented in the FEIS (1999) uses McDowell Road, McKellips Road, Brown Road and University Drive as a representative east-west corridor sample, as show in Figure 5-7. Placing the screenline north-south between Mesa Drive and Country Club Drive to match the FEIS (1999), the existing and the projected ADT's are shown below. One should also note that this graphic represents a timeframe from 1996 to 2020 (see Figure 5-8).

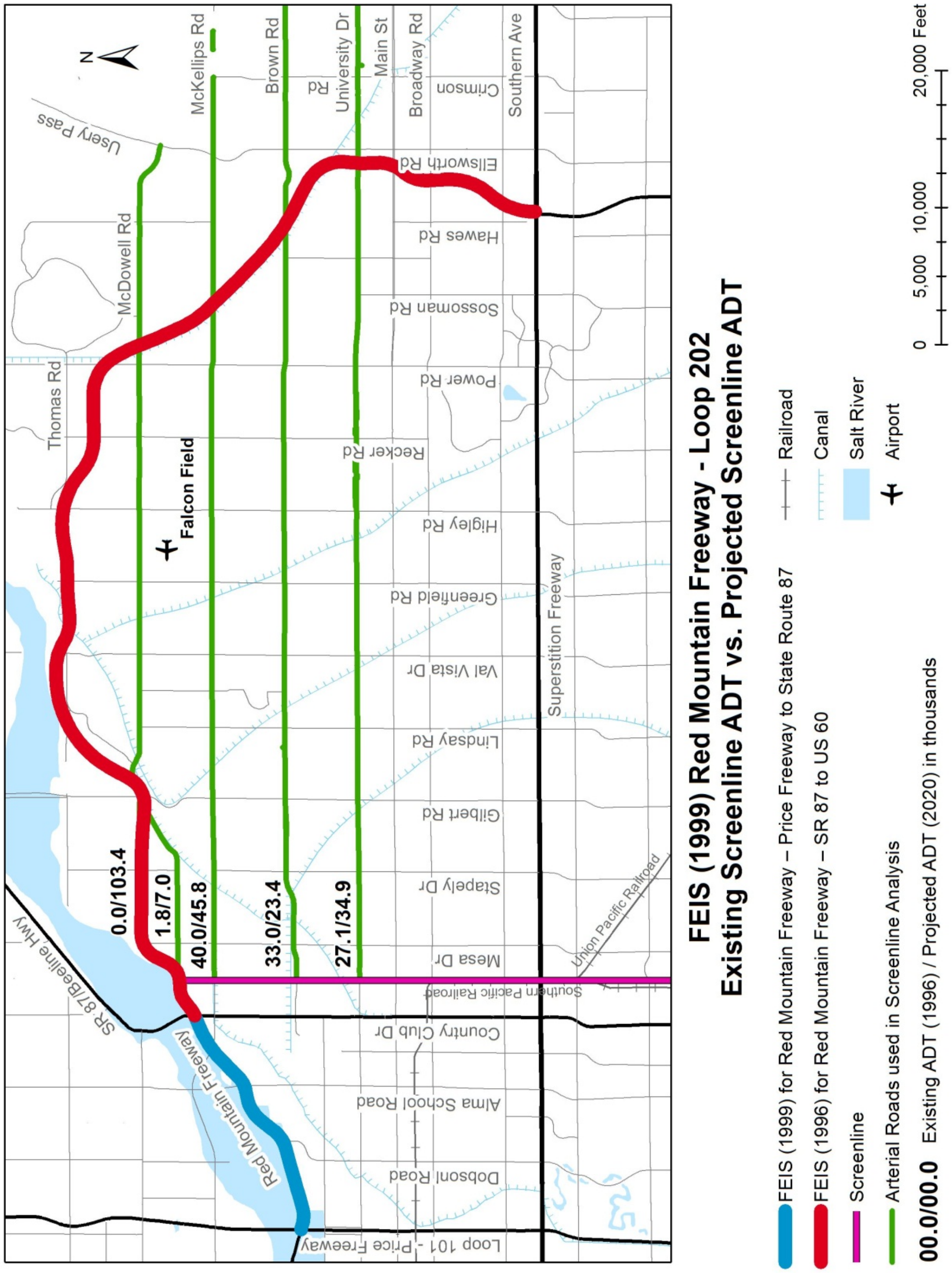


Figure 5-7: Traffic Volume Comparison for FEIS (1999)

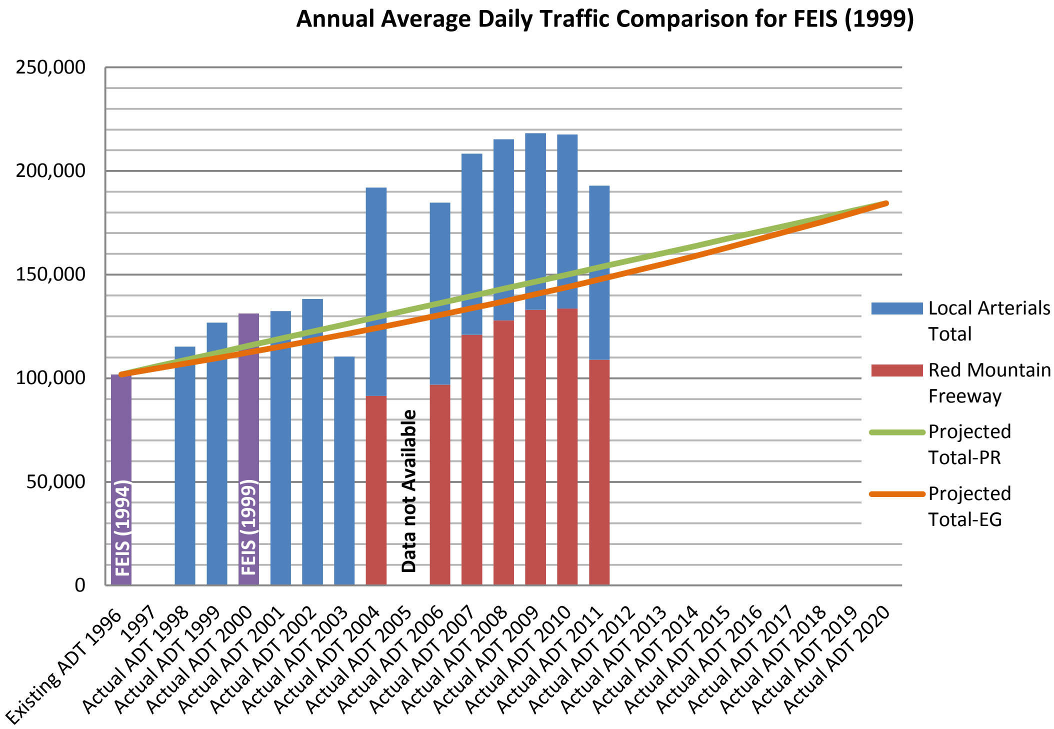


Figure 5-8: ADT Comparison for FEIS (1999)

What a difference moving the screenline from between Alma School and Dobson Road to Mesa and Country Club Drive can make. Or are the results so different due to the east-west local arterials included in this traffic analysis? Perhaps, the FEIS (1999) timeframe of 1996 to 2020 when compared to the FEIS (1994) timeframe of 1992 to 2015, had such a dramatic effect? Regardless, the **actual increase in ADT from 1996 to 2011 is 89.30 percent**, above the projected 81 percent.

