NBSIR 73-265

The Shirley Highway Express-Bus-On -Freeway Demonstration Project-Users' Reactions to Innovative Bus Features

Theodore H. Saks
Richard F. Yates
Keith M. Goodman

Technical Analysis Division
Institute for Applied Technology
National Bureau of Standards
Washington, D. C. 20234

June 1973

Interim Report 3

Prepared for
Urban Mass Transportation Administration
Department of Transportation
Washington, D. C. 20591
Program Manager, Ronald J. Fisher (UMTA)

NBSIR 73-265

THE SHIRLEY HIGHWAY EXPRESS-BUS-ON-FREEWAY DEMONSTRATION PROJECT-USERS' REACTIONS TO INNOVATIVE BUS FEATURES

Theodore H. Saks
Richard F. Yates
Keith M. Goodman

Technical Analysis Division
Institute for Applied Technology
National Bureau of Standards
Washington, D. C. 20234

June 1973

Interim Report 3

Prepared for
Urban Mass Transportation Administration
Department of Transportation
Washington, D. C. 20591
Program Manager, Ronald J. Fisher (UMTA)

U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary

NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

Acknowledgment

The authors wish to acknowledge the contribution of Gerald K. Miller who helped to direct these analyses and edit this report. Appreciation is also expressed to Dr. James J. Filliben of the Applied Mathematics Division for his statistical advice. Gratitude is extended to Mrs. Carol Harrison who helped prepare and administer the survey and who prepared the graphics, and to Mrs. Terry Schultz and Mrs. Janet Stamper who were responsible for typing the final and earlier versions of this report.

Abstract

The Shirley Highway Express Bus-on-Freeway Project demonstrates the application of a new mass transit technology. The elements tested in this demonstration project include: an exclusive bus lane in the median of a freeway and bus priority lanes in the downtown distribution area; fringe parking facilities which are coordinated with the bus service; new-look/new-feature buses; and extension of service to additional residential areas in an overall systems approach to the improvement of mass transit. As part of the evaluation of this demonstration project, a survey of commuters on board these buses was undertaken in order to obtain users attitudes concerning the special interior bus features as well as transit service features.

The results obtained from this study should be of interest to persons considering how to allocate expenditures for new bus vehicles and transit service improvements.

Bus commuters perceptions of the relative importance of various bus interior features (i.e., carpeting, special lighting, etc.) and transit service features (i.e., reliable schedules, assurance of a seat, etc.) are analyzed in this report, along with their relative satisfaction assessments of the special bus interior features. Analyses were conducted to determine if marginal improvements in interior comfort and aesthetic features proved significantly more appealing to bus commuters. The relative impact of various project marketing and promotional techniques is also presented.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Background

One major objective of the Shirley Highway Express Bus-On-Freeway Demonstration Project[1] is to test the hypothesis that the provision of rapid and improved bus service over an exclusive busway will attract significant numbers of passengers who formerly commuted by automobile. Such a diversion from autos to buses should increase the people-moving productivity of the presently congested highway system and enable all rush-hour commuters to travel more quickly and conveniently. Coordinated with the development of the exclusive busway, bus service is being enlarged and improved with new bus vehicles, expanded routes and schedules, and the construction and incorporation of additional park-and-ride facilities.

All of the Demonstration Project buses are air-conditioned, free of interior advertising, and have special interior design features such as contour vinyl seats and floors covered with tile or carpeting. Some of the special buses differ in that they are six inches wider than the standard urban bus and are powered by eight-cylinder engines. These larger buses are outfitted with wider red vinyl bucket seats, interior wall and ceiling carpeting to reduce noise levels, and indirect interior lighting broadcast through translucent panels embellished with historic scenes of Virginia.

---

[1] Sponsored by the Urban Mass Transportation Administration of the Department of Transportation, with the Northern Virginia Transportation Commission (NVTC) and AB&W (now the Alexandria Division of the Washington Metropolitan Area Transit Authority) as participants. The Technical Analysis Division (TAD), National Bureau of Standards is performing the evaluation of the project.

In August 1971, two months after the initiation of the project service, an on-board survey found that service features such as schedule reliability and seat assurance were more important to bus riders than special interior features such as floor covering and vinyl seats.[2] The new bus users also said that in their decision to switch from auto to bus (mode choice), service features were more important than comfort and aesthetic considerations. Surveys and studies by others have produced similar conclusions.[3] For an interesting development of a mode choice model using auto and bus commuters' assessments of various service and interior features, refer to Hartgen and Tanner's work dealing with a University of Maryland study.[4]

A second on-board survey was administered in July 1972 to amplify these earlier results. Assessments were solicited from the bus users concerning their satisfaction with the new interior bus features. In addition they were asked to indicate the relative importance of these and other bus features. Since the contingent of wider buses had recently been put into service and since the two bus types offered somewhat different features,[5] the survey also provided an opportunity to

---

[2] Chapter 5, The Shirley Highway Bus-On-Freeway Demonstration Project-First Year Results, Interim Report 2 (Report DOT/UMTA 2), November 1972.

[3] Golob, Canty, Gustafson; "An Analysis of Consumer Preferences for a Public Transportation System"; Transportation Research Department, Research Laboratories, General Motors Corporation, GMR-1037, October 1970.

[4] Hartgen and Tanner, "Investigations of the Effect of Traveler Attitudes in a Model of Mode-Choice Behavior." Highway Research Record No. 369, 1971.

[5] See Appendix A for a description of the different bus types.

compare user reactions to the features on the two bus types. The results of the 1972 survey are presented in this report.

1.2 Purpose

The objectives of this study are threefold:

(1) Examine commuters' relative satisfaction with the special interior bus features; examine the importance they place on these interior features compared to service related features; and compare the importance they place on the features with their satisfaction (Section 3.0).

(2) Determine if marginal improvements in interior comfort and aesthetic features (as in the wider buses) are significantly more appealing to bus commuters, by comparing commuter reactions to the features of the two bus types (Section 4.0).

(3) Gain insight for marketing and promotion of the bus service (Section 5.0).

The results obtained from this study should be of interest to persons considering how to allocate expenditures for new bus vehicles and transit service improvements.

1.3 Scope

This study is based upon an on-board survey of bus users taken during the peak commute period on a representative sample of bus routes during the week of July 5, 1972. Excellent response[6] produced 551 complete and usable questionnaires. At the time there were two different series of buses in use. Each series is equipped with a different package of special interior features. The focal points of the questionnaire are questions concerning the special interior bus features, as well as certain aspects of bus service. The special interior features include: vinyl padded contour seats which are color coordinated with carpeting or

[6]Response rate for the questionnaire was better than 95%.

textured vinyl floor coverings, special covered side walls and ceilings, and indirect lighting with no interior advertising. All of the buses are equipped with air pollution control devices. In addition the buses in the second series are 6 inches wider and have decorative interior lighting panels.

1.4 Content

This report consists of five sections including this introduction. Section 2.0 contains a summary of the major findings while Sections 3.0 through 5.0 present the survey data and their analyses. Sections 3.0, 4.0, and 5.0 address the study's objectives as outlined in paragraph 1.2 (Purpose). In Section 3.0 the responses for all those surveyed are analysed and presented, and Section 4.0 compares the responses to the two different bus types. The effectiveness of past advertising methods is briefly reviewed in the last section.

The appendices contain a description of the features of the various bus types, and a copy of the questionnaire. It also contains an inclusive analysis to determine if a special promotional orientation is needed to attract present auto commuters to use the special project buses.

1.5 Survey Methodology

1.5.1 Survey Sample and Collection Method

During the week of July 5, 1972, a survey was conducted on a sample of the twelve project peak period bus routes.[7] One bus on each route was selected, and the first 47 boarding passengers were given a

[7] The project routes are designated 2G, 3G, 4G, 4H, 6G, 7G, 8G, 17G, 17M, 18G, 18M, and 19G.

questionnaire by a survey distributor.[8] The riders were asked to complete and return the form before departing from the bus. A copy of the questionnaire is in Appendix B.[9]

1.5.2 Summary of the Survey Questions

The form consisted of a brief introductory segment which was followed by three main sections. In the introductory segment the respondents were asked which types of buses they had used in the past.

Section one solicited users perceived satisfaction with the various special interior bus features. This was accomplished by asking the bus patron to complete the following for each of 12 innovative interior comfort and aesthetic bus features listed:

CONSIDERING EACH FEATURE BY ITSELF, PLEASE RATE THE FOLLOWING FEATURES OF THIS BUS BY PLACING AN "X" IN THE APPROPRIATE BOX

	Very Poor	Poor	Fair	Good	Very Good
FEATURES	☐	☐	☐	☐	☐

[8]The seating capacity of the buses is 47; in some cases standees volunteered to complete the questionnaires and were allowed to do so, up to a limit of 3 per bus. Very few passengers refused to complete the questionnaire.

