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16. Abstract

This report presents the results of an evaluation of the cost effectiveness of the Northeast Transit Terminal, an existing Sun Metro bus transit terminal located 23 km north of downtown El Paso, Texas. The evaluation of the transit terminal's cost effectiveness was conducted from a full-cost perspective and consisted of hypothesizing the amount of existing bus ridership that is attributable to the presence of the transit terminal.

We first estimated the differences in the full life-cycle cost of transportation activity in the corridor between two hypothetical scenarios of reduced bus ridership and a scenario of existing conditions. These differences were then compared with the full life-cycle cost of the transit terminal. Our findings suggest that, from a full-cost perspective, reducing the number of single occupant vehicles (SOVs) using the corridor by even a small percentage would be sufficient to justify the construction of the Northeast Transit Terminal.

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FULL-COST EVALUATION OF THE NORTHEAST TRANSIT TERMINAL IN EL PASO, TEXAS

by

Michael T. Martello

Jiefeng Qin

José Weissmann

Mark A. Euritt

Research Report Number 1356-7

Research Project 0-1356

Development of an Urban Transportation Investment Model

conducted for the

Texas Department of Transportation

in cooperation with the

U.S. Department of Transportation
Federal Highway Administration

by the

CENTER FOR TRANSPORTATION RESEARCH
Bureau of Engineering Research
THE UNIVERSITY OF TEXAS AT AUSTIN

November 1996

IMPLEMENTATION STATEMENT

This report, one of five case studies assessing the full cost of urban passenger transportation alternatives, evaluates the hypothetical cost-effectiveness of an existing transit terminal located 23 km north of downtown El Paso, Texas, adjacent to the Patriot Freeway. Given its effectiveness for valuing transportation investment alternative comparisons, full-cost analysis represents a critical element in developing a multimodal transportation investment plan. In terms of implementation, the findings in this report demonstrate that full-cost analysis is capable of enhancing qualitative assessments and planning/engineering judgment.

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

REPORTS FOR THIS PROJECT

1356-1, "Full-Cost Analysis of Urban Passenger Transportation," by Jiefeng Qin, Karen M. Smith, Michael T. Martello, Mark A. Euritt, and José Weissmann. This report examines methods for evaluating and comparing urban passenger transportation projects regardless of mode. After identifying the full-cost approach as an effective tool for undertaking such comparisons, this report describes MODECOST, a full-cost evaluation model developed by the Center for Transportation Research (CTR) of The University of Texas at Austin.

1356-2, "Development of a Multimodal Full-Cost Model — MODECOST," by Jiefeng Qin, José Weissmann, Michael T. Martello, and Mark A. Euritt. This report summarizes the development of MODECOST, a multimodal full-cost model. First, various cost categories for three modes of a passenger transportation system — auto, bus, and light rail — are identified. This is followed by a discussion of procedures used for annualizing the life-cycle costs of each component of a transportation system. The report also summarizes the unit cost data found in the literature and data received from officials at the Texas Department of Transportation as well as from staff of other public agencies around the country.

1356-3, "Full-Cost Analysis of the Katy Freeway Corridor," by Jiefeng Qin, Michael T. Martello, José Weissmann, and Mark A. Euritt. Using a full-cost approach, this report evaluated the different transportation improvement alternatives (developed by Parsons Brinckerhoff Quade & Douglas, Inc.) available for the IH-10 Katy Freeway corridor. Through MODECOST — a computer model based on the full-cost analysis concept — we found that the current facility cannot meet future traffic demands.

1356-4, "The Houston-Harte of San Angelo: A Case Study Application of a Full-Cost Model for Evaluating Urban Passenger Transportation," by Karen M. Smith, Jiefeng Qin, José Weissmann, Mark A. Euritt, and Michael T. Martello. This report evaluates the full costs of transportation alternatives on the Houston-Harte corridor in San Angelo, Texas. The alternatives examined are those considered by the San Angelo District of the Texas Department of Transportation, which include: (1) the continuation of the existing frontage lanes-only configuration and (2) the construction of the mainlanes for completion of the facility. The results of MODECOST — a computer model developed by a Center for Transportation Research (CTR) team — indicate that the addition of mainlanes to the Houston-Harte corridor is both feasible and cost effective.

1356-5, "US 59 Harris County/Fort Bend County: A Case Study Application Of A Full-Cost Model For Evaluating Urban Passenger Transportation," by Michael T. Martello, Jiefeng Qin, José Weissmann, and Mark A. Euritt. This report evaluated transportation improvement alternatives for the US 59 Southwest Freeway corridor from the full-cost, life-cycle approach perspective. The alternatives involve hypothetical facility improvements as well as vehicle occupancy improvements. Our findings suggest that the current facility will not be able to service the projected peak-hour traffic demand; and after running MODECOST — a computer model based on the full-cost analysis concept — we observed that travelers bore a significant amount of external costs, including congestion costs and air pollution costs.

1356-6, "Application of Full Cost of Urban Passenger Transportation Case Study: Northeast (IH-35) Corridor," by Jiefeng Qin, Michael T. Martello, José Weissmann, and Mark A. Euritt. Using a full-cost approach, we evaluated the different transportation improvement alternatives (developed by Rust Lichliter/Jameson) available for the Northeast (IH-35) corridor in San Antonio, Texas. Through MODECOST — a computer model based on the full-cost analysis concept — we found that the current facility cannot meet future traffic demands.

1356-7, "Full-Cost Evaluation of the Northeast Transit Terminal in El Paso, Texas," by Michael T. Martello, Jiefeng Qin, José Weissmann, and Mark A. Euritt. This report presents the results of an evaluation of the cost effectiveness of the Northeast Transit Terminal, an existing Sun Metro bus transit terminal located 23 km north of downtown El Paso, Texas. The evaluation of the transit terminal's cost effectiveness was conducted from a full-cost perspective and consisted of hypothesizing the amount of existing bus ridership that is attributable to the presence of the transit terminal. MODECOST, a computer model developed through this project, was used for the analysis.

1356-8F, "Development of an Urban Transportation Investment Model: Executive Summary," by Michael T. Martello, José Weissmann, Mark A. Euritt, and Jiefeng Qin. This final report summarizes the objectives of the project and provides recommendations for implementation.

DISCLAIMERS

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration or the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation.

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SUMMARY

This report presents the results of an evaluation of the cost effectiveness of the Northeast Transit Terminal, an existing Sun Metro bus transit terminal located 23 km north of downtown El Paso, Texas. The evaluation of the transit terminal's cost effectiveness was conducted from a full-cost perspective and consisted of hypothesizing the amount of existing bus ridership that is attributable to the presence of the transit terminal.

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CHAPTER 1. INTRODUCTION

1.1. THE CONCEPT OF FULL-COST ANALYSIS

Within Texas, a vast, 467,000-km (290,000-mile) transportation network has been developed to address mobility and accessibility needs of state travelers (Ref. 11). Today, more than 70 percent of local travel occurs within Texas cities having populations over 200,000 (Ref. 12), with most of these trips made by travelers using personal vehicles. The dependence on personal vehicles has created new problems for transportation professionals, environmentalists, and the public. These problems include congestion in many major metropolitan areas, air pollution and global weather change, noise, accidents, and high energy use. The Federal Highway Administration (FHWA) reported that 25 percent of Texas' urban interstate highways exceed 95 percent of capacity, and that 43 percent are operating at over 80 percent of their carrying capacity.

Prior to 1990, transportation policy focused primarily on the development of the Interstate system. Cost evaluations of transportation alternatives in the urban environment typically considered initial capital investments only. However, the passage of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Clean Air Act Amendments of 1990 (CAAA) prompted a more comprehensive approach to evaluating transportation options. ISTEA and CAAA shifted traditional planning and decisionmaking to a multimodal transportation perspective, a process which examines highway, transit, and rail issues in combination. In this approach, the transportation planning process looks at the problem from the perspective of an integrated system, emphasizing efficient and productive transfer of people and goods. Costs, including indirect social and environmental costs, must be fully accounted for in comparing modes and management strategies to identify the most cost-effective options.

Transportation full-cost analysis is the first step in developing a multimodal transportation investment plan. Full-cost analysis takes into account not only infrastructure costs, but also user and external costs, thus enhancing transportation planning significantly. Focus on any singular cost may result in an inefficient system and can lead to reduced long-term economic investment. The full-cost approach provides a stronger platform from which to evaluate transportation investment decisions without modal bias. It identifies least-cost alternatives, and promotes efficient use of the system.

1.2. A BRIEF REVIEW OF THE MODECOST MODEL

Previous reports (Refs. 9, 10) reviewed the literature and current practice of full-cost transportation system planning. In this project, the Center for Transportation Research (CTR) of The University of Texas at Austin investigated the full-cost analysis approach for evaluating transportation decisions. As a result of this research effort, the computer model MODECOST was developed. MODECOST has the ability to assist metropolitan planning organizations (MPOs) and regional and municipal authorities in comparing multimodal transportation alternatives by accounting for the full cost of each mode. MODECOST incorporates many aspects of modal costs that have not traditionally been accounted for, such as air pollution cost, accident cost, and personal vehicle user cost. By taking costs such as these into account, MODECOST can estimate the direct and indirect costs from the perspective of how much society is paying for that mode of transportation.

In summary, MODECOST allows the transportation planner to compare the full cost of three major urban transportation modes — auto, bus, and rail — along a particular corridor. It is based on full-cost and life-cycle-cost concepts discussed in previous reports (Refs. 9, 10). MODECOST is an easy-to-operate, interactive and menu-driven software program that compares transportation alternatives. The software can be run on any IBM-PC or compatible computer using Microsoft Windows.

