16 Oct 1980

Correlation of Bus Ridership with the Trend of Gasoline Price in a Major Metropolitan Area

Andrew D. Jones

Braja M. Das

CORRELATION OF BUS RIDERSHIP WITH THE TREND OF GASOLINE PRICE IN A MAJOR METROPOLITAN AREA

Andrew D. Jones and Braja M. Das
Civil Engineering Department
The University of Texas at El Paso
El Paso, Texas

Abstract

A case study of the public bus ridership for the city of El Paso (Texas) for the years 1978, 1979, and 1980 has been presented. This has been correlated with increasing trend of the price of gasoline. Although the study presented is for a short duration, it reflects a general trend of slow but definitely encouraging public awareness for the conservation of energy.

1. INTRODUCTION

Public transportation in the United States, after suffering a decline beginning in the 1920's with the growing number and popularity of private autos, enjoyed a brief resurgence during World War II when new cars, tires, and gasoline were in short supply. However, during the period following World War II, the public preference for travel using private automobiles again increased sharply. More recently, the Arab oil embargo from October 1973 to March 1974 and the events that followed have resulted in a steady increase of gasoline prices all over the world. Also, it exposed the economic vulnerability of the industrialized nations of North America, Western Europe, and Japan.

In an effort to reduce the import of crude oil and reliance on the oil-exporting countries, several measures have been taken in the United States. One of these is to encourage the public to use public transportation as much as possible instead of using private automobiles. Some of the results of this have been summarized by ASCE[2]. According to this, "Los Angeles buses now exceed their passenger loads by some 150% beyond seating capacity; trains into New York City from Long Island carry an average of 4,000 standees every day; the Chicago bus system is severely strained at peak hours; and similar stories come from Nashville, Tennessee; Syracuse, New York; and Seattle, Washington; to name a few."

The purpose of this paper is to analyze the correlation of the use of public bus transportation with the increase of gasoline price in the El Paso metropolitan areas for the years 1978, 1979, and 1980.

2. EL PASO METROPOLITAN AREA

The El Paso metropolitan area is located in the western part of Texas and is the largest city along the U.S. and Mexican border (Fig. 1). It is composed of approximately 450,000 people and is one of the fastest-growing cities in the so-called Sun Belt. Its sister

