MTI Report 01-04

Norman Y. Mineta
International Institute for
Surface Transportation Policy Studies
Created by Congress in 1991

How Best to Serve Seniors on Existing Transit Services

Mineta Transportation Institute
San José State University
San Jose, CA 95192-0219

MTI Report 01-04

How Best to Serve Seniors on Existing Transit Services

September 2001

David Koffman
Roger Salstrom, PhD

a publication of the
Mineta Transportation Institute
College of Business
San José State University
San Jose, CA 95192-0219

Created by Congress in 1991

Technical Report Documentation Page

1. Report No. FHWA/CA/OR-2001-23	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle How Best to Serve Seniors on Existing Transit Services		5. Report Date September 2001 6. Performing Organization Code
7. Authors David Koffman, Roger Salstrom, PhD		8. Performing Organization Report No. 01-04
9. Performing Organization Name and Address Norman Y. Mineta International Institute for Surface Transportation Policy Studies College of Business, San José State University San Jose, CA 95192-0219		10. Work Unit No. 11. Contract or Grant No. 65W136
12. Sponsoring Agency Name and Address California Department of Transportation Sacramento, CA 95819 U.S. Department of Transportation Research and Special Programs Administration 400 7th Street, SW Washington, DC 20590-0001		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code

15. Supplementary Notes

This research project was financially sponsored by the U.S Department of Transportation's Research and Special Programs Administration and by the California Department of Transportation (Caltrans).

16. Abstract

Increases in the size of the elderly population and changes in travel patterns are expected to create significant new mobility expectations. The research documented here is intended to provide tools for transit providers and public policy makers to make the greatest use of existing transit resources to serve mobility needs of the growing senior population. The research demonstrates how customer satisfaction surveys can be used to set priorities for improving existing fixed route services. The primary analysis technique used is the impact score technique. This method determines the relative impact of various improvements on overall customer satisfaction. It does this by measuring how much customers' overall satisfaction changes depending on their satisfaction with particular aspects of service. Satisfaction data from rider surveys from three West Coast transit systems were analyzed, comparing the responses of seniors and non-seniors.

Many of the results are specific to individual transit systems; however, a number of general patterns were observed: 1) in general, seniors appear to rate service attributes more highly than do non-seniors; 2) while importance scores for non-seniors tended to cluster together, the results for seniors appear to indicate that certain service attributes are significantly more important than others; 3) at the two systems that used a similar method of survey administration and question format, there is broad consistency in importance ratings for seniors. Among the most important attributes at both systems were drivers, reliable equipment, and on-time performance.

Direct questioning suggests that the greatest increase in ridership would result from adding service. However, the impact analysis shows that other improvements could have a greater impact on customer satisfaction.

17. Key Words Elderly persons; Public transit; Surveys; Transit operating agencies; Transit vehicle operations	18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22161		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 33	22. Price $15.00

Form DOT F 1700.7 (8-72)

Library of Congress Catalog Card Number: 2001094835

To order this publication, please contact the following:
Mineta Transportation Institute
College of Business BT-550
San José State University
San Jose, CA 95192-0219
Tel (408) 924-7560
Fax (408) 924-7565
E-mail: mti@mti.sjsu.edu
http://transweb.sjsu.edu

AUTHORS AND ACKNOWLEDGEMENTS

The MTI Project Team consisted of David Koffman, Principal Investigator, and Dr. Roger L. Salstrom. Student Assistant Randall Schmidt was responsible for preparing survey tabulations using the Statistical Package for the Social Sciences.

The research could not have been completed without the cooperation of the three transit agencies, which were willing to share their rider survey data. Thanks are due to Jane Glascock at the King County Department of Transportation, Kurt Brotcke at the Orange County Transportation Authority, and Chris Augenstein and Martin DeNero at the Santa Clara Valley Transportation Authority for obtaining the necessary permissions at their respective agencies and providing the data as SPSS files for our tabulations. Trixie Johnson, Research Director at MTI, was persistent in her efforts to arrange for the needed software license for Randall Schmidt's work and in supporting our data requests with the transit agencies. Additional thanks to Research and Publications Assistant Sonya Cardenas, Graphic Artist Ben Corrales and Editorial Associates Robyn Whitlock and Irene Struthers.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Increases in the size of the elderly population and changes in travel patterns are expected to create significant new mobility expectations. The research documented here is intended to provide tools for transit providers and public policy makers to make the greatest use of existing fixed-route transit resources to serve the mobility needs of the growing senior population. The research demonstrates how customer satisfaction surveys can be used to set priorities for improving fixed-route service. The primary analysis technique used is the *impact score* technique. This method determines the relative impact of various improvements on overall customer satisfaction. It does this by measuring how much customers' overall satisfaction changes depending on their satisfaction with particular aspects of service. Satisfaction data from rider surveys from three West Coast transit systems were analyzed, comparing the responses of seniors and non-seniors.

Many of the results are specific to individual transit systems; however, several general patterns were observed:

1. In general, seniors appear to rate service attributes more highly than do non-seniors.
2. While importance scores for non-seniors tended to cluster together, the results for seniors appear to indicate that certain service attributes are significantly more important than others.
3. At the two systems that used a similar method of survey administration and question format, there is broad consistency in importance ratings for seniors. Among the most important attributes at both systems were drivers, reliable equipment, and on-time performance.

Direct questioning suggests that the greatest increase in ridership would result from adding service. However, the impact analysis shows that other improvements could have a greater impact on customer satisfaction.

BACKGROUND

Increases in the size of the elderly population and changes in travel patterns are expected to create significant new mobility expectations. Key trends include the following:

- The size of the elderly population is growing. For example, between 1995 and 2030, the percentage of the population age 65 or older is expected to grow from 12.8 percent to 20.4 percent, and the percentage age 75 or older is expected to grow from 6.5 percent to 12.2 percent (U.S. Bureau of the Census, 1996).
- Most older people rely on private automobiles for local travel and are likely to continue to do so. This trend is documented in many sources. (See, for example, Ecosometrics, 1998.)
- Older people need and chose to limit their driving as they age, resulting in declining ability and increasing dependence on friends, relatives, and neighbors (Burdkhardt, 1994; Rosenbloom, 1995).
- Although many seniors do ride transit, many find that existing transit services do not meet their needs. Reasons include the orientation of transit services toward commuters, suburban activity patterns that are not well serviced by transit, and the increasing tendency for seniors to be people with established habits of automobile usage (Rosenbloom, 1988; Transportation Research Board, 1988).

A premise of the research reported here is that public transportation can play a key role in addressing these issues if transit systems respond to the needs and preferences of seniors. The research documented here is intended to provide tools for transit providers and public policy makers to make the greatest use of existing fixed-route transit resources to serve mobility needs of the growing senior population. Providing for the needs of seniors by using separate services, on the model of paratransit provided under provisions of the Americans with Disabilities Act (ADA), would be ruinously expensive. The tools demonstrated here can help create priorities for improving and modifying existing services so that seniors will find them more usable without compromising the travel needs of non-seniors. For example, it might be expected that seniors would place more value on physical and psychological security, comfort, and convenience to local destinations than to attributes commonly valued by working age riders, such as speed, frequency, and access

to regional destinations. Quantified information about such preferences can provide guidance in experimenting with service modifications.