1.3. SCOPE OF THE REPORT

The purpose of this case study is to evaluate the feasibility of constructing and maintaining an existing transit terminal in northeast El Paso, Texas, from a system life-cycle cost perspective. The question the study poses is, from a system life-cycle cost perspective, was it feasible to construct the terminal?* The transit station is operated by El Paso Sun Metro and is identified as the Northeast Transit Terminal. Two bus routes utilize this terminal and service the downtown area some 23 km (14 miles) to the south.

Chapter 2 discusses the background and development of the two scenarios assessed in order to evaluate the feasibility of the Northeast Transit Terminal. Chapter 3 describes the data inputs and assumptions made in the analysis. Chapters 4 and 5 build on the calculations of MODECOST to present the full cost of urban passenger transportation for different investment alternatives. Specifically, Chapter 4 presents the results for existing conditions, which serve as the basis for comparison. Chapter 5 then provides the results of other investment alternatives. Chapter 6 summarizes the findings of this report.

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* The verb tenses and certain sentence structures in this report reflect the fact that we are conducting a cost feasibility evaluation of an existing facility based on the full-cost analysis concept and on hypothetical bus mode splits. The facility is extant but the evaluation of it in this study is new.

CHAPTER 2. BACKGROUND

2.1 INTRODUCTION

The City of El Paso is the county seat of El Paso County and accounts for about 90 percent of the county's entire population of approximately 600,000 persons (Ref. 1). El Paso's transborder sister city in Mexico is Ciudad Juarez, Chihuahua, and it has an estimated population of 1.5 million (Ref. 2). Having close economic, cultural, and historical ties, these two cities behave to some degree as one large international city.

Sun Metro is the transit department that services the El Paso metropolitan area. The Sun Metro transit system consists of 45 separate routes and operates a fleet of 153 vehicles (Ref. 3). Total passengers in 1993 were over 16 million (Ref. 3).

El Paso is currently classified by the U.S. Environmental Protection Agency to be in non-attainment for three National Ambient Air Quality Standards (NAAQS): ozone, carbon monoxide, and particulate matter (Ref 4.).

2.2 PROJECT ANALYSIS SCENARIOS

Owing to the varying roadway geometric characteristics and traffic volume levels, the 23-km (14-mi) Northeast Transit Terminal corridor under study from downtown El Paso to the North Park Mall near the Diana/Dyer intersection is divided into 21 segments. They are:

- Seg 1: IH10 WB off-ramp at Campbell
- Seg 2: Missouri from Campbell to Kansas
- Seg 3: Kansas from Missouri to Franklin
- Seg 4: Kansas from Franklin to Mills
- Seg 5: Kansas from Mills to Myrtle
- Seg 6: Myrtle from Kansas to Stanton plus Stanton from Myrtle to Main
- Seg 7: Main from Stanton to Santa Fe plus Santa Fe from Main to Franklin
- Seg 8: Franklin from Santa Fe to Mesa
- Seg 9: Franklin from Mesa to Campbell
- Seg 10: IH10 from EB on-ramp at Campbell to Piedras
- Seg 11: IH10 from Piedras to Patriot Freeway (US 54)
- Seg 12: Patriot Freeway (US 54) from IH10 to 6-ln/4-ln transition
- Seg 13: Patriot Freeway (US 54) from 6-ln/4-ln transition to Dyer
- Seg 14: Patriot Freeway from Dyer to Diana
- Seg 15: Hondo Pass from Patriot Freeway to Diana
- Seg 16: Diana from Hondo Pass to Northeast Transit Terminal
- Seg 17: Diana from Patriot Freeway (US 54) to T-Intersection
- Seg 18: Diana from T-Intersection to Dyer
- Seg 19: Diana from Dyer to Northeast Transit Terminal
- Seg 20: WB Hondo Pass over Patriot Freeway (Route 2 SB access to frwy)
- Seg 21: WB Diana over Patriot Freeway (Route 42 SB access to frwy)

The downtown El Paso surface streets, which Sun Metro Route 42 and Route 2 traverse, are idealized as one-way, three-lane local streets with a green split of 0.4 at the signalized intersections. The surface streets that provide freeway access to the transit terminal are modeled as arterials with a green split of 0.6 at the signalized intersections. Figure 2.1 shows the location of the transit terminal and the corridor utilized by Route 2 and Route 42, which service the terminal and travel to downtown El Paso.

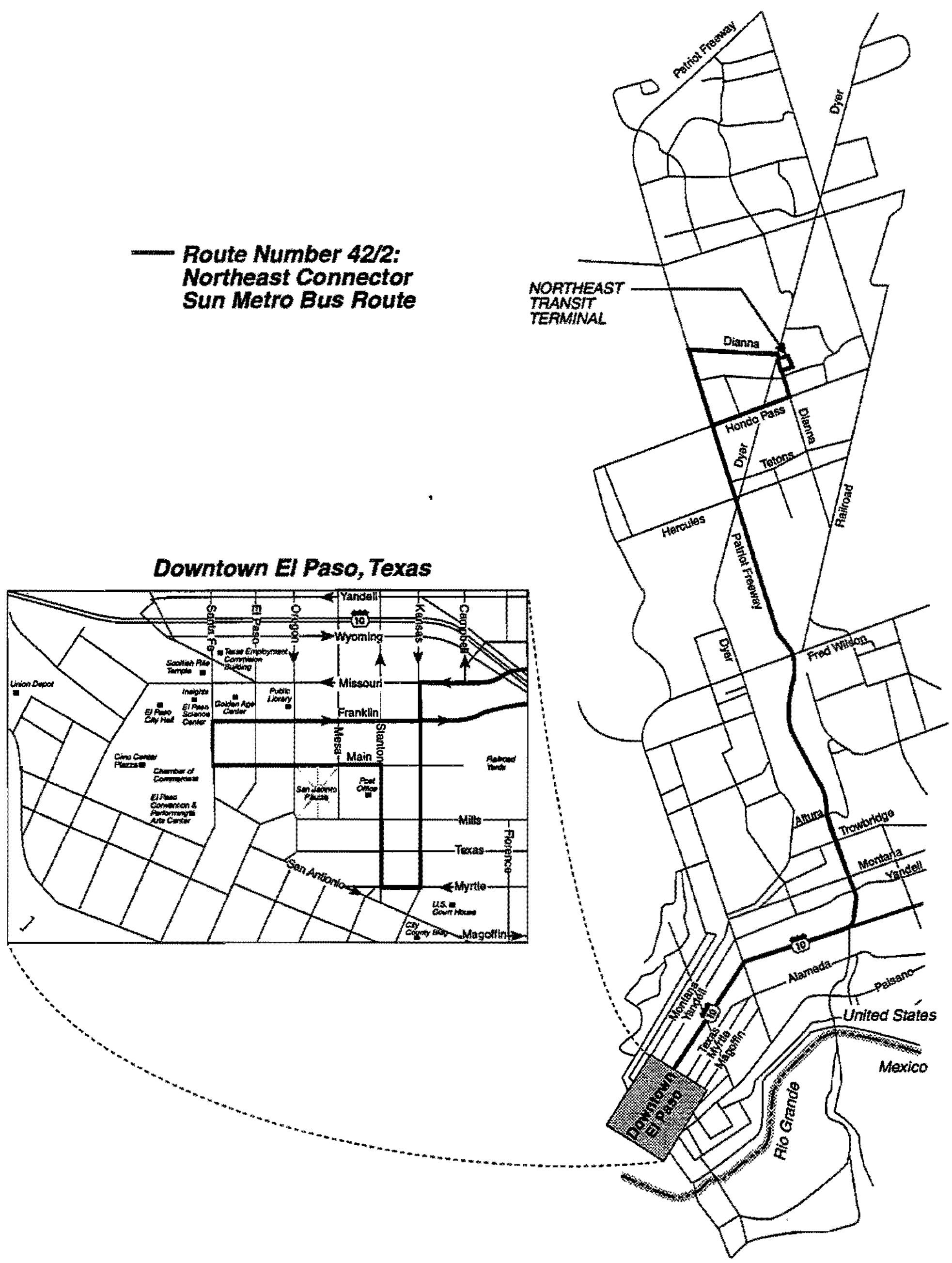

Figure 2.1 Location of El Paso transit terminal and the corridor utilized by Route 2 and Route 42

2.3 NORTHEAST TRANSIT TERMINAL RIDERSHIP ALTERNATIVES

The purpose of the Northeast Transit Terminal case study is to assess the feasibility of making transportation investments to improve public transit ridership from the perspective of a system life-cycle cost analysis. We do not attempt to establish the actual difference in bus ridership before and after the terminal was built. Rather, we hypothesize changes in ridership for the two bus routes that service this transit terminal, and compare any changes in the corridor's system life-cycle cost with that of the life-cycle cost of building and operating the transit terminal.

Three transit ridership scenarios are assessed in this case study. None of the alternatives consider any future facility improvements, such as additional general purpose lanes or installation of HOV lanes. Scenario 1 simulates existing conditions and is used as the base case to compare the results of alternative scenarios. Scenario 2 hypothesizes the elimination of 10 one-way bus trips during the weekday from Route 42 (from the current 56 one-way trips) and 1 one-way bus trip during the weekend from Route 42 (from the current 19 one-way trips). The average number of passengers on these buses are assumed to drive single-occupant vehicles (SOVs) and are added to each segment's average daily traffic (ADT). Scenario 3 is similar to Scenario 2, except that only 1 one-way bus trip is hypothesized to be eliminated on Route 42 during the weekday as well as during the weekend. Scenario 2 and Scenario 3 increase the mode-split for autos by varying amounts, depending on the corridor segment. Table 2.1 summarizes the changes in auto mode-splits to the nearest 0.1 percent for each scenario by segment. "Auto" includes SOVs as well as an assumed number of carpools. The remaining trips are taken by bus.

