TRANSIT COOPERATIVE RESEARCH PROGRAM

SPONSORED BY

The Federal Transit Administration

TCRP Report 47

A Handbook for Measuring Customer Satisfaction and Service Quality

Transportation Research Board

National Research Council

TRANSIT COOPERATIVE RESEARCH PROGRAM

Report 47

A Handbook for Measuring Customer Satisfaction and Service Quality

MORPACE INTERNATIONAL, INC.
Farmington Hills, MI

in association with

CAMBRIDGE SYSTEMATICS, INC.
Cambridge, MA

Subject Areas

Public Transit

Research Sponsored by the Federal Transit Administration in Cooperation with the Transit Development Corporation

TRANSPORTATION RESEARCH BOARD
NATIONAL RESEARCH COUNCIL

NATIONAL ACADEMY PRESS
Washington, D.C. 1999

TRANSIT COOPERATIVE RESEARCH PROGRAM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, some of which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry. The Transit Cooperative Research Program (TCRP) serves as one of the principal means by which the transit industry can develop innovative near-term solutions to meet demands placed on it.

The need for TCRP was originally identified in *TRB Special Report 213—Research for Public Transit: New Directions*, published in 1987 and based on a study sponsored by the Urban Mass Transportation Administration—now the Federal Transit Administration (FTA). A report by the American Public Transit Association (APTA), *Transportation 2000*, also recognized the need for local, problem-solving research. TCRP, modeled after the longstanding and successful National Cooperative Highway Research Program, undertakes research and other technical activities in response to the needs of transit service providers. The scope of TCRP includes a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.

TCRP was established under FTA sponsorship in July 1992. Proposed by the U.S. Department of Transportation, TCRP was authorized as part of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). On May 13, 1992, a memorandum agreement outlining TCRP operating procedures was executed by the three cooperating organizations: FTA, the National Academy of Sciences, acting through the Transportation Research Board (TRB); and the Transit Development Corporation, Inc. (TDC), a nonprofit educational and research organization established by APTA. TDC is responsible for forming the independent governing board, designated as the TCRP Oversight and Project Selection (TOPS) Committee.

Research problem statements for TCRP are solicited periodically but may be submitted to TRB by anyone at any time. It is the responsibility of the TOPS Committee to formulate the research program by identifying the highest priority projects. As part of the evaluation, the TOPS Committee defines funding levels and expected products.

Once selected, each project is assigned to an expert panel, appointed by the Transportation Research Board. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, TCRP project panels serve voluntarily without compensation.

Because research cannot have the desired impact if products fail to reach the intended audience, special emphasis is placed on disseminating TCRP results to the intended end users of the research: transit agencies, service providers, and suppliers. TRB provides a series of research reports, syntheses of transit practice, and other supporting material developed by TCRP research. APTA will arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by urban and rural transit industry practitioners.

The TCRP provides a forum where transit agencies can cooperatively address common operational problems. The TCRP results support and complement other ongoing transit research and training programs.

TCRP REPORT 47

Project B-11 FY'95
ISSN 1073-4872
ISBN 0-309-06323-X
Library of Congress Catalog Card No. 99-71030

Price $53.00

NOTICE

The project that is the subject of this report was a part of the Transit Cooperative Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the project concerned is appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical advisory panel selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and while they have been accepted as appropriate by the technical panel, they are not necessarily those of the Transportation Research Board, the National Research Council, the Transit Development Corporation, or the Federal Transit Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical panel according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

To save time and money in disseminating the research findings, the report is essentially the original text as submitted by the research agency. This report has not been edited by TRB.

Special Notice

The Transportation Research Board, the National Research Council, the Transit Development Corporation, and the Federal Transit Administration (sponsor of the Transit Cooperative Research Program) do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the clarity and completeness of the project reporting.

Published reports of the

TRANSIT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

and can be ordered through the Internet at
http://www.nas.edu/trb/index.html

Printed in the United States of America

FOREWORD

By Staff
Transportation Research Board

This handbook focuses on how to measure customer satisfaction and how to develop transit agency performance measures. It will be of interest to transit managers, market research and customer service personnel, transit planners, and others who need to know about measuring customer satisfaction and developing transit agency performance measures. The handbook provides methods on how to identify, implement, and evaluate customer satisfaction and customer-defined quality service.

Transit agencies are concerned with delivering quality service to customers, which is often defined by on-time performance, comfort, safety, and convenience. Transit agencies continually strive to define quality service, yet a problem exists—definitions of such service often evolve from management's perceptions of what constitutes quality. These management definitions may vary significantly from what current and potential customers perceive to be quality service.

Consumer definitions of quality service could prove helpful to the transit industry. Under TCRP Project B-11, *Customer-Defined Transit Service Quality*, research was undertaken by MORPACE International, Inc., to develop a methodology to assist transit agencies in identifying, implementing, and evaluating customer-defined service quality and in defining performance indicators that include customer-defined quality service measures for fixed-route transit. This research includes rural, suburban, and urban markets.

To achieve the project objective of producing a handbook, the researchers conducted a review of current literature related to customer-defined transit service quality measures, customer satisfaction measurement techniques within transit and other industries, and transit performance measures and indicators. Next, the research team developed a comprehensive list of service-quality measures from the customer's perspective, ensuring that each measure was specific and clearly defined. A survey was administered to customers to arrive at a ranking of service-quality measures, in order of their impact on overall customer satisfaction. The survey instrument was developed and refined based on the results of pretests. Alternative methods for ranking servicequality measures were explored and evaluated, and a new approach was introduced. Finally, the list of service-quality measures was compared with the list of agency performance indicators, and the performance measures were revised to reflect customerdefined service. Using the research findings from the field test, the methodology was refined and a preliminary method for assessing transit operations was developed. Methods for benchmarking and tracking information are also identified.