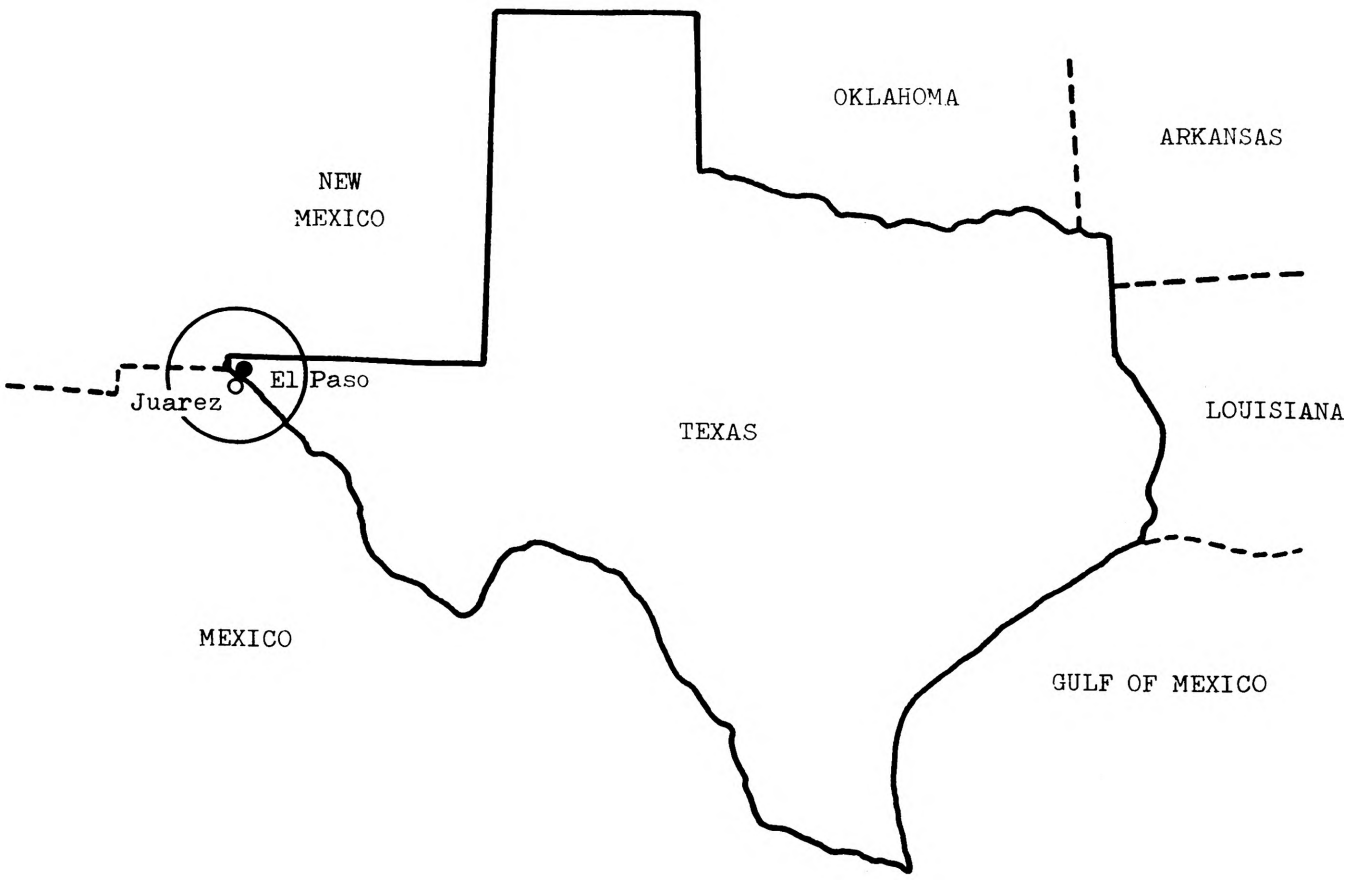

Fig. 1. Location of El Paso

city Juarez is on the Mexican side and has a population of about 800,000. These two cities are separated by the Rio Grande River, which is the international boundary. The two cities have a substantial person movement from Mexico to the U.S. and back, and it represents workers in the areas of construction, manufacturing, and other domestic works. Currently, a Mexican-owned and operated bus line provides the only international public transportation.

3. PRESENT PUBLIC TRANSPORATION SYSTEM IN EL PASO

Until 1978, the public transportation system in the city of El Paso was privately owned and operated. The city of El Paso took over the bus system in mid-1978. In order to encourage the public to use the buses more and private automobiles less, and at the same time realizing that the actual public usage of the buses depends on the type of service it provides, the city of El Paso acquired 84 RTS-2 buses. It started operating from September 1978 in a more coherent basis. The present bus system is referred to as the Sun City Area Transit (SCAT) and operates over 31 routes. Figure 2 shows a schematic diagram of the various transit districts, i.e., Central, Northwest, Northeast, East Side, and Lower Valley, which are planned based on the general needs of the passengers using the public bus system.

4. VARIATION OF GASOLINE AND DIESEL PRICE

The average variation of the price of all grades of gasoline in the state of Texas from November 1978 up to June 1980 is shown in Fig. 3. Most of this information has been gathered from the News Service Bulletins of the American Automobile Association (Texas Division)[1]. The average price in the El Paso metropolitan area is approximately the same as this with slight variation. It needs to be pointed out that the actual variations of the gasoline price between November 1978 and