Table 2.1 Weekday passenger trip auto mode split — El Paso case study

	AUTO MODE SPLIT (percent)		
SEGMENT	Scenario 1	Scenario 2	Scenario 3
1	92.7	93.2	92.8
2	92.0	92.5	92.0
3	73.5	74.0	73.6
4	71.8	72.3	71.8
5	65.1	65.8	65.2
6	64.6	65.6	64.7
7	71.2	72.3	71.3
8	64.5	65.9	64.7
9	69.1	70.4	69.3
10	98.2	98.3	98.2
11	98.3	98.4	98.4
12	98.8	99.0	98.9
13	98.8	99.0	98.9
14	99.0	99.2	99.0
15	99.9	99.9	99.9
16	93.9	95.0	94.0
17	93.9	95.0	94.0
18	99.9	99.9	99.9
19	94.6	95.6	94.7
20	99.8	99.8	99.8
21	93.9	95.0	94.0

CHAPTER 3. DESCRIPTION OF INPUT DATA

3.1 PERSON TRIP DEMAND

Average daily traffic (ADT) volumes, growth rates, percent trucks, directional factors (D), and K-factors have been provided by El Paso's MPO. Table 3.1 summarizes the data received.

Table 3.1 Northeast Transit Terminal corridor existing traffic data

SEGMENT	1992 ADT	Average Annual Growth Rate	Percent Trucks	Peak Hour Direction Factor (D)	Peak Hour Factor (K)
1	19,050	5%	3%	0.6	0.10
2	17,180	5%	3%	0.6	0.10
3	18,040	5%	3%	0.6	0.10
4	16,560	5%	3%	0.6	0.10
5	12,190	5%	3%	0.6	0.10
6	5,570	5%	3%	0.6	0.10
7	6,010	5%	3%	0.6	0.10
8	4,450	5%	3%	0.6	0.10
9	5,460	5%	3%	0.6	0.10
10	160,040	5%	3%	0.6	0.10
11	177,005	5%	3%	0.6	0.10
12	98,180	5%	3%	0.6	0.10
13	98,180	5%	3%	0.6	0.10
14	117,000	5%	3%	0.6	0.10
15	20,101	5%	3%	0.6	0.10
16	8,630	5%	3%	0.6	0.10
17	17,260	5%	3%	0.6	0.10
18	40,202	5%	3%	0.6	0.10
19	19,900	5%	3%	0.6	0.10
20	17,460	5%	3%	0.6	0.10
21	17,460	5%	3%	0.6	0.10

Using these and other assumed data, we converted the ADT to person trips for each segment, as summarized in Table 3.2.

Table 3.2 Northeast Transit Terminal corridor — Year 1996 person trips

US 59 SEGMENT	Weekday	Weekend
1	25,346	17,262
2	23,031	15,617
3	30,043	18,327
4	28,211	17,025
5	22,801	13,181
6	10,397	5,825
7	10,277	6,006
8	8,346	4,633
9	9,596	5,522
10	201,652	141,799
11	222,655	156,723
12	122,924	87,002
13	122,924	87,002
14	146,223	103,558
15	24,905	17,683
16	11,353	7,907
17	22,706	15,814
18	49,809	35,367
19	25,974	18,137
20	21,655	15,360
21	22,954	15,990

3.2 FREIGHT TRUCK DEMAND

Percent trucks for each segment was estimated by the El Paso MPO staff to be 3 percent. Table 3.3 summarizes the corresponding number of trucks for each segment. We assume that the percent truck data apply to the ADT data received. We have assumed that weekend ADT is 70 percent of the weekday ADT, and that the weekend percent trucks is about half of the 3 percent trucks estimated for the weekday. Truck classification data were not available. Our estimation of these truck classifications (Table 3.4) is based on data used in a previous case study (Ref. 5).

3.3. MODE SPLIT AND VEHICLE OCCUPANCY

MODECOST is designed so that the user can input daily person trips, mode splits, and occupancies for each segment or link in the network. However, link data are normally available in the form of vehicle trips (ADT), not person trips. Therefore, we converted the ADT data into person trips by first estimating the *vehicle* mode split in the traffic stream, i.e., the percent passenger vehicles that are SOVs, carpools, and buses. From this, we then estimate the total person-trips and person-trip mode splits. Sun Metro provided bus trip and ridership data from which bus ADT and occupancies data were estimated. Carpools with an average occupancy of 2.0 were assumed to comprise 5 percent of the passenger ADT.

3.4. VEHICLE TRAFFIC DISTRIBUTION IN PEAK AND NON-PEAK PERIODS

The El Paso MPO provided estimates of directional and peak hour factors for average daily traffic. These factors are used to estimate AM and PM peak-hour directional vehicle trips for an average day. The remaining 22 hours of non-peak-hour traffic are classified as 14 hours of "daytime" period and 8 hours of "nighttime" period, as designated in MODECOST. The percent share of total vehicle trips of the night period is assumed to be 3.0 percent. The remaining non-peak vehicle trips are assumed to occur during the day. For a given segment, the total daily inbound vehicle trips are assumed to equal the total daily outbound person-trips. Table 3.5 summarizes the weekday trip distributions. As shown in Table 3.6, weekends are assumed to not have peak-hour periods.

Table 3.3 Northeast Transit Terminal corridor — 1996 freight truck trips

SEGMENT	Weekday	Weekend
1	695	248
2	626	224
3	658	235
4	604	216
5	445	159
6	203	73
7	219	78
8	162	58
9	199	71
10	5,836	2,083
11	6,455	2,304
12	3,580	1,278
13	3,580	1,278
14	4,266	1,523
15	733	262
16	315	112
17	629	225
18	1,466	523
19	726	259
20	637	227
21	637	227

Table 3.4 Freight truck mix

Truck Category	Percent
2-axle Single Unit	18.0
3/4-axle Single Unit	4.6
3/4-axle Semi-Trailer	4.6
5-axle Semi-Trailer	66.6
6-axle Semi Trailer	3.3
5-axle Trailer	2.3
6-axle Trailer	0.6

Table 3.5 Weekday distribution of vehicle traffic

	AM Peak (1 hour)		PM Peak (1 hour)		Day (14 hour)		Night (8 hour)		
	In	Out	In	Out	In	Out	In	Out	Total
All Segments	6	4	4	6	37	37	3	3	100

Table 3.6 Weekend distribution of vehicle traffic

	AM Peak (1 hour)		PM Peak (1 hour)		Day (14 hour)		Night (8 hour)		
	In	Out	In	Out	In	Out	In	Out	Total
All Segments	0	0	0	0	45	45	5	5	100

3.5. VALUE OF TIME

Although the inclusion of travel time costs in the analysis makes the results more meaningful, it also introduces questions about some of the assumptions. Passenger travel-time values are very difficult to measure, and various studies have disagreed regarding the appropriate estimate for the value of travel time. Furthermore, some planners are skeptical of a single assumed value for travel time. However, from the perspective of alternative comparisons, the single-value method is adequate. In this analysis we assume a value of $5.00 per passenger per hour for travel-time. The value equals to one-third of the average wage rate (Ref. 6), which is assumed to be $15.00 per passenger per hour.

3.6. ROADWAY FACILITY COST DATA

Most data on facility unit costs have been obtained from the *General Guidelines for Estimates* provided by the Texas Department of Transportation. The purchase of right-of-way is not included in this study.

3.7. EMISSION VALUE DATA

The emission values, which are based primarily on damage value estimates of stationary source emissions, are found elsewhere in the literature (Ref. 7). In the Houston metropolitan area, the values are $6,890 per ton for nitrogen oxides (NO_X), $3,540 per ton for hydrocarbons (HC), $5,190 per ton for soot-like particulates (PM10), $2,910 per ton for sulfur oxides (SO_X), and $2,000 per ton for carbon monoxide (CO). We used these damage value estimates for our study in El Paso.

3.8. TRANSIT AGENCY DATA

We use Houston Metro's transit vehicle cost data in this analysis. The bus fleet running on the Katy Freeway consists of the Low-Floor 12.2-m (40-foot) New Flyer, which has an initial capital cost of $257,000 per bus and a life of 12 years.

Cost data for the Northeast Transit Terminal were provided by Sun Metro as follows:

1. Construction Cost........ $425,625 (initial lump sum)
2. Security.................... $65,520 (annual)
3. Janitorial Services........ $10,716 (annual)
4. Cleaning Supplies........ $3,300 (annual)
5. Maintenance............... $4,600 (annual)
6. Insurance.................. self-insured

Assuming a 30 year life-span with no periodic rehabilitation costs and a discount rate of 10 percent, the transit terminal has an annualized life-cycle cost of $129,286.

3.9. CAPITAL AND OPERATING DATA FOR PERSONAL VEHICLES

The cost of owning and operating a motor vehicle is of major significance. The data listed in Table 3.7 trace selected vehicles in personal use and their costs over a 12-year lifetime by FHWA (Ref. 8). The costs were based on the operation of typical vehicles.

Table 3.7 Auto capital and operating data

Cost Category	Cost
Average Vehicle Price ($/vehicle)	13,534
Average Pickup and Van Price ($/vehicle)	15,813
Percent being Financed	75%
Loan Period (year)	5
Loan Rate	10.0%
Salvage Value ($/vehicle)	1,000
Vehicle Life (year)	12
Average Annual Driven Miles (mile)	10,700
Annual Scheduled Maintenance ($/vehicle)	232
Annual Unscheduled Maintenance ($/vehicle)	195
Annual Oil Change ($/vehicle)	59
Annual Tire Change ($/vehicle)	97
Annual Insurance ($/vehicle)	600
Annual Parking ($/vehicle)	360
Enhanced I/M ($/vehicle)	55
Average Gasoline Price without Taxes ($/gallon)	0.70

Source: *Cost of Owning & Operating Automobiles, Vans & Light Trucks 1991*. U.S. Department of Transportation, Washington, D.C., 1992.