CONTENTS

A Handbook for Measuring Customer Satisfaction and Service Quality

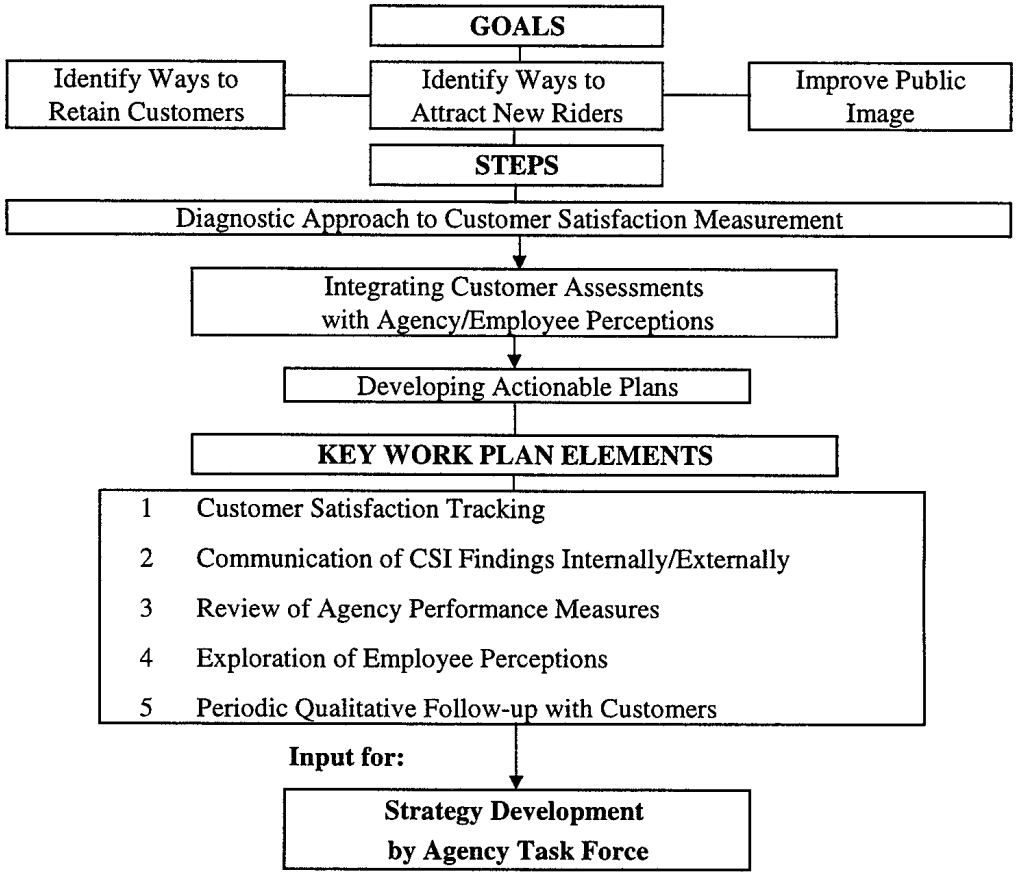
CHAPTER 1. INTRODUCTION

1A. The Goals of Customer Satisfaction and Service Quality Measurement

For transit agencies, as in other service industries, increases in customer satisfaction translate into retained markets, increased use of the system, newly attracted customers, and a more positive public image. To accomplish these ends, public transit needs reliable and efficient methods for identifying the determinants of service quality from the customers' perspective.

The primary focus of this handbook is how to measure customer satisfaction and how to develop transit agency performance measures in response to research findings. These are key elements of an ongoing customer satisfaction monitoring process. However, before proceeding with these tasks, it is helpful to consider the framework implied when customer feedback becomes the driver of agency service improvement actions. Chart 1.1 below sets forth the goals, steps, and key work plan elements of a successful customer satisfaction management plan.

Chart 1.1
Overall Customer Satisfaction Management Plan



The results of a customer satisfaction measurement program cannot be expected to drive transit agency service improvement plans unless the findings correlate with agency-based performance measures, i.e. that data which the agency collects on a regular basis to document service performance. Customer perspectives must also be validated or understood by frontline transit agency employees if corrective action plans are to translate into successful implementation.

Hence, the customers' perspective, as measured, must be effectively communicated to agency personnel. This communication should facilitate management's use of customer feedback in determining which service improvements require immediate attention, which require further monitoring, and which indicate a need for educating customers about service parameters. For while customers must always be first, customers may not always be right. A fully diagnostic approach to customer satisfaction measurement is essential, rather than reliance on ratings and ranking of service attributes alone.

Customer satisfaction indices, or CSIs, are determined from benchmark and tracking customer surveys. These indices rely on measuring the impact of customers' ratings of individual service attributes on overall satisfaction with service.

Several quantitative survey analysis techniques for this measurement are in use within transit and other service industries. These include quadrant and gap analysis, factor analysis and multiple regression analysis, and scattergrams. Of these, only factor and regression analysis can provide quantitative benchmarks for continuous tracking, but problems are inherent. These include the need for large sample sizes, the complications of explaining variability and weights, and reduction of potentially rich individual service attribute findings into results for aggregated dimensions — with less relevancy for specific transit improvements and performance measures.

This handbook proposes a new, simpler "impact score" or problems encountered approach. This approach determines the relative impact of service attributes on overall satisfaction, when a recent problem with the attribute is reported. Since the primary way transit agencies can improve customers' overall satisfaction with service is to reduce customers' problematic experiences, the goal is to identify those attributes which have the greatest negative impact on overall satisfaction and the greatest number of customers encountering a problem. These "driver attributes" can be identified and prioritized in a threestep process. Large sample and subsample sizes, and multivariate analysis techniques, are not required.

Another advantage of the impact score approach is that while more demanding telephone benchmark surveys are recommended to establish baselines, periodic (annual or biannual) updates and tracking of impact scores can be accomplished via on-board rider surveys only. These tracking updates can focus on problem occurrence and those measures of service quality found in the baseline survey to have the greatest impact on overall satisfaction.

For those transit agencies currently conducting customer satisfaction research using other methods, adding the impact score approach will require only the following minor addition to the questionnaire. After asking customers for their satisfaction rating on each individual service attribute (a series of questions almost always included), the follow-up question, "Have you experienced a problem with this service attribute within the last 30 days?" *(1: "Yes", 2: "No")* will be asked.

Unquestionably, all customer satisfaction analytical methods can be used in combination to fully explore underlying relationships in customer perceptions, with the overall, diagnostic goal of determining what elements of service need improvement. In combination with other approaches, or alone, impact scores provide a straightforward method with results that are easy to explain, do not require large sample sizes, and that streamline procedures for measuring — and improving — customer satisfaction over time.

The TCRP B-11 project comparatively field-tested the impact score and other customer satisfaction measurement approaches at three transit agency sites:

- an urban rail system, the Chicago Transit Authority (CTA) Red Line and CTA Blue Line in Chicago, Illinois,
- a suburban bus system, Sun Tran in Albuquerque, New Mexico, and
- a small city bus system, Greater Lynchburg Transit Company (GLTC) in Lynchburg, Virginia.

1B. How to Use This Handbook

This handbook is organized for the "new ideas" and "comprehensive" customer satisfaction measurement reader.

If you are interested in:

1.	How to Measure and Compute Impact Scores	→	GO TO CHAPTERS 5 AND 6
2.	Benefits, Requirements, and a Brief History of Customer Satisfaction Measurement	→	GO TO CHAPTER 2 AND APPENDIX A
3.	Identifying the Determinants of Service Quality from a Qualitative Perspective	→	GO TO CHAPTER 3 AND APPENDICES B AND C
	Example List of Transit Service Quality Measures	→	Page 13
4.	A Review of Quantitative Customer Satisfaction Measurement Techniques	→	GO TO CHAPTERS 4 AND 8
5.	Customer Satisfaction Research Design and Data Collection Methods	→	GO TO CHAPTER 7 AND APPENDICES D, E, AND F
	Customer Satisfaction Benchmark Survey Instrument	→	APPENDIX F
6.	The Development of Agency Performance Measures	→	GO TO CHAPTERS 9, 10, AND 11 AND APPENDIX G

1C. Key Words

Customer satisfaction measurement or indexing, or customer-defined service quality — determining the relevant impact of customers' ratings of individual service attributes on overall satisfaction with service.

Impact score or things gone wrong approach — a new approach to customer satisfaction measurement used extensively within automotive research and described herein.

Drivers of overall satisfaction — those service attributes with the greatest impact on overall satisfaction with service.

Attribute impact scores — scores that indicate the relevant position of a service attribute in terms of its impact on overall customer satisfaction and rate of customer reported problem occurrence.

Problem occurrence — the percent of customers experiencing a problem with a service attribute within the past 30 days.

CHAPTER 2. GOALS FOR TRANSIT INDUSTRY SERVICE QUALITY MEASUREMENT

2A. Benefits and Requirements of Service Quality Measurement for Transit

Although empirical evidence is limited, increases in customer satisfaction are generally believed to:

- shift the demand curve upward and/or make the slope of the curve steeper (i.e., lower price elasticity, higher margins)
- reduce marketing costs (customer acquisition requires more effort)
- reduce customer turnover
- lower employee turnover (satisfied customers affect the satisfaction of front-line personnel)
- enhance reputation and public image (positive customer word-of-mouth)
- reduce failure costs (handling customer complaints).[1]

For transit agencies, an increase in customer satisfaction translates into retained riders, increased use of the system, newly attracted customers, and an improved public image.

