REFERENCES

1. America's Number 1 Passenger Transportation Service. American Bus Association, Washington, DC, Annual Rept., 1978.
2. The Intercity Bus Industry: A Preliminary Study. Interstate Commerce Commission, May 1978.
3. E.A. Pinkston. The Intercity Bus Transportation Industry. Yale Univ., New Haven, CT, Ph.D. dissertation, 1975.
4. E.L. Ramsdell. Assessment of Motor Carriers of Passengers Statistical Data Filed with the Interstate Commerce Commission. Proc., Transportation Research Forum, Richard B. Cross, Oxford, IN, Vol. 19, No. 1, 1978, pp. 430-437.
5. B. Rotenberg. Total State of California Comparison of Mainline Operating Statistics for 1967, 1978, 1979. Exhibit C-15 in the Matter of Applications 57797, 57939, California Public Utilities Commission, San Francisco, CA, April 30, 1980.
6. K.A. White. What Dictates Levels of Intercity Bus Service to Nonurbanized Communities of Similar Size. Greyhound Lines, Inc., Phoenix, AZ, July 24, 1979.
7. R.C. Zelrick. Comparison of Schedule Miles Operated in California. Exhibit C-38, in the Matter of Applications 57797, 57939, California Public Utilities Commission, San Francisco, CA, May 1, 1980.
8. F.L. Nageotte. The Case for Nationwide Intercity Bus Deregulation. Greyhound Lines, Inc., Phoenix, AZ, 1980.
9. J.L. Kerrigan. Intercity Bus Lines: Competing with Uncle Sam. Indiana Business Review, Vol. 5, July-Aug. 1978, pp. 11-14.
10. J.E. Burkhardt and A.M. Lago. The Demand for Rural Public Transportation Routes. Proc., Transportation Research Forum, Richard B. Cross, Oxford, IN, Vol. 17, No. 1, 1976, pp. 498-503.
11. D.A. Schroeder. A Multiple Linear Regression Analysis of Intercity Air Passenger Travel to San Francisco and to Los Angeles. Univ. of California, Berkeley, Master's thesis, Sept. 1970.
12. D.L. Dean. The Frequency of Intercity Bus Transportation to Intermediate Service Points: A California Case Study of Carrier Strategies. Univ. of California, Davis, Ph.D. dissertation, 1980.

Publication of this paper sponsored by Committee on Intercity Bus Transportation.

Intercity Bus Riders in Texas

THOMAS URBANIK II, PATTI BASS, AND KENNETH MARSHALL

This paper includes summary information obtained from an on-board intercity bus survey performed in selected locations throughout Texas. The purpose of the survey was to gain insight into the socioeconomic and travel characteristics of intercity bus passengers in Texas. The survey instrument was also designed to collect data on general attitudes concerning service and fares and to identify the features of the existing service that are most important in generating ridership. The first section of this paper presents the major findings of the on-board survey. Then the results are presented of a comparison between the results of this on-board survey and the results of an on-board survey conducted in Michigan in 1977. The most significant findings of the user survey were that mean trip length was longer than generally reported, that users are generally satisfied with current service, and that Texas intercity bus riders do not appear to be significantly different from those in other parts of the United States. A large portion (28 percent) of intercity bus riders do not have an automobile available for the trip. Trips are made infrequently (the median is 3 times/year). The most significant trip purpose is to visit friends (38 percent). Any improvement in service should focus on safety, on-time performance, and comfort.

The Texas State Department of Highways and Public Transportation, with funding from the Federal Highway Administration, contracted with the Texas Transportation Institute to conduct an extensive study of the intercity bus industry. The study was prompted by interest expressed by operators in the state. This paper reports the results of a portion of the study that concerned an on-board survey.

Although some information existed concerning intercity bus riders (1-4), there is reason to believe that intercity bus riders in Texas might have some unique characteristics. The reason for this belief is the generally healthier condition of the intercity bus industry in the Southwest (5). For this reason, it was decided to undertake an on-board study of bus passengers.

Since other on-board studies had been undertaken (1,4,6,7), it was also decided that a somewhat more extensive questionnaire would be used. The size of the questionnaire selected was both sides of one page. This length was thought to be brief enough to elicit a good response and also allow for the inclusion of some attitudinal questions not included in any previous survey. Both English and Spanish versions of the survey instrument were used because of the significant number of Spanish-speaking residents in the state.

A stratified sampling frame was selected because of regional differences within the state. [Previous studies (1,2,8) indicated that low-income persons are a significant part of intercity bus ridership.] The border area of the state is economically poorer than the rest of the state. Based on county economic characteristics, one region includes those counties along the border identified as having a lower economic base. The remaining counties were roughly divided in half.