CHAPTER 4. RESULTS OF BASE CASE

SCENARIO 1

Scenario 1 represents existing facility and mode-split conditions as estimated on the Northeast Transit Terminal corridor. Figure 4.1 summarizes the systemwide life-cycle annual cost findings for this scenario. Total agency cost, including highway and transit, is $13.1 million, or about 0.1 percent of the total system annual cost. The auto-user cost, which includes the cost of purchasing and operating an automobile, is $300.5 million, or 2.0 percent of the total system annual cost. The reader should be aware that MODECOST assumes that transit riders do not incur automobile ownership and operation costs and therefore do not contribute to the total system annual cost for auto users.

Total external costs are estimated to be $14.623 billion, or 97.9 percent of the total system annual cost. External costs include monetary estimates of travel time under recurring congestion, air pollution, accidents, incident delays, and other external costs.

Figure 4.2 depicts the systemwide annual life-cycle costs for Scenario 1 in more detail by disaggregating the main external cost categories. The monetization of travel time in this analysis results in a travel time cost accounting for 86.8 percent of the total system cost. For comparison purposes, Figure 4.3 and Figure 4.4 present the results of the analysis minus the system travel time cost estimate and without the air pollution cost estimate.

As shown, the cost of owning and operating an auto becomes the predominant system cost component when these two external costs (travel time and air pollution) are ignored in the analysis.