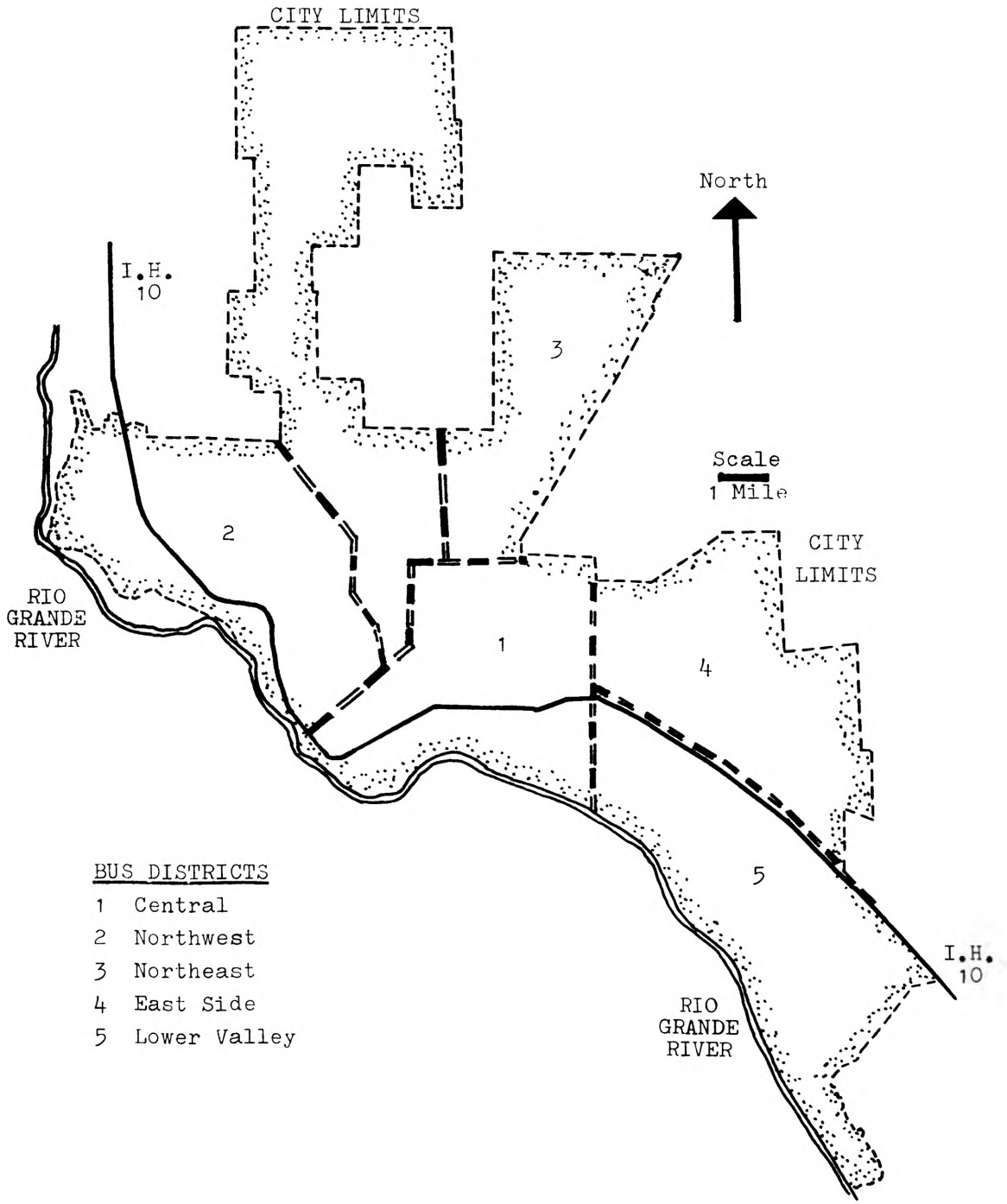

Fig. 2. Sun City Area Transit Districts

May 1979 were not readily available; and, for that reason, these two points have been joined by broken lines in Fig. 3.

Although not directly utilized in this study, for comparison purposes, the general increase of the price of diesel fuel per gallon from 1976 to 1979 in the El Paso area is also given in Table 1.