It is clear that the projected traffic volume was exceeded by the time Loop 202 opened as seen in Figure 5-8. The actual total ADT certainly exceeds the projected total traffic volume trend line, even during the decreasing traffic volume years starting in 2009. With the opening of the Red Mountain Freeway segment from Gilbert Road to Higley Road in 2003, Figure 5-8 suggests that most of the traffic volume on the local arterials remained on the local streets, supported by the fact that the ADT for University Drive increased by 13.28 percent. The traffic volume for Loop 202, then, can be considered as induced demand, possibly originating from Apache Junction, Gilbert, or Queen Creek.

5.3.5 Adjusted Traffic Volume Comparison

I would be remiss if I did not provide a traffic volume comparison for the entire east-west roadway network that includes the US 60 and all of the local arterials. The following comparisons are similar to sections 5.3.3 Traffic Volume Comparison as Defined in FEIS (1994) and 5.3.4 Traffic Volume Comparison as Defined in FEIS (1999), except that all arterials between McDowell Road and Southern Avenue, and the US 60 are included in the traffic analysis, keeping the screenline location north-south between Dobson and Alma School Road for FEIS (1994) and north-south between Mesa Drive and Country Club Drive for FEIS (1999).

The FEIS (1994) projected a total traffic volume increase of 81 percent. The adjusted traffic volume comparison for the FEIS (1994) resulted in the values provided in Table 6-1. These values show the traffic volumes for the local arterials did decrease by an average of approximately 30 percent, except for Southern Avenue, the traffic volume for US 60 more than doubled, and the traffic volume for the entire east-west network increased by 40 percent.

Table 5-6: Adjusted Traffic Volume Comparison for FEIS (1994)

	FEIS (1994) Existing (1992) ADT	FEIS (1994) Projected (2015) ADT	Actual ADT 2011	Actual Increase
Red Mountain Freeway (Loop 202)	0	0	109,000	-
McDowell Road	32,000	57,920	0	-
McKellips Road	25,000	50,499	0	-
Brown Road	20,000	40,447	13,300	-33.50%
University Drive	31,300	61,540	19,700	-37.06%
Main Street	30,400	46,698	17,300	-43.09%
Broadway Road	40,000	63,893	30,700	-23.25%
Southern Avenue	30,000	60,271	35,000	16.67%
US 60	112,000	227,015	224,500	100.45%
Total	**320,700**	**580,467**	**449,500**	**40.16%**

The traffic volume for US 60 did not decrease as was projected in the purpose and need of the FEIS (1994). The graph illustrates how the US 60 affects the traffic volume analysis (see Figure 6-1).

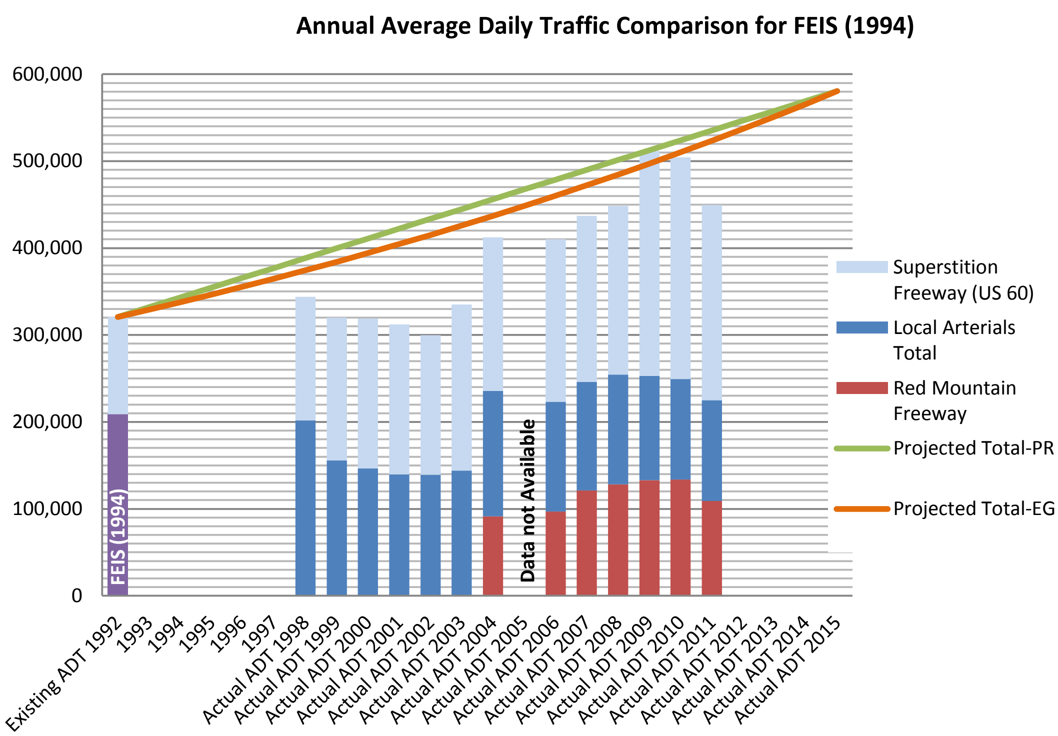


Figure 5-9: Adjusted ADT Comparison for FEIS (1994)

The sum of the local arterials, the Red Mountain Freeway and US 60 provided a new starting point for the linear 81 percent traffic volume projection and the EG projection curve. The total traffic volume does fall under both projections, coming close in 2009, then, trailing off. The economic downturn in 2008, however, did not seem to have an effect on the total traffic volume until after 2009.

One would expect the results for the FEIS (1999) adjusted traffic volume analysis to be similar, especially when given the same projected traffic volume increase of 81 percent. They are in that the total traffic volume for the local arterials decreased as well, except in this case, for University Drive instead of Southern Avenue. The traffic volume for US 60 increased, except not as dramatically as in Table 5-6 (see Figure 5-10). The graph, however, clearly illustrates what a time shift of five years can do. Here, the projected EG curve more closely reflects the actual traffic volume for the entire system, trailing off in 2010 rather than in 2009. The traffic volume for the Red Mountain Freeway seems to be in addition to the entire system and does not produce the relief in traffic on the US 60 as anticipated in the EIS (1999) goals.

Table 5-7: Adjusted Traffic Volume Comparison for FEIS (1999)

	FEIS (1999) Existing (1996) ADT	**FEIS (1999) Projected (2020) ADT**	**Actual ADT 2011**	**Actual Increase**
Red Mountain Freeway (Loop 202)	0	103,400	109,000	-
McDowell Road	1,800	3,258	-	-50.00%
McKellips Road	40,000	45,800	33,300	-16.75%
Brown Road	33,000	23,400	19,000	-42.42%
University Drive	27,100	34,900	30,700	13.28%
Main Street	38,000	68,780	19,700	-48.16%
Broadway Road	37,800	68,418	23,400	-38.10%

	FEIS (1999) Existing (1996) ADT	FEIS (1999) Projected (2020) ADT	Actual ADT 2011	Actual Increase
Southern Avenue	32,100	55,934	27,300	-14.95%
US 60	135,000	235,238	227,400	68.44%
Total	**344,800**	**639,128**	**489,800**	**42.31%**