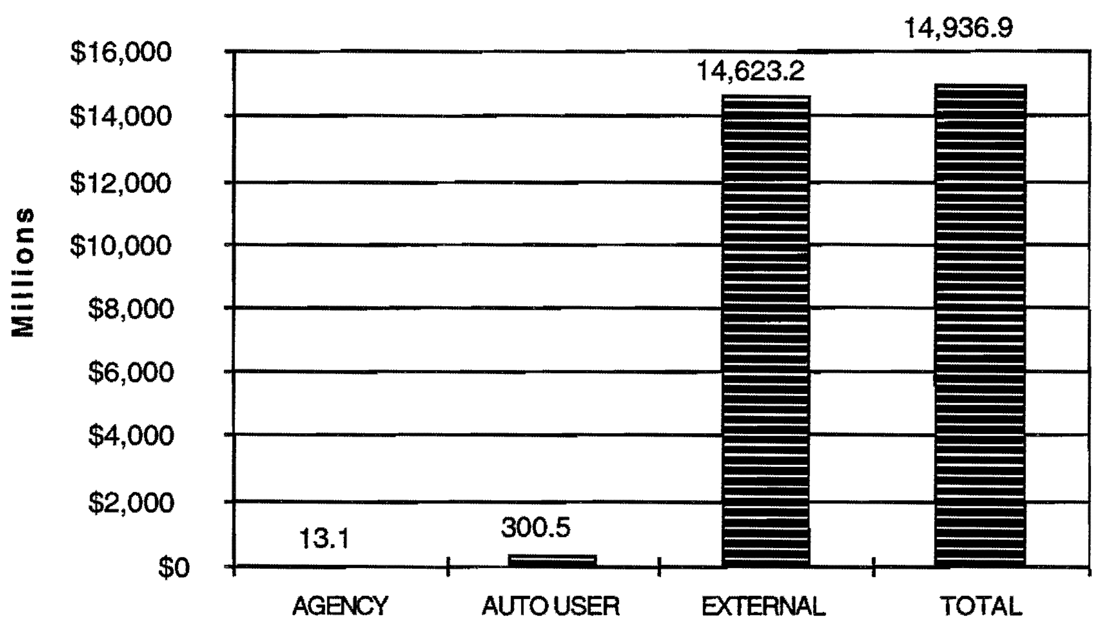

Figure 4.1 El Paso case study — Scenario 1 life-cycle annual costs

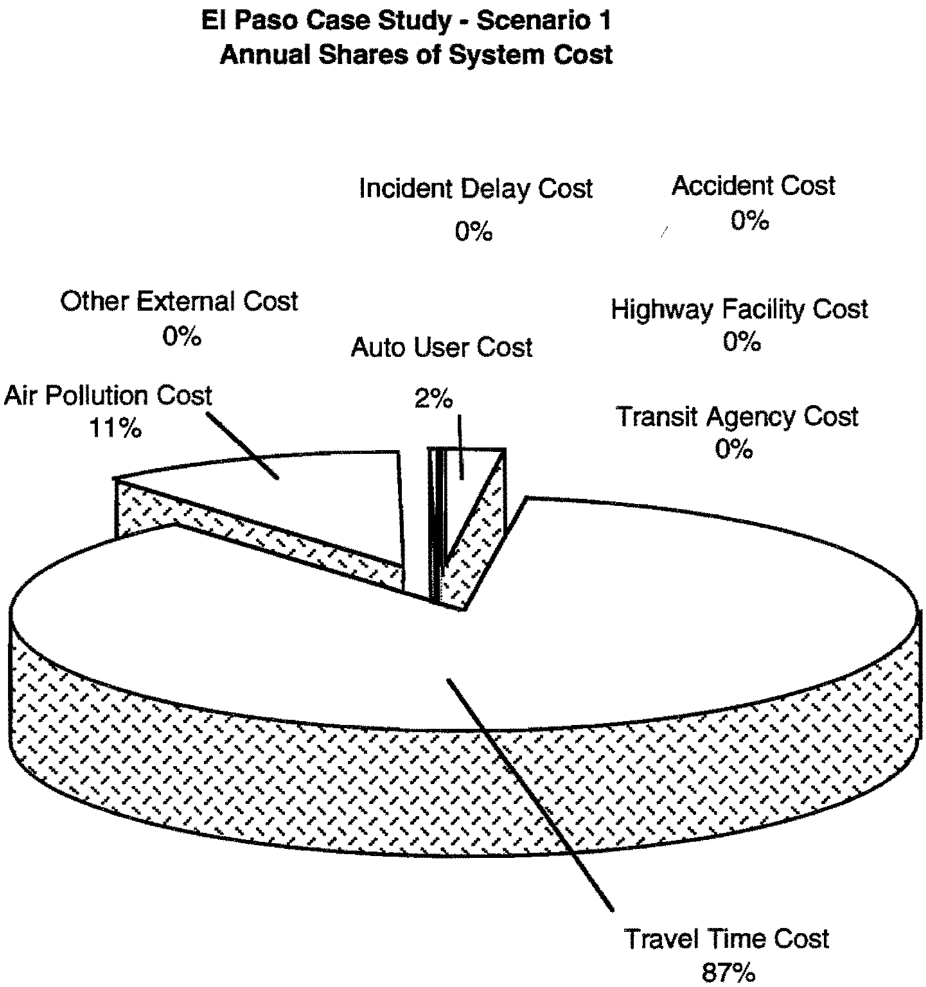

Figure 4.2 Annual shares of system cost — Scenario 1

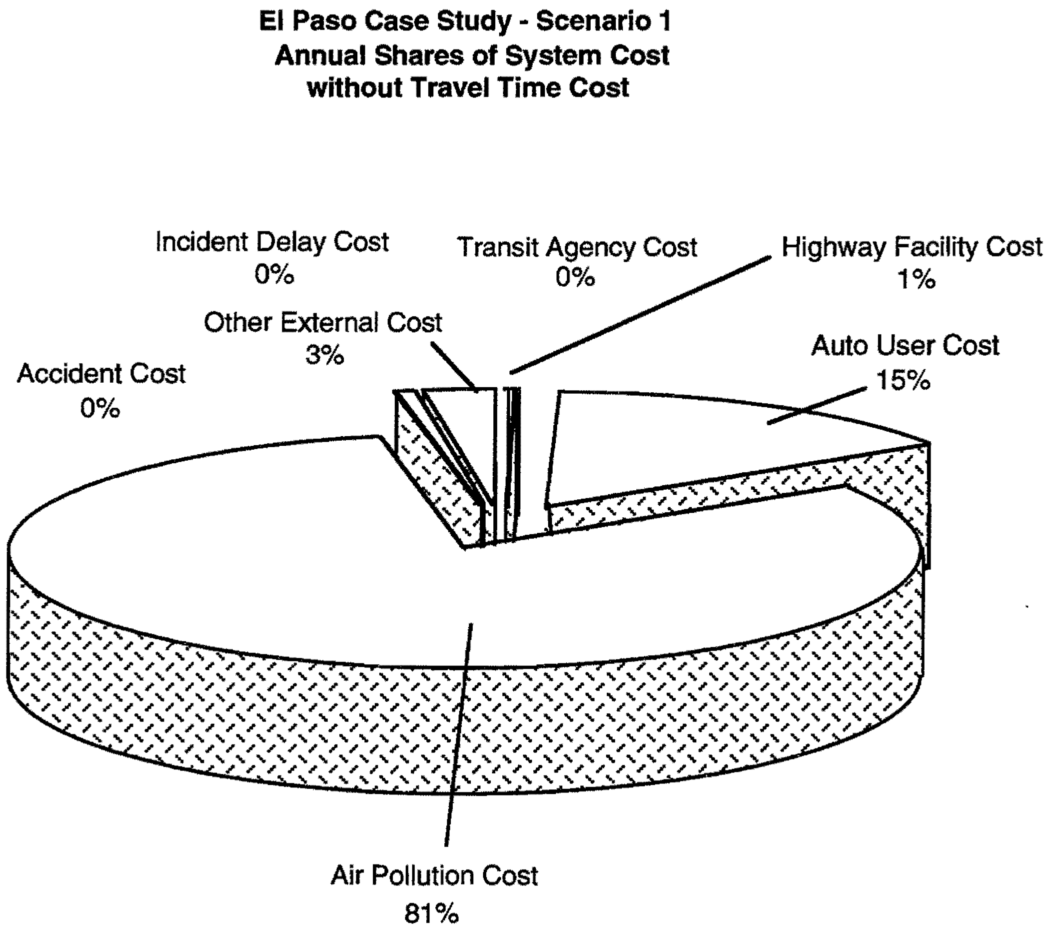

Figure 4.3 Annual shares of system cost — Scenario 1 without travel time cost

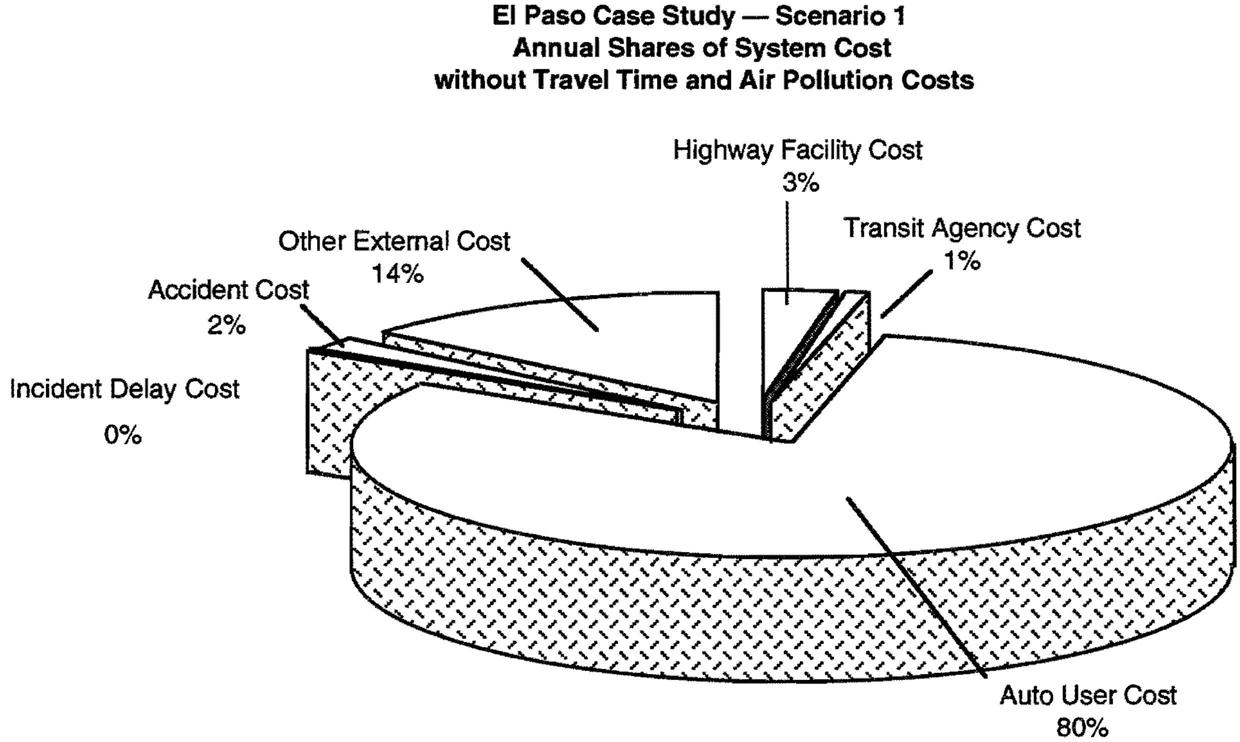

Figure 4.4 Annual shares of system cost — Scenario 1 without travel time and air pollution costs

CHAPTER 5. ANALYSIS OF ALTERNATE SCENARIOS

In order to evaluate the feasibility of making improvements to public transit — in this case the construction of the Northeast Transit Terminal — from a system life-cycle cost perspective, two hypothetical alternate scenarios are assessed. The alternate scenarios reduce the current ridership on Route 42 by different amounts and assign these person trips to single occupant vehicles in the corridor. The resulting system life-cycle costs are then compared with the existing conditions as estimated in Scenario 1. To the extent that the current amount of bus ridership can be attributed to the existence of the transit terminal, the transit terminal can be justified from a system life-cycle cost perspective if the difference in the life-cycle costs of the alternate scenarios and the base case scenario is at least as great as the life-cycle cost of the transit terminal.

SCENARIO 2

Scenario 2 assumes that 10 out of the total 56 daily one-way bus trips are eliminated from Route 42 each weekday (1 out of 19 one-way trips for the weekend) and that the average ridership on these buses change modes and drive single-occupant vehicles on the corridor.

Figure 5.1 summarizes the system life-cycle annual cost findings for this scenario. Total agency cost, including highway and transit, is $12.9 million, or about 0.1 percent of the total system annual cost. The auto-user cost, which includes the cost of purchasing and operating an automobile, is $300.9 million, or 2.0 percent of the total system annual cost. The reader should be aware that MODECOST assumes that transit riders do not incur automobile ownership and operation costs and therefore do not contribute to the total system annual cost for auto users.

Total external costs are estimated to be $14.662 billion, or 97.9 percent of the total system annual cost. External costs include monetary estimates of travel time under recurring congestion, air pollution, accidents, incident delay, and other external costs.

Figure 5.2 depicts the systemwide annual life-cycle costs for Scenario 2 in more detail by disaggregating the main external cost categories. The estimate of travel time and its monetary value in this analysis results in travel time costs that account for 86.8 percent of the total system cost. For comparison purposes, Figure 5.3 and Figure 5.4 present the results of the analysis minus the system travel time cost estimate (and without the air pollution cost estimate).

SCENARIO 3

Scenario 3 assumes that only 1 out of the total 56 one-way bus trips is eliminated from Route 42 each weekday (1 out of 19 one-way trips for the weekend) and that the average ridership on these buses change modes and drive single-occupant vehicles on the corridor.

Figure 5.5 summarizes the systemwide life-cycle annual cost findings for this scenario. Total agency cost, including highway and transit, is $13.0 million, or about 0.1 percent of the total system annual cost. The auto-user cost, which includes the cost of purchasing and operating an automobile, is $300.6 million, or 2.0 percent of the total system annual cost. The reader should be aware that MODECOST assumes that transit riders do not incur automobile ownership and operation costs and therefore do not contribute to the total system annual cost for auto users.

Total external costs are estimated to be $14.633 billion, or 97.9 percent of the total system annual cost. External costs include monetary estimates of travel time under recurring congestion, air pollution, accidents, incident delay, and other external costs.

Figure 5.6 depicts the systemwide annual life-cycle costs for Scenario 3 in more detail by disaggregating the main external cost categories. The estimate of travel time and its monetary value in this analysis results in travel time costs that account for 86.8 percent of the total system cost. For comparison purposes, Figure 5.7 and Figure 5.8 present the results of the analysis minus the system travel time cost estimate (and without the air pollution cost estimate).