Although extensive research has been conducted on the public transportation requirements of people with disabilities, relatively little work has been done on similar needs of seniors. Although many seniors have disabilities, and many disabled people are seniors, seniors as a group have many different concerns and needs. Most seniors have no identifiable disability, do not identify themselves as "disabled," and certainly do not qualify as eligible for ADA paratransit services.

The research reported here has used market research techniques that use customer satisfaction data based on existing services. In market research there is a growing body of experience with analysis of consumer satisfaction and preference information to establish priorities for improving service in ways that will have the greatest impact. These techniques have been documented for general public transit use in two TCRP reports: TCRP Report 36, *A Handbook: Using Market Segmentation to Increase Transit Ridership* (Yalch, 1998a) and TCRP Report 37, *A Handbook: Integrating Market Research into Transit Management* (Yalch, 1998b). These and related techniques have been applied here to the issue of serving the particular needs of seniors.

ANALYSIS METHOD

The primary analysis technique used is the *impact score*. This method determines the relative impact of various aspects of satisfaction, by measuring how much customers' overall satisfaction changes depending on their satisfaction with particular aspects of service. The method is described in *TCRP Report 47: A Handbook for Measuring Customer Satisfaction and Service Quality* (Morpace International, Inc., 1999). The method uses two steps, first computing a Satisfaction Gap, which is a measure of importance, then computing an impact score. For example, consider how senior respondents rated "On Time" at one transit system:

Rating for On Time	***Percent of Respondents***	***Average Rating for Overall Transit Service (Scale from 1= Excellent to 4 = Poor)***
Excellent or Good	75%	1.82
Fair, Poor, or No Opinion	25%	2.63

Satisfaction Gap Due to Buses Running on Time:	0.81

The *Satisfaction Gap* due to buses running on time is the difference in average rating for Overall Transit Service between those people who rated On Time as Excellent or Good and those people who rated it Fair or Poor, or had No Opinion. This is illustrated in Figure 1. This satisfaction gap may also be interpreted as a measure of the *Importance* of the service attribute On Time. In other words, the importance to riders of the attribute On Time is the degree to which this attribute affects overall satisfaction of the average rider. This is a measure of the correlation between individual attribute satisfaction and overall satisfaction.

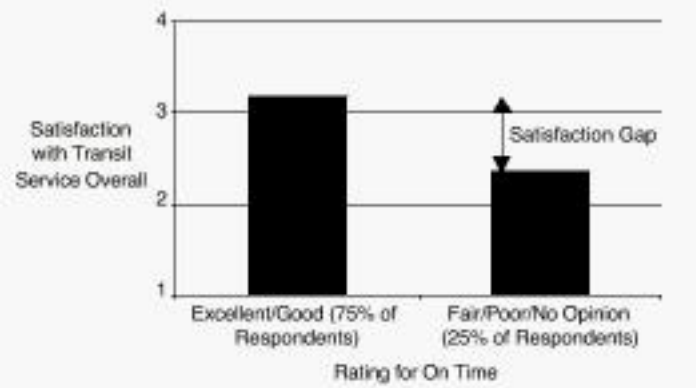

Figure 1
Measuring Importance Using the Satisfaction Gap

The second step in the method combines the Satisfaction Gap with the percentage of riders who rated the service attribute less than Good or Excellent. For example, the impact score for On Time is calculated as follows:

Impact Score =
(Satisfaction Gap) x (% rating On-time as Fair/Poor/No Opinion) =
(0.81) x (25%) = 0.20

This formula expresses the intuitive connection that the potential impact of improving on-time performance depends on the importance of this attribute and the percentage of riders who currently find it less than Good or Excellent. For example, if on-time performance is very important (highly correlated to overall satisfaction) but 95 percent of riders currently rate it as Good or Excellent, then further improvements will have little impact. Similarly, suppose some other attribute is very weakly connected to overall satisfaction. Then, even if it were currently rated Good or Excellent by only 50 percent of riders, improvements to this attribute would still have little impact. The biggest impact comes for attributes that are important and currently have only moderate or low levels of satisfaction.

Mathematically, the impact score shows how much the average rating for Overall Transit Service for all senior respondents combined would be improved if they all rated On Time as Excellent or Good. This calculation assumes that, when riders' satisfaction with On Time improves, their overall satisfaction improves to match that of riders who are already satisfied with On Time. An equivalent calculation would be:

Impact score =

(Overall satisfaction of respondents rating On Time as Good or Excellent) - (Overall satisfaction of all respondents)

Note that impact scores for various improvements are not generally additive. For example, improving both On Time and Frequency of Service would not generally cause the average rating for Overall Transit Service to increase by the sum of their impact scores. This is because there are significant correlations among the satisfaction ratings for the various service attributes.

The impact score method can be contrasted with a method sometimes used in market research, in which respondents are asked directly to rate the importance of various attributes. For each attribute, say on-time performance or reliability, respondents are asked:

- How satisfied are you now with this aspect of service?
- How important is this aspect of service to you?

Those items with low-to-medium satisfaction and high importance are given the highest priority for action. A pitfall of this method is that respondents may have difficulty separating out importance from their current satisfaction level. Further, from a practical point of view, this method doubles the number of questions that must be asked. By comparison, the impact score method does not provide a measure of importance for any one respondent, but it does provide a measure of average importance that does not require a second, fairly abstract, judgment by respondents.

The impact score method requires the researcher to make a somewhat arbitrary decision on how to divide the attribute ratings. For example, in the example just used, respondents were given a four-point scale (Excellent, Good, Fair, Poor) plus No Opinion for each attribute. The impact score was computed by dividing the responses into two groups (Excellent/Good vs. Fair/Poor/No Opinion) and comparing the overall satisfaction ratings of the two groups. It would be possible to divide the responses differently, for example Excellent and Not Excellent. How to make this division is a matter of judgment, depending on the actual distribution of responses and on expectations about what kind of improvements can be targeted reasonably.

DATA SOURCES

The research analyzed data from rider surveys conducted in 1988 by three West Coast transit agencies: the King County Department of Transportation (King County Metro), the Orange County Transportation Authority (OCTA), and the Santa Clara Valley Transportation Authority (VTA). The results include information about current satisfaction rates at all three systems. Because it is not the intention of this research to compare service quality among systems, when results are given in this report these systems are referred to as System A, System B, and System C (not necessarily in the order listed).