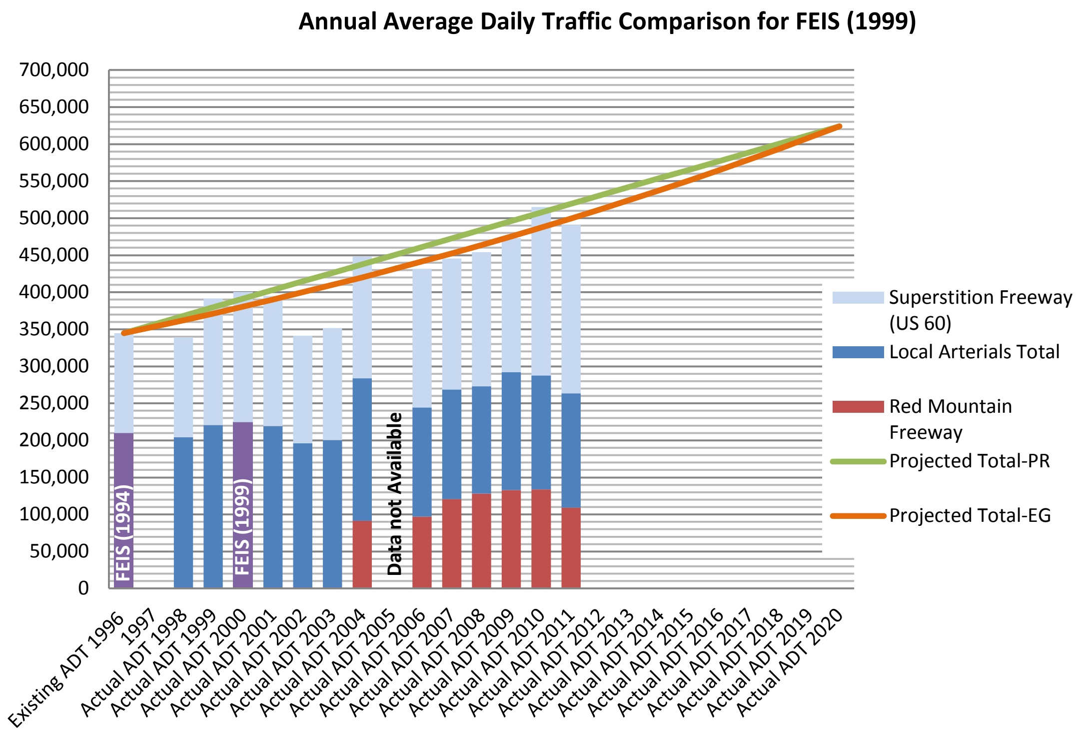


Figure 5-10: Adjusted ADT Comparison for FEIS (1999)

5.3.6 Project Costs Analysis

ISTEA requires metropolitan areas to undertake investment studies that will evaluate the cost effectiveness of a major transportation investment, among other requirements. It was determined within the FEIS (1994), that the "cost effectiveness of the Red Mountain Freeway between Price Freeway and State Route 87 has been compared to other major highway projects, and the cost per VMT of this portion of the Red Mountain Freeway was found to be lower than average, which is representative of both efficient construction and projected high volume use." (FHWA, ADOT, & USACE, 1994, p. 1.21)

The TRB defines the cost measure as a factor that should reduce the incidence of cost variability, that is, change in cost estimates during the project development process should not occur. (TRB, 2009, p. 61) As shown in Table 5-8, Loop 202 did not fare well in meeting project budget. For example, the cost estimate for the segment of Gilbert Road to Higley Road in the FEIS (1999) is $91.2 million (adjusted) while that same segment in the RTP (2003) is estimated at $42.7 million (adjusted) and in the RTP (2006) at $35.2 million (adjusted). The challenge among these documents is to ensure that the cost estimates compare the same types of costs, costs that can include design, right-of-way acquisition, and construction costs, or any combination of the three. To ensure that the same costs are compared, the projected cost estimates discussed in the individual documents (which are not itemized, only totals given) are matched with the actual, bid costs, which, fortunately were itemized. Thus, the FEIS (1999) includes all three costs while the RTPs include construction costs only. However, it is unclear why the RTP (2006) lowered the construction costs for this segment when compared to the RTP (2003).

Table 5-8: Cost Comparison

Description	**Projected Cost Estimate (millions)**	**Cumulative Inflation Factor**	**Adjusted Cost Estimate [6] (millions)**	**Actual Cost (millions)**	**Cost Overrun (percent)**
FEIS (1994) Price Freeway to State Route 87 [1] [5]					
• Price Freeway to Dobson	$ 37.4	7.5%	$ 40.2		
• Dobson Road to SR 87	$ 22.6	12.5%	$ 25.4		
Total	**$60.0**		**$65.6**	**$94.6**	**44.2%**
FEIS (1999) State Route 87 to US 60 [2]					
• SR 87 to Gilbert	$ 60.6	4.1 %	$ 63.1	$ 105.2	66.7%

Description	Projected Cost Estimate (millions)	Cumulative Inflation Factor	Adjusted Cost Estimate [6] (millions)	Actual Cost (millions)	Cost Overrun (percent)
• Gilbert Road to Higley	$ 86.3	5.7 %	$ 91.2	$ 85.1	-6.7%
• Higley Road to Power	$ 89.7	9.9 %	$ 98.6	$ 36.1	-63.4%
• Power Road to Baseline	$197.8	16.3 %	$ 230.0	$ 332.6	44.6%
Total	**$ 434.4**		**$ 482.9**	**$ 559.0**	**15.8%**
RTP 2003 [4]					
• Price Freeway to Gilbert	$ 51.0	0 %	$ 51.0	$124.5	144.1%
• Gilbert Road to Higley	$ 42.0	1.7%	$ 42.7	$ 59.3	38.9%
• Higley Road to US 60	$ 85.0	12.3%	$ 95.5	$ 330.3	245.9%
Total	**$ 178.0**		**$ 189.2**	**$ 514.1**	**171.7%**
RTP 2006 Update [3]					
• Price Freeway to Gilbert	$ 46.0	-9.0 %	$ 41.9	$124.5	197.1%
• Gilbert Road to Higley	$ 38.0	-7.3 %	$ 35.2	$ 59.3	68.5%
• Higley Road to US 60	$77.0	6.1 %	$ 81.7	$ 330.3	304.3%
Total	**$ 161.0**		**$ 158.8**	**$ 514.1**	**223.7%**

Source: (ADOT, 2001, p. 2.37), (ADOT, 1999, p. 2.28), (MAG, 2006, p. 5) and (MAG, 2003, p. 79)

Notes: (1) Construction costs are pending final selection of alternative, are estimated in 1992 dollars, and include construction and acquisition costs.
(2) Construction costs estimates are in 1997 dollars, and include construction, design, and acquisition costs.
(3) Construction costs estimates are in 2006 dollars, are for the construction of general purpose lanes only, and include construction costs only.
(4) Construction costs estimates are in 2002 dollars, are for the construction of general purpose lanes only, and include construction costs only.
(5) Only cost totals can be compared because the project phasing between the FEIS (1994) and the actual construction of the freeway do not match.
(6) Adjusted costs are costs adjusted to the construction year using an inflation factor according to the methodology outline in section 4.4.

As for the conclusions reached by Flyvbjerg on cost estimates, the difference between the actual costs and the adjusted cost estimates in all instances is the result of gross underestimation. Table 5-8 shows an average total cost overrun of 114 percent, with the Higley Road to US 60 segment as having the highest budget overrun of 223.7 percent. In Flyvbjerg's research, he found that 9 out of 10 transportation projects were underestimated and the actual construction costs were on an average of 20 percent higher than estimated. He also concludes that this underestimation occurs globally, that technology and time have not improved the estimation process, and that underestimating transportation infrastructure costs is a strategic misrepresentation. (Flyvbjerg, Holm, & Buhl, 2005, p. 290)

5.4 Comments

The biggest surprise in both FEISs is the fact that the purpose and need stated as a goal a reduction in traffic volume on US 60. But, traffic volume data for US 60 was not included in either FEIS (1994 or 1999) traffic analysis. Reasons for selecting the local arterials included in the screenline analysis were also not discussed by either FEIS, for the screenline moved from between Dobson Road and Alma School Road in the FEIS (1994) to between Mesa Drive and Country Club Drive in the FEIS (1999).