[9]Two versions of the form were distributed; the order of the questions, on the 2nd and 3rd page of the forms, were reversed in order to minimize ordering biases. (i.e., the tendency to give higher ratings to those items at the beginning of the list because they are considered first.) One version inadvertently omitted the "No Interior Advertising" feature from the list of satisfaction items.

The second section of the survey form (on the page opposite the above question) requested bus users to consider 15 bus interior and service related features and assign each of them an importance rating:

PLEASE RATE
THE IMPORTANCE OF EACH OF THE FOLLOWING
FEATURES OF BUS TRANSIT BY PLACING AN "X"
IN THE APPROPRIATE BOX

	Not At All	Only Slightly	Somewhat	Quite	Extremely	Would You Be Willing To Do Without This Feature For A 5 Cent Reduction In Fare? Yes	No
FEATURE	☐	☐	☐	☐	☐	☐	☐

The "Yes-No" questions, asking the respondent if he would do without the feature for a reduction in fare, were designed to provide another measure of importance to check for consistency. While the second section of the survey requested importance ratings for 15 service and interior features, section one asked for satisfaction ratings for only interior features.

The third part of the questionnaire solicited age, sex, and household income level. Riders were also asked how they first learned of the bus service and who they would contact for bus information. General comments were also requested.

1.5.3 Tabulation

The survey responses were computer tabulated.[10] The number of responses and accompanying percentages were calculated for each of the possible responses to each question on the questionnaire. These response

[10] 551 of the 590 returned forms were complete and usable.

distributions for the features are presented graphically or in tables throughout the report. The nature of the five categories for each features' satisfaction and importance response precludes the use of one numerical value (such as an average) that would provide a simple means for comparison of the features. This is because the categories have ordinal values, and the true intervals between them are not known (i.e., ordinal scaling exists but interval scaling does not).[11]

For the questions requesting satisfaction appraisals the features were ranked by the percent of responses in the highest satisfaction level ("Very Good"). However, to rank the features in terms of importance two responses that are believed to reflect high importance assessments were combined. The percent responding to the highest satisfaction category ("Extremely" important), and the percentage of the responses who answered "that they would not be willing to do without the feature for a 5 cent reduction in fare," were summed. The rankings are intended to provide an estimate of relative order of the features. The actual response distributions should be examined for insight into feature differences.

[11] Seigel, "Non-Parametric Statistics," McGraw-Hill, 1956.

2.0 MAJOR FINDINGS

2.1 Summary of Major Findings

1. The bus commuters were highly satisfied with the special interior features on the project buses (i.e., "No Interior Advertising," "Seat Comfort," "Floor Covering," etc.) but, with the exception of "Air Conditioning/Heating," they did not consider them particularly important.

2. The service related features (i.e., "Constant, Reliable Schedules," "Assurance of Getting a Seat," and "Less Time Between Buses") were considered most important. In addition, "Air Conditioning/Heating" (a comfort related interior feature) and "Reduction in Exhaust Emissions" were deemed to be very important. (Satisfaction ratings were not solicited for service related features).

3. Reactions to the two bus types revealed that slight differences were perceived by males for some of the interior features ("Seat Width," "Seat Comfort," "Aisle Width," and "Air Conditioning/Heating"). None of the differences in the interior features on two bus types were perceived by females. All riders on both bus types were highly satisfied with the interior features.

These three findings suggest that alterations in bus design which upgrade already adequate interior comfort and aesthetic features are less attractive to the commuter than service improvements.

4. "Word of mouth" promotion was the most frequently identified means of informing commuters about the service. This means that while formal advertising methods may be useful in attracting patrons as well as informing the public, a campaign urging regular satisfied patrons to

encourage others to use the service would seem to be potentially very effective.

2.2 Thoughts on Future Research

If similar research in this area is undertaken in the future, consideration should be given to obtaining satisfaction as well as importance ratings for both interior and service related features. To more completely understand the potential market for new bus service, the auto commuters should be surveyed directly to obtain their perceptions of the interior and service related features of buses.

3.0 USER REACTION TO INNOVATIVE INTERIOR BUS FEATURES - TOTAL SAMPLED POPULATION (BOTH BUS TYPES)

3.1 Introduction

In order to provide an overall picture of how commuters using the specially equipped buses view these features and other aspects of bus service, this section presents the analysis and results of the responses for all the individuals surveyed. The demographic characteristics of the persons sampled are presented and the relative satisfaction and importance assessments of the various features are discussed. The satisfaction responses are then compared to the importance assessments and bus riders comments are summarized.

3.2 Demographic Characteristics and Sample Size

A total of 551 complete and usable questionnaires were returned. The demographic characteristics of the bus users sampled are summarized in Table 1. Bus user profiles are presented, stratifying respondents by sex, age, and income level. For the survey population, most are male (57%), most are between 21 and 39 years of age (59% of all respondents), and most have household incomes over $15,000 a year (58% of all respondents). Chapter 4.0 further stratifies the male and female bus users by bus type.

3.3 Satisfaction and Importance Responses

Analysis of the satisfaction and importance assessments reveals that generally bus users consider the special interior features satisfactory although less important than service oriented features. A complete tabulation of the satisfaction and importance questions is presented in Appendix C.

Table 1

Project Bus User Demographic Characteristics

CHARACTERISTIC	NUMBER	PERCENT
SEX		
Males	314	57
Females	237	43
No Response	0	-
Total	551	100
AGE		
Under 21	50	9
21 - 39	325	59
40 - 65	175	32
Over 65	1	0
No Response	0	-
Total	551	100
INCOME		
0 - $5000	17	3
$5001-$15000	207	39
$15001-$30000	248	47
Over $30000	60	11
No response	19	-
Total	551	100

3.3.1 Satisfaction

Bus commuters are generally satisfied with the innovative features. Table 2 presents the features ordered with respect to satisfaction responses (using the "Very Good" category).[12] As can be seen in the next column, the overwhelming majority of the features (10 out of 12) were rated as "Very Good" or "Good" by 77% or more of those responding. In fact, no feature received less than 60% of the responses in one of these two categories.

The relative satisfaction for each feature is best illustrated by the overall response patterns as shown in Figure 1. The great majority of responses were highly favorable while there were relatively few responses in the dissatisfied categories of "Poor" or "Very Poor."

3.3.2 Importance

In contrast to the satisfaction response, bus riders' assessments of importance for the interior bus features do not all cluster in a single high rated group, but are stratified along several levels of perceived importance. Table 3 presents three general levels into which the importance responses are grouped.[13] All of the service oriented features ("Constant, Reliable Schedules," "Assurance of Getting a Seat"; and "Less

[12]It is not surprising that "No Interior Advertising" received a very high rating since there is no advertising inside the bus. In Addition, responses for the "Air Conditioning/Heating" feature may have been negatively biased by the fact that the drivers on some of the 6 cylinder buses will turn the air conditioning off when going up a steep hill.

[13]Based on a comparison of the overall response patterns, as well as the rankings and other data presented in Table 3 (particularly the sums of the percentages), three groupings of features were defined and labeled Levels I, II and III. These groupings are intended to provide a general classification and means for discussion.

Table 2

Relative Satisfaction With Interior Features - Total Sampled Population

FEATURES	PERCENT RATING FEATURE "Very Good"	RANK	PERCENT RATING FEATURE "Very Good" or "Good"
No Interior Advertising	64	1	90
Seat Comfort	49	2	92
Floor Covering	43	3	92
Total Interior Design	41	4-5*	90
Seat Width	41	4-5*	83
Leg Room	38	6	82
Artificial Light Level	33	7-8*	92
Air Conditioning/Heating	33	7-8*	80
Interior Sound Level	25	9	77
Riding Stability	23	10	80
Aisle Width	21	11	71
Acceleration Ability	17	12	60

*Tie in ranking.