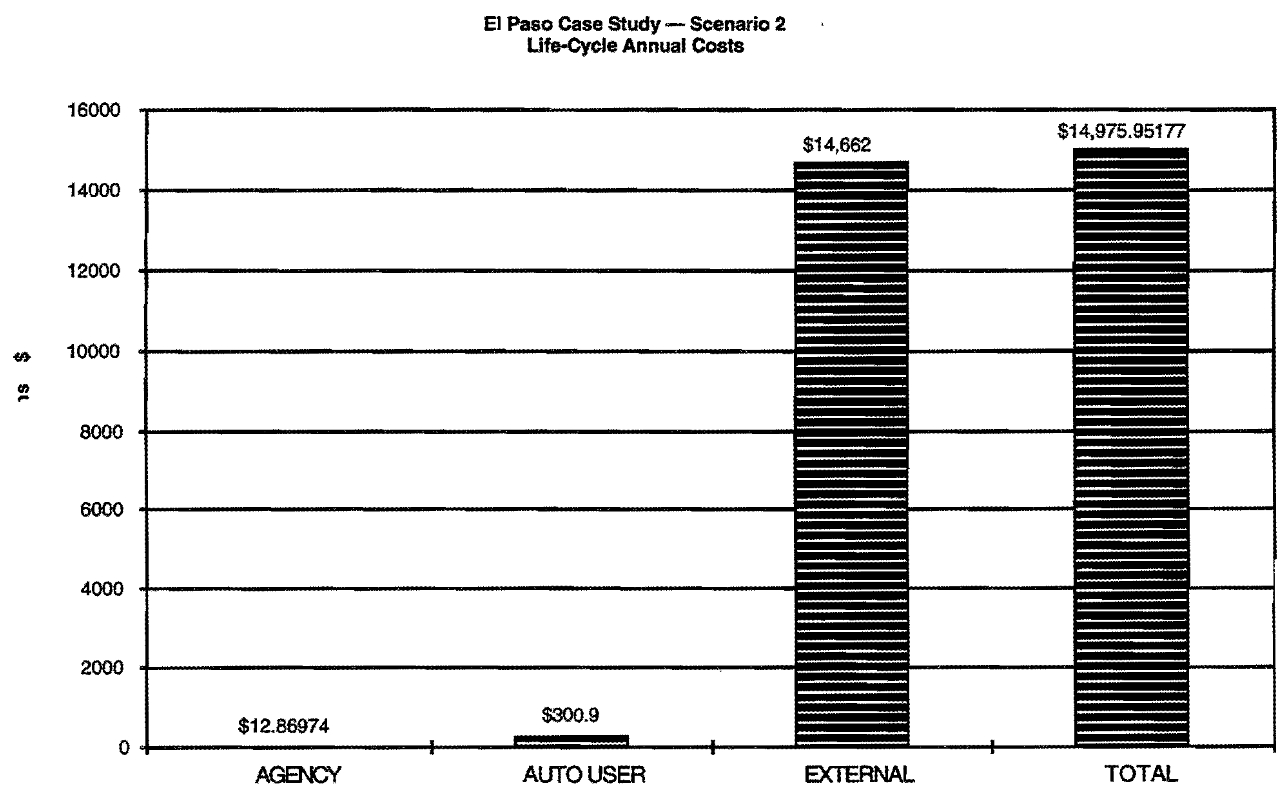

Figure 5.1 El Paso Case Study — Scenario 2 life-cycle annual costs

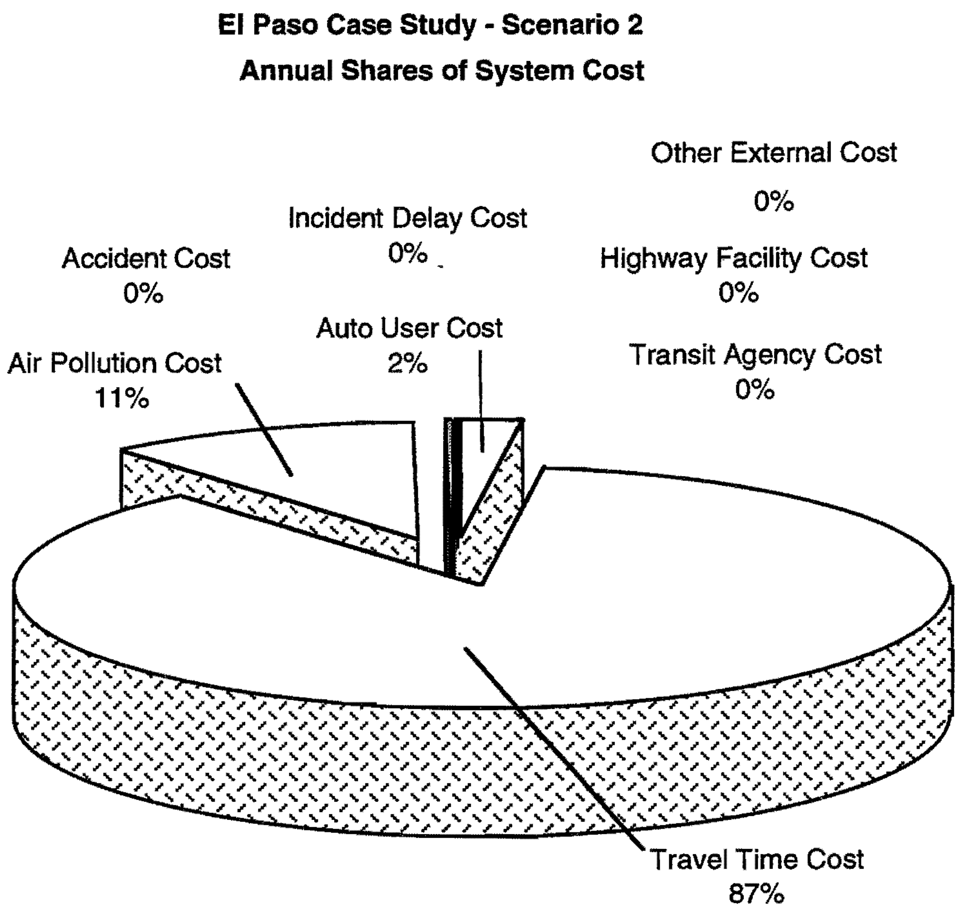

Figure 5.2 Annual shares of system cost Scenario 2

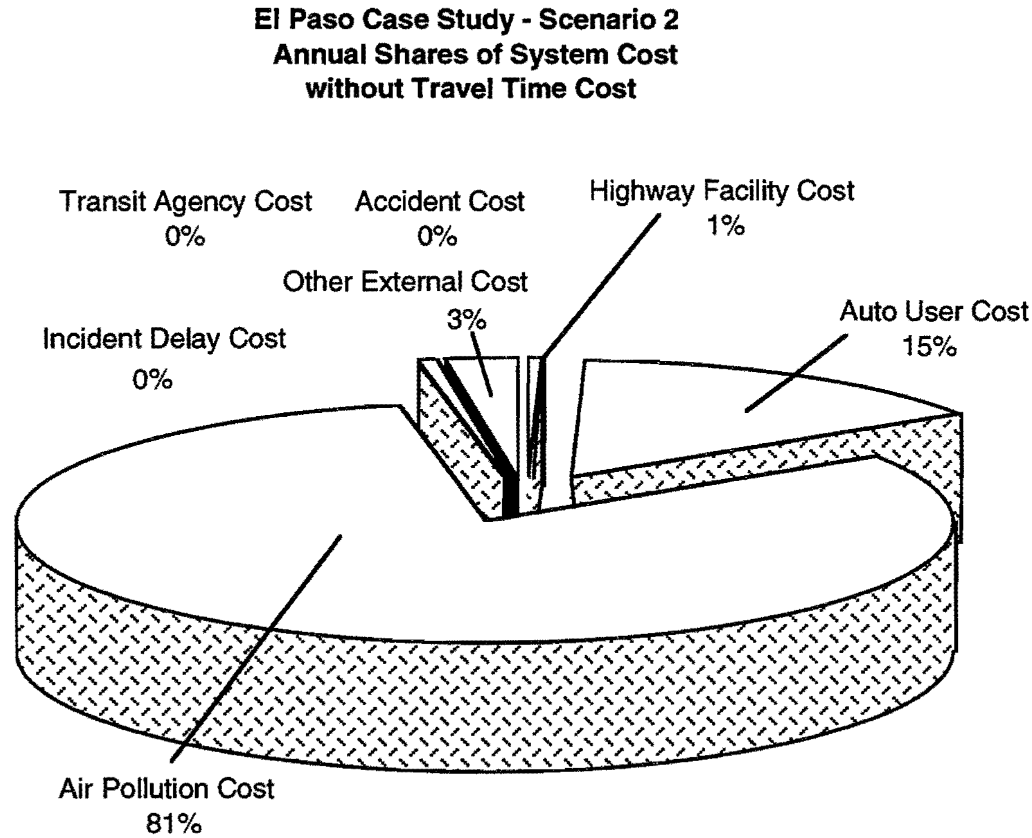

Figure 5.3 Annual shares of system cost — Scenario 2 without travel time cost

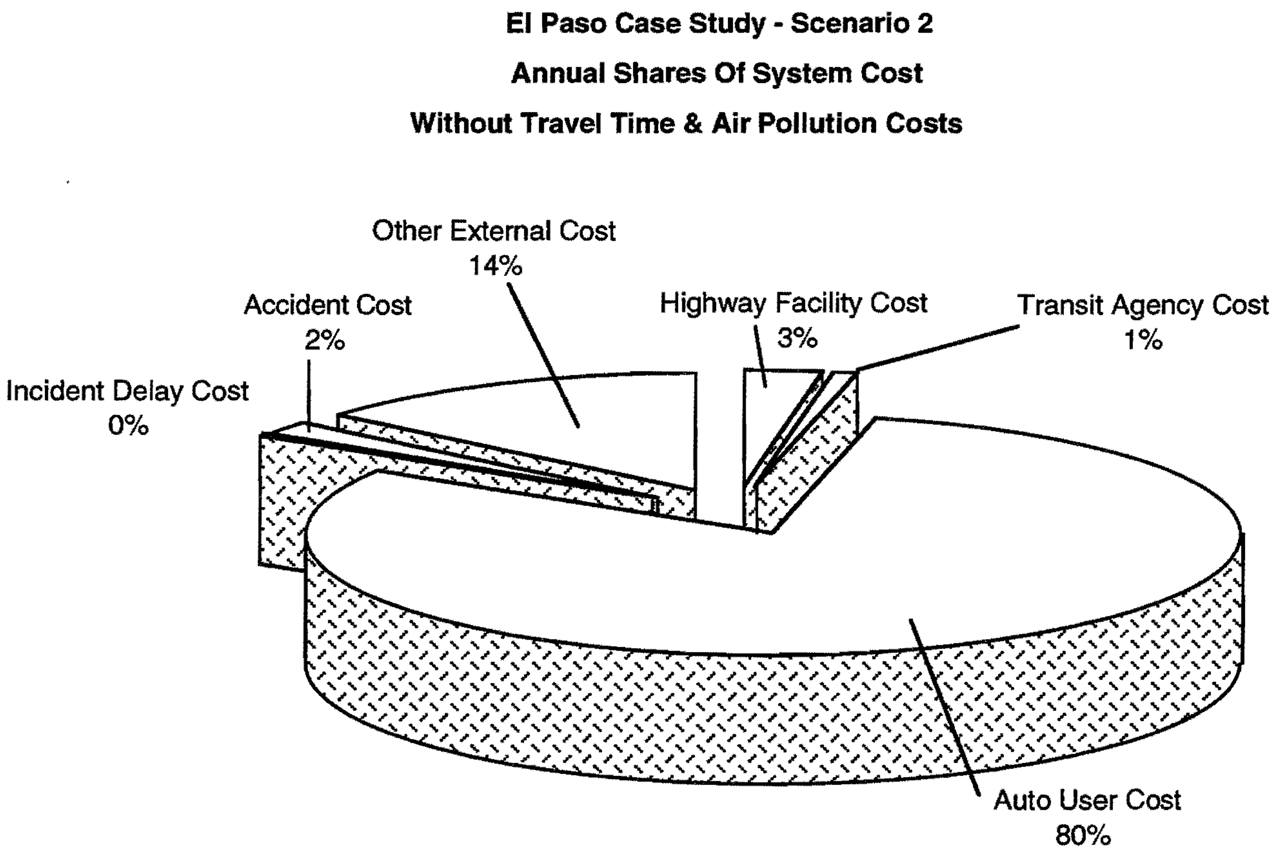

Figure 5.4 Annual shares of system cost — Scenario 2 without travel time and air pollution costs