The surveys included questions asking riders to rate service attributes such as on-time performance, drivers, cleanliness, customer information, security and safety, as well as "overall transit service." Riders were also asked a question of the type, "What improvements would make you use transit more often?" The survey types and sample sizes, based on the final, cleaned data files, were:

	System A	***System B***	***System C***
Survey Type	On-board	On-board	Telephone
Total Sample of Transit Riders	14,963	15,058	1,399
Sample of Transit Riders Age 65 or Older	462	440	145

System C's survey, administered by telephone, also included data from 1,037 nonriders, including 163 seniors age 65 or older; however, nonriders were not asked questions about satisfaction with transit services. The telephone method of administration enabled System C to use a longer questionnaire with many more questions about satisfaction than the other transit agencies. However, to save time, several questions were asked of only half the sample. As a result, for several service attributes that would have been of particular interest, the sample of senior respondents is too small for this analysis. All three transit agencies provided raw data from the surveys in the form of SPSS (Statistical Package for the Social Sciences) files so that additional tabulations could be done as needed for this research. In all three surveys, the transit agency developed weighting factors that were used to make tabulations from the samples correspond to the actual ridership of the system. These weighting factors were used in calculation for this research.

As noted before, the impact score method requires dividing respondents into two groups for each service attribute, based on their satisfaction ratings. This was done in two different ways for this analysis.

System A and System B asked riders to rate each service attribute using the following scale:

- Excellent
- Good
- Fair
- Poor
- No Opinion

At both systems, on the order of 15% to 30% of respondents rated the various attributes as Excellent, while 50% to 80% rated them as Excellent or Good. Both systems, in their reports of the surveys, combined the percentage rating each attribute as Good or Excellent. Dividing the sample according to Excellent/Good vs. Fair/Poor/No Opinion ensures that there is an adequate number of responses in both groups for analysis for all attributes. This division implies that a reasonable target for improvement is that all attributes would be rated as Good or Excellent by all riders.

System C used a five-point satisfaction scale:

- Very satisfied
- Somewhat satisfied
- No opinion
- Somewhat dissatisfied
- Very dissatisfied

For most attributes, on the order of 25 percent to 65 percent of respondents were Very Satisfied and on the order of 65 percent to 95 percent were either Somewhat or Very Satisfied. Intuitively, Somewhat Satisfied is not a strong statement. Also, combining the Somewhat and Very Satisfied groups would leave small subgroups of less satisfied respondents for analysis in many attributes. Therefore, for System C, the sample was divided for each attribute

into respondents who were Very Satisfied and those who were less than Very Satisfied.

RESULTS OF THE ANALYSIS

Figures 2, 3, and 4 present the results of the analysis in graphical form. For each transit system, there are three graphs:

- **Current satisfaction:** percent of respondents rating each attribute as Excellent or Good (Systems A and B) or the percent of respondents Very Satisfied with each attribute (System C).
- **Importance:** the importance of each attribute based on the satisfaction gap calculation as described above.
- **Impact score:** the potential for increasing overall satisfaction as a result of improving satisfaction with each attribute, using the impact score calculation as described above.

The results were calculated for seniors (age 65 or older) and non-seniors (age less than 65). In the figures, results for seniors are represented by black bars and results for non-seniors are represented by white bars. The same data are presented in tabular form in Appendix A.

EXPECTATIONS

It would be expected that satisfaction ratings of various service attributes would vary considerably among the transit systems. Further, since seniors and non-seniors use the same services, their relative ratings of various attributes would not necessarily vary. For example, if a transit system has friendly drivers but poor on-time performance, both seniors and non-seniors might be expected to rate drivers more highly than on-time performance. At a second transit system, the pattern might be reversed.

In the case of importance ratings, however, some consistency among transit systems might be expected, but less consistency between seniors and non-seniors. If the analysis method is capable of separating out importance from current satisfaction, then seniors might, for example, consider friendly drivers and on-time performance of equal importance, while non-seniors might see on-time performance as significantly more important. Further, these importance ratings might be expected to show some consistency among transit systems. That is, seniors might be expected to have similar priorities in different regions.

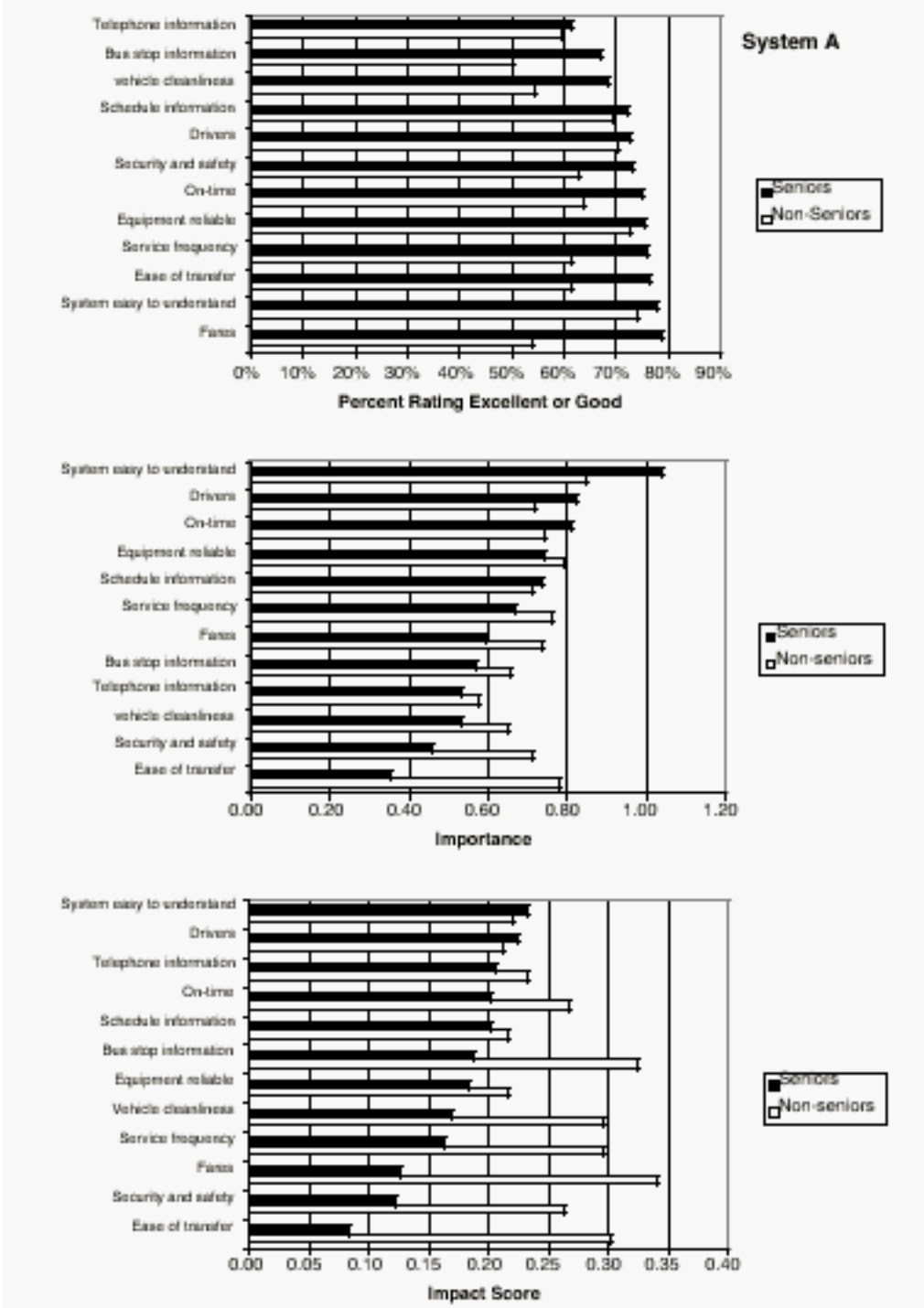

Figure 2. Analysis Results for System A

(See Appendix A)