The requirements for a transit industry service quality measurement process are:

- to derive the determinants of service quality from the customers;
- to benefit from best practices established for service quality measurement within other industries;
- to take into account the complexities and unique aspects of public transit service;
- to consider the differences inherent in urban, suburban, and rural systems – including modal differences; and
- to develop methods that are reasonably easy to describe and to implement so that cost and time allocations are efficient.

Within the transit industry, only limited survey based customer satisfaction indexing research has been conducted. The 1993 IDEA study[2], based on small sample sizes within three urban transit systems, the 1995 Northwest Research Chicago Transit Authority Customer Satisfaction Report[3], and customer satisfaction studies conducted by BART in San Francisco[4], TRI-MET in Portland, Oregon, and MARTA in Atlanta are notable among the studies that have been published.

2B. Brief History of Customer Satisfaction Measurement

Appendix A provides a thorough literature review summary as to historical and methodological perspectives of customer satisfaction research.

Consumer behavior as a distinct discipline dates only from the mid 1960s. Interest in understanding and tracking specific consumer problems grew dramatically in the late 1970s under the broad label of consumer satisfaction/dissatisfaction (CS/D) research. Its growth coincided with a growing interest on the part of government regulators and consumer advocates in making policy formulation more rational and systematic. The earliest comprehensive CS/D studies were, in fact, motivated by the policy planning needs of a public regulatory agency, the Federal Trade Commission (Technical Advisory Research Program 1979), and a private non-profit sector organization, Ralph Nader's Center for Study of Responsive Law. Most CS/D research from 1975 to 1985 was conducted within product and goods industries. Only after 1980 were initial concepts and models developed to measure consumer satisfaction/dissatisfaction within service industries.

Since 1985, two different patterns have emerged. First, there has been a considerable drop in CS/D research from a public policy perspective. At the same time, however, there has been substantial growth in interest in the topic of consumer satisfaction research in the private sector. This has been driven primarily by the growth of the service sector of the economy where managers have realized that tracking satisfaction is crucial to success when intangibles such as personal attention and atmospheres are the "product". A number of private sector satisfaction tracking services have emerged. Many of these services have made extensive use of earlier methodological developments in social policy research.

Most of the early studies were based on survey data. An alternative approach was complaints data, data on the extent to which consumers voluntarily speak up about their dissatisfactions. Such data have the advantage of not requiring field surveys; however, they are typically biased in two important ways. First, some types of problems in some types of industries are more likely to be voiced than others, and some problems are less serious than others, and/or less costly than others. Monopolies, such as some transit systems, are often relatively "immune" to complaining except from a small elite. Finally, not all consumers complain. These problems have led researchers in recent years to fall back on the more costly, but more objective, survey research methods.

Initial survey research studies on CS/D sought to calibrate the amount and types of dissatisfaction in the marketplace as a basis for policy planning. This body of research was largely descriptive. Wide variation was found across purchase categories. These studies differ widely in the basic measure of dissatisfaction they used. Some focused on more or less objective measures of "problems", others on subjective feelings of "dissatisfaction." Some counted any negative experience whatsoever, some only "serious" dissatisfactions, and some only the most recent problem. Also, there was the issue of opportunity for problems. Definitional problems persist today.

2C. Defining Service Quality Measurement

Customer satisfaction research literature traditionally agrees that service quality is a measure of how well the service level delivered matches customer expectations. Delivering quality service means conforming to customer expectations on a consistent basis.[5] However, clearly, the fact that expectations are confirmed is not always sufficient for satisfaction.

Generally, a set of discrepancies or gaps exists regarding organizational perceptions of service quality and the tasks associated with service delivery to consumers. These gaps can be major hurdles to attempting to deliver a service that consumers would perceive as being high quality. Chart 2.1 on the following page shows the five gap areas identified.

These are:

GAP 1: Consumer expectation — management perception gap

These are discrepancies between executive perceptions and consumer expectations. Transit agency executives may not always understand what features connote high quality to consumers in advance, what features a service must have in order to meet consumer needs, and what levels of performance on those features are needed to deliver high quality service.

GAP 2: Management perception — service quality specifications

There may be constraints (resources, or market conditions) which prevent management from delivering what the consumer expects, or there may be an absence of total management commitment to service quality.

GAP 3: Service quality specifications — service delivery gap

There may be difficulty in standardizing employee performance even when guidelines exist for performing services well and treating consumers correctly.

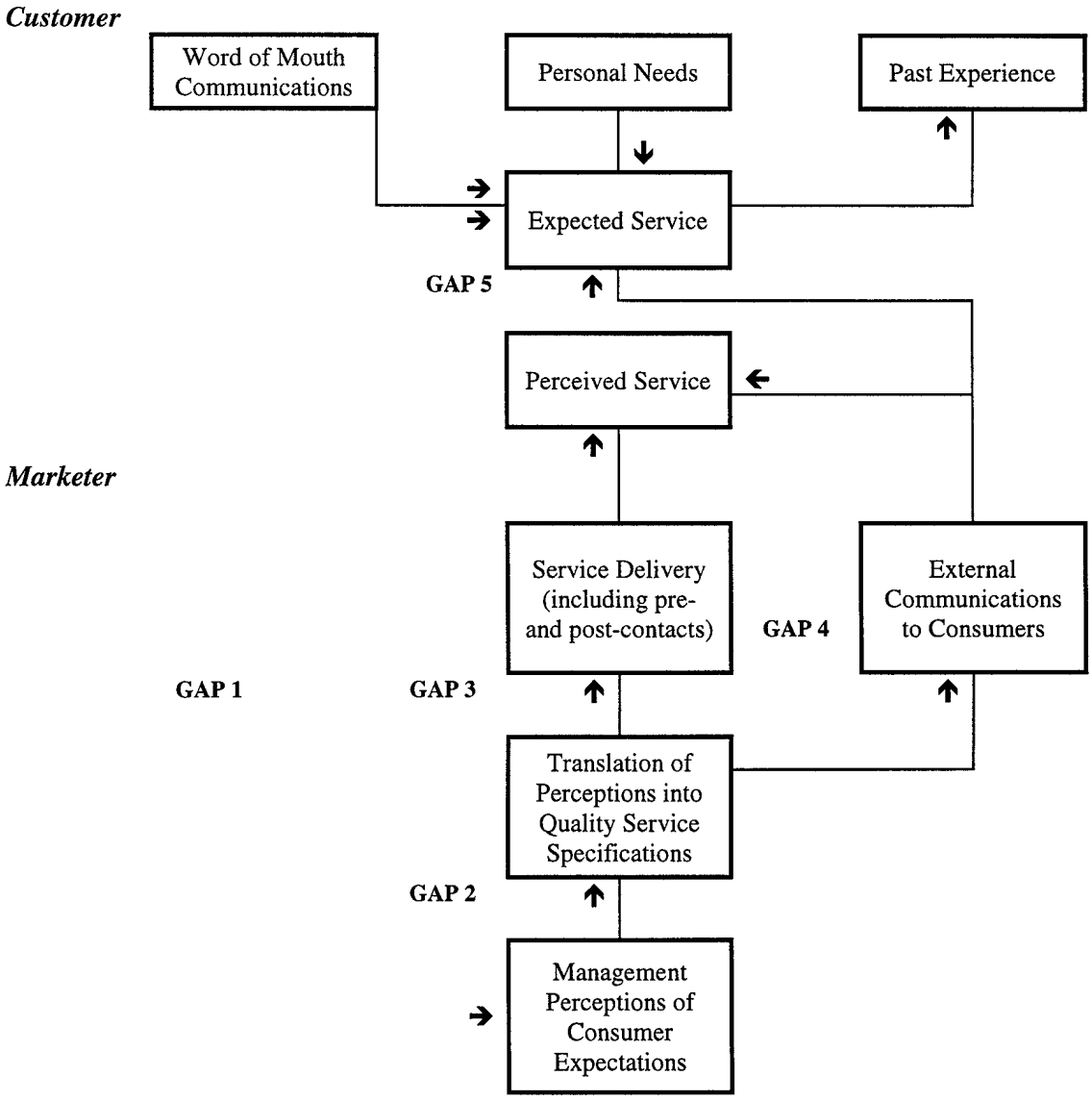
GAP 4: Service delivery — external communications gap