5. SUN CITY AREA TRANSIT PASSENGERS

Figure 4 shows a breakdown of all the SCAT passengers on a monthly basis starting from January 1978 through May 1980. These ridership figures have not been normalized, i.e., reduced to daily figures and eliminating holidays. Based on the data presented in this, the following general observations can be made:

TABLE 1. DIESEL FUEL PRICE IN THE EL PASO AREA[4]

Year	Price/gallon (cents)
1976	35.01[a]
1977	39.18[a]
1978	43.25[a]
1979	83.29[a]
1980	86.37[b]

[a]Prices are from the fourth quarter (Oct.-Dec.) of each year

[b]Price for the first quarter (Jan.-Mar.)

(1) Starting from January 1978 through July 1978, the passengers using the bus system generally dropped although the gasoline price steadily increased. This is during the period of transition from a privately-owned bus system to the city-owned SCAT system.

(2) The bus ridership from October 1978 through January 1979 shows a gradual decline, and a similar trend is observed for the period October 1979 through January 1980. Several reasons can be attributed to this decline, such as colder weather without bus shelters and the holiday season.

(3) Since July 1978, the bus ridership has shown a sharp increase when compared for a given month of a year to the corresponding month of the previous year. For example, in the month of October 1978, a total of 661,550 passengers used the city bus system. In October 1979, this number rose to 833,680 passengers, which is an increase of about 26%.

Another factor to note is that the total number of passengers using the city bus system are as follows:

Year	Passengers
1978 (Jan.-Dec.)	7,899,498
1979 (Jan.-Dec.)	8,565,975
1980 (Jan.-May)	3,721,029

The above figures show that there was a net passenger increase of 8.4% (666,477 passen-

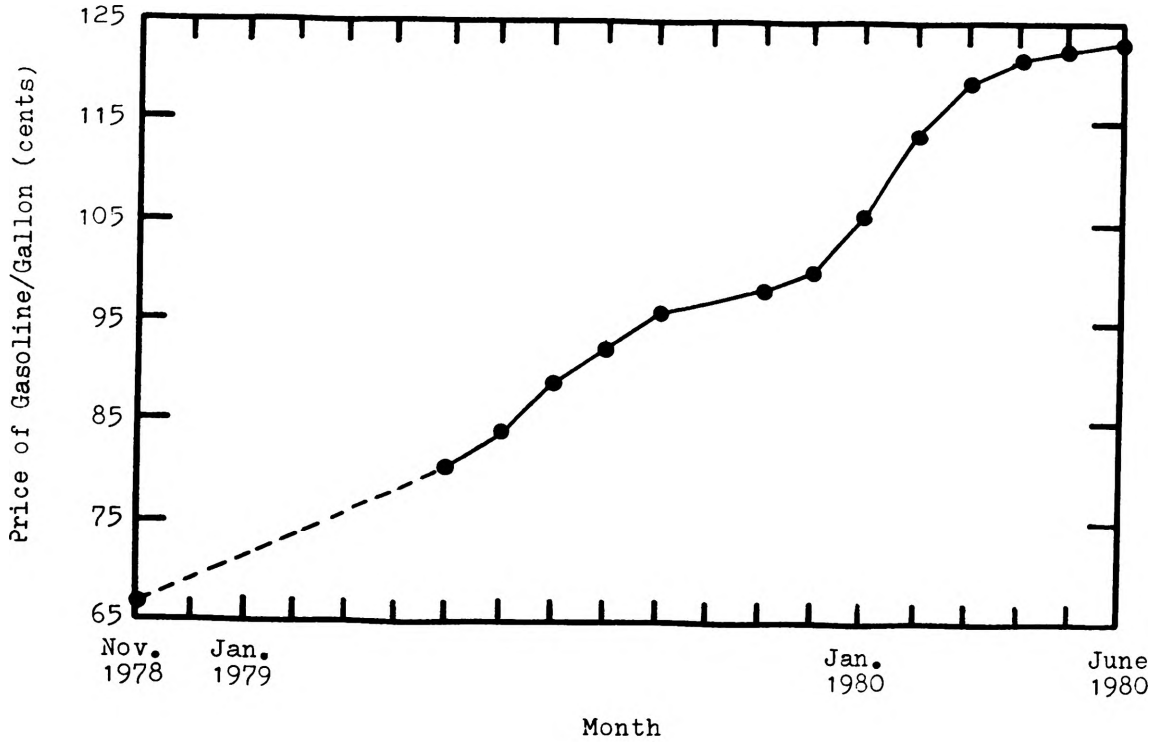

Fig. 3. Variation of the average price of gasoline in Texas (based on data collected from AAA News Service Bulletins)[1]