Discussing the cost estimates proves to be a challenge simply because the documents are not consistent in what costs are actually included in the estimate, and the actual costs incurred were not readily available. Through personal contacts, I was able to obtain the final contractor bids which, fortunately, itemized the costs into the design, right-of-way acquisition, and construction costs, so that the cost estimates as presented in the FEIS and RTP documents could be matched (see Table 5-6). See Appendix C for the actual contractor bids.

6 CONCLUSIONS

In taking a look at the FEIS (1994), it is evident that the NEPA process was not all-inclusive as it is today, for no RTP was referenced in the EIS, only the *Mesa Transportation Study* published by the City of Mesa. By the time the FEIS (1999) was published, the NEPA process was in full swing and the guidelines to complete an EIS enforced.

The difficulties in the analysis presented include:

- The FEIS documents do not use the same timeframe for their population and traffic volume projections;
- The FEIS documents do not use the same north-south screenline and local arterials in their traffic volume analysis;
- The screenline analysis for the FEIS (1994) includes McDowell and McKellips Road closures, possibly skewing the actual total ADT increase result of 11.34 percent; and
- The actual data does not go beyond 2010 for the population and 2011 for the traffic volume, possibly altering the original growth estimates.

Despite these difficulties, however, the graphs shown in Figure 5-6 and 5-8 provide an interesting illustration of the effects the Red Mountain Freeway had on the traffic volumes of the local arterials.

It is important to point out that these FEIS documents were not intended for comparison. However, efforts should be made toward a comprehensive discussion that includes reasons for selecting the local arterials used in their traffic analysis, especially when these facts are discussed as a primary goal of the FEIS. In general, then, if we are to use FEIS documents as tools for future or related analyses, we need to develop some type of process that will solve issues of inconsistency and allow for performance measures analysis across multiple transportation systems and environmental documents.

As I see it and as with any other collaboration, information sharing process, standards need to be set; standards in

- The units of analysis for each application, i.e. traffic volume analysis, loss of habitat, greenhouse gas emissions, and the many other measures that are incorporated in an EIS document or document that will be referenced in an EIS;
- Document requirements based on scope;
- How information is to be provided and shared, including sources and accuracy of the data;
- Interoperability of tools used in the EIS analyses;
- Defining the function of each stakeholder so processes are not repeated;
- Legal agreements and set guidelines as stakeholders contribute to the project; and
- A documented and set project schedule and workflow.

Only then can comparisons, using such performance measures as defined by the Transportation Research Board in their *Performance Measurement Framework for Highway Capacity Decision Making* guidelines, between projected to actual be made and the transportation planning process be evaluated. Only then can policies serve to streamline and improve the efficiency of this planning process and perhaps minimize the negative influence of political issues and funding. The House Bill 2660 provides a good start toward this effort.

6.1 Red Mountain Freeway (Loop 202) Project Goals

The goals defined in the purpose and need for both FEIS documents share the need to construct a new freeway that will relieve traffic congestion on local arterials and the US 60, and connect Mesa to the regional freeway system to meet the traffic volume demands as they were projected.

Did the Red Mountain Freeway project meet the goals as defined in the FEIS document? It is hard to say, for both FEIS documents agreed on the project goals of relieving traffic congestion on existing east-west local arterials, relieving congestion on US 60, and connecting the City of Mesa to the regional freeway system. We then must ask; did the Red Mountain Freeway relieve traffic congestion on local arterials? Both, Tables 5-3 and 5-4 show that the local traffic volume on local arterials decreased, suggesting, then, that local arterial traffic volume decreased due to the Red Mountain Freeway. Even the adjusted traffic volume comparison tables show a decrease in traffic volume for the local arterials, for the most part (see Tables 5-6 and 5-7). As for the reasons why the US 60 was not included in the FEIS screenline analysis, and the remaining east-west arterials, for that matter, may have come to light. Including the US 60 in the analysis would have contradicted the purpose and need to build the Red Mountain Freeway to reduce US 60 traffic. So, did the Red Mountain Freeway relieve local east-west arterial traffic congestion? Yes, the total traffic volume for the local arterials did decrease. No, the total network traffic volume did not decrease. Did Loop 202 relieve traffic volume on US 60? No, it did not. I would venture to say that the widening of US 60 generated its own induced demand much like the opening of Loop 202.

Did the Red Mountain Freeway connect the City of Mesa to the regional freeway system? Yes, the Red Mountain Freeway (Loop 202) allows you to connect to I-10 and I-17, major interstates that service the entire state of Arizona and beyond, both north-south and east-west directions.

Did the Red Mountain Freeway meet the traffic volume demands as they were projected? This question is a bit more difficult to answer, for the average daily traffic began to exceed the projected total traffic volume by 2004 for FEIS (1999) as shown in Figure 5-8, but was well under the projected total traffic volume for FEIS (1994) as shown in Figure 5-6, and remained under the projected total traffic volume in the adjusted traffic analysis shown in Figures 6-1 and 6-2. It would seem that lowering the starting point of the projected traffic volume trend line from existing ADT in 1992 of 158,700 to the existing ADT in 1996 of 101,900, a difference of 56,800 vehicles per day, had an impact.

If we use LOS to answer this question, then, no, the Red Mountain Freeway did not meet the projected traffic volume demand. The actual 2011 ADT of 109,000 receives a system LOS E. To meet this traffic volume, the Red Mountain Freeway would have had to have been built as an 8-lane freeway, where an LOS of C ranges from 84,000 to 121,000 vehicles per day. This fact accounts for the widening project for Loop 202 that started in 2005.

Did Loop 202 meet the goals as defined in the EIS purpose and need? The Red Mountain Freeway did meet four out of the five project goals, giving it an academic score of 80 percent.

6.2 Research Questions Answered

Were the population and traffic volume projections, and the forecasted project costs consistent among the documents? As defined in both FEIS documents, the population projections and the traffic volume projections did not remain consistent in timeframe, projections and traffic volume analysis. Both documents have the same population projection of 86 percent for Maricopa County and 82 percent for the City of Mesa, but, these projections cannot be easily compared due to the adjusted timeframe. The traffic volume projection of 81 percent in both FEIS documents may seem the same, except the FEIS (1999) document shifted that projection by five years and lowered the starting point to the existing actual ADT for 1996. The cost estimates also were not the same between the documents. For that matter, they were not consistent among any of the documents, including the RTPs. This is not a bad thing, for the TRB's SHRP 2 specifically states that "it is important to examine project costs early and often", but does not provide specific tools or guidance on how to estimate project costs. (TRB, 2009, p. 60)

Were the forecasted numbers accurate and to what degree? Well, surprisingly, the population growth numbers, when projected as exponential growth, are all within two to three percent of each other. They are also consistent between the FEIS documents, although, the differences in timeframes proved to be a challenge. A summary of the calculated exponential population growth is shown in Table 6-1.