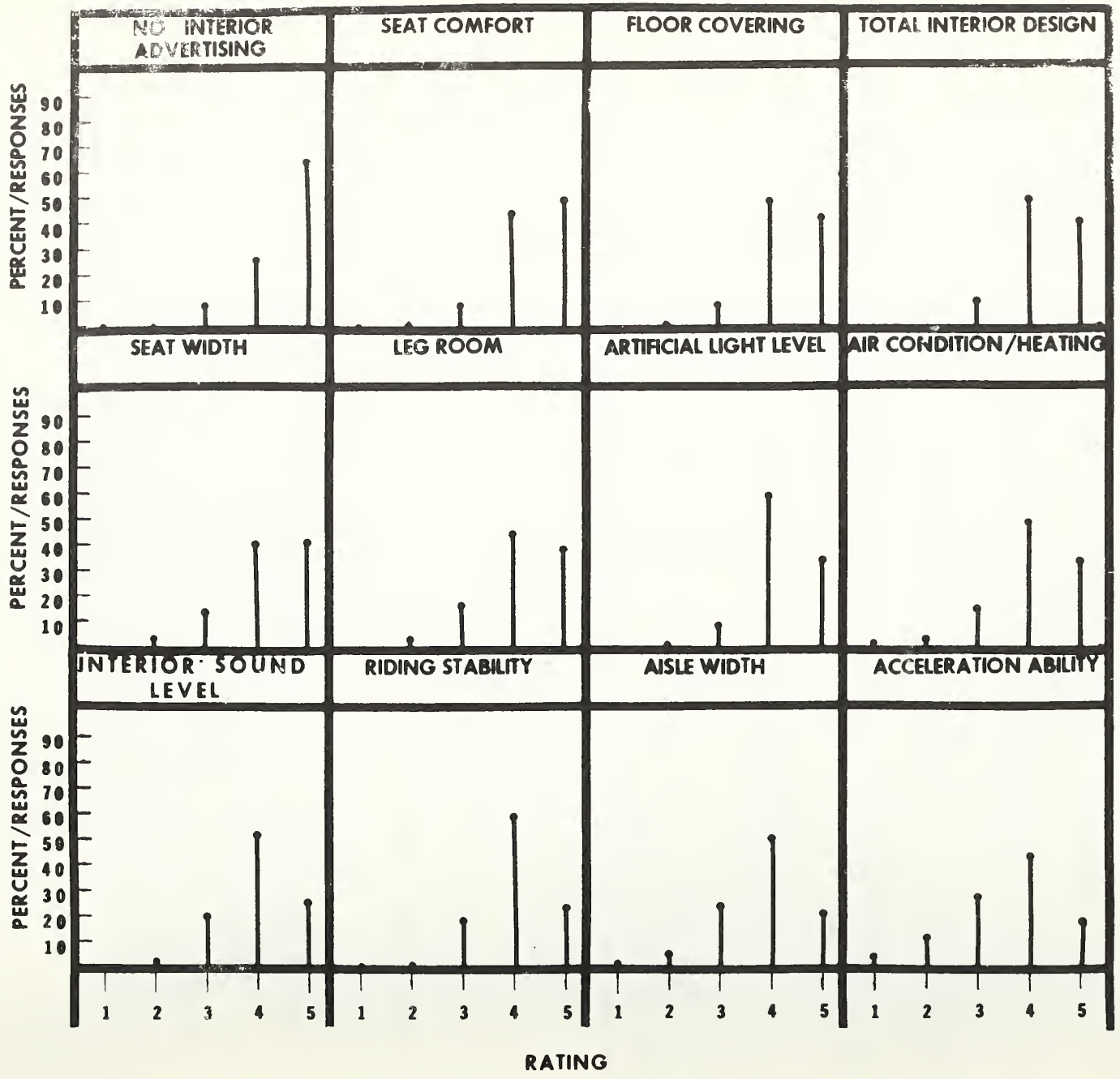

Figure 1. Feature Satisfaction Responses For The Total Population

Table 3

Relative Importance For Interior & Service Related Features - Total Sampled Population

Features	Percent Not Willing To Do Without This Feature For A 5¢ Fare Reduction Column 1	Percent of Responses "Extremely" Important Column 2	Sum Of Column 1&2	Ranked by Column 3	Percent of Responses "Extremely" or "Quite" Important
Level I					
Constant Reliable Schedules 1/	87	77	164	1	92
Air Conditioning/Heating	85	56	141	2	84
Assurance of Getting a Seat 1/	73	53	126	3	81
Reduction in Exhaust Emissions	68	43	111	4	68
Less Time Between Buses 1/	70	38	108	5	64
Level II					
Shelters at Bus Stops	42	21	63	6	48
Level III					
Additional Leg Room	39	9	48	7-8 2/	32
Wider Seats	40	8	48	7-8 2/	30
Reduced Interior Sound Level	36	9	45	9	31
The Total Interior Design	37	6	43	10	27
Improved Acceleration Ability	34	7	41	11	29
Increased Aisle Width	28	7	35	12-13 2/	22
Improved Interior Lighting	30	5	35	12-13 2/	22
No Interior Advertising	21	10	31	14	21
Special Floor Covering	24	4	28	15	15

1/Service Feature
2/Tie

Time Between Buses") fall into the highest level (I). Also included in the high importance level are "Air Conditioning/Heating" and "Reduction in Exhaust Emissions."[14] It should be noted that even within Level I "Constant, Reliable Schedules" was rated somewhat higher than the other features.

The large interval between the one feature in Level II and the lowest ranked feature in Level I indicates that those features which fall into Level I were rated considerably above the rest. Similarly, there exists an interval, though smaller, between the feature in Level II and the first feature in the third importance level.

The relative importance of each feature and the overall response patterns are depicted in Figure 2, which shows the importance response distribution for each feature. For the features in the highest level (first five, top row) the responses are considerably grouped to the right with the heaviest density of importance response in the "Quite" and "Extremely" classes. The Level II importance feature ("Shelters at Bus Stops") presents a distribution where the "Extremely" and "Quite" categories are about equal and the amount of response in the remaining categories slowly decreases. The lowest level features (last 9) present distributions which are grouped to the left and received the greatest concentration of response in the "Not At All," "Only Slightly," and "Somewhat" categories. As reflected earlier, the response pattern for the feature in

[14]The high importance placed on air conditioning is very understandable since the survey was conducted during the summer in the Washington area where the weather is very hot and humid. The concern for a reduction in exhaust emissions is consistent with the public awareness of pollution problems.

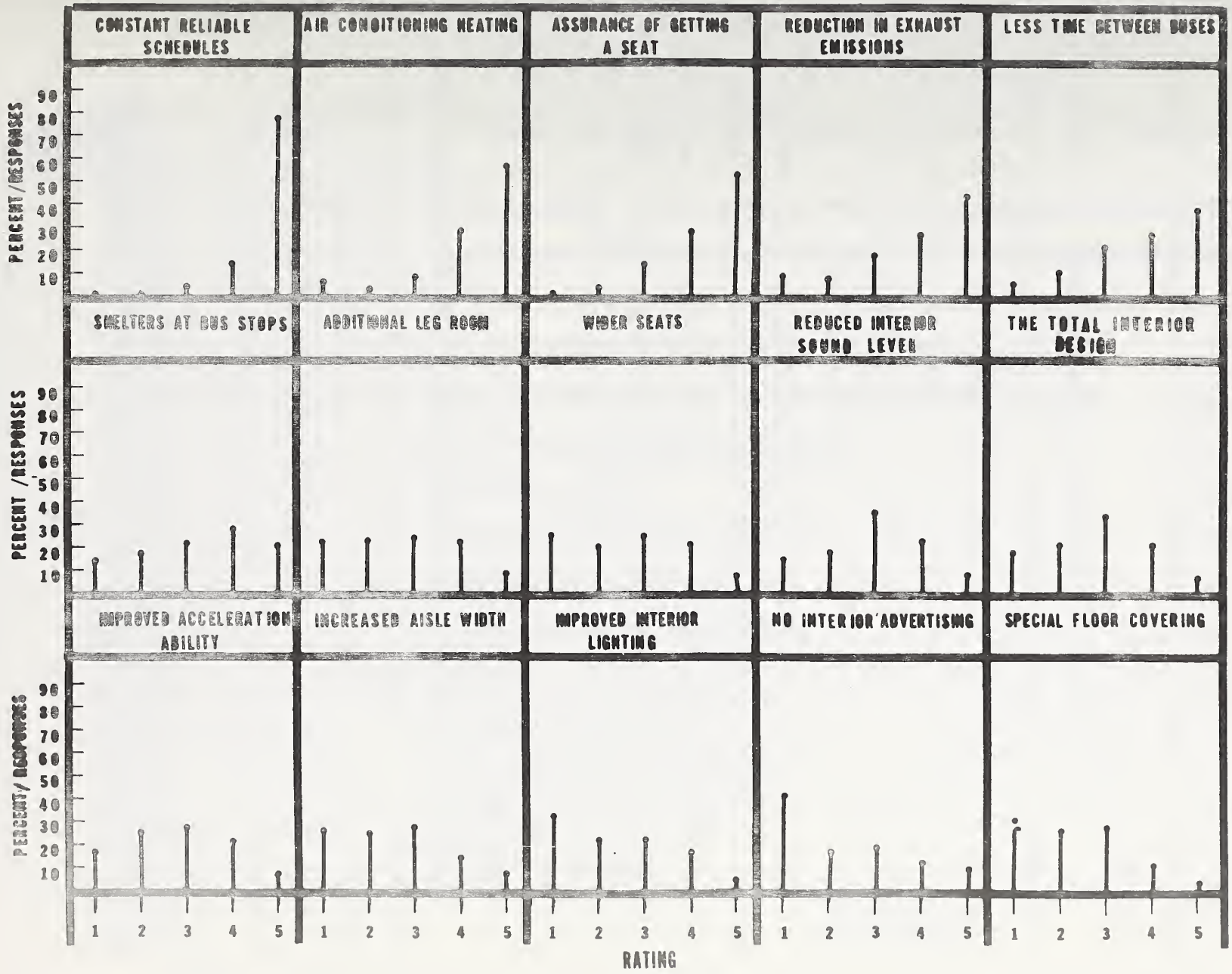

Figure 2. Feature Importance Responses For The Total Population

1—NOT AT ALL
2—ONLY SLIGHTLY
3—SOMEWHAT
4—QUITE
5—EXTREMELY

Level II (far left, middle row) differs dramatically from the response pattern for the higher rated features in Level I. Aside from this instance there is a fairly gradual transition between the response distribution for any feature to the response distribution for the next highest (or lowest) rated feature.