Media advertising and other communications by an agency can affect consumer expectations. Promising more than can be delivered will raise initial expectations but lower perceptions of quality when the promises are not fulfilled. Also, transit agencies can neglect to inform consumers of special efforts to assure quality that are not visible to consumers, thereby affecting consumer perceptions of the delivered service.

GAP 5: Expected service — perceived service gap

This is how consumers perceive the actual service performance in the context of what they expected. The quality that a consumer perceives in a service is a function of the magnitude and direction of the gap between expected service and perceived service.

Chart 2.1
Service Quality Model



Service quality, as perceived by a consumer, depends on the size and direction of GAP 5 which, in turn, depends on the nature of the gaps associated with the design, marketing, and delivery of services. That is, the magnitude and direction of each gap will have an impact on service quality.

ENDNOTES

[1] Fornell, Claes, "*A National Customer Satisfaction Barometer: The Swedish Experience"*, Journal of Marketing, January 1992, Volume 56, Number 1, pp. 6-21.

[2] IDEA Program Final Report, Customer Satisfaction for the Mass Transit Industry, Contract: TRANSIT-1, Transportation Research Board, prepared by: Tri-County Metropolitan Transportation District of Oregon, August, 1995.

[3] Customer Satisfaction Survey of Chicago Transit Authority Riders, Northwest Research Group, Inc., December, 1995.

[4] Passenger Environment Survey Report, BART Customer and Performance Research, January - March 1997.

[5] Lewis, Robert C. and Bernard H. Booms (1983), "The Marketing Aspects of Service Quality" in *Emerging Perspectives on Services Marketing*, L. Berry, G. Shostack, and G. Upah, eds., Chicago: American Marketing, pp. 99-107.

This page left intentionally blank.

CHAPTER 3. IDENTIFYING DETERMINANTS OF SERVICE QUALITY

Exploratory investigation suggests that, within most service industries, consumers use basically similar criteria in evaluating service quality.[6] These criteria seem to fall into 10 key categories labeled "service quality determinants". These determinants are listed below. Overlap among the 10 determinants may exist.

Determinants of Service Quality

1	RELIABILITY involves consistency of performance and dependability.
2	RESPONSIVENESS concerns the willingness or readiness of employees to provide service. It also involves timeliness of service.
3	COMPETENCE means possession of the required skills and knowledge to perform the service.
4	ACCESS involves approachability and ease of contact.
5	COURTESY involves politeness, respect, consideration, and friendliness of contact personnel.
6	COMMUNICATION means keeping customers informed in language they can understand and listening to them. It may mean that the company has to adjust its language for different consumers — increasing the level of sophistication with a well-educated customer and speaking simply and plainly with a novice.
7	CREDIBILITY involves trustworthiness, believability, and honesty. It involves having the customer's best interests at heart.
8	SECURITY is the freedom from danger, risk, or doubt.
9	UNDERSTANDING/KNOWING THE CUSTOMER involves making the effort to understand the customer's needs.
10	TANGIBLES includes the physical environment and representations of the service.

Research in other service industries indicates consumers "group" a wide array of attributes of service under one of the 10 dimensions noted when judging service quality. However, this research is preliminary and also suggests that it is advisable to determine, within the industry of study, whether identifiable service quality segments exist — and whether, and in what ways, consumer expectations differ across industry segments. Investigating how transit customers aggregate attributes of service into collapsed quality dimensions is important to understanding how customer satisfaction should be measured within an industry.

Regardless of what eventual quantitative analytical approaches are used, the process must begin with acquiring a list of service attributes *from the customers*, through an exhaustive "listening to the voice of the customer" process. This qualitative research is usually conducted through a series of focus groups. Customers are requested to describe the ideal service or product in all of its feature details. Then customers are asked to list their basic service or product requirements, starting with primary requirements and continuing through the secondary and tertiary components of each of these requirements. The moderator proceeds until the group has exhausted all the possible attributes of service quality they would consider.

This process is repeated at multiple geographic and customer segment sites and the results are combined and itemized into a full and complete attribute listing. The wording of the attributes is refined for clarity and linkage with expected results. For example, "frequent service so that wait times are short". (Or if further quantification is desirable: "frequent service so that wait times do not exceed 15 minutes".) This process usually results in a listing of 40 to 55 defined attributes of transit service that can be rated by customers (see Table 3.1, as an example).

A prototype moderator's guide for focus group sessions conducted to extract and prioritize customer service quality requirements can be found in Appendix B. Appendix C contains a more detailed description of the qualitative focus group explorations conducted as a part of the field test for this study, at each of the three demonstration transit agency sites. The same format was used at each site and for each transit mode. Recruitment of customers for the focus group sessions was accomplished through distribution and collection of an on-board, or at-station, questionnaire to passengers. Basic demographic and trip pattern data were requested, in addition to telephone numbers for the recruitment process.

Once the customer-defined service quality attribute list is developed for a locality, exhaustive qualitative research with customers does not need to be repeated for several years (every four to seven years is usually recommended). An open-ended question on the quantitative survey format which asks respondents to name the one change they would make to improve service, or to name any additional attributes or factors that have not been mentioned that affect their ratings of service quality, is usually sufficient to update service quality attribute listings for subsequent tracking research.

Table 3.1
Example List of Transit Service Quality Measures

1	Absence of graffiti
2	Absence of offensive odors
3	Accessibility of trains/buses to handicapped
4	Availability of handrails or grab bars on trains/buses
5	Availability of monthly discount passes
6	Availability of schedule information by phone/mail
7	Availability of schedules/maps at stations/stops
8	Availability of seats on train/bus
9	Availability of shelter and benches at stations/stops
10	Cleanliness of interior, seats, windows
11	Cleanliness of stations/stops
12	Cleanliness of train/bus exterior
13	Clear and timely announcements of stops
14	Comfort of seats on train/bus
15	Connecting bus service to stations/main bus stops
16	Cost effectiveness, affordability, and value
17	Cost of making transfers
18	Displaying of customer service/complaint number
19	Ease of opening doors when getting on/off train/bus
20	Ease of paying fare, purchasing tokens
21	Explanations and announcement of delays
22	Fairness/consistency of fare structure
23	Freedom from nuisance behaviors of other riders
24	Frequency of delays for repairs/emergencies
25	Frequency of service on Saturdays and Sundays
26	Frequent service so that wait times are short
27	Friendly, courteous, quick service from personnel
28	Having station/stop near destination
29	Having station/stop near my home
30	Hours of service during weekdays
31	Number of transfer points outside downtown
32	Physical condition of stations/stops
33	Physical condition of vehicles and infrastructure
34	Posted minutes to next train/bus at stations/stops
35	Quietness of the vehicles and system
36	Reliable trains/buses that come on schedule
37	Route/direction information visible on trains/buses
38	Safe and competent drivers/conductors
39	Safety from crime at stations/stops
40	Safety from crime on trains/buses
41	Short wait time for transfers
42	Signs/information in Spanish as well as English
43	Smoothness of ride and stops
44	Station/stop names visible from train/bus
45	Temperature on train/bus — not hot/cold
46	The train/bus traveling at a safe speed
47	Trains/buses that are not overcrowded
48	Transit personnel who know system

ENDNOTES

[6] A. Parasuraman, Valerie A. Zeithaml, and Leonard L. Berry, Journal of Marketing, Fall 1985, Vol. 49, Number 4, pp. 41-50.