Within each region survey points were further segmented by small [nonstandard metropolitan statistical areas (SMSAs)], medium (SMSAs less than 1 million) and large (SMSAs greater than 1 million) cities. Texas has approximately 1000 potential survey points, but only 25 points are in the medium or large category. The number of survey points in each strata are given in the table below.

	Survey Points		
Region	Small City	Medium City	Large City
North-east	4	2	1
North-west	2	2	0
South-west	2	1	1

Figure 6. Mode of travel from bus station.

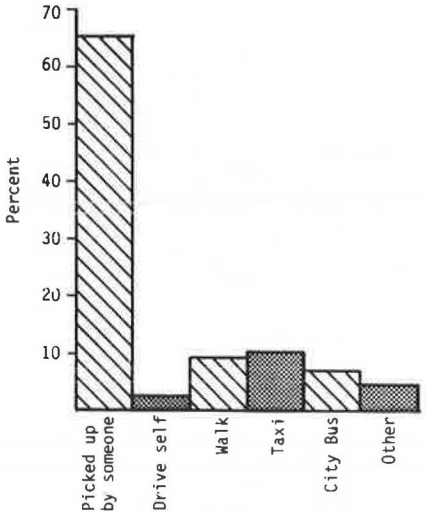


Figure 7. Trip purpose.

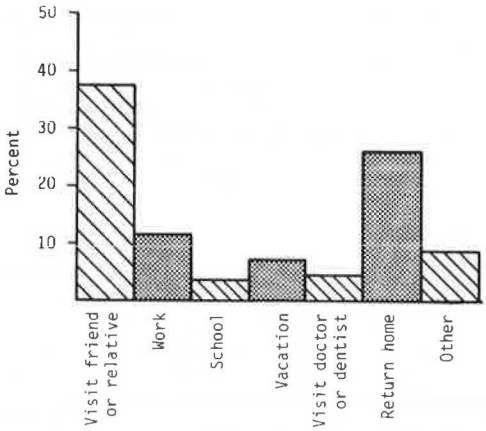


Figure 8. Alternative travel mode.

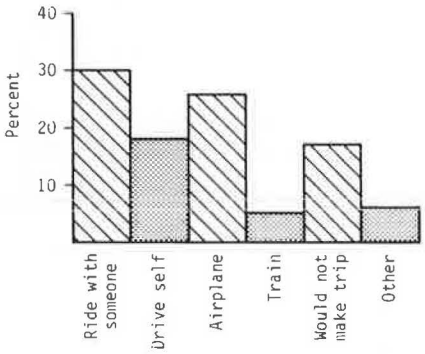
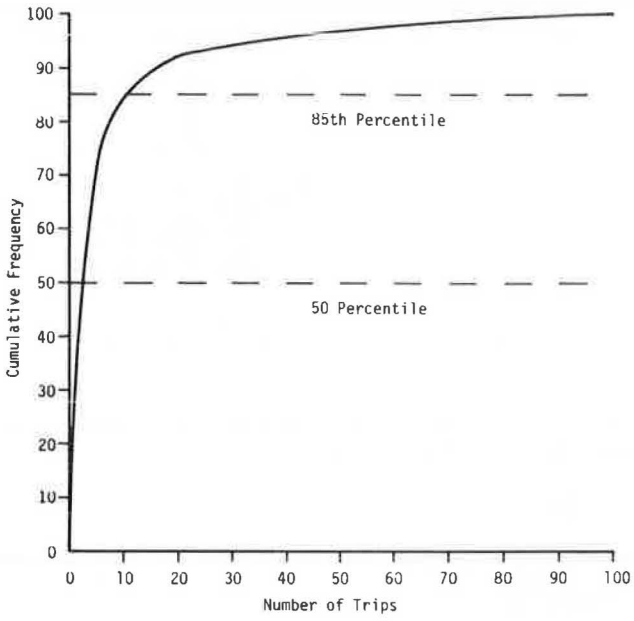


Figure 9. Number of intercity bus trips made by passengers in past year.



categories--those that have a choice of mode of travel and those that are captive and have no alternative mode of travel available. Passengers were asked how they would have made this trip if intercity bus service were not available. The responses are shown in Figure 8.

Forty-seven percent of the riders responded that they would have ridden with someone else or driven themselves. Twenty-five percent stated that they would have made the trip by airplane. This may have been the choice of those passengers making long trips, as 25 percent of the riders surveyed were traveling more than 600 miles. Seventeen percent of the riders stated they would not have made the trip if bus service had not been available.

Further analysis of data from those stating that they would not make the trip if intercity bus service was not available indicated that 45 percent owned a car that was available for the trip. Thus, the loss of bus service would appear to leave only a small number of persons without an alternative mode of travel.

Number of Intercity Bus Trips in Past Year

Figure 9 illustrates the number of bus trips made by the respondents within the past year. For this survey a round trip was counted as two trips. As indicated, 50 percent of the users had ridden three times or less and 85 percent had ridden fewer than 10 times.