The consistency of importance-related responses is confirmed by comparing two indicators of importance: the percent of people "unwilling to do without a particular feature in lieu of a five cent reduction in fare" to the percent rating the feature "Extremely" or "Quite" important (Table 3, page 14). Figure 3 graphically presents the percent of respondents "not willing to do without a particular feature for a 5 cent fare reduction" versus the features ordered according to the percent of responses rating them "Extremely" or "Quite" important. The parallelism between these indicators of importance suggests consistency by those interviewed; for the features that were highly rated in terms of importance, the respondents would not be willing to do without them for a 5 cent fare reduction.

3.4 Satisfaction Versus Importance

In addition to examining user reactions to the interior features, this study attempts to identify those interior features which might enhance auto commuters motivation to ride the bus. Since it can be assumed that most riders on the sampled routes formerly commuted by auto,[15] the satisfaction and importance responses can be interpreted in the following ways:

[15] It was established that most of the users of the peak period service switched from auto to bus commuters. See Chapter 4.0 The Shirley Highway Bus-On-Freeway Demonstration Project-First Year Results, Interim Report 2 (Report DOT/UMTA 2), November 1972.

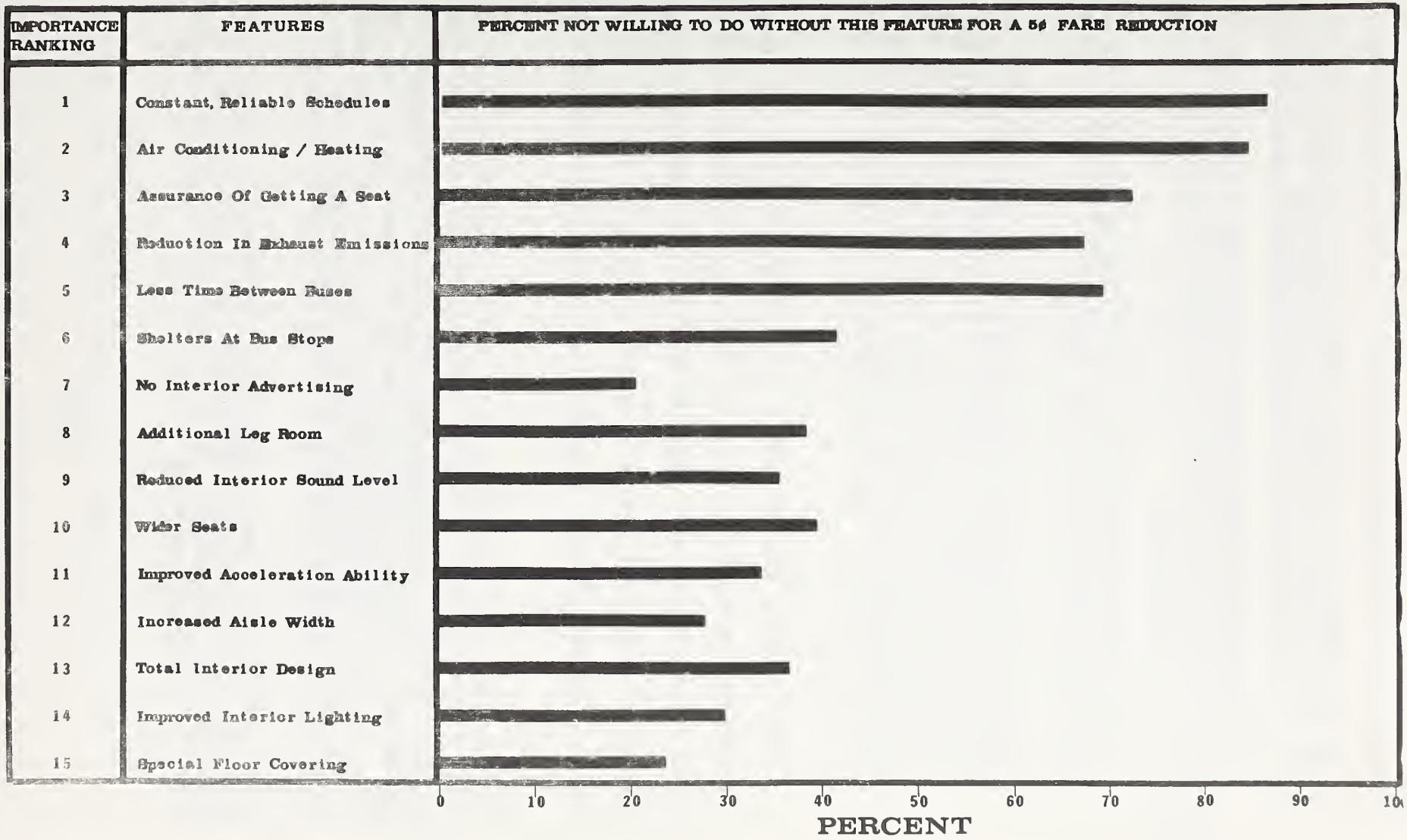

Figure 3. Percent Not Willing To Exchange A Feature For A Fare Reduction Versus Ranking By Percent Rating The Features "Extremely" or "Quite" Important

If bus commuters are satisfied with a special interior feature but do not indicate it is relatively important, then that feature may not be as desirable an investment as features rated more important.

If the commuters express dissatisfaction with a special feature and place relatively high importance on it, then a situation which may not be conducive to retaining the present patrons or attracting new riders is represented.

If the reported importance and satisfaction of bus commuters is high for a special feature, this would imply a favorable condition for retaining and attracting bus patrons.

Finally, if the special feature receives low values for both satisfaction and importance, this represents a marginal condition. (There was no attempt to determine the relative importance and satisfaction of different combinations of features, for example, to determine if special floor coverings might be more important without special seats and wall coverings. In addition, no attempt was made to incorporate into the analysis the costs for the various features.)[16]

Figure 4 plots, for the special interior bus features, the percent of respondents rating the features as "Very Good" or "Good" versus the percent of respondents that rated the feature as "Extremely" or "Quite" important.[17] The concentration of points in the upper left corner represents a general positive assessment of satisfaction, with the special

---

[16] The main purpose of this survey was to obtain consumer attitudes toward interior features. Since the costs of the special comfort and aesthetic features vary greatly depending on the circumstances of purchase, it would be difficult to use feature cost experience to generate any investment guidelines for use by other bus systems. The users reactions to the new features provide an information framework. Given a specific set of feature costs, the "tradeoffs" between the costs and the relative satisfaction and/or importance assessments could then be examined.

[17] Since satisfaction ratings for service features were not asked, they could not be included in this comparison. Similarly, "Riding Stability" and "Seat Comfort" were not compared as they do not appear among the importance questions.