Table 6-1: Comparison of Actual and Projected Population Growth

		Exponential Growth
FEIS (1994)	Projected for Maricopa County 1990-2015	2.51
	Actual for Maricopa County 1990-2010	2.98
	Projected for the City of Mesa 1992-2015	2.64
	Actual for the City of Mesa 1992-2010	2.16
FEIS (1999)	Projected for Maricopa County 1990-2015	2.51
	Actual for Maricopa County 1995-2010	2.60
	Projected for the City of Mesa 1995-2015	2.57
	Actual for the City of Mesa 1995-2010	2.87

One would expect then, that if the population projections are accurate, so would the traffic projections. However, the traffic volume on the Red Mountain Freeway was underestimated by quite a bit, especially as illustrated in Figure 5-8, where with the opening of Loop 202, almost all the local arterial traffic volume was added to the freeway. Where did all this traffic come from? Loop 202 immediately operates at a congested, inefficient level, and represents a perfect case for induced travel demand, especially when level-of-service is the basis for analysis. I cannot conclude that the traffic projections were inaccurate, for the actual traffic volume was overestimated by 70 percent in the FEIS (1994) and underestimated by 8 percent in the FEIS (1999), and overestimated in both the adjusted analysis by 40 percent in section 6.1. I do, however, agree with Flyvbjerg who concluded that “for road projects, the two most often stated causes for inaccurate traffic forecasts are uncertainties about trip generation and land-use development.” (Flyvbjerg, Holm, & Buhl, 2005, p. 140)

I believe that a road project, in this case, the Red Mountain Freeway, must be analyzed on a larger scale. The FEISs for this project selected the City of Mesa for its area of analysis simply because the freeway lies almost entirely within the City of Mesa city limits. However, because the Red Mountain Freeway is part of the Regional Freeway System, should the study area not incorporate the entire system when projecting traffic volume. At the minimum, should not traffic volumes from Mesa, Apache Junction, Gilbert and Chandler be part of the analysis? The project goal of reducing local arterial road congestion was met and the traffic rerouted to the Red Mountain Freeway. Why are we then surprised that the induced traffic volume exceeds the forecasted traffic volume?

Are the estimated cost projections for the Loop 202 segments accurate when compared to actual costs? Unfortunately, this is where the accuracy of forecasting for the Red Mountain Freeway project goes south, for not only did the FEISs (1994 and 1999) underestimate the project costs, the costs estimates were just plain wrong. We can only speculate as to the reasons for an average project overrun of 48 percent. News headlines claim that an increase in land prices added to freeway costs. General contractors blame the increases in higher material and fuel costs. Planners focus on unforeseen costs such as removing an old materials mining operation from the path of the Red Mountain Freeway, requiring "explosives to remove more than 20 years of concrete slag, left over from cleaning out cement trucks." (Wendel, 2002, p. 1) Flyvbjerg, Holm and Buhl, accuse cost estimators of using "deception and lying as tactics in power struggles aimed at getting projects started and at making a profit". (Flyvbjerg, Holm, & Buhl, 2002, p. 290) Whatever the reasons, the process of estimating costs for a major transportation project needs to be reviewed, restructured and revised.

Did the Red Mountain Freeway (Loop 202) meet project goals? Yes, I believe they did. Hence, the Red Mountain Freeway as defined in the FEISs and analyzed using the ADT and LOS performance measures discussed by the TRB can be considered a success.

Finally, **would the cost for the Red Mountain Freeway be justified among potential investors and tax payers?** I cannot speak for other tax payers and investors, but have observed that development along the Red Mountain Freeway was booming until 2007, as in the examples of the Tempe Market Place and Riverview. I also believe that the commuter time-savings for east-valley residents is tremendous, considering the alternatives.

On a personal note, I feel that the Red Mountain Freeway is money well spent. My commute to work used to take 45 to 60 minutes each way. Now, I am able to get to work in 25 to 35 minutes, saving me up to an hour a day. Yes, I do carpool and am able to use the HOV lane. Mass transit is not an option for it would take me more than 90 minutes to get to work. Who has that kind of time? Perhaps, this is my answer. Employment is west toward Tempe, Scottsdale, and the City of Phoenix. The Red Mountain Freeway provides the quickest way to go west and everyone in Mesa and perhaps in the east valley is taking advantage of that time savings and convenience. Even under congested conditions, the freeway is quicker than the local arterials. I may change my mind once the traffic volume catches up to the projections.

BIBLIOGRAPHY

Transportation Performance Measures. (2002, November 1). *ITE Journal, 72*(11), 48-49.

Arizona Indicators. (2011, November 7). (Morrison Institute for Public Policy) Retrieved November 7, 2011, from Inflation: http://arizonaindicators.org/content/inflation

94th Arizona Town Hall. (2009). *From Here to There: Transportation Opportunities for Arizona.* Arizona State University, School of Geographical Sciences, School of Planning, School of Sustainability. Tempe: Arizona State University.

ADOT. (1994). *Final Environmental Impact Statement.* Phoenix: Arizona Department of Transportation.

ADOT. (1999). *Red Mountain Freeway (Loop 202) - SR 87 to US 60 Final Environmental Impact Statement/Section 4(f) Evaluation.* Phoenix: Arizona Department of Transportation.

ADOT. (2001, February). Red Mountain Construction Update. Arizona, Maricopa: Arizona Department of Transportation.

ADOT. (2004). *Move AZ - Long Range Transportation Plan.* Oakland: Cambridge Systematics, Inc.

ADOT. (2006). *Categorical Exclusion and Environmental Determination - Completion Guidelines and Format.* Phoenix: Arizona Department of Transportation.

ADOT. (2010, October 26). *Multimodal Planning Division*. Retrieved 20 2011, February, from Average Annual Daily Traffic (AADT): http://www.azdot.gov/mpd/data/aadt.asp

ADOT. (2011, January 31). *Regional Transportation Plan Freeway Program - Major Status Report*. Retrieved 12 2011, October, from Arizona Department of Transportation: http://www.azdot.gov/Highways/VPM/PDF/RTPFP_Major_Proj_Stat_Rpt_Jan_2011.pdf

APA. (2010, February). News Briefs. *Planning, 76*(2), p. 5.

Bacon, J. (2006, October 1). Intelligent Transportation Systems. *IEEE Pervasive Computing, 5*(4), 63-67.

Bartlett, A. A. (2000, November 18). *Minnesotans For Sustainability.* Retrieved February 4, 2011, from Population Myths: http://www.mnforsustain.org/bartlett_a_population_myths_minnesota.htm

Behbahani, H. (2009, June 1). Presentation of Land-Use and Traffic Efficiency Assessment. *Journal of Environmental Engineering and Landscape Management, 17*(2), 1A-1i.

Bittner, J., & Rosen, H. (2004, January 1). Transportation Asset Management Overview. *Public Works Management & Policy, 8*(3), 151-155.

Boame, A. (2004, September 1). The Technical Efficiency of Canadian Urban Transit Systems. *Transportation Research. Part E, Logistics and Transportation Review, 40*(5), 401-416.

Cervero, R. (2003, Spring). Road Expansion, Urban Growth, and Induced Travel. *Journal of the American Planning Association, 69*(2), 145-162.

Cervero, R., & Hansen, M. (2002). Induced Travel Demand and Induced Road Investment. *Journal fo Transport Economics and Policy, 36*(3), 469-490.

Chen, A., Yang, C., Kongsomsaksakul, S., & Lee, M. (2007, September 1). Network-based Accessibility Measures for Vulnerability Analysis of Degradable Transportation Networks. *Networks and Spatial Economics, 7*(3), 241-256.

Chen, C., Jia, Z., & Pravin, V. (2001, December 01). Causes and Cures of Highway Congestion. *IEEE Control Systems, 21*(6), 26-32.