As previously mentioned, almost 50 percent of the riders stated that the purpose of their trip was to visit friends or relatives for vacation or for a medical appointment. These trips are generally not made frequently. Thus, this may be the reason for the low number of trips made by bus in the past year.

Trip Length

Passengers were asked the origin and destination of their trips. From this information the length of each trip was calculated. Figure 10 shows the distribution of trip lengths for the passengers surveyed. Approximately 41 percent of the trips were less than 200 miles in length. However, 25 percent of the trips were more than 600 miles in length, and the average trip length was 498 miles.

The average trip length for intercity bus travel on a national level is reported to be 125 miles (9). However, there is reason to believe that the average trip length is actually longer than this due to the overcounting of passengers (10). Thus, the longer average trip found in Texas may not be as much of an anomoly as it appears.

Figure 10. Intercity bus trip length.

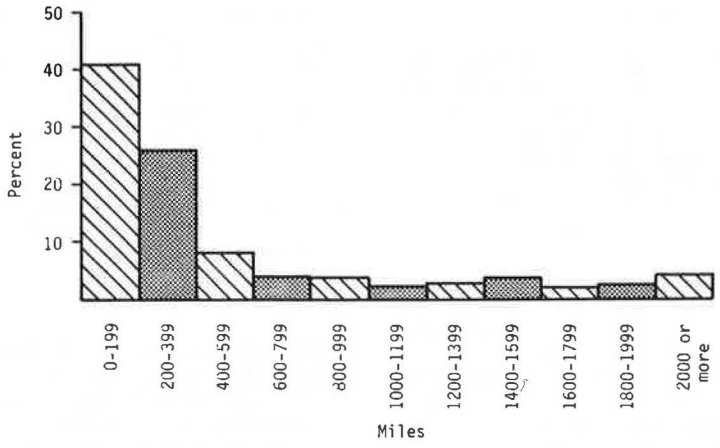


Figure 11. Passenger attitudes toward increased fares.

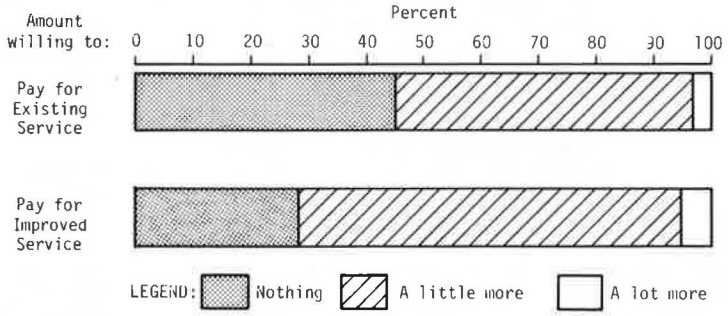


Table 1. Relative importance of various intercity bus features to users.

Feature	Overall Rating[a]	Significance Level[b]
Safety at bus station and on bus	4.44	Most
Leaving and arriving on time	4.38	
Leg room and comfortable seats	4.32	
Availability and cost of gasoline	4.13	Intermediate
Having express bus service	4.09	
Frequency of intercity bus service	4.05	
Bus fare	3.98	
Speed of bus trip	3.92	
Cost of owning car	3.90	
Location of bus station	3.87	
Riding in new modern bus	3.80	
Local city bus transportation at destination	3.67	
Food service at bus station	3.64	
Availability of air or train service	3.41	Least
Automobile parking near bus station	3.31	

[a] Each feature was rated on a scale of 1 (not important) to 5 (very important).
[b] To assess statistically significant differences in the responses, a Duncan's multiple range test for variable rank was performed to identify significantly different means. The responses fell into the three general significance levels shown in the table.

General Attitudes

The survey asked certain questions designed to identify attitudes concerning intercity bus service and fares and to identify those features that were important to users in their decision to use intercity bus service.

Service and Fares

Questions were asked concerning satisfaction with the existing bus service and attitudes toward the cost of the service. The response to the question "How would you rate your satisfaction with intercity bus service overall?" is summarized in the table below. As indicated, the overwhelming majority thought that the existing service is satisfactory. In fact, only 5 percent of the respondents were not pleased with the current service.

Level of Satisfaction	Response (n = 1024) (%)
Very satisfactory	41.8
Satisfactory	47.6
Not satisfactory	5.4
No opinion	5.2

Figure 11 shows the results of the questions concerning how much more users would be willing to pay for existing service and for improved service. Most riders surveyed indicated that they would be willing to pay a little more for both the existing service (51 percent), and for improved service (66 percent). Only a small number of persons would be willing to pay a lot more for either existing or improved service.