CHAPTER 4. QUANTITATIVE ANALYTICAL TECHNIQUES

4A. Overview

In a typical quantitative customer satisfaction study, respondents evaluate overall satisfaction, then rate each individual service attribute that customers have defined. A key question for researchers is which attributes are the drivers of overall satisfaction (since not all attributes have equal impact)? When there are 40 to 50 attributes that can impact customer satisfaction, and transit agency resources are limited, how can it be determined which limited number of attributes should be targeted for problem occurrence reduction, in order to produce the greatest possible increase in overall customer satisfaction with transit service?

Researchers have suggested many procedures for dealing with this problem. Several are considered by Green and Tull (1975)[7] and reviewed in *The Maritz Marketing Research Report* (1993).[8] Work continues in this area; no true "answer" for all applications has emerged. However, *derived importance measures* are usually preferred over *stated importance measures.*

Stated importance measures ask respondents to explicitly state their perception of the importance of each attribute, usually using a 10-point scale. The results of this method can be straightforwardly interpreted; however, results can be few, if any, statistical differences among attributes, so the aim of the method — to prioritize attributes — is thwarted. For example, if 600 customers are asked to rate the transit service on 46 attributes, each on a scale of one to ten, the mean ratings for 8 to 10 of the attributes may range from 7.3 to 7.5, making the differences among their means statistically insignificant, using a *t-test of significance.* This makes quadrant analysis unreliable since differentiations among attributes by their mean importance or mean satisfaction ratings may not be statistically significant, at least without very large sample sizes. The statistical significance challenge is compounded when the results of a new tracking survey are compared with benchmark results. Additionally, the approach does not take into account, or provide a reliable means, for measuring the relative impact of service attributes on overall satisfaction.

Derived importance methods rely on the statistical association between individual ratings (predictors) and an overall satisfaction rating. The importance of an attribute is statistically determined from this relationship. These measures can be generally described as follows:

1. *Bivariate (Pearson) Correlation:*
   This measure separately tests the strength of the relationship of each independent variable (attribute) with the dependent variable (overall satisfaction). It has the advantages of familiarity and relative simplicity. However, joint effects with other attributes go undiscovered, and often many attributes are similarly correlated with overall satisfaction.

2. *Multiple Regression Analysis:*
   This approach allows the inclusion of additional independent variables (attributes) when testing the relationship with the dependent variable (overall satisfaction). However, an important consideration is that it is common in customer satisfaction research for attributes to be correlated — sometimes highly — with each other. This multicolinearity makes it difficult to measure the separate effects of the individual attributes on overall satisfaction using the multiple regression approach.

3. *Factor Analysis:*
   Factor analysis is a statistical technique that is used for many purposes including:

   - revealing patterns of intercorrelationships among variables, and

   - reducing a large number of variables to a smaller number of statistically independent variables (dimensions) that are each linearly related to the original variables.

4. *Combining Factor Analysis and Multiple Regression Analysis*
   When multicolinearity is encountered in multiple regression modeling, factor analysis can be used to first transform the independent variables to a smaller set of dimensions or artificial variables that are uncorrelated among themselves. Then multiple regression modeling is performed to predict the relative impact of the newly constructed dimensions on the dependent variable (overall satisfaction).

To date, factor analysis combined with multiple regression analysis has been the most prevalent analytical technique applied in customer satisfaction research within the transit industry.

4B. Problems with the Factor Analysis Approach

The *first* inherent problem is that a lot of the richness of the data is lost through factor analysis. Individual attributes that, in isolation, have a high impact on overall satisfaction may not get targeted because the factor analysis placed them within a dimension that did not prove crucial. For example, the attribute of "freedom from the nuisance behaviors of others" may, in isolation, be highly correlated with overall satisfaction. However, as a result of the factor analysis, this attribute can get placed within the dimension of "travel environment" or "appearance", a newly constructed dimension which is not found to have a strong impact on overall satisfaction.

The *second* is that factor analysis and multiple regression modeling, since they are highly complex, are not easy to describe to transit managers and operations personnel. Empirical data indicates that its use in other service industries limits "buy-in" by the very personnel who most need to be committed to the translation of customer expectations into agency performance measures.

The *third* and an important consideration is that it is not a good idea to build complex models if the data sets or subsample sets are small and the list of independent variables (attributes) you want to measure is extensive. Large sample sizes are required. This is particularly problematic for the transit industry where measures are needed for subsample groups such as by transit mode, transit dependent rider versus non-transit dependent rider, secure customer versus vulnerable or at-risk customer, or by geographic region of a city, or city vs. suburbs.

As a general rule, the minimum is to have at least five times as many observations as there are variables to be analyzed, and the more acceptable range would be a ten-to-one ratio. Some researchers even propose a minimum of 20 cases for each variable. (If 40 service attributes are being measured, the sample size or sampling strata should be a minimum of 800). "One must remember that with 30 variables, for example, there are 435 correlations in the factor analysis. At a .05 significance level, perhaps even 20 of those correlations would be deemed significant and appear in the factor analysis just by chance. The researcher should always try to obtain the highest cases-per-variable ratio to minimize the chances of "overfitting" the data,.. deriving factors that are sample specific with little generizability."[9]

The *fourth* consideration is a cautionary one that, while more sophisticated and elegant analytical methods have an appeal, it is risky to proceed when simpler and less demanding approaches will work as well.

The results of the Northwest Research 1995 report for the "Customer Satisfaction Survey of Chicago Transit Authority Riders" indicate that problems of multicolinearity may exist with the factor analysis approach to customer satisfaction measurement within the transit industry.[10] (MORPACE International, Inc. does not have the primary factor analysis data results for the previous "IDEA Project" conducted by J. D. Powers in 1993; however, the sample sizes for this pilot study were so small that a serious question arises about the validity of the factor analysis results.)

The 1995 CTA Customer Satisfaction Report gives the correlation data results for the dimensions of both bus travel and rail travel (sample sizes less than 600 each). The report acknowledges that: "It should be noted that in some cases, variables (attributes) are highly correlated with dimensions that are different than might be expected — for example, smoothness of ride correlates with driver attributes rather than with comfort of the ride as might be expected. This would suggest that riders think about attributes and combine attributes for evaluations in a way that is different from the traditional performance indicators used by transit (and, we would note, different from the way in which attributes are traditionally assembled by customers in other industries)."

In Chapter 8 of this report, we provide the results of our factor/regression analysis based on field test results. The usefulness and reliability of results will be compared with those provided by our proposed impact score approach.