Department of Transportation. (2010, August 1). *TRB-Transportation Research Board.* Retrieved February 26, 2011, from Driver's Asynchronous Day-to-Day Route Choices with Information Provision: http://rip.trb.org/browse/dproject.asp?n=27981

Dunn, J. A. (1999, September 1). Transportation-Policy-Level Partnerships and Project-Based Partnerships. *The American Behavioral Scientist, 43*(1), 92-106.

Ezell, S. (2010, June). Bringing U.S. Roads into the 21st Century. *Intelligent Transportation, 26*(4), 77-86.

Falcioni, J. G. (2007, June 30). Transportation Explosion. *Mechanical Engineering, 129*(6), 4.

FHWA. (1987). *Guidance for Preparing and Processing Environmental and Section 4(f) Documents.* Federal Highway Administration, U.S. Department of Transportation. U.S. Department of Transportation.

FHWA. (2007, September). *The Transportation Planning Process: Key Issues*. Retrieved July 7, 2011, from A Brief Book for Transportation Decisionmakers, Officials, and Staff: http://www.planning.dot.gov/documents/BriefingBook/BBook.htm

FHWA. (2011, June 17). *Planning, Environment, & Realty*. Retrieved July 7, 2011, from Environment: http://www.fhwa.dot.gov/environment/

FHWA. (2012). *Traffic Volume Trends.* Washington D.C.: Office of Highway Policy Information.

FHWA, ADOT, & USACE. (1994). *Final Environmental Impact Statement - Red Mountain Freeway - Price Freeway to State Route 87.* Phoenix: Federal Highway Administration.

FHWA, ADOT, & USACE. (1999). *Final Environmental Impact Statement - Red Mountain Freeway (Loop 202) - SR 87 to US 60.* Phoenix: Federal Highway Administration.

Flyvbjerg, B., Holm, M. K., & Buhl, S. L. (2005, Spring). How (in)accurate Are Demand Forecasts in Public Works Projects? *Journal of the American Planning Association, 71*(2), 131-146.

Flyvbjerg, B., Holm, M. S., & Buhl, S. (2002, Summer). Underestimating Costs in Public Works Projects - Error or Lie? *Journal of the American Planning Association, 68*(3), 279-295.

Groden, B. T. (2000, July 1). Meeting Great Expectations Through Performance Measures. *Public Works Managment & Policy, 5*(1), 13-25.

Hall, P. (1969, November 1). Transportation. *Urban Studies, 6*(3), 408-435.

Hartgen, D. T. (2002, March 31). Performance. *Transportation Quarterly, 56*(1), 5-19.

Hess, D. B. (2006, May 1). Transportation Beautiful. *Journal of Urban History, 32*(4), 511-545.

Jordan, J. (2011, October 7). *Chambers Chart Different Paths on Transportation, HUD Spending*. Retrieved October 11, 2011, from APA Policy News for Planners: http://blogs.planning.org/policy/2011/10/07/chambers-chart-different-paths-on-transportation-hud-spending

Kirk, C. (2003, October 13). Transportation Systems Streamlined. *Transport Topics*(3558), 18-21.

Levy, J. M. (2009). *Contemporary Urban Planning* (8 ed.). (D. Musslewhite, Ed.) Pearson Education Ltd.

MAG. (2003). *Regional Transportation Plan.* Phoenix: Maricopa Association of Governments.

MAG. (2006). *Regional Transportation Plan - 2006 Update.* Phoenix: Maricopa Association of Governments.

Mayer, M. (2009, January 1). Extending Monetary Values to Broader Performance and Impact Measures: Transportation Applications and Lessons for Other Fields. *Evaluating and Program Planning, 32*(4), 332-341.

McCarron, J. (2010, October). Taking It Private - Outsourcing Deals Need Solid, Up-Front Planning. *Planning*, pp. 18-22.

Meyer, M., & Schuman, R. (2002). Transportation Performance Measures and Data. *ITE Journal*, 48-49.

Meyer, P. E. (2007, December). *Balancing Wants and Needs in Transportation Policy-Making: The Energy/Environment Dilemma.* Retrieved January 20, 2010, from IEEE-USA Today's Engineer: http://www.todaysengineer.org/2007/Dec/transportation.asp

Mohan, V. (2005, September 1). Deriving Performance Measures for Transportation Planning using ITS Archived Data. *Civil Engineering and Environmental Systems, 22*(3), 171-188.

NEPA. (2011, July 7). *National Environmental Policy Act (NEPA)*. Retrieved July 7, 2011, from Basic Information/Compliance and Enforcement: http://www.epa.gov/oecaerth/basics/nepa.html

Neumann, L. A. (2004, January 1). Performance-based Planning and Asset Management. *Public Works Management & Policy, 8*(3), 156-161.

Owen, W. (1957, January 1). Transportation. *The Annals of the American Academy of Political and Social Science, 314*(1), 30-38.

Paschalis, G. A. (2010). *Tappan Zee Bridge/I-287 Corridor Environmental Review.* Howard/Stein-Hudson Associates, Inc., Public Involvement-Strategic Planning. New York: http://www.city-journal.org.

Quiroga, C. (2000, February 1). Performance Measures and Data Requirements for Congestion Management Systems. *Transportation Research Part C, 8*(1-6), 287-306.

Schreibman, L. (2010, July). Irrational Fear. *Planning - the Magazine of the American Planning Association, 76*(6), 40.

Schwartz, W. (1998, January 1). Conference on Performance Measures Held in California. *ITE Journal, 68*(1), 9-10.

Tarnoff, P. (2005, May 1). Customer-focused Performance Measures. *ITE Journal, 75*(5), 33-36.

Taylor, B., & Norton, A. T. (2009, August 1). Paying for Transportation. *Journal of Planning Literature, 24*(1), 22-36.

Texas A&M University, College Station. (2009, September 1). *TRB-Transportation Research Board.* Retrieved February 2, 2011, from Research in Progress - Performance Measures for Transportation Planning and Operations for MPO's: http://rip.trb.org/browse/dproject.asp?n=23446

TRB. (2006). *National Cooperative Highway Research Program Report 574.* Transportation Research Board. Washington, D. C.: Transportation Research Board.

TRB. (2009). *SHRP 2 Capacity Research - Performance Measurement Framework for Highway Capacity Decision Making.* Washington DC: Transportation Research Board.

TRB. (2009, March 14). *Strategic Highway Research Program 2 (SHRP 2).* (T. R. Board, Ed.) Retrieved February 26, 2011, from A Framework for Improving Travel Time Reliability: http://rip.trb.org/browse/dproject.asp?n=21420

TRB. (2009). *Update Capacity Research Plan - SHRP 2 - Providing Highway Capacity in Support of the Nation's Economic, Envriomental, and Social Goals.* Transportation Research Board. Washington DC: Transportation Research Board.

TRB. (2010). *Building a Better Driving Experience.* the National Academies, Strategic Highway Research Program (SHRP 2). Washington DC: Transportation Research Board.

University of Southern California/California State Long Beach. (2009, August 16). *TRB-Transportation Research Board.* Retrieved February 26, 2011, from End-to-End Performance in Vehicular Networks with an Emphasis on Safety and Security Applications: http://rip.trb.org/browse/dproject.asp?n=26958

USDOT. (2010). *Efficient Use of Highway Capacity - Summary Report to Congress.* Texas Transportation Institute, Federal Highway Administration. College Station: Federal Highway Administration.