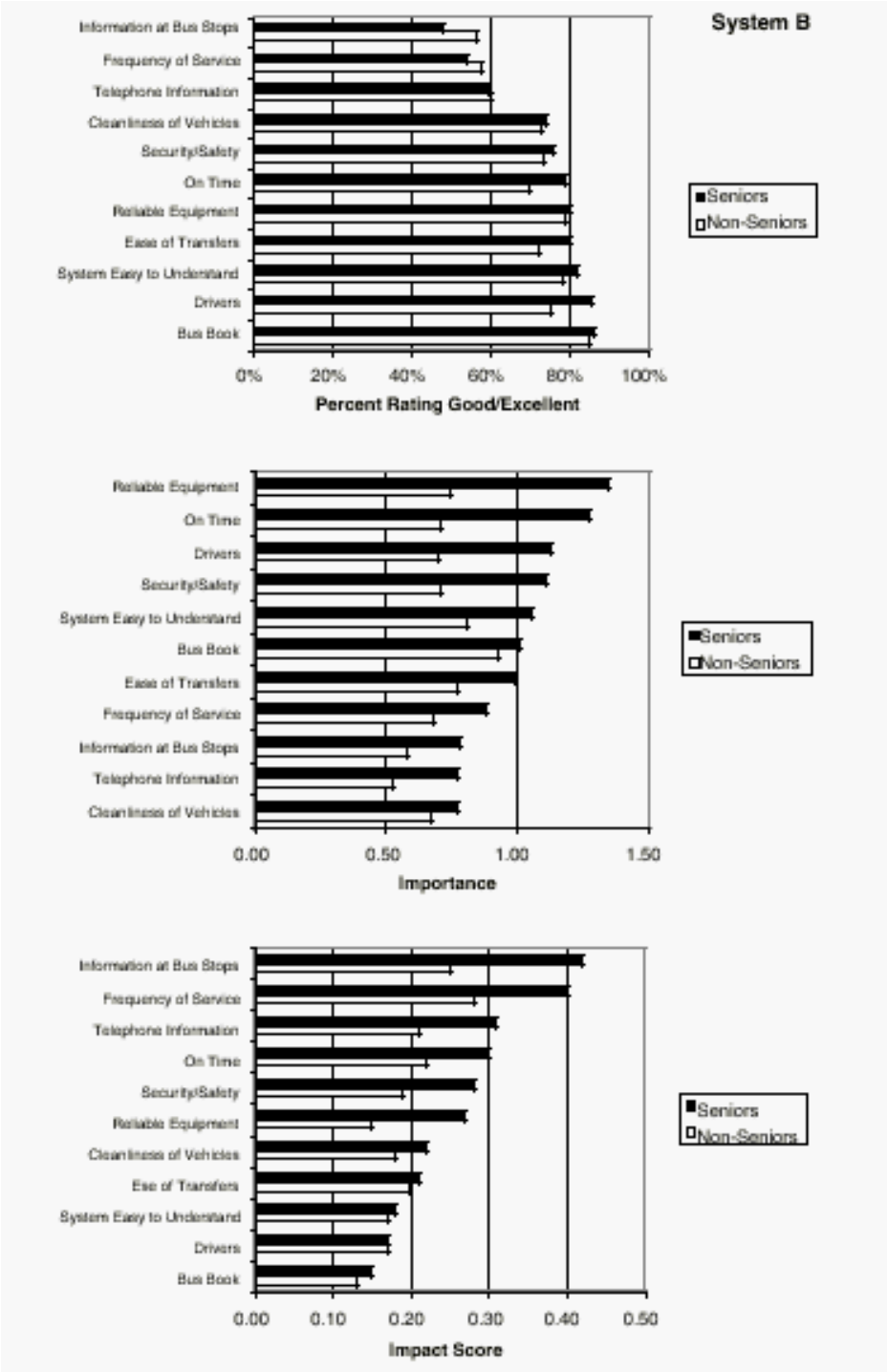

Figure 3. Analysis Results for System B

(See Appendix A)