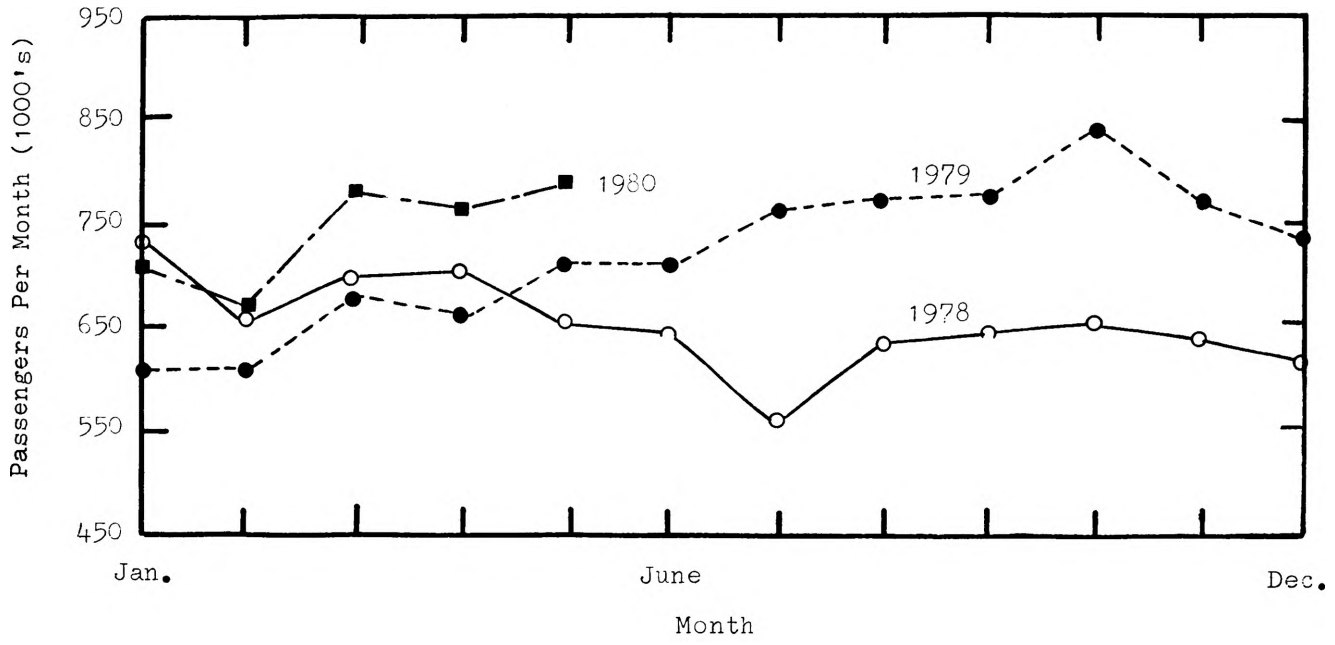

Fig. 4. Total passengers using the bus system in El Paso (based on data collected from SCAT authorities)[5]

gers) in 1979 over 1978. Between the period of January through May 1979, the total passengers on the SCAT system was 3,257,413. During the same period, there appears to be a net increase of 463,616 passengers in 1980 over 1979, i.e., about 14%. However, it remains to be seen if the same gain can be retained over the remaining seven months of 1980.