USDOT. (2011, July 7). *Transportation Planning*. Retrieved July 7, 2011, from Federal Lands Highway: http://flh.fhwa.dot.gov/programs/planning.htm

USDOT. (October 2007). *Federal Surface Transportation Programs and Transportation Planning for Federal Land Management Agencies - A Guidebook.* Washington D.C.: U.S. Department of Transportation.

USEPA. (2010, October 21). *National Environmental Policy Act (NEPA)*. Retrieved July 7, 2011, from Basic Information: http://www.epa.gov/oecaerth/basics/nepa.html#requirement

USGAO. (2004). *Surface Transportation - Many Factors Affect Investment Decisions.* Washington D.C.: United States General Accounting Office.

USGAO. (2009). *As Initial Implementation Unfolds in States and Localities, Continued Attention to Accountability Issues Is Essential.* Washington D.C.: United States Government Accountability Office.

Vickner, S. (2009, December). When Deep Pockets Open. *Planning*, pp. 30-32.

Wendel, R. K. (2002). *Red Mountain Express.* Phoenix: Southwest Contractor.

APPENDIX A

KEY PLANNING PRODUCTS

KEY PLANNING PRODUCTS

	Who Develops?	Who Approves?	Time Horizon	Content	Update Requirements
UPWP	MPO	MPO	1 or 2 Years	Planning Studies and Tasks	Annually
MTP	MPO	MPO	20 Years	Future Goals, Strategies, and Projects	Every 5 Years 4 years for nonattainment and maintenance areas
TIP	MPO	MPO/ Governor	4 Years	Transportation Investments	Every 4 Years
LRSTP	State DOT	State DOT	20 Years	Future Goals, Strategies, and Projects	Not Specified
STIP	State DOT	US DOT	4 Years	Transportation Investments	Every 4 Years

Source: (FHWA, The Transportation Planning Process: Key Issues, 2007)

Figure 2-1: Key Planning Products

Brief definitions of these products are:

- The Unified Planning Work Program (UPWP) lists transportation studies and tasks that will be completed by the Metropolitan Planning Organization (MPO);
- The Metropolitan Transportation Plan (MTP) or the Long-Range Transportation Plan (LRTP) is a statement of long-range and short-range strategies and actions that lead to the development of an intermodal transportation system;
- The Transportation Improvement Program (TIP) is a list of projects generated from the MTP/LRTP that will receive federal funding and will be processed within the next four years;

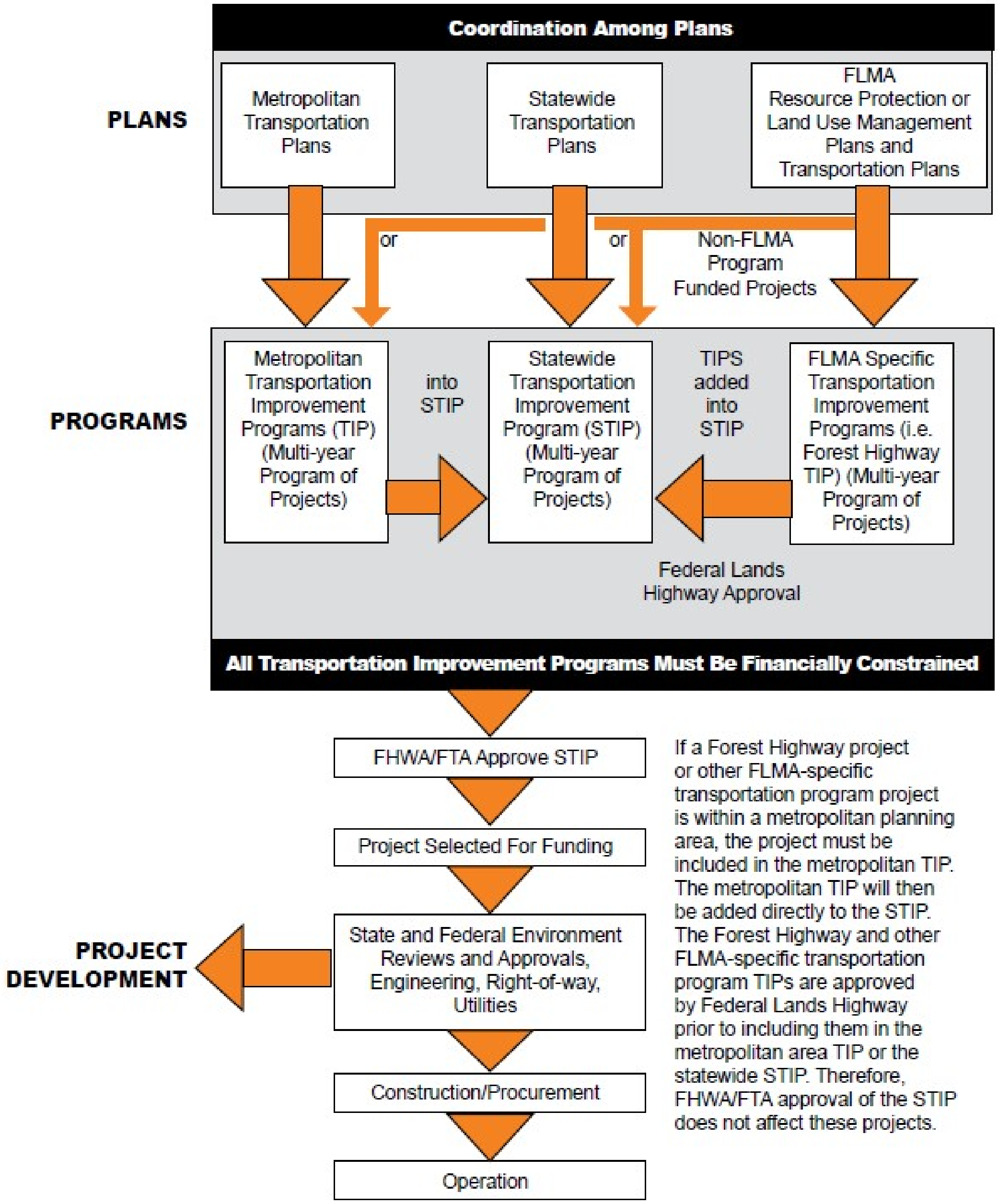
- The Long-Range Statewide Transportation Plan (LRSTP) is developed by the state DOT and includes a long-range statewide transportation plan; and
- The Statewide Transportation Improvement Program (STIP) is similar to the TIP but contains projects from rural, small urban, and urbanized areas of the state.

It should be noted that the MTP and the LRTP both have a 20 year time-frame, but one is developed by the MPO and the other by the state DOT, respectively.