Important and Unimportant Features of Intercity Bus Service

This study attempted to identify those features of existing intercity bus service that were most important to the users in their decision to use the service. In essence, an attempt was made to document those features of intercity bus travel that should be emphasized in the planning and operation of the service.

The survey included the following statement: "A number of different factors are important in deciding to use intercity bus service. Please circle the number that best explains how important the following features are to you in deciding to use the intercity bus." Following that, 15 intercity bus features were listed; the user rated each on a scale of 1 (not important) to 5 (very important). These results are summarized in Table 1. The three most

significant factors are within the control of operators.

To test for statistically significant differences in the responses, a Duncan's multiple range test for variable rank was performed to identify significantly different means. The Duncan method is a refinement of the protected least significant difference criterion for comparing ranked means on a pairwise basis. The Duncan method provides a reasonable tradeoff between type 1 and type 2 errors.

COMPARISON WITH MICHIGAN SURVEY

In order to ascertain whether Texas intercity bus riders or trips have any unique characteristics, the results of the survey were compared with the results of a 1977 on-board survey conducted in Michigan (1). The survey results were compared by using the Kolmogorov-Smirnov test (11), which is a nonparametric test for differences between two cumulative distributions. The two-sample test analyses the hypothesis that the two independent samples come from identical continuous distributions. The test is sensitive to population differences with respect to location, dispersion, or skewness.

The Texas on-board survey was compared with eight questions from the Michigan survey. Questions concerning age, sex, occupation, vehicle ownership, mode of arrival at the bus station, mode of departure from the bus station, trip purpose, and the number of intercity bus trips made in the past year were compared. All comparisons were made at a level of significance of $\alpha = 0.05$. If the null hypothesis was rejected, evidence was sufficient to conclude that the samples are drawn from different populations. As given in the table below, the null hypothesis was only rejected for occupation.

	Sample Population	
Question	Identical	Different
Age	X	
Sex	X	
Occupation		X
Vehicle ownership	X	
Mode of arrival	X	
Mode of departure	X	
Trip purpose	X	
No. of trips	X	

Note that the conclusion that occupations are different is dependent on the need to equate two different classification schemes. The differences between the two samples could be solely the result of the classification scheme. Therefore, the conclusion concerning differences in occupations is tenuous.

SUMMARY AND CONCLUSIONS

The most notable finding concerning intercity bus riders is that the average trip length is nearly 500 miles. This is significantly longer than generally reported elsewhere. The difference appears to be due to the way ridership data are reported by individual companies.

The on-board survey indicated that 89 percent of the users were satisfied with the service. Improvement of service for existing riders would, therefore, not be likely to result in increased ridership. Features of intercity bus service most important to users included safety, being on time, and comfort. User attributes were not shown to be different for riders in Texas and Michigan. The most significant attribute of intercity bus riders is their lack of an available automobile with which to make the trip.

ACKNOWLEDGMENT

This paper is the result of a study sponsored by the Texas State Department of Highways and Public Transportation in cooperation with the Federal Highway Administration. The contents reflect our views, and we are responsible for the facts and the accuracy of the data presented. The paper has not been reviewed by the sponsors and the contents do not necessarily reflect their official views or policies. The paper does not constitute a standard, specification, or regulation.

REFERENCES

1. Michigan Intercity Bus Study. Michigan Department of State Highways and Transportation, Lansing, Nov. 1977.
2. Census of Transportation National Travel Survey. U.S. Bureau of the Census, 1977.
3. J.E. Purdy and L.A. Hoel. An Evaluation of the Effect of Level of Service and Cost on Demand for Intercity Bus Travel. Virginia Highway and Transportation Research Council, Charlottesville, Sept. 1980.
4. R.L. Carstens; Engineering Research Institute, Iowa State University. Intercity Passenger Carrier Improvement Study. Iowa Department of Transportation, Ames, Aug. 1977.
5. Senate Committee on Commerce, Science, and Transportation. Intercity Bus Service in Small Communities. U.S. Congress, 95th Congress, 2nd session, July 1978.
6. Intercity Bus Transportation in Wisconsin. Wisconsin Department of Transportation, Madison, Vol. 1, Nov. 1976.
7. Intercity Bus Transportation in Oregon. Oregon Department of Transportation, Salem, Prelim. Rept., Feb. 1975.
8. The Intercity Bus Industry. Interstate Commerce Commission, Washington, DC, Prelim. Study, May 1978.
9. Transportation Facts and Trends. Transportation of America, Washington, DC, 16th ed., July 1980.
10. E. MacNeal. The Semantics of Air Passenger Transportation. Norfolk Port and Industrial Authority, Norfolk, VA, 1981.
11. M. Hollander and D.A. Wolfe. Nonparametric Statistical Methods. Wiley, New York, 1973.

Publication of this paper sponsored by Committee on Intercity Bus Transportation.