4C. Uses of Quadrant Analysis

Quadrant analyses of customer satisfaction measures are often used to provide an underlying understanding of ratings. Thus, for example, "strengths" are shown in one quadrant of the graphs as those attributes that are above the median in customer importance and also above the median in customer satisfaction. (Sometimes, as in a Gap Analysis, importances are derived by a bivariate correlation of attribute satisfaction with overall satisfaction). Likewise, the "weaknesses" or "opportunity" quadrant contains those attributes above the median in importance, but below the median in satisfaction. Those attributes below the median in importance, but above the median in satisfaction can be labeled the "maintenance of effort" quadrant; while the last "non-critical" quadrant contains those attributes low in importance on which satisfaction is also judged to be low.

The disadvantages of this approach are that the divisions by quadrant are somewhat arbitrary and the magnitude of the differences between attribute ratings is not usually taken into account. This approach, while giving a general overview of the relationship between attribute importance and satisfaction ratings, does not provide a stable quantitative measure of the impact of attributes on overall customer satisfaction. There are no established numbers for each attribute that provide the benchmarks against which future similarly collected customer satisfaction attribute measures can be tested — for statistically significant changes in customer perception.

4D. Regional and Industry Response Bias

Customer measurements are often contaminated by a culture-induced scale bias that may invalidate crossnational or regional comparisons. The bias reveals itself as a tendency for some customers to give consistently higher or lower ratings of performance (even when actual performance levels are identical and expectations are controlled). For example, people from the New England region of the U.S. exhibit a temperament and follow norms quite unlike those found in Texas ... they are clearly working from different frames of reference which can color their evaluations.

The following discussion of this problem is excerpted from a 1996 copyright article by Symmetrics Marketing Corporation, entitled "Measuring Cross-National and Within-Country Response Bias Using the International Scale Bias Index (ISBI)".

> "While methods exist for estimating scale bias, all require that additional information be obtained from customers. Some of these methods are rather elaborate and tedious (e.g., conjoint-based) and/or are difficult to explain to customers (e.g., magnitude estimation). A *(proprietary)* technique developed by Symmetrics (Crosby, 1994; Crosby, 1992) makes it possible to reliably estimate the magnitude of the scale bias by asking customers additional questions that are a part of the International Scale Bias Index (ISBI). The index is formed averaging the ratings of composite items. The items are statements of performance categorized into six life domains: suppliers, sports, arts, education, science, and services. Differences between regions/countries in their mean index scores are mainly reflective of culture induced scale bias, i.e., a generalized tendency to be a harder or easier grader of performance. The index scores can be used to make adjustments in the customer measurements from each region/country in order to facilitate "apples-to-apples" comparisons."

Current methods for correcting cross-regional bias in customer satisfaction measures are proprietary and costly to incorporate. We point out their existence as a caution against comparing transit service quality measures across regions and transit agencies.

An additional concern is the comparison of transit customer measures with those measures found within other industries. In Sweden, the Customer Satisfaction Barometer (CSB) for more than 30 industries and more than 100 corporations found that CSB scores are significantly higher for products than for services, and that service monopolies score lower than competitive services (Fornell, 1993). Staple foods and automobiles score at the top of the CSB; the police force and television broadcasting are at the bottom (transportation services were not measured as a part of the Sweden CSB).

Thus, given present research methods, it is not advisable to set expected "target zones" for customer satisfaction within transit, or to compare these measures directly by region, or with measures derived for other industries. The best use of quantitative service quality measures is as internal benchmarks for an agency against which future progress can be measured. Additionally, the research must determine which measures, if targeted, will yield the greatest increase in overall customer satisfaction with service.

4E. Customer Loyalty and Establishing Customer Satisfaction Indices

Most major conceptual and measurement models of customer satisfaction explicitly include elements related to customer value and customer loyalty. Satisfaction is a necessary, but not a sufficient, condition of customer loyalty (D. Randall Brandt, 1996).[11] Customer loyalty is not repeat users or transit dependent riders. Many repeat customers may be choosing transit because of necessity, convenience, or habit. For these customers, if an alternative becomes available, they may quickly switch to that service or mode. Instead, customer loyalty is reflected by a combination of attitudes and behaviors. It usually is driven by customer satisfaction, yet also involves a commitment on the part of the customer to make a sustained investment in an ongoing relationship with transit service. Attitudes and behaviors that go with customer loyalty include:

- an intention to use transit service again
- a willingness (often an eagerness) to recommend transit service to friends, associates, and other persons

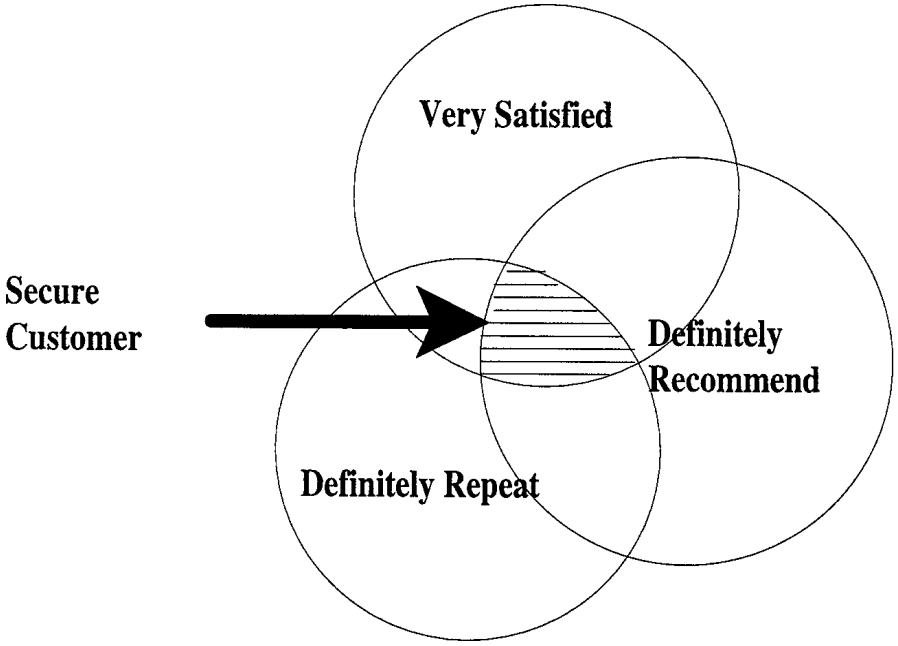
- commitment to, and even identification with, transit service
- disinterest in and/or a general resistance to alternative means of transportation, when these are available.

One measure of customer loyalty is the Secure Customer Index (D. Randall Brandt, 1996). A secure customer is one who says that he or she is:

- very satisfied with the service
- definitely will continue to use the service in the future
- definitely would recommend the service to others

The definition is illustrated in the diagram below:

Chart 4.1
Secure Customer Index



Responses to the three items — overall satisfaction, likelihood to continue using the service, and likelihood to recommend — can be combined to create multiple classifications or segments based on the degree of customer security. For example:

Secure Customers	=	% very satisfied/definitely would repeat/definitely would recommend
Favorable Customers	=	% giving at least "second best" response on all three measures of satisfaction and loyalty
Vulnerable Customers	=	% somewhat satisfied/might or might not repeat/might or might not recommend
At Risk Customers	=	% somewhat satisfied or dissatisfied/probably or definitely would not repeat/probably or definitely would not recommend

The capacity to establish linkages between customer satisfaction, customer loyalty, and business results should be part of the architecture of any organization's customer satisfaction measurement process.

4F. Market Segmentation of Customer Satisfaction Findings

An important advantage of the impact score approach, as will be illustrated in Chapter 8, is that once segments such as secure and vulnerable customers are identified, impact benchmark and tracking scores can be easily computed, ordered, and compared by customer loyalty segments.