APPENDIX B

COORDINATION OF PLANNING PROCESSES

COORDINATION OF PLANNING PROCESSES

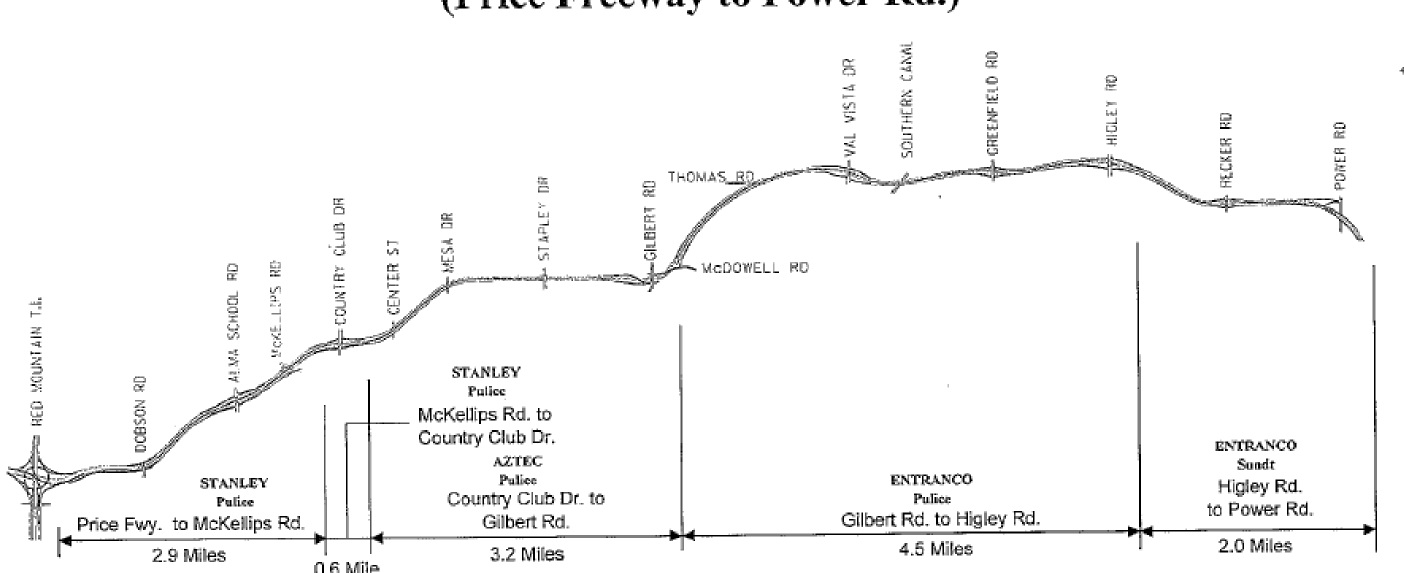


Source: (USDOT, October 2007, p. 12)

APPENDIX C

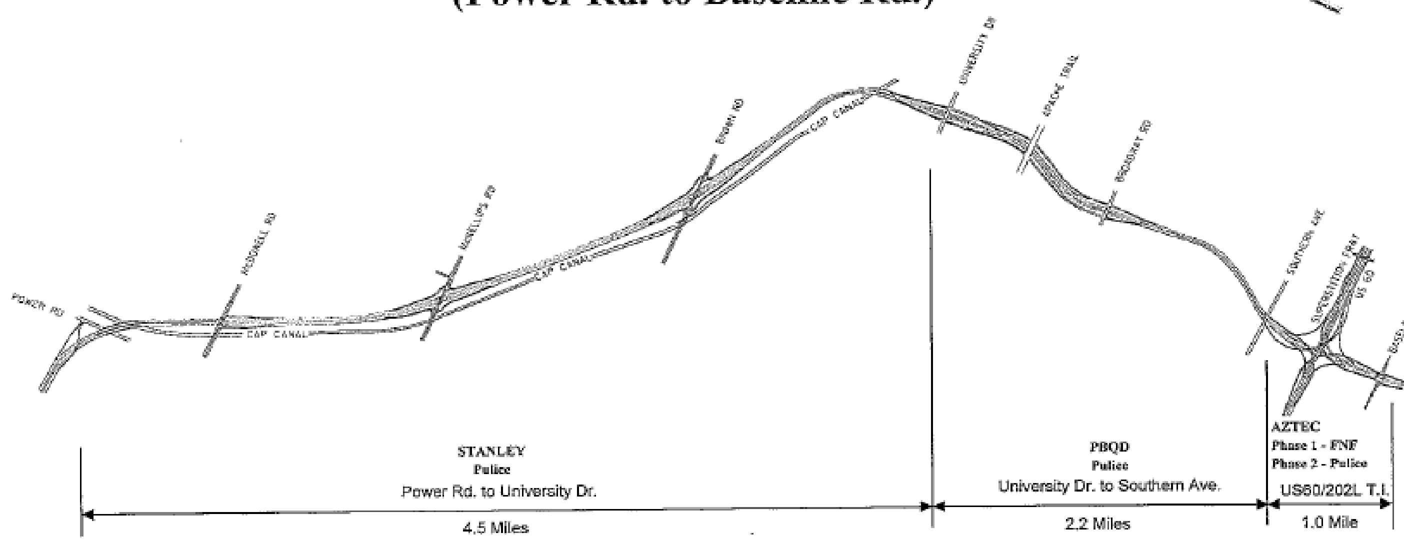
CONTRACTOR BIDS FOR ACTUAL COSTS

RED MOUNT^IN FREEWAY
(Price Freeway to Power Rd.)



WORK ELEMENT	PRICE FREEWAY TO McKELLIPS RD.			McKELLIPS RD. TO COUNTRY CLUB DR.			COUNTRY CLUB DR. TO GILBERT RD.			GILBERT RD. TO HIGLEY RD.			HIGLEY RD. TO POWER RD.		
	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.
DESIGN	Oct-94	Mar-96	1,569	Jan-96	Mar-97	400	(Nov-98)[3] Jan-00	(Feb-00)[3] Mar-01	4,372	Sep-00	Jun-01	4,026	Apr-02	Jun-03	1,721
RIGHT - OF - WAY	Oct-94	Oct-95	22,820	Jan-96	Jun-97	23,999	(Nov-98)[3] Dec-99	(Mar-00)[3] Feb-01	23,630	Oct-99	Nov-01	21,321	Apr-02	Jun-03	6,138
CONSTRUCTION	Jun-96 Apr-96	Oct-97 Dec-96	32,476 2,788[1]	Jun-97	Sep-98	10,701	(May-00)[3] Oct-01 Jan-01[4]	(Jan-02)[3] Jun-03 Jan-02[4]	67,254 7,431[4]	(Sep-01)[3] May-01	(Jan-03)[6] Feb-02	53,083 2,887[5]	Jan-04	Jun-05	26,061
LANDSCAPING -DESIGN -CONSTRUCTION	Aug-97 Sep-98	May-98 Aug-99	208 1,599[2]				(Dec-00)[3] Sep-02	(Nov-01)[3] Aug-03	236 2,296	Jan-02 Mar-05	Oct-04 Feb-06	363 3,375	Apr-04 Sep-05	Mar-05 Aug-06	207 1,985

RED MOUNTAIN FREEWAY
(Power Rd. to Baseline Rd.)



WORK ELEMENT	POWER RD. TO UNIVERSITY DR.			UNIVERSITY DR. TO SOUTHERN AVE.			US60/202L T.I. PHASE I			US60/202L T.I. PHASE II		
	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.	BEGIN	COMP.	COST $ Thous.
DESIGN	Mar-04	Aug-05	6,600	Feb-04	Jun-05	3,280	May-02	Jun-03	2,551	Jan-03	Feb-05	3,317
RIGHT - OF - WAY	Jul-03	Aug-05	10,381	Jan-04	Jun-05	9,355	Apr-02	Jun-03	18,803			
CONSTRUCTION	Jan-06 Aug-05	Aug-08 Jul-06	211,180 6,468[2]	Dec-05	Oct-07	77,497	Nov-03	Jan-05	46,681	Jul-05	Jun-07	82,236
LANDSCAPING												
-DESIGN	Jan-06	Dec-06	540	Jan-06	Dec-06	174				Jan-06	Aug-06	563[1]
-CONSTRUCTION	Jun-08	May-09	5,400	Jan-07	Dec-07	1,744				Dec-06	Nov-07	5,634[1]