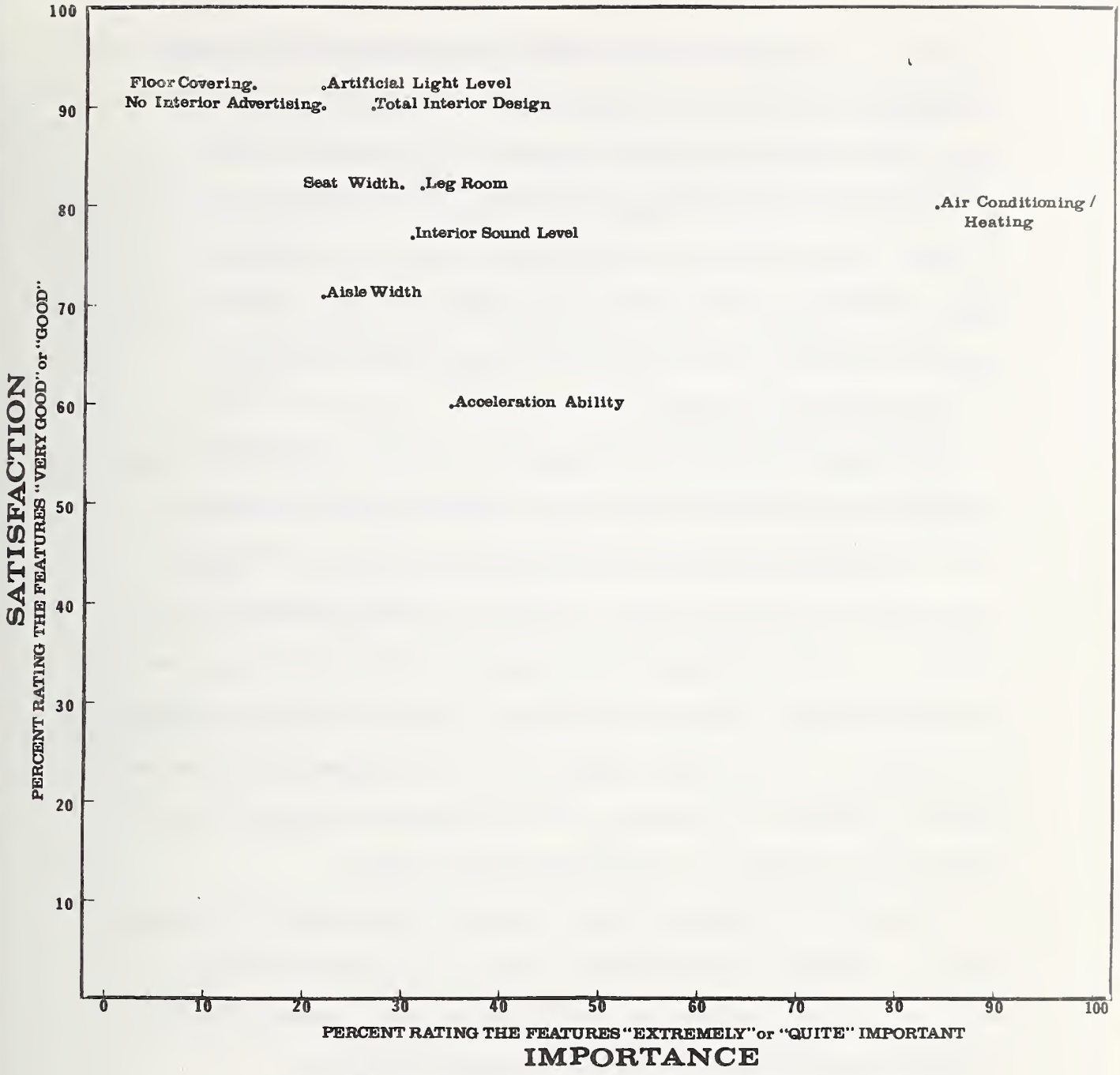

Figure 4. Comparison Of Importance And Satisfaction Responses

qualities of the project buses, coupled with the belief that these features are of low relative importance. The isolated point in the upper right corner ("Air Conditioning/Heating") demonstrates that air conditioning is regarded as both satisfactory and important. Therefore, of those interior features for which satisfaction and importance ratings can be compared, "Air Conditioning/Heating" appears to be a useful incentive to attract new riders and to retain present patrons.

3.5 Bus Commuters' Comments

Response to the additional comments area of the questionnaire was abundant and informative. Most of the riders embellished the survey forms with general praise of the new express bus service. However, some requests for better service accompanied these compliments. Specifically, riders highlighted the absence of sufficient seating, an inadequate number of buses and infrequent service as the main points to be improved. A few comments suggested that bus shelters and more dependable schedules are necessary. Some respondents mentioned the desirability of extending or modifying certain routes.

The positive response reflects a general appreciation for the new service. Commuters are enthusiastic about the bus demonstration project. As indicated earlier and reaffirmed by their comments, service related considerations generate the predominate concern.

3.6 Summary of User Reactions to Innovative Bus Features

1. The bus commuters are highly satisfied with the new interior features of the buses. However with the exception of "Air Conditioning/Heating," they do not consider them particularly important.
2. The most important aspects of the bus transit, according to the riders, are generally service related (i.e., "Constant, Reliable Schedules"; "Assurance of Getting a Seat," and "Less Time Between Buses"). "Air Conditioning/Heating" and "Reduction in Exhaust Emissions" also were considered as highly important. (Satisfaction assessments were not asked for the service features.)

4.0 COMPARISON OF REACTIONS TO THE TWO BUS TYPES

4.1 Introduction

In this section reactions to each of the two bus types are compared. A comparison is made between the user satisfaction levels for the two bus types[18] to discover if the more luxurious Type II buses stimulate a different response pattern than the Type I buses. A similar comparison is performed for the importance items. An attempt is made to determine if slight improvements in comfort and aesthetic features that are already satisfactory are significantly more appealing to commuters.

4.2 Methodology

In order to compare two populations, such as the user of Type I (green-yellow seats) buses with the users of Type II buses (red seats),[19] it is necessary that the two comparison groups be as homogeneous as possible.[20] Homogeneity will help to ensure that any response differences observed between the two groups are related to the different buses and not different demographic compositions of the groups.

To test the homogeneity of the groups, Chi-Square statistical tests were performed on the age, household income, and sex distributions of the riders using the two bus types. The Chi-Square statistical test was used to determine if differences in responses to one measuring (classification)

---

[18] See Appendix A for detailed descriptions of the two bus types.

[19] Of the 551 respondents from both bus types, 217 were from Type I buses, (standard 96" width with green-yellow seats) and 334 were from the Type II buses (102" width with red seats).

[20] Perfectly homogeneous groupings are difficult to achieve in a survey of this nature because of the lack of detailed socio-economic data.

scheme (e.g., income $0-5,000/yr., $5,001-15,000/yr., $15,001-30,000/yr., over $30,000/yr.) for two different groups (e.g., riders on Type I buses, riders on Type II buses) may be attributed to random (chance) fluctuation[21] in the sample or are due to underlying differences in the two groups.

The results of the Chi-Square[22] tests showed that the respondents on the two types of buses differed significantly on all three areas of comparison (age, income, sex). This means that the riders on the two types of buses were not homogeneous. Therefore, it was necessary to stratify each of the two groups in order to find groupings that would allow comparisons between homogeneous groups of bus users.

Acceptable homogeneous groupings were achieved by separating the different respondents by sex. Male respondents on Type II buses were contrasted with male respondents on Type I, and similar comparisons were made with the female populations. These statistical comparisons indicated that there was no significant difference between these like-sex group compositions. Grouping the respondents by sex provided reasonably homogeneous groups of sufficient size to allow meaningful comparisons of their responses.[23] (This was also verified when the importance questions were analyzed, see page 29).

---

[21] Random fluctuations - unpredictable variability in the data which cause differences to exist between an estimate derived from a sample survey and that which would have been obtained from a complete enumeration.

[22] A .025 level of significance was used.

[23] The sample sizes are, Males: Type I bus 104 and Type II bus 210; Females: Type I bus 113 and Type II bus 124.

4.3 Satisfaction Responses

Each of the groups for the two bus types (males: Type I and II; females: Type I and II) reported a high level of satisfaction with the special bus features.

Chi-Square tests for the two male groups comparing satisfaction responses revealed significant differences for some items. A similar comparison of responses from the female group demonstrated that significant differences did not exist (See Table 4).

4.3.1 Males

The two male groups showed significantly different response patterns for only the following features: "Seat Width," "Seat Comfort," "Aisle Width," and "Air Conditioning/Heating." Figure 5 shows that for all these items a greater percent of the males on Type II buses rated the features "Very Good" than did the males riding Type I buses. In addition, a greater percent of the males on the Type I buses rated the features "Very Poor" or "Poor." Apparently, the males on the Type II buses were more satisfied with these items than were their counterparts on Type I buses. This result implies that some of the differences between bus Type I and bus Type II are being perceived in terms of satisfaction.

4.3.2 Females

Analysis of the response showed no significant differences in satisfaction response patterns among female bus riders for any of the interior bus features. This result implies that the females, in general do not perceive a significant difference between the two bus types in terms of satisfaction for their respective features.

Table 4

Features Grouped By The Results of Statistical Comparisons Of The Satisfaction Responses By Males[1] On The Two Bus Types

(Statistically) Significantly[2] Different Responses	Not (Statistically) Significantly[2] Different Responses
Seat Comfort	No Interior Advertising
Seat Width	Floor Covering
Air Conditioning/Heating	Total Interior Design
Aisle Width	Leg Room
	Artificial Light Level
	Interior Sound Level
	Riding Stability
	Acceleration Ability

[1] No statistically significant differences existed for females.
[2] A .025 level of significance was used in the Chi-Square tests.