Modest sample sizes will allow the full impact score analysis to be performed by transit mode segment, as well as by transit dependent status and such segments as commuters versus non-commuters, and frequency of use categories.

Chapter 5, which follows, presents a thorough explanation of the Impact Score Approach.

4G. Linking Customer Satisfaction to Performance Measures

The process of linking goals to performance through measuring Customer Satisfaction (CS) is exploratory and preliminary for even the most forward-thinking companies. First, companies must formalize and quantify the relationship between CS and firm or agency performance. By determining how CS improves performance or what specific CS components correlate with different improvements, corporations can focus on only the most effective endeavors, allowing them to become more efficient in implementation.

Delivering CS is at an early evolutionary state in most U.S. firms. Most firms are not focused on satisfying customers, even though research now correlates CS with improved performance. A firm's CS implementation process must reflect the needs of individual customer segments, and the overall program must be flexible enough to allow each business unit to develop measures and processes that fit its management needs.

Properly implemented and managed, the performance measures process ensures that customer input drives an organization's efforts to improve and innovate, and that the impact of these efforts can be assessed. The key question is how does the "voice of the customer" data compare with the "voice of the process" data? Customer expectations must be translated to, and linked with, performance measures for the agency.

The whole relationship of transit agency performance measures to customer-defined measures is the topic of Chapters 9, 10, and 11 of this report.

ENDNOTES

[7] Green, Paul E. and Tull, Donald S., Research for Marketing Decisions; 3rd edition; Prentice-Hall, Inc. 1975 (Englewood Cliffs, New Jersey), pp. 478-484.

[8] *Maritz Marketing Report*, 1993.

[9] Hair, Anderson, Tatham, Black, Multivariate Data Analysis, pp.373-374, Prentice Hall, New Jersey.

[10] Customer Satisfaction Survey of Chicago Transit Authority Riders, Northwest Research Group, Inc., December, 1995.

[11] "Customer Satisfaction Indexing" D. Randall Brandt, Conference Paper, American Marketing Association, 1996.

This page left intentionally blank.

CHAPTER 5. IMPACT SCORE TECHNIQUE: AN EXPLANATION OF THE METHOD

To address the impasse that often occurs in customer satisfaction measurement within the transit industry, MORPACE International, Inc. has developed a non-proprietary method for deriving customer satisfaction measures. The approach has an implicit logic that is easily understood and applied. Variations of this method have been used by MORPACE in major customer satisfaction studies within the automotive and health care industries.[12] Within the automotive industry this approach is known as the "Things Gone Wrong" approach.

The Impact Score approach determines the relative impact of attributes on overall satisfaction, by measuring customers' relative decreases in overall satisfaction, when a recent problem with an attribute is reported. This makes sense because, within the delivery of quality service framework, the primary way transit agencies can improve customers' overall satisfaction with service is to reduce customers' problematic experience with those attributes which have the greatest negative impact on overall satisfaction. These driver attributes can be identified and prioritized in a three-step process.

> ***Step One*** is to determine which attributes have the most impact on *overall* customer satisfaction. For each attribute, the sample is divided into those respondents who have had a recent problem with the attribute and those respondents who have not recently experienced a problem with the attribute. (Those who have not experienced the attribute within the past 30 days are grouped with those who have, but have not had a problem.) The mean overall satisfaction ratings of the two groups are compared. The difference between the two mean overall satisfaction ratings is called the "gap score". Gap scores are computed and the attributes are then ordered by the size of their gap scores. A *t-test* can be used to determine where statistical significance lies among gap scores.
>
> The magnitude of an attribute's gap score should not change significantly over time. The relationship between a service quality attribute and overall satisfaction with transit service can be assumed to be structural. That is, once it is determined that an attribute is a driver of customer satisfaction it will probably remain so, unless significant societal changes occur, i.e., graffiti comes to be viewed as an art form.
>
> ***Step Two*** lists the attribute problem incidence rate for each attribute in a column next to its gap score. (The percent of customers who experienced a problem with the service attribute within the past 30 days). It will be important to take into account the rate at which a problem with an attribute occurs within the customer base. It may be that a particular attribute has a large gap score (and thereby a significant impact on overall satisfaction), but the percent of customers reporting a problem with the attribute is relatively small. In this case, it probably is not worth a transit agency's time and expense to attempt to further lower the problem occurrence rate for the attribute. On the other hand, if an attribute's gap score (impact on overall satisfaction) is moderately low, while the rate at which customers experience a problem with the attribute is high, the effect of the attribute on overall satisfaction is magnified and will require attention. Whether future increases or decreases in problem incidence rates are statistically significant can be validated by statistical tests (e.g., *chi-square test, z-test of proportions,* etc.).

Step Three creates a composite index by multiplying the attribute's overall satisfaction gap score by the attribute's problem incidence rate. The result is an attribute "impact score". The attributes are then placed in descending order of their impact scores. The top attributes are the drivers of customer satisfaction.

To summarize, impact scores are computed as shown in the following example:

Table 5.1
Impact Score Approach

	A Had Problem*: Mean Overall Satisfaction Rating	B No Problem*: Mean Overall Satisfaction Rating	C (B-A=C) Gap Score	D Reported Problem Occurrence Rate**		E (CxD=E) Impact Score
Attribute 1	6.5	8.5	2.0	0.548	=	1.0960
Attribute 2	6.3	8.2	1.9	0.442	=	0.8398
Attribute 3	5.3	8.1	2.8	0.173	=	0.4844

* within the past 30 days
** percent of customers experiencing a problem with the service attribute within the past 30 days

The impact score data analysis can be implemented using just a spreadsheet program. The spreadsheet can be structured so that the relevant inputs reside in one worksheet, the data analysis is conducted in a second worksheet, and the results summarized in a third worksheet. Inputs from the survey can be fed into simple formulas to determine mean ratings by group, gap values, percentages of respondents who had a problem with transit service, impact scores and *t-tests* to determine the statistical significance of identified differences. If this data analysis system is constructed in the benchmark year, transit agencies can input their own tracking data (from on-board surveys) during subsequent years.

This analytical approach is easy to describe to transit managers, the logic is implicit, and the method can be implemented without using advanced statistical analysis techniques, and with smaller sample and subsample sizes. The impact scores serve as statistically valid benchmarks for future customer satisfaction monitoring.

The appropriateness of the formula of multiplying the gap score by the problem incidence rate can be validated through a quadrant analysis of gap scores against problem incidence rates. What is the relative impact score of an attribute with a high gap score but a low incidence rate, or a low gap score but high incidence rate? Does the impact score prioritizing make sense when compared within a quadrant analysis? If not, weighting schemes for problem incidence rates can be considered.

ENDNOTES

[12] Proprietary studies conducted by MORPACE International, Inc. for Ford Motor Company and Aetna Health Plans during the 1990s.

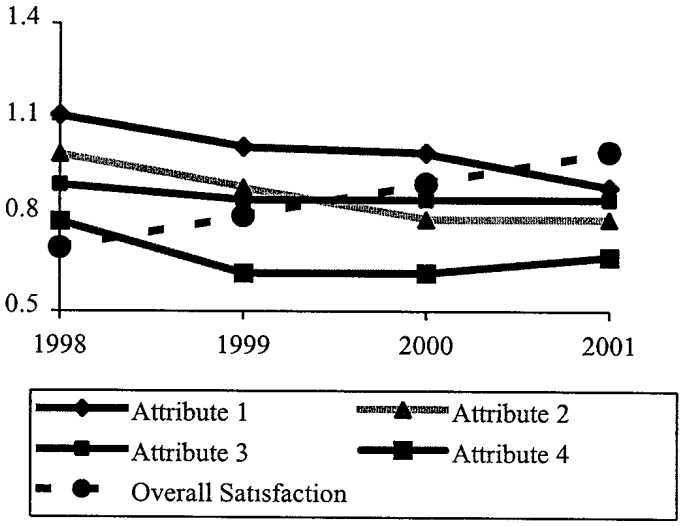
This page left intentionally blank.