An El Paso transportation study[3] reports that the average trip length of home-base work trips is about 13.3 minutes. Assuming a conservative average speed of 25 miles per hour, the average trip would be about 5.54 miles. If we consider the additional 666,477 passengers attracted by the SCAT system in 1979 as compared to those in 1978, this amounts to about 3,692,283 private automobile miles not driven. This would represent some 200,000 to 250,000 gallons of gasoline saved.

Although the preceding figures seem definitely encouraging, the authors do recognize that there are numerous compounding variables which may preclude stating that this increase of bus ridership is entirely due to the increase in the price of gasoline. Some other major variables that can be identified are as follows: (1) Routes were modified at the same time as the new SCAT buses began operation, and (2) the availability of RTS-2 type buses on various routes.

Had these comfortable buses been available prior to 1978 and had they been operating over the present routes, some passengers could be using the bus system irrespective of the cost of gasoline. On the other side of the spectrum, some of the passengers could use the SCAT system but for the alleged unauthorized pickups of passengers by the Mexican-based international autobuses along the SCAT routes. In any case, it is unlikely that any of the above factors would considerably change the figures of the increased SCAT ridership compared to the increasing cost of gasoline.

6. CORRELATION OF BUS RIDERSHIP WITH GASOLINE COST

Utilizing the price of gasoline as an independent variable and bus ridership as a dependent varaible, a regression analysis has been performed. This is based on the figures starting from November 1978 up to May 1980. The equation for the correlation can be expressed as,

$$R = 471.62 - 2.6055(G) \qquad (1)$$

where,

R = bus ridership, in thousands, and

G = price of gasoline per gallon,(in cents

The coefficient of correlation is 0.64.

7. CONCLUSIONS

The statistical figures of the public bus ridership and the cost of gasoline for the El Paso, Texas, metropolitan area for 1978, 1979, and 1980 have been presented. Based on these figures, the following tentative conclusions can be drawn:

(1) In order to attract the public from using private automobilies to the public transporation system, proper planning of transportation routes is required. Also, the public transit authorities need to give attention to the comfort of the passengers.

(2) With a careful planning of the public bus system, the city of El Paso has been able to increase the public bus ridership in 1979 by about 8% over that in 1978. During the first five months of 1980, the bus passengers have increased by about 14% over the same period of 1979.

(3) The statistical correlation between the bus ridership with the cost of gasoline per gallon for the period of November 1978 through May 1980 is given in Eq. (1).

(4) The gradual change in the public attitude is definitely encouraging. This not only helps the household economy but also conserves energy, which is one of the prime national considerations of the 1980's.

7. REFERENCES

(1) American Automobile Association (Texas Division), News Service, May-Dec., 1979, Jan. and Feb., 1980.

(2) American Society of Civil Engineers, Civil Engineering, August, 1979, p. 6.

(3) Metropolitan Planning Organization Office, El Paso, El Paso Transportation Study: The Development and Application of Trip Generation and Distribution Models, 1970-1975 - 1985-2000.

(4) Public Transit Administration, El Paso, Energy Contingency Plan--Draft Copy, August, 1980.

(5) Sun City Area Transit Authority, Private Communication, May, 1980.

8. BIOGRAPHIES

Andrew D. Jones received his B.S. degree in Civil Engineering from the University of Houston in 1953. He received his M.S. degree in Civil Engineering from The University of Texas at Austin in 1965 and his Ph.D. in Transportation Planning and Engineering from Purdue University in 1972. He was employed by the Texas Highway Department in various capacities such as design engineer, supervising planning engineer, and district construction engineer between 1952 and 1970. From 1972 to 1979, he was Professor and Head of the Civil Engineering Department of California State Polytechnic University, San Luis Obispo, and is presently the Chairman of the Civil Engineering Department at The University of Texas at El Paso.

Braja M. Das received his B.Sc. in Civil Engineering from Utkal University, India, in 1963. He received his M.S. degree in 1967 and his Ph.D. in 1972 from the University of Iowa and University of Wisconsin at Madison, respectively. His previous teaching experience includes three years at South Dakota State University, Brookings, and two years at Tri-State University, Angola, Indiana. Since September, 1978, he has been with the Civil Engineering Department at The University of Texas at El Paso.