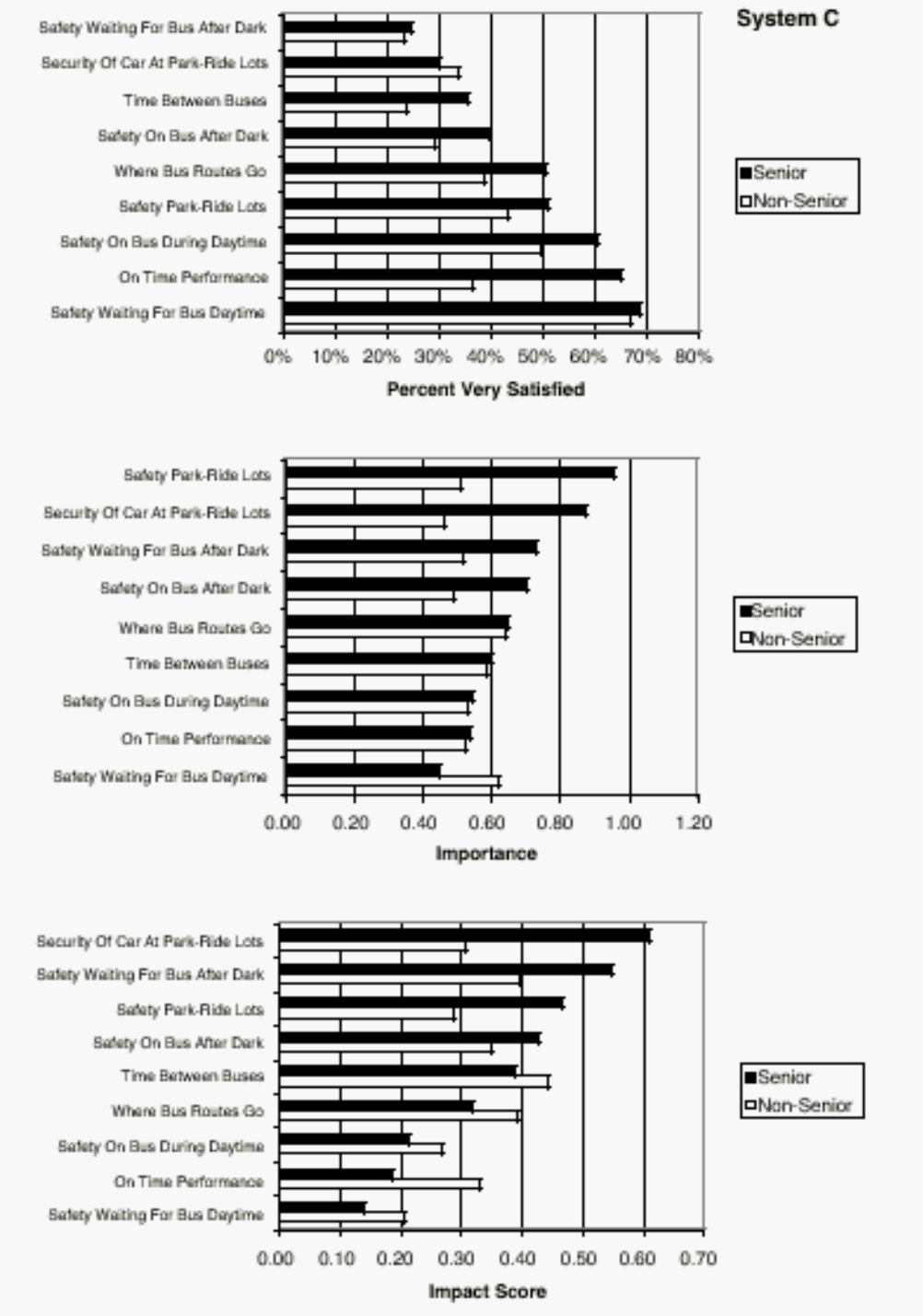

Figure 4. Analysis Results for System C

(See Appendix A)

Impact scores should show the combined influence of current satisfaction and importance scores. Since importance may differ between seniors and non-seniors, and relative satisfaction may be different among transit systems, there is no reason to expect any consistency in impact scores between seniors and non-seniors or among transit systems.

CURRENT SATISFACTION

For the most part, seniors are more satisfied with most service attributes than non-seniors at all three transit systems. However, there is broad consistency in relative satisfaction with various attributes between the two groups. For the samples sizes at Systems A and B, differences of 5 percent or more are statistically significant at the 95 percent confidence level. For the sample size at System C, differences of 8% or more are statistically significant at the 95 percent confidence level.

System A. System A had the least consistency between ratings of seniors and non-seniors. Between 62 percent and 69 percent of seniors rated every attribute as Excellent or Good. By comparison, less than 60 percent of non-seniors gave Excellent or Good ratings for three items:

- Fares
- Vehicle cleanliness
- Bus stop information

The last two items were also among the least well rated by seniors. In the case of fares, it is not surprising that seniors are more satisfied than others because they pay the discounted fare, which is about one-third the regular adult fare.

System B. At System B, there is general consistency between seniors and non-seniors in relative satisfaction with the various attributes. The highest-rated items by seniors are also highly rated by non-seniors and the lowest-rated items among seniors are also the poorest-rated items by non-seniors. For both groups, three items stand out as having poorer ratings than other items:

- Telephone information
- Frequency of service
- Information at bus stops

System B did not include a question about fares in its survey.

System C. System C had many more attributes on its survey than the other systems, but questions about only eight attributes were asked of all respondents. Only half the sample was asked about the following attributes:

- Cleanliness of bus shelters.
- Inside cleanliness of buses.
- Availability of seating on the bus.
- Helpfulness of drivers.
- Access to park-and-ride lots.
- Clarity of timetable information
- Ability to get information by phone.
- Mechanical dependability of buses.
- Personal safety on the bus related to operation of the bus.
- Outside condition of buses.

Statistical uncertainty associated with these questions was too high for this analysis.

In the items that are analyzed here, while there is broad consistency in the relative ranking between seniors and non-seniors, one item stands out as being ranked better by seniors than non-seniors—on-time performance. This result might be expected if seniors travel more for discretionary purposes and more at off-peak times than non-seniors. For both seniors and non-seniors, the most poorly rated items were.

- Safety waiting for bus after dark.
- Security of car at park-and-ride lots.
- Time between buses.
- Safety on bus after dark.

IMPORTANCE

As anticipated, there are some significant differences between seniors and non-seniors in the importance of various service attributes. At all three systems, importance ratings for seniors show much greater variation than they do for non-seniors. For example, at System A, the importance ratings for non-seniors range between 0.53 for Telephone Information and 0.85 for System Easy to Understand, a spread of 0.32. (These figures mean, for example, that improving telephone information so that all riders rate it as Excellent or Good would improve the overall satisfaction score for the transit system by 0.53 points on a scale from 1 to 4.) By comparison, importance ratings for seniors range between 0.36 for Ease of Transfer to 1.04 for System Easy to Understand, a spread of 0.62. Similar differences in variability can be seen for the other two systems.

Since sample sizes for seniors are not large, and importance is a difference of two means, statistical uncertainly is an issue in considering importance differences. These are shown in Table 1.[1] Confidence intervals for seniors are much wider than for non-seniors because seniors comprise a small part of the total samples.

Table 1. Approximate 95% Confidence Intervals for Importance

	Seniors	***Non-seniors***
Systems A and B	+/– 0.20	+/– 0.03
System C	+/– 0.22 to +/– 0.29	+/– 0.09

Figure 5 illustrates the ranking of importance by seniors at Systems A and B. Items that had the highest importance ratings are at the top of the list for each transit system. The connecting lines are provided to help judge the extent to which there is consistency in the importance ratings among the three systems. The figure shows that there is general but not complete consistency between Systems A and B. There were too few comparable questions on System C's survey with sufficient sample sizes to make a meaningful comparison. Systems A and B used the same method of survey administration and similar survey instruments.

[1] Computed by SPSS using the Compare Means procedure, not assuming equal variances.