CHAPTER 6. IMPACT SCORES AS TRACKING MEASURES

As previously indicated, gap scores will not change significantly over time. It is problem occurrence rates that can fluctuate and which can be reduced by transit agency actions. Future increases or decreases in problem occurrence rates can be measured and validated with a *t-test or chi-square* test.

This makes it possible to limit tracking surveys to a re-measure of overall satisfaction and problem occurrence rates for each service attribute. With these data, impact scores can be recomputed and updated. Beyond the benchmark survey, short-form questionnaires can be administered on-board, greatly reducing continuing research costs for an ongoing customer satisfaction measurement program. The end result is service quality attribute tracking from the customer's perspective, as shown in Chart 6.1. This tracking information is crucial for developing appropriate, and sufficiently targeted, transit agency performance measures. It also provides a means for evaluating the specific impacts of planned agency actions over time.

Chart 6.1
Example
Overall Satisfaction and Attribute Impact Score Tracking



This page left intentionally blank.

CHAPTER 7. QUANTITATIVE RESEARCH DESIGN

7A. Overview

There are two primary requisites of any market research process:

1. As we have discussed, the analytical plan must be sufficiently powerful to produce results that are both useful and statistically valid and, concomitantly,

2. Sampling plans and data collection procedures must assure the reliability of the input data.

The 1996 two-part *Travel Survey Manual* prepared by Cambridge Systematics, Inc. (with Barton Aschman Associates) for the U.S. Department of Transportation and the U.S. Environmental Protection Agency is a primary source and reference document for research methods as they apply to transit customer surveys.

In relation to prerequisite #1 above, as we have explained, both quadrant analysis and factor analysis combined with multiple regression analysis, can be unreliable in producing results that are sufficient foundations for transit agency actions. Depending on final collected sample sizes, these approaches can also end up being statistically unreliable for transit subgroup markets. Other industries such as automotive, health care, and financial services have learned from hard experience that these multivariate analysis approaches are often best used as added value analytical explorations, which may add benefit to predictable findings.

Prerequisite #2 stipulates that, for the analytical results to be both useful and valid, the data on which it is based must have been collected in a way that minimizes both sampling errors and non-sampling errors and biases. (For a full discussion of these issues the reader is referred to Section 5.0 of the above referenced *Travel Survey Manual.*) Essentially, increasing sample size is the primary means of reducing sampling error; while non-sampling error is reduced by ensuring that the sample collected is fully representative of the population of transit riders.

A major problem for most initial Customer Satisfaction/Service Quality Benchmark Surveys (and our impact score approach is no exception) is that they must almost always be conducted by phone, due to the length of the questionnaire required to measure all possible attributes. There are some exceptions to this, such as BART and other commuter rail lines, where time on the service is adequate to allow customers to fill out a questionnaire of modest length. However, as previously noted, since the gap scores (the measure of relationship between each attribute and overall satisfaction) do not change much over time, it is possible to limit customer satisfaction tracking surveys to a re-measure of overall satisfaction and the percent of customers experiencing a problem with each attribute — plus relevant transit use and demographic questions. With these data, impact scores can be recomputed and updated. Future increases or decreases in problem occurrence rates can be validated by a *chi-square* test.

For tracking surveys it is also appropriate to consider paring the original list of attributes being tested to those which received the top 10 to 15 impact scores in the Benchmark Survey. This reduction in length makes it feasible to administer the tracking questionnaire via a representative on-board or an at-station survey, thus greatly reducing future research costs.

The second difficulty with data collection methods for the Benchmark Survey is that it is almost always inefficient, and sometimes inappropriate, to conduct this survey using a random-digit-dial (RDD) household telephone sample, because of the low incidence rate of transit riders within most populations. The market research industry rule of thumb is that RDD sampling methodology is not cost effective for customer surveys if the incidence rate of customers falls below 15%. Additionally, there is some evidence (BART and CTA survey experience) that when RDD survey methodologies are used to capture transit riders, infrequent riders are over sampled. Therefore, an alternative step is required to compile a representative sampling frame of transit customer telephone numbers. This can be accomplished through on-board or at-station surveys.

A detailed sampling plan for the on-board or at-station surveys must be developed by mode, route, travel days, and time of day. Sampling plans will differ widely by site and, again the *Travel Survey Manual* (Section 8.0) is the best reference for designs. The specific sampling plans for the on-board or at-station surveys at the three transit agency sites for this project are detailed in Appendix D. Contact points with riders varied.

7B. Questionnaire Development

Questionnaires distributed must be serially numbered and tracked to verify route/station and time of day of distribution. Surveyors keep written records of the numbers of the questionnaires distributed on or during their assigned trip or time period, so that segment response rates can be tabulated and the data weighted according to agency provided ridership counts by mode, routes, and time of day.

The Sampling Frame Collection Instrument is a short-form questionnaire suitable for obtaining rider transit usage and demographic information, essential as a baseline for measuring the validity of Benchmark Survey phone respondents. A sample on-board or at-station questionnaire is included as Appendix E. Survey items, at a minimum, should include:

a. frequency of use
b. transit dependency status trip purpose
c. transfer patterns
d. zip code
e. age
f. employment status
g. income
h. ethnic group
i. sex
j. overall satisfaction with service
k. respondent's phone number

7C. Response Rates and Sampling Error Estimates

Respondents are asked to provide their home or work telephone number so that the follow-up Benchmark Survey can be completed by phone at their convenience. To encourage the provision and legibility of valid telephone numbers, prizes of $100 each can be offered through a lottery of those who complete and return the on-board or at-station questionnaire — with a valid phone number.

For the TCRP B-11 project field test, a total of 10,000 questionnaires were distributed on CTA, 5,000 on the Red Line and 5,000 on the Blue Line; 2,720 questionnaires were distributed on Sun Tran in Albuquerque, and 821 on GLTC in Lynchburg, Virginia. An at-station survey response rate of 46.3% was accomplished for CTA Rail (29.5% with valid phone numbers); the response rate for Sun Tran was

48.6% (43.2% with valid phone numbers); and for GLTC 33.6% (27.4% with valid phone numbers). When the demographics and transit usage patterns of those riders who provided numbers were compared with those riders who did not provide numbers, no statistically significant differences were found.

Some weights were required to assure results from the on-board and at-station surveys were representative by lines and stations for CTA, by routes for Sun Tran, and by time of day at each of the three transit sites (See Appendix D).

For completion of the Benchmark Survey phone interviews at each site, quotas were established by line, station or route, and time of day, as required to assure fully representative samples. Additionally, phone completes were monitored for frequency of transit use, income, and age to assure representativeness with on-board/at-station survey sample rider characteristics.

Within the field test time and budget available, a total of 974 phone interviews were completed — 300 with customers of the CTA Red Line, 302 with customers of the CTA Blue Line, 303 with customers of Sun Tran, and 69 with GLTC customers. Results for the CTA Blue Line, Red Line, and Sun Tran have a sampling margin of error of ± 4.7% at the 90% confidence level. At the 90% confidence level, weighted results for combined CTA rail