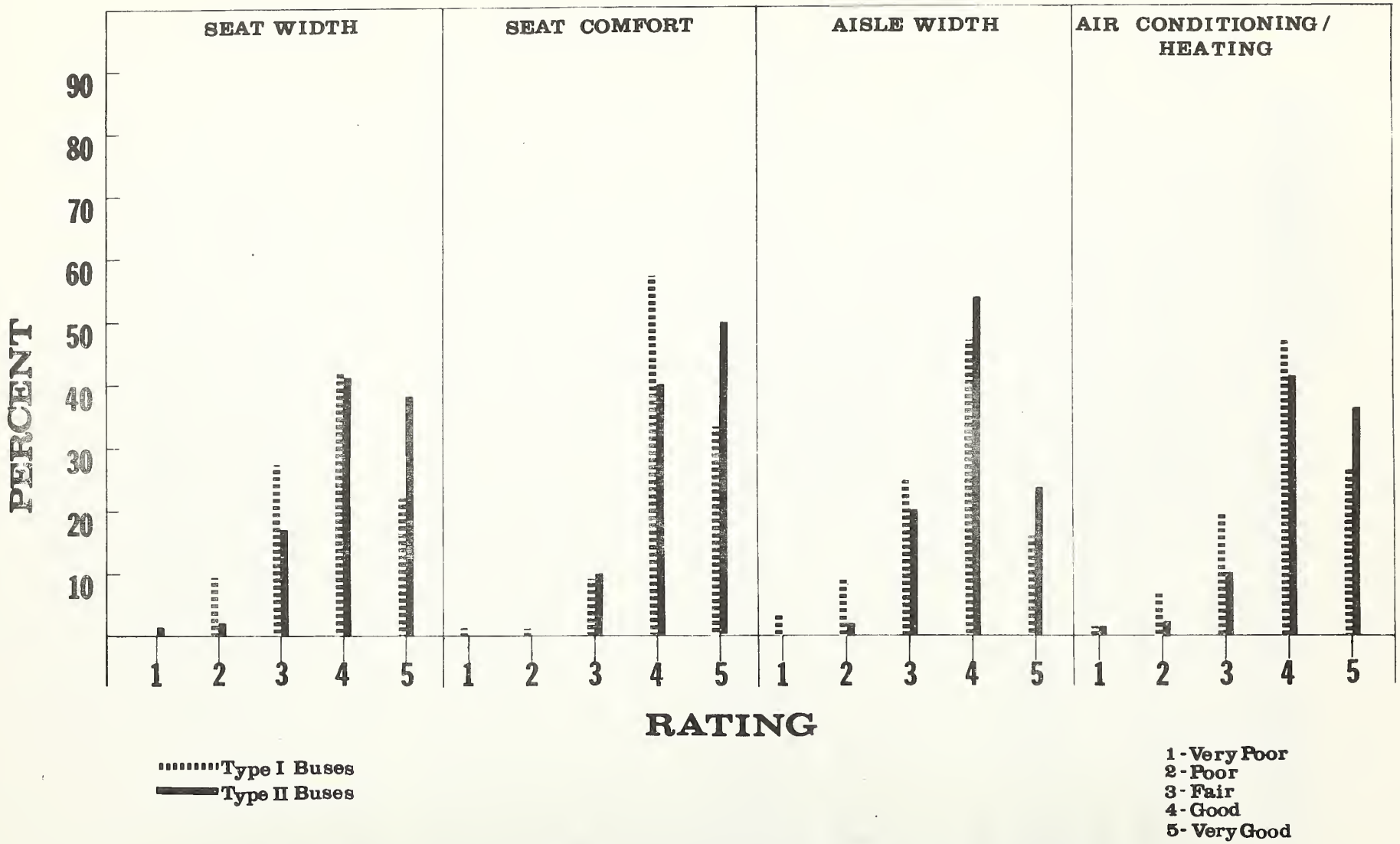

Figure 5. Statistically Different Feature Satisfaction Responses For Males On Bus Types I And II

These results may be partially explained by the fact that males generally have a larger build than females and might therefore be more appreciative of the slightly wider seats on the Type II buses. The more favorable responses to "Air Conditioning/Heating" or to the "Aisle Widths" given by males on these buses could be due to an influence not accounted for when trying to achieve homogeneous groupings. However, all satisfaction items were rated high for both bus types regardless of sex groupings. For all the groups every satisfaction item had the majority of ratings in the "Very Good" or "Good" category.

4.4 Importance Ratings

When male riders on Type I buses were compared with males on Type II buses no significant differences in their response patterns to the importance questions was found. The same results were observed for females on bus Types I and II. (See Table 4). This is reasonable since homogeneous groups should exhibit the same perceived importance values. Therefore, this outcome gives more credence that the stratification by sex created the desired homogeneous groupings.

The absence of any statistically significant differences in the importance response patterns for the male-female groupings establishes the applicability of the earlier importance results, contained in Section 3.0 of this report (total population), for all segments of the bus user population.

4.5 Summary of the Comparison of Reactions to the Two Bus Types

Based on the comparison responses for male-female groupings for the different bus types the following results were obtained:

1. The two male groups exhibited significantly different satisfaction responses for "Seat Width," "Seat Comfort," "Aisle Width," and "Air Conditioning/Heating," though the reasons for the differences in satisfaction are not clear. These features were rated slightly higher on Type II buses. The two female groups showed no disparity of satisfaction responses. Both males and females demonstrated a high degree of satisfaction for all the interior bus features.
2. There were no significant differences in the importance responses for any of the groups on the two bus types.

5.0 MARKETING AND PROMOTION

5.1 Introduction

One of the principal aims of the demonstration project involves attracting new patrons to an improved bus service. Complementing the innovative transit developments was a comprehensive marketing and promotion campaign intended to apprise the public of the experiment. This survey was taken one year after the inauguration of service, and the attendant initial publicity.

The key elements of the publicity effort were special displays located at shopping centers, flyers containing promotional facts mailed to Virginia residents, and limited newspaper and radio advertisements. Other components included news coverage, public service announcements, and a few favorable newspaper, radio and television editorials. In evaluating the various advertising techniques emphasis will be placed on their relative effectiveness for future planning.

By examining the responses of a group of bus riders who resemble auto commuters, an attempt was made to determine if certain features would warrant a special marketing and promotion approach for attracting present auto users to the express bus service. The rather indecisive results of this investigation are presented in Appendix D.

5.2 Relative Effectiveness of Advertising Techniques

Analysis of the response for the survey question "How did you first learn of the 'Shirley Express' service?" is presented in Table 5. Remarkably, only one person of the 551 interviewed reported that shopping center advertisements first notified him of the bus service; 7% of all

Table 5

How Respondents First Learned of The "Shirley Express" Service

PUBLICITY MECHANISM	NUMBER	PERCENT
Newspaper or Radio Advertisements	55	10
Mail "flyers" from NVTC	36	7
Word of Mouth	225	41
Seeing Buses on Busway	82	15
Ads at Shopping Center	1	0
Other*	63	12
Multiple Responses	84	15
No Response	5	-
Total	551	100

*The responses included some word of mouth through methods such as friends or relatives and other sources like apartment information services, T.V., called the bus company, etc.

respondents indicated that the Northern Virginia Transportation Commission (NVTC) "flyer" was their source of information; 10% gave credit to newspaper and radio promotions; while 15% believed that seeing buses on the busway was responsible. In vivid contrast to these advertising modes, "word of mouth," which garnered 41% of the replies, was demonstrated the most effective news mechanism. This suggests that one promotional method that might prove to be effective would be to encourage regular satisfied[24] patrons to inform others of the service.[25]

5.3 Who Bus Riders Would Contact For Information About Other AB&W Bus Service

Seventy-seven percent of those responding testified that they would contact the AB&W Bus Company (now part of WMATA - Regional Bus System) if they had any questions about other service (See Table 6). The number of "vague" responses (14% of those who replied) may suggest that some people do not know how to get information, implying a potential need for better announcement of the information services.

5.4 Summary of Marketing and Promotion

Word of mouth promotion was the most frequent means of informing commuters about the service. This implies that while formal advertising methods are required for initial publicity, it is highly desirable to augment patronage by encouraging regular, satisfied patrons to attract others.

---

[24]This implies that riders are satisfied with those aspects of bus commuting they consider important.

[25]Word of mouth advertising has been found to be one of the most powerful tools in promotion. Some of the psychological and methodological aspects of this process are discussed in the article, "How Word of Mouth Advertising Works" by Ernest Dichter, Harvard Business Review, Volume 44, Number 6, page 147, November/December 1966.