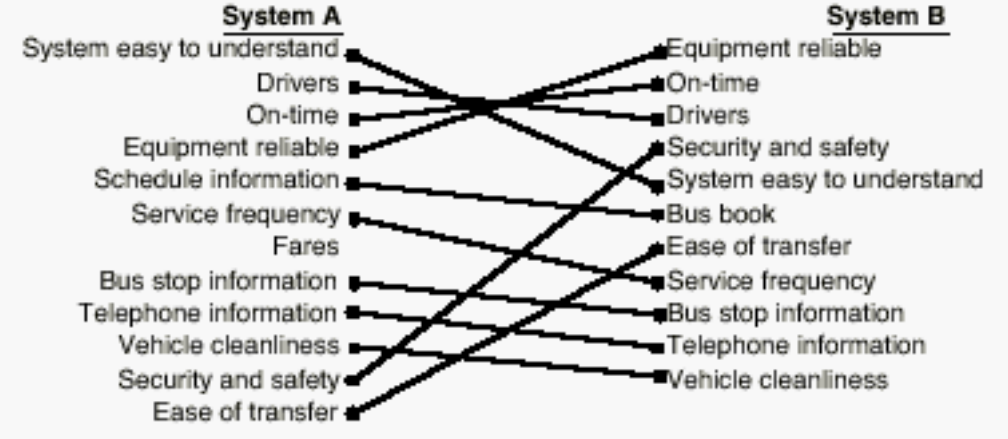

Figure 5. Comparison of Importance Rankings

Both surveys were conducted by the same contractor. System C used a very different instrument and method of administration.

Three items were near the top of importance ratings at Systems A and B:

- Drivers
- On time
- Equipment reliable

Similarly, three items were near the bottom of importance ratings at Systems A and B:

- Bus stop information
- Telephone information
- Vehicle cleanliness

Two items fell in the middle of the rankings for both Systems A and B:

- Schedule information/bus book
- Service frequency

Three items stand out as having notably different importance at Systems A and B. Security and Safety and Ease of Transfer were low ranked at System A but ranked near the middle at System B. System Easy to Understand was top-ranked at System A but only mid-ranked at System B.

Overall, the importance scores for seniors at Systems A and B show broad consistency. Using a statistical test of rank correlation (Mosteller and Rourke, 1973), the importance ranks at Systems A and B are correlated with better than 95 percent confidence (there is less than a 5% chance the similarity of rankings could have occurred by chance). A similar test was performed for ranking of importance by non-seniors. The similarity in rankings at Systems A and B are different from chance, with better than 97.5 percent confidence.

IMPACT SCORES

The impact scores show the combined influence of importance and current satisfaction. Because current satisfaction varies among systems, impact scores do too and would even if importance were completely consistent among systems. Table 2 shows the service attributes with the top impact scores at each system for seniors and non-seniors.

Table 2. Service Attributes with Greatest Impact on Overall Satisfaction

System A	
Seniors	**Non-seniors**
System easy to understand Drivers Telephone information On time Schedule information	Fares Bus-stop information Ease of transfer Service frequency Vehicle cleanliness
System B	
Seniors	**Non-seniors**
Information at bus stops Frequency of service Telephone information On time Security and safety	Frequency of service Information at bus stops On time Telephone information Ease of transfers
System C	
Seniors	**Non-seniors**
Security of car at park-and-ride lots Safety waiting for bus after dark Safety at park-and-ride lots Safety on bus after dark	Time between buses Safety waiting for bus after dark Where bus routes go On-time performance

At System A, the highest impact items are completely different for seniors and non-seniors. Since there is relatively little spread among attributes in the current satisfaction ratings for seniors, the impact scores mostly reflect the influence of the importance ratings. Four of the top five impact items are also among the items with the five highest importance scores. The remaining item, Telephone Information, had the poorest current satisfaction ranking of all the attributes.

At System B, a different pattern emerges. Four out of five items with the highest impact overlap for seniors and non-seniors. In this case, it appears that

the impact scores are dominated by the current satisfaction ratings rather than the importance score. This reflects the greater spread of current satisfaction ratings at System B compared to System A. Recall that impact = (importance) x (percent of respondents in the lower satisfaction group). If 60 percent of respondents rate Attribute X as Excellent or Good, and 80 percent rate Attribute Y as Excellent or Good, then Attribute X has twice the percentage of respondents who gave a rating of less than Excellent or Good.

A mixed pattern emerges at System C. The list of high-impact items contains some quite different items than at System A or B. However, this is at least partly because some attributes that might be important to seniors were excluded from analysis due to small samples sizes. The differences between seniors and non-seniors reflect both importance and current satisfaction. For seniors, there is close correspondence between satisfaction and importance ratings—three safety-related items with low current satisfaction are also those with high importance. As a result, these have the highest impact scores as well. Time Between Buses, which has a low satisfaction rating by seniors, has a lower-than-average importance for seniors, so it is not among the items with the highest impact scores. For non-seniors, there is relatively little spread in the importance ratings, so the impact scores largely reflect current satisfaction. Note that non-seniors are much less satisfied than seniors with Time Between Buses and On Time Performance, which is why these items are among the highest-impact items for non-seniors but not for seniors.

DIRECT QUESTIONING ABOUT IMPROVEMENTS

All three transit systems included questions that asked respondents directly about whether various named improvements to transit service would result in respondents riding more. Systems A and B allowed respondents to check up to three suggested improvements on a list of nine or ten improvements. System C read improvements and asked respondents to judge how likely each would be (on a scale from 1 to 4) to make the respondent ride the bus more. Figures 6, 7, and 8 show the results for the three transit systems.

Only a few service attributes were included in the satisfaction questions and these lists of improvements. At all three systems, the improvements judged most likely to increase ridership were additions to the overall level of service, especially more frequent service and, at System C, direct service to destinations. Frequency of service was among the highest-impact items at System B, but not at System A. At System A, seniors already rated frequency of service highly (76 percent rated it Good or Excellent compared to 61 percent of non-seniors) and assigned it only medium importance. In this case, it appears that ridership is not the same thing as satisfaction. It stands to reason that if total service levels could be significantly increased, ridership of all types would go up. Even in this case, however, riders would not necessarily like the service more.

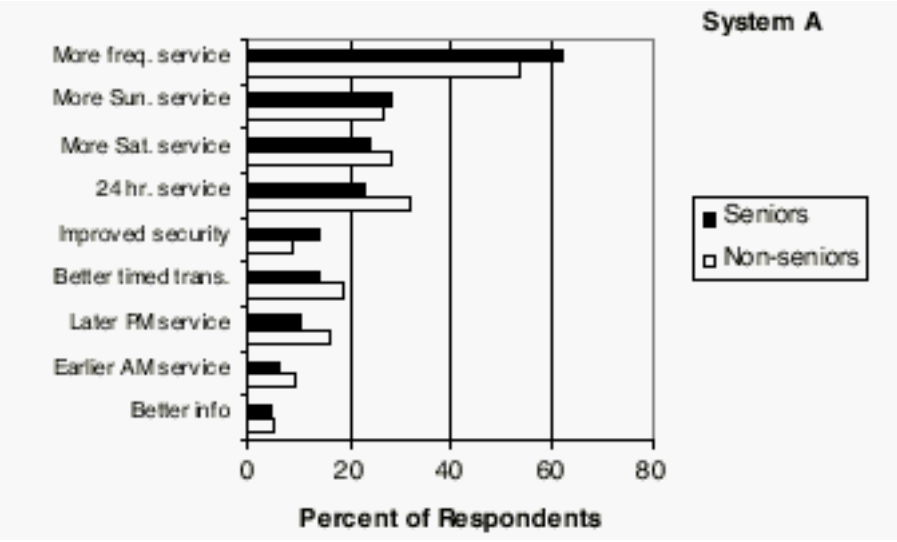

Figure 6. What Improvements Would Make You Ride More Often?