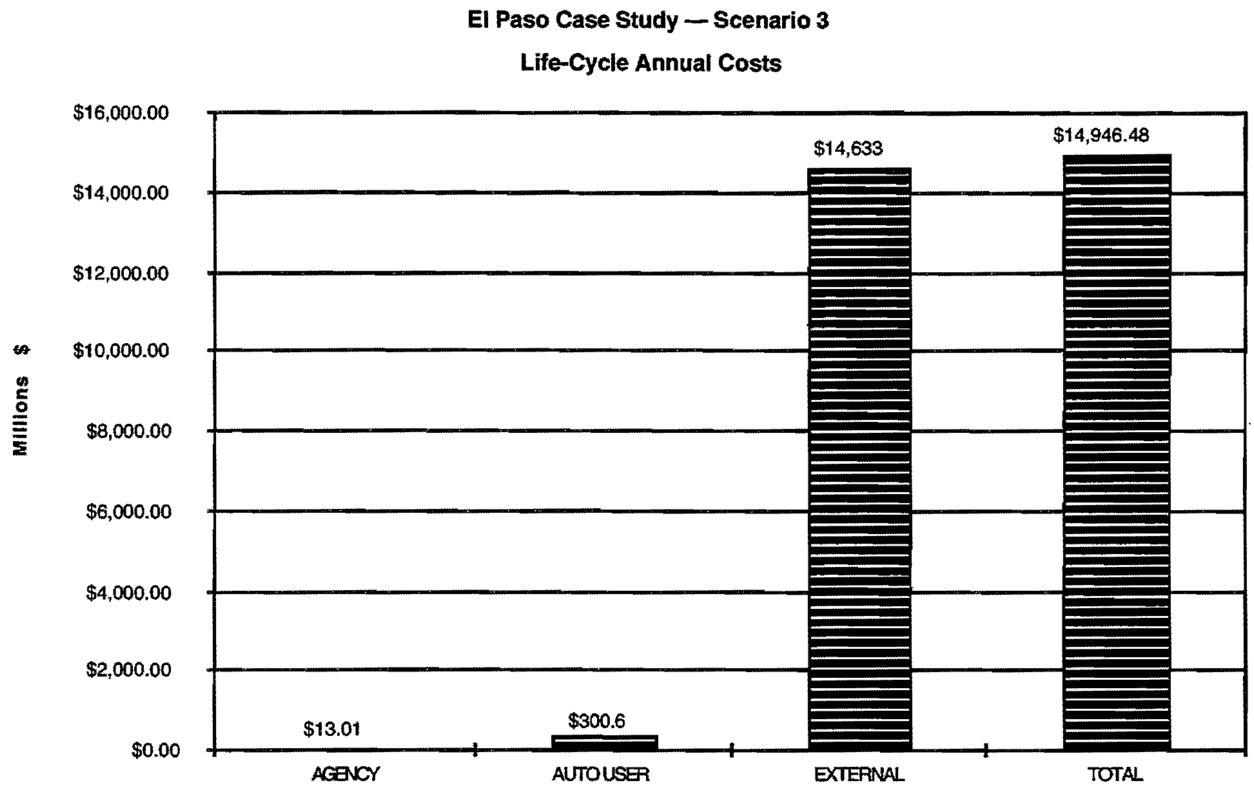

Figure 5.5 El Paso case study — Scenario 2 life-cycle annual costs

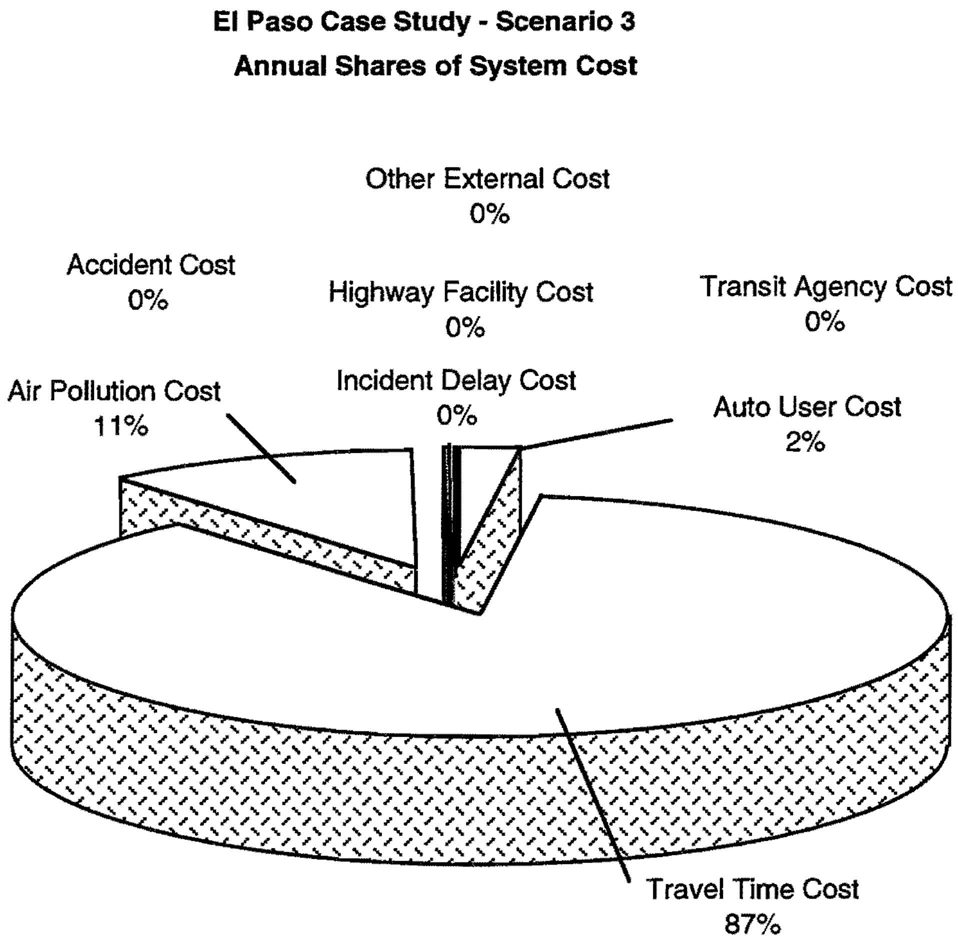

Figure 5.6 Annual shares of system cost Scenario 2

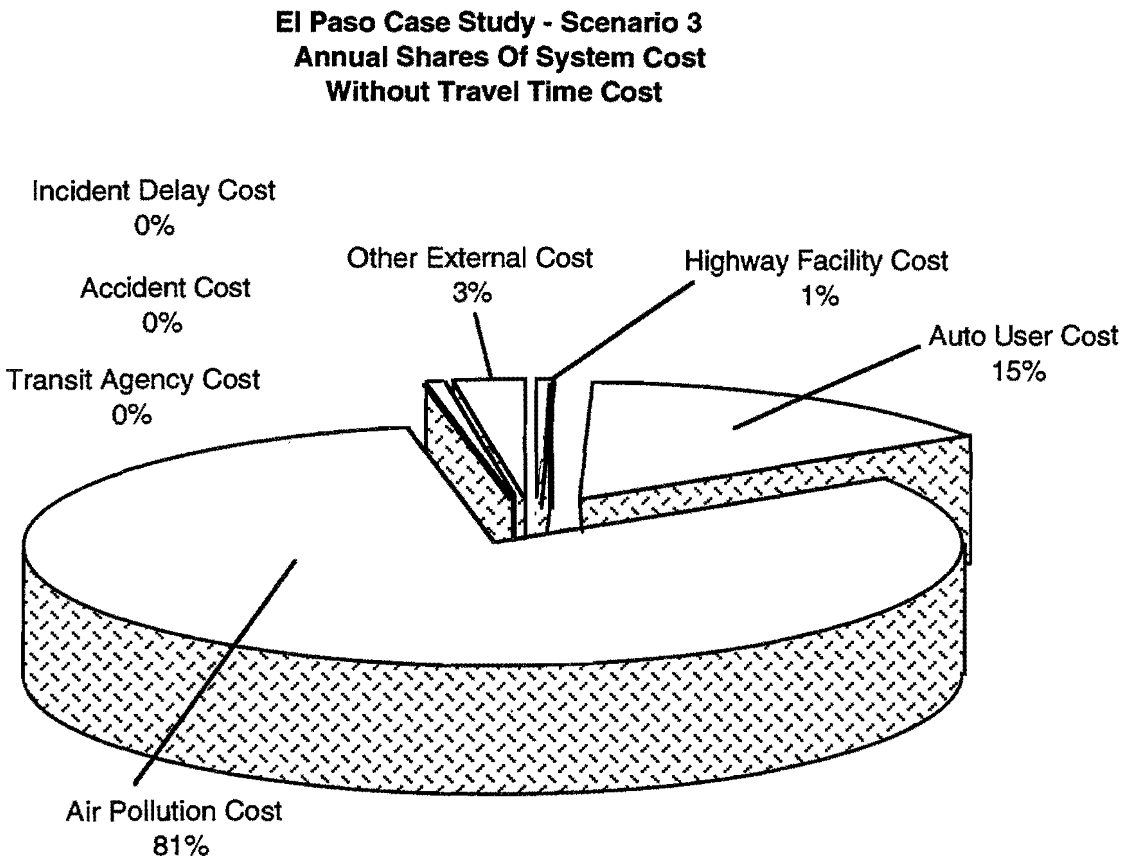

Figure 5.7 Annual shares of system cost — Scenario 2 without travel time cost

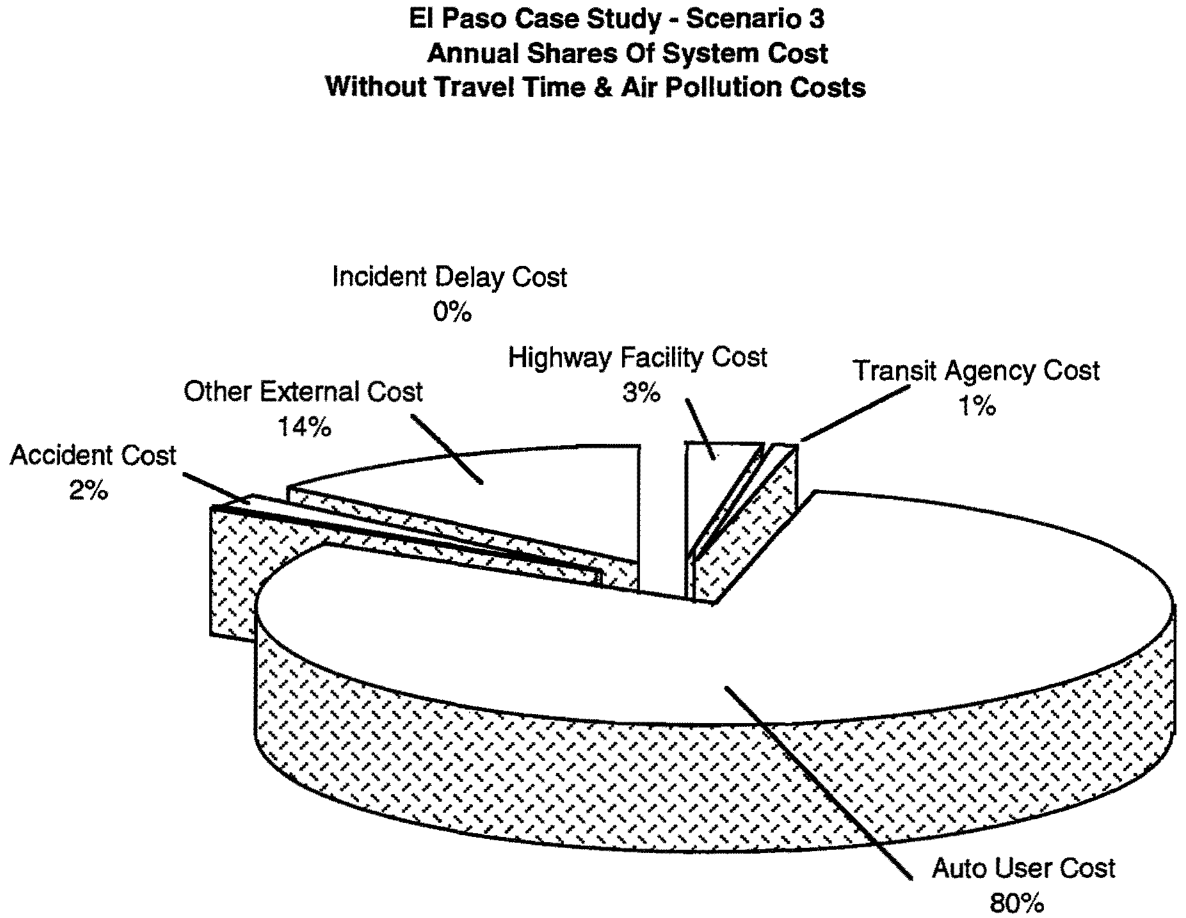

Figure 5.8 Annual shares of system cost — Scenario 2 without travel time and air pollution costs

CHAPTER 6. COMPARISON OF ALTERNATIVES

In this chapter, we compare the results of the three scenarios analyzed. To the extent that the current amount of bus ridership can be attributed to the existence of the transit terminal, the transit terminal can be justified from a system life-cycle cost perspective if the difference in the life-cycle costs of the two alternate scenarios and the base case scenario is at least as great as the life-cycle cost of the transit terminal.

Table 6.1 summarizes both the annualized system costs for each of the three scenarios evaluated and the estimated annualized cost for the transit terminal. "Annual System Cost Impact" refers to the annual system cost difference between one of the alternative mode split scenarios and existing conditions. As the table shows, the annual system cost impacts of shifting existing bus passengers to single-occupant vehicles under Scenario 2 and Scenario 3 are large relative to the annual cost of the transit terminal.

Table 6.1 Annual system cost summary — El Paso case study

	Scenario 1 (Existing Mode Splits)	Scenario 2	Scenario 3	Northeast Transit Terminal
Annual System Cost (Million $)	$14,937	$14,976	$14,947	$0.13
Annual System Cost Impact (Million $)	-	$39.0 (+0.3%)	$10.0 (+0.1%)	-

The estimated increases to the annual system cost under Scenario 2 and Scenario 3 are mostly due to increases in travel time costs, with air pollution costs increasing as well. Taken as a percentage of the system annual cost of Scenario 1, these increases are small, yet they are greater than the estimated annual life-cycle cost of the transit terminal.