Table 6

Who Bus Riders Would Contact If They Had Questions About Other AB&W* Bus Service

SOURCE OF INFORMATION	NUMBER	PERCENT
AB&W Company*	338	77
NVTC	3	1
Ask Driver	33	7
Ask Friend	6	1
Vague Response	62	14
No Response	109	-
Total	551	100

*AB&W is now the Alexandria Division of the Washington Metropolitan Area Transit Authority (WMATA)

APPENDICES

A Description of the Bus Types

B Copy of the Survey Questionnaire

C1 Importance Responses for Total Population

C2 Satisfaction Responses for Total Population

D Marketing and Promotion of the Express Bus Service to Attract Present Auto Users

APPENDIX A

Description of The Bus Types

TYPICAL URBAN BUS	SHIRLEY HIGHWAY - PROJECT BUSES	
	Type I	Type II
96" Wide Body	96" Wide Body	102" Wide Body
6 Cylinder Engine	6 Cylinder Engine	V8 Engine
Center Strip Lighting	Center Strip Lighting	Decorative Overhead Side Panel Lighting
Fiberglass or Vinyl Padded Straight Back Seats (17" Wide)	Green and Yellow Vinyl Padded Bucket Style Seats (18" Wide)	Red Vinyl Padded Bucket Style Seats (19" Wide)
Rubber Flooring	Carpeting or Textured Vinyl Floor Covering	Carpeted Flooring
Metal or Plastic Covered Interior Walls	Plastic Covered Interior Walls	Carpeted Interior Walls
Metal or Plastic Covered Ceilings	Plastic Covered Ceilings	Carpeted Ceilings
Environmental Improvement Kit (On Some New Buses)	Environmental Improvement Kit	Environmental Improvement Kit
Inside and Outside Advertising	No Inside or Outside Advertising	Decorated Translucent Interior Lighting Panels in lieu of Inside and Outside Advertising

APPENDIX B

Copy of The Survey Questionnaire

Form Approved
OMB No. 41-S-72026

HELLO!

New buses are being tested in the Shirley Express Bus System. We would like your reaction.

Three types of buses are in service now.

Have you used:	Yes	No
an A B & W bus with green and yellow vinyl seats?	☐	☐
an A B & W bus with red vinyl seats?	☐	☐
a standard bus?	☐	☐

When did you begin regularly riding this bus? ___month ___year

Sponsored by the

Northern Virginia Transportation Commission

and the

U. S. Department of Transportation

Please Open

APPENDIX B

CONSIDERING EACH FEATURE BY ITSELF, PLEASE RATE THE FOLLOWING FEATURES OF THIS BUS BY PLACING AN "X" IN THE APPROPRIATE BOX

	Very Poor	Poor	Fair	Good	Very Good
Artificial Light Level	☐	☐	☐	☐	☐
No Interior Advertising	☐	☐	☐	☐	☐
Riding Stability	☐	☐	☐	☐	☐
Acceleration Ability	☐	☐	☐	☐	☐
Total Interior Design	☐	☐	☐	☐	☐
Seat Width	☐	☐	☐	☐	☐
Seat Comfort	☐	☐	☐	☐	☐
Leg Room	☐	☐	☐	☐	☐
Aisle Width	☐	☐	☐	☐	☐
Air Conditioning/Heating	☐	☐	☐	☐	☐
Floor Covering	☐	☐	☐	☐	☐
Interior Sound Level	☐	☐	☐	☐	☐

(continue)

APPENDIX B

PLEASE RATE
THE IMPORTANCE OF EACH OF THE FOLLOWING
FEATURES OF BUS TRANSIT BY PLACING AN "X"
IN THE APPROPRIATE BOX

	How Important?					Would You Be Willing To Do Without This Feature For A 5 Cent Reduction In Fare?	
	Not At All	Only Slightly	Somewhat	Quite	Extremely	Yes	No
Shelters at Bus Stops	☐	☐	☐	☐	☐	☐	☐
Increased Aisle Width	☐	☐	☐	☐	☐	☐	☐
No Interior Advertising	☐	☐	☐	☐	☐	☐	☐
Improved Acceleration Ability	☐	☐	☐	☐	☐	☐	☐
The "Total Interior Design"	☐	☐	☐	☐	☐	☐	☐
Air Conditioning/Heating	☐	☐	☐	☐	☐	☐	☐
Constant, Reliable Schedules	☐	☐	☐	☐	☐	☐	☐
Reduction in Exhaust Emissions	☐	☐	☐	☐	☐	☐	☐
Reduced Interior Sound Level	☐	☐	☐	☐	☐	☐	☐
Less Time Between Buses	☐	☐	☐	☐	☐	☐	☐
Special Floor Covering	☐	☐	☐	☐	☐	☐	☐
Assurance of Getting a Seat	☐	☐	☐	☐	☐	☐	☐
Additional Leg Room	☐	☐	☐	☐	☐	☐	☐
Improved Interior Lighting	☐	☐	☐	☐	☐	☐	☐
Wider Seats	☐	☐	☐	☐	☐	☐	☐

(turn page)

APPENDIX B

Considering all of the interior features of this bus, please assign the trip a grade from 0 to 100 (where 60 equals passing).

grade_____

How did you first learn of "Shirley Express" service:

Newspaper or Radio Advertisement _____

Mail "flyer" from NVTC_____ Word of Mouth _____

Seeing buses on busway _____ Ads at shopping center _____

Other _____

If you have a question about other A B & W bus service who do you contact?

_____

FOR OUR STATISTICAL SUMMARIES

Are You: Male ☐ Female ☐

Your Age: Under 21 ☐ 21-39 ☐ 40-65 ☐ Over 65 ☐

The combined annual income of all members of your household:

0-$5,000 ☐ $5,001-15,000 ☐ $15,001-30,000 ☐ Over $30,000 ☐

ANY COMMENTS?

_____

_____

_____

_____

THANK YOU, WE HOPE YOU
ENJOY OUR SERVICE

APPENDIX C1: IMPORTANCE RESPONSES FOR TOTAL POPULATION (551 SAMPLED)

FEATURES	PERCENT IN EACH IMPORTANCE CATEGORY					NUMBER		WOULD YOU BE WILLING TO DO WITHOUT THIS FEATURE FOR A 5¢ REDUCTION IN FARE?			
								PERCENT		NUMBER	
	NOT AT ALL	ONLY SLIGHTLY	SOMEWHAT	QUITE	EXTREMELY	RESPONSES	NOT ANSWERING	YES	NO	RESPONSES	NOT ANSWERING
Shelters at Bus Stops	14	16	22	27	21	529	22	58	42	524	27
Increased Aisle Width	26	25	27	15	7	527	24	72	28	506	45
No Interior Advertising	42	17	20	11	10	528	23	79	21	504	47
Improved Acceleration Ability	18	26	27	22	7	516	35	66	34	494	57
The Total Interior Design	18	21	34	21	6	531	20	63	37	501	50
Air Conditioning/Heating	6	3	7	28	56	533	18	15	85	517	34
Constant Reliable Schedules	2	2	4	15	77	533	18	13	87	518	33
Reduction in Exhaust Emissions	8	7	17	25	43	523	28	32	68	504	47
Reduced Interior Sound Level	15	19	35	22	9	523	28	64	36	498	53
Less Time Between Buses	5	10	21	26	38	527	24	30	70	513	38
Special Floor Covering	32	26	27	11	4	528	23	76	24	500	51
Assurance of Getting a Seat	2	4	13	28	53	532	19	27	73	520	31
Additional Leg Room	22	22	24	23	9	527	24	61	39	509	42
Improved Interior Lighting	33	22	23	17	5	526	25	70	30	503	48
Wider Seats	25	20	25	22	8	529	22	60	40	519	32

APPENDIX C2: SATISFACTION RESPONSES FOR TOTAL POPULATION (551 SAMPLED)

FEATURES	PERCENT IN EACH SATISFACTION CATEGORY					NUMBER	
	VERY POOR	POOR	FAIR	GOOD	VERY GOOD	RESPONSES	NOT ANSWERING
Artificial Light Level	00	01	07	59	33	542	9
No Interior Advertising	01	01	08	26	64	272*	4
Riding Stability	01	01	18	57	23	546	5
Acceleration Ability	03	11	26	43	17	537	14
Total Interior Design	00	00	10	49	41	547	4
Seat Width	00	03	14	42	41	548	3
Seat Comfort	00	01	07	43	49	549	2
Leg Room	00	03	15	44	38	548	3
Aisle Width	01	05	23	50	21	547	4
Air Conditioning/Heating	01	03	16	47	33	546	5
Floor Covering	00	01	07	49	43	547	4
Interior Sound Level	00	03	20	52	25	545	6

*The feature "No Interior Advertizing" appeared as a satisfaction item on only about half of the questionnaires.

Appendix D

Marketing and Promotion of the Express Bus Service to Attract Present Auto Users

D.1 Introduction

When marketing a project or service, useful advice can be obtained by polling the opinions of those individuals who are already customers. Where the greatest potential market for the product or service consists of an identifiable group of individuals, valuable information might derive from an examination of the attitudes of similar individuals who have used it.