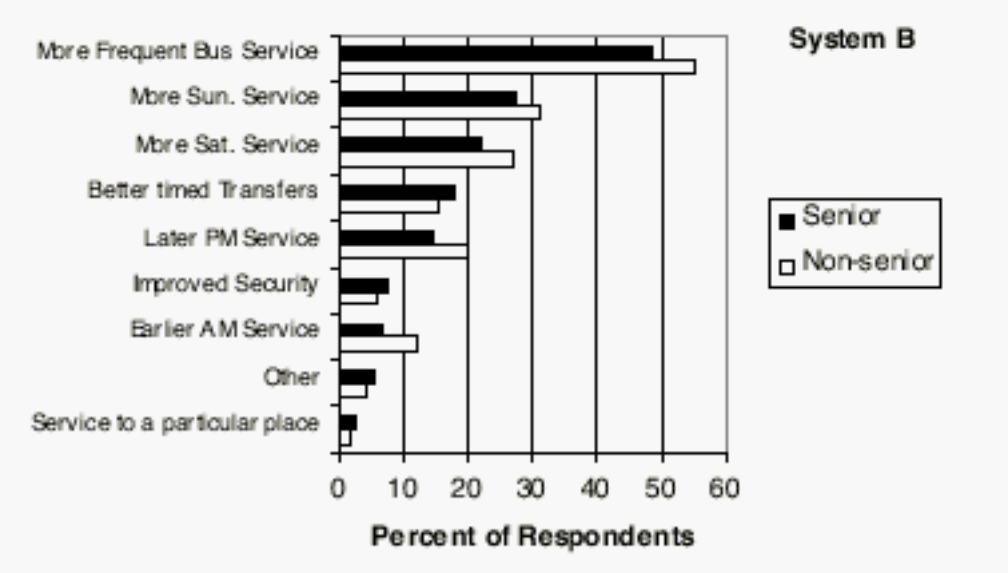

Figure 7. What Improvements Would Help You Choose to Ride the Bus More Often?

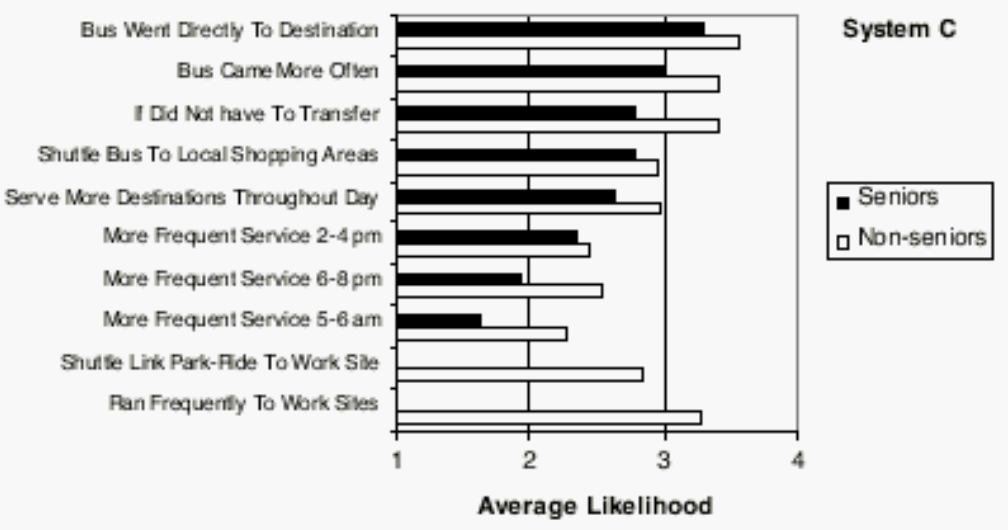

Figure 8. Would You Be More Likely to Ride the Bus If....

CONCLUSIONS

The impact analysis appears to provide valid indications of the relative importance that riders assign to various aspects of service, enabling calculation of the impact that improvements would have on service satisfaction. Many of the results are specific to individual transit systems; however, several general patterns were observed:

- While adding service would probably have the greatest impact on ridership, the impact analysis shows that other improvements can have a major impact on satisfaction.
- In general, seniors appear to rate service attributes more highly than do non-seniors.
- The analysis showed a wider range of importance scores for seniors than for non-seniors. While importance scores for non-seniors tended to cluster together, the results for seniors appear to indicate that certain service attributes are significantly more important than others.
- At the two systems that used a similar method of survey administration and question format, there is broad consistency in importance ratings for seniors. Among the most important attributes at both systems were drivers, reliable equipment, and on-time performance.
- The items for which improvement would have the greatest impact on satisfaction are not necessarily the same as those that would result in the greatest increase in ridership.

Note that the satisfaction questions at Systems A and B did not include a number of items that would be interesting from a policy point of view, such as access to destinations, distance from home to a bus stop, and the number of transfers needed to complete a trip. System C did include questions about these issues, but the sample size for seniors was too small for our analysis. The method appears to separate current satisfaction from importance. However, note that importance is not necessarily independent of current satisfaction.

The analysis is limited to results from three West Coast transit systems. Since the surveys were all large-sample, professionally administered, systemwide surveys, the seniors who were surveyed are probably reasonably representative of seniors who ride these transit systems. However, we cannot be certain that seniors who ride other systems would have similar preferences.

Despite this limitation, the analysis indicates that the impact analysis method provides a valid way of assessing the improvements, short of adding service, that will have the greatest impact on seniors or the general public.

APPENDIX A—DETAILED SATISFACTION, IMPORTANCE, AND IMPACT DATA

System A		
	Percent Good/Excellent	
	Seniors	**Non-Seniors**
Fares	79%	54%
System easy to understand	78%	74%
Ease of transfer	76%	61%
Service frequency	76%	61%
Equipment reliable	75%	73%
On time	75%	64%
Security and safety	73%	63%
Drivers	73%	70%
Schedule information	72%	70%
Vehicle cleanliness	68%	55%
Bus-stop information	67%	51%
Telephone information	62%	60%
	Importance	
	Seniors	**Non-Seniors**
Ease of transfer	0.36	0.78
Security and safety	0.46	0.71
Vehicle cleanliness	0.53	0.65
Telephone information	0.53	0.58
Bus-stop information	0.57	0.66
Fares	0.60	0.74
Service frequency	0.67	0.76
Schedule information	0.74	0.71
Equipment reliable	0.74	0.79
On time	0.81	0.75
Drivers	0.82	0.72
System easy to understand	1.04	0.85
	Impact Score	
	Seniors	**Non-Seniors**
Ease of transfer	0.08	0.30
Security and safety	0.12	0.26
Fares	0.13	0.34
Service frequency	0.16	0.30
Vehicle cleanliness	0.17	0.30
Equipment reliable	0.18	0.22
Bus-stop information	0.19	0.32
Schedule information	0.20	0.22
On time	0.20	0.27
Telephone information	0.21	0.23
Drivers	0.22	0.21
System easy to understand	0.23	0.22