Therefore, based on these results, the construction and maintaining of the transit terminal is justified even if the need for only one weekday one-way bus trip can be attributed to the presence of the transit terminal. In other words, if the construction of the transit terminal caused drivers of single-occupant vehicles to change modes from autos to bus (about 25 SOVs per day), then the transit terminal is a cost-effective improvement from a system life-cycle cost perspective.

To illustrate how the model can estimate travel time cost savings on the order of magnitude of $10 million annually just by removing 25 SOVs per day, we have plotted the changing travel time cost for each year over a 40-year life-cycle on Segment 12 of the highway facility, as shown in Figure 6.1. Beginning around the year 2008, the annual travel time cost begins to grow at an exponential rate.

These annual travel time costs result from two calculations made in the model. First, an estimate of total travel time is made based on speed-flow relationships and on queuing algorithms found in the literature. As the traffic volume approaches and exceeds the capacity of the facility, travel time estimates grow at an exponential rate. There is no demand restraint placed on the analysis, so that by the year 2026 the estimated AM peak hour demand-to-capacity ratio on the facility is greater than 5.0. Second, the cost of travel time in this study is set at $5 per hour of total travel time. These two estimations — total travel time and the unit cost of travel time — result in annual travel time costs.

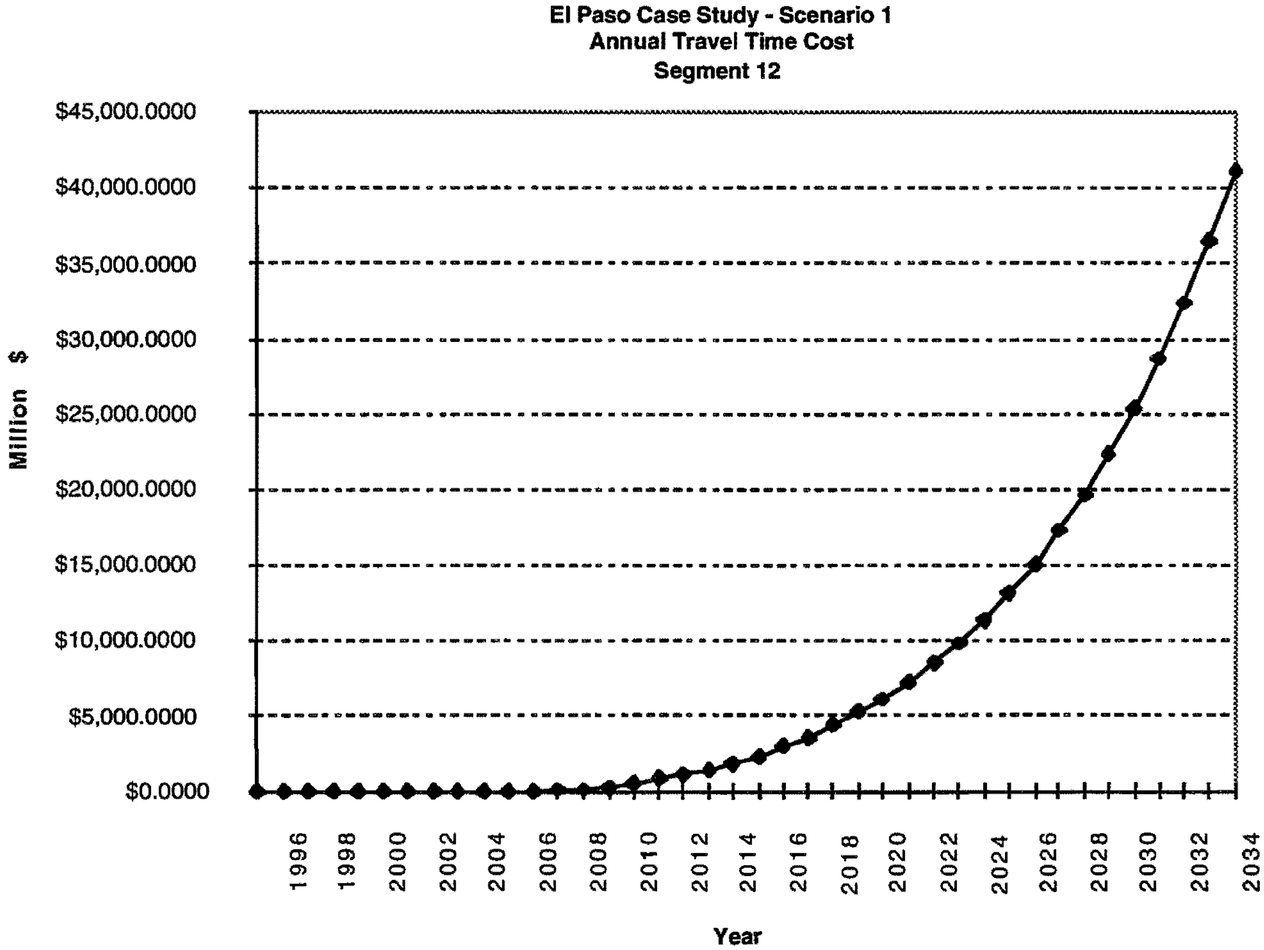

Figure 6.1 Changing travel time cost for each year over a 40-year life-cycle on Segment 12

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