For the Shirley Highway Express bus service, the main source of potential demand is the group of individuals who presently commute by auto. Hence, this analysis focused on the attitudes of that segment of current bus users which most closely resemble auto commuters as a group.[1] If the opinions registered by this subset of all bus users are not the same as those for the remaining bus population (with regard to importance and satisfaction items) this could suggest special attention in terms of marketing and promotion of the service.[2]

---

[1] It would have been desirable to directly survey auto commuters who presently commute on the Shirley Highway, but such an effort was beyond the scope of this study. A survey of both bus and auto commuters was made in 1971. The analysis of that survey will be incorporated into a mode-choice study that will be presented in the Second Year Results, Interim Report 4 to be published late in 1973.

[2] Sections 3.0, 4.0 and 5.0 of this report present results which are useful for marketing and promotion. However, these analyses are based on interviews of present bus commuters and may not reflect the opinions of present auto commuters. In this section the responses of a subset of bus users chosen to closely represent auto users are examined for attitudes differing from those of all other bus users. If differences do exist the earlier findings of this report may not pertain to auto users.

The Shirley Highway Corridor Auto Commuter survey of October 1971[3] revealed that males with annual household incomes over $15,000 constitute the majority of auto commuters using the Shirley Highway corridor. A subgroup of those surveyed with these characteristics was therefore designated for further analysis. The results obtained for all male bus users with household incomes greater than $15,000 (Group A) were compared with those of all other bus users interviewed (Group B). From the total survey population of 551, there were 212 individuals who qualified for Group A, with the remainder comprising Group B.

The analysis of responses given by the two groups focuses on the relative importance ratings of the bus features: If Group A considered certain items more important than did Group B it might be wise to stress these in promotional efforts.

D.2 Importance Responses

Figure 6 presents the distributions for importance responses. A statistical comparison[4] of response patterns for Group A and Group B showed significant differences in importance ratings for only three of the bus features: "Additional Leg Room," "Shelters at Bus Stops," and "Less Time Between Buses." Reviewing these responses with emphasis on the two highest importance categories ("Extremely" and "Quite" important) it appears that Group A considers "Additional Leg Room" slightly more important than Group B did. In contrast Group A seems to consider

[3]The Shirley Highway Bus-on-Freeway Demonstration Project-First Year Results, Interim Report 2 (Report DOT/UMTA 2), November 1972.

[4]Chi-Square tests used with a .025 degree of significance.

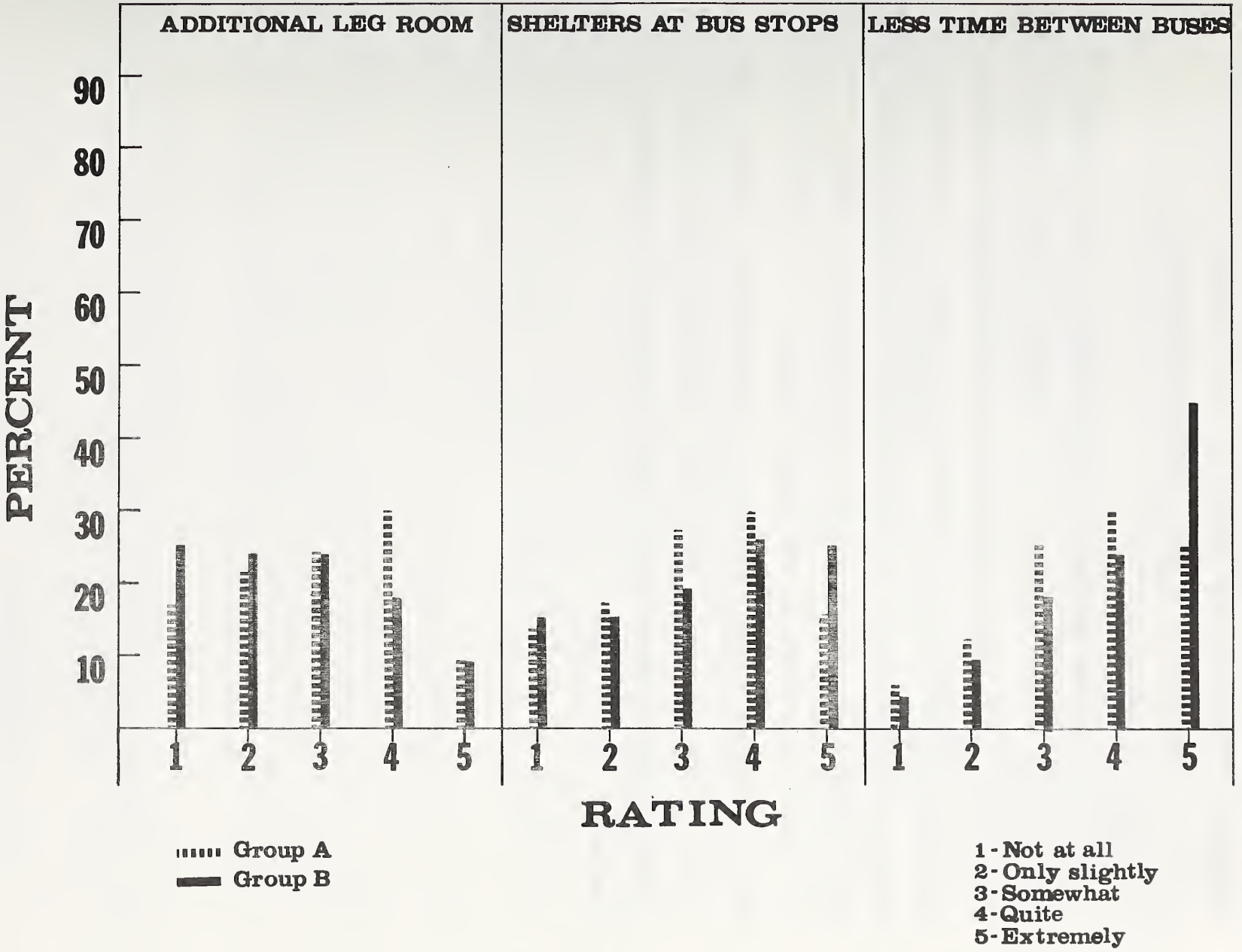

Figure 6. Statistically Different Feature Importance Responses For Group A And Group B

"Less Time Between Buses" not as important as does Group B. To a lesser extent, the same can be said about "Shelters at Bus Stops."

D.3 Summary of Appendix D

Only one feature, "Additional Leg Room," appears to be considered more important by Group A (those bus users surveyed selected to be representative of auto users) than by Group B (the remainder of bus users surveyed). This feature was considered only slightly more important by Group A. If indeed Group A is representative of auto commuters on the Shirley Highway then, on the overall it would seem that no special orientation, with respect to the surveyed features, is necessary in terms of marketing and promotion for the auto commuters. Therefore, the findings of the main body of this report, describing present bus user preferences, would seem to also be applicable toward attracting auto commuters.

FORM NBS-114A (1-71)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBSIR 73-265	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

The Shirley Highway Express-Bus-On-Freeway Demonstration Project - Users' Reactions to Innoviative Bus Features

5. Publication Date: June 1973

6. Performing Organization Code

7. AUTHOR(S) Theodore H. Saks, Richard F. Yates, Keith M. Goodman

8. Performing Organization: NBSIR 73-265

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.: 4314552

11. Contract/Grant No.: DOT AT 10005

12. Sponsoring Organization Name and Address

Urban Mass Transportation Administration
Department of Transportation
Washington, D.C. 20591

13. Type of Report & Period Covered: Interim Report 3

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

16. ABSTRACT (A 200-word or less factual summaty of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

The Shirley Highway Express Bus-on-Freeway Project demonstrates the application of a new mass transit technology. The elements tested in this demonstration project include: an exclusive bus lane in the median of a freeway and bus priority lanes in the downtown distribution area; fringe parking facilities which are coordinated with the bus service; new-look/new-feature buses; and extension of service to additional residential areas in an overall systems approach to the improvement of mass transit. As part of the evaluation of this demonstration project, a survey of commuters on board these buses was undertaken in order to obtain users attitudes concerning the special interior bus features as well as transit service features.

The results obtained from this study should be of interest to persons considering how to allocate expenditures for new bus vehicles and transit service improvements.

Bus commuters perceptions of the relative importance of various bus interior features (i.e., carpeting, special lighting, etc.) and transit service features (i.e., reliable schedules, assurance of a seat, etc.) are analyzed in this report, along with their relative satisfaction assessments of the special bus interior features. Analyses were conducted to determine if marginal improvements in interior comfort and aesthetic features proved significantly more appealing to bus commuters. The relative impact of various project marketing and promotional techniques is also presented.

17. KEY WORDS (Alphabetical order, separated by semicolons)

Attitudinal survey; bus-on-freeway; exclusive bus lanes; importance assessments; interior bus features; mass transit technology; satisfaction assessments; transit service features

18. AVAILABILITY STATEMENT	19. SECURITY CLASS (THIS REPORT)	21. NO. OF PAGES
X UNLIMITED.	UNCLASSIFIED	46
[ ] FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NTIS.	20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED	22. Price

USCOMM-DC 66244-P71