System B		
	Percent Good/Excellent	
	Seniors	Non-Seniors
Bus book	86%	85%
Drivers	86%	75%
System easy to understand	82%	78%
Ease of transfers	80%	72%
Reliable equipment	80%	79%
On time	79%	70%
Security/safety	76%	73%
Cleanliness of vehicle	74%	73%
Telephone information	60%	60%
Frquency of service	54%	58%
Information at bus stops	48%	57%
	Importance	
	Seniors	Non-Seniors
Cleanliness of vehicles	0.77	0.67
Telephone information	0.77	0.53
Information at bus stops	0.78	0.58
Frequency of service	0.88	0.68
Ease of transfer	0.99	0.77
Bus book	1.01	0.93
System easy to understand	1.06	0.81
Security/safety	1.11	0.71
Drivers	1.13	0.70
On time	1.28	0.71
Reliable equipment	1.35	0.75
	Impact Score	
	Seniors	Non-Seniors
Bus book	0.15	0.13
Drivers	0.17	0.17
System easy to understand	0.18	0.17
Ease of transfers	0.21	0.20
Cleanliness of vehicles	0.22	0.18
Reliable equipment	0.27	0.15
Security/safety	0.28	0.19
On time	0.30	0.22
Telephone information	0.31	0.21
Frequency of service	0.40	0.28
Information at bus stops	0.42	0.25

System C		
	Percent Very Satisfied	
	Seniors	**Non-Seniors**
Safety waiting for bus in daytime	69%	67%
On-time performance	65%	37%
Safety on bus during daytime	61%	50%
Safety of park-ride lots	51%	43%
Where bus routes go	50%	39%
Safety on bus after dark	40%	29%
Time between buses	36%	24%
Security of car at park-ride lots	30%	34%
Safety waiting for bus after dark	25%	23%
	Importance	
	Seniors	**Non-Seniors**
Safety waiting for bus in daytime	0.45	0.62
On-time performance	0.54	0.52
Safety on bus during daytime	0.55	0.54
Time between buses	0.60	0.59
Where bus routes go	0.65	0.64
Safety on bus after dark	0.71	0.49
Safety waiting for bus after dark	0.73	0.52
Security of car at park-ride lots	0.87	0.47
Safety of park-ride lots	0.96	0.51
	Impact Score	
	Seniors	**Non-Seniors**
Safety waiting for bus in daytime	0.14	0.21
On-time performance	0.19	0.33
Safety on bus during daytime	0.21	0.27
Time between buses	0.32	0.39
Where bus routes go	0.39	0.45
Safety on bus after dark	0.43	0.35
Safety waiting for bus after dark	0.47	0.29
Security of car at park-ride lots	0.55	0.40
Safety of park-ride lots	0.61	0.31

BIBLIOGRAPHY

Burkhardt, J.E. *Transportation Needs and Problems Among the Elderly.* Bethesda, MD: Ecosometrics, Inc., 1996.

Ecosometrics, Inc. *Mobility and Independence: Changes and Challenges for Older Drivers*. Bethesda, MD: Ecosometrics, Inc., 1998.

Morpace International, Inc. *A Handbook for Measuring Customer Satisfaction and Service Quality,* Transit Cooperative Research Program Report 47. Washington, D.C.: National Research Council, 1999.

Mosteller F., and E.K. Rourke. *Sturdy Statistics*. Reading, MA: Addison-Wesley, 1973.

Rosenbloom, S. "Travel by the Elderly," in *Nationwide Personal Transportation Survey: Demographic Special Reports.* Washington, D.C.: U.S. Department of Transportation, 1995.

Rosenbloom, S. "The Mobility Needs of the Elderly," in *Special Report 218, Transportation in an Aging Society: Improving Mobility and Safety for Older Persons, Volume II.* Washington, D.C.: Transportation Research Board, National Research Council, 1988.

Transportation Research Board, *Special Report 218, Transportation in an Aging Society: Improving Mobility and Safety for Older Persons, Vol. I.* Washington, D.C.: National Research Council, 1998.

U.S. Bureau of the Census. *65+ in the United States: Current Population Reports.* Special Studies, pp. 23-190. Washington, D.C.: U.S. Government Printing Office, 1996.

Yalch, R. *A Handbook: Using Market Segmentation to Increase Transit Ridership*, Transit Cooperative Research Program Report 36. Washington, D.C.: National Research Council, 1998.

Yalch, R. *A Handbook: Integrating Market Research in Transit Management,* Transit Cooperative Research Program Report 37. Washington, D.C.: National Research Council, 1998.

ABOUT THE AUTHORS

PRINCIPAL INVESTIGATOR

David Koffman is President of Crain & Associates, Inc., of San Carlos, California. He has been active in planning for the transportation needs of seniors and people with disabilities since 1977. His research has been performed under contract for the U.S. Department of Transportation and numerous public transportation agencies throughout the United States. He is a frequent presenter at professional meetings on paratransit and an active member of the Committee on Paratransit of the Transportation Research Board. His work has focused on predicting ridership, efficient operation, fare structures, complying with requirements of the Americans with Disabilities Act, and innovative service methods. He holds an undergraduate degree in mathematics from M.I.T. and a masters in city planning from Harvard.

TEAM MEMBER

Dr. Roger L. Salstrom is Assistant Professor in the Department of Organization and Management of San José State University. Dr. Salstrom received his PhD in operations management from the University of California, Berkeley, and has an MBA from Indiana University and a BS in Aeronautical Engineering from Purdue. He has extensive industry experience as a Planning and Control Manager for FMC Corporation and has worked for other businesses in a variety of positions. He has published in *Systems Engineering, Interfaces, Northern California Executive Review,* and other publications.

STUDENT ASSISTANT

Randolph R. Schmidt is an undergraduate student of Business with an accounting concentration at San Jose Staté University. Before working on this project, he was assistant to the professor of Business Statistics at San José State University.

PRE-PUBLICATION PEER REVIEW

San José State University, of the California State University system, and the MTI Board of Trustees have agreed upon a peer review process required for all research published by MTI. The purpose of the review process is to ensure that the results presented are based upon a professionally acceptable research protocol.

Research projects begin with the approval of a scope of work by the sponsoring entities, with in-process reviews by the MTI Research Director and the project sponsor. Periodic progress reports are provided to the MTI Research Director and the Research Associates Policy Oversight Committee (RAPOC). Review of the draft research product is conducted by the Research Committee of the Board of Trustees, and may include invited critiques from other professionals in the subject field. The review is based on the professional propriety of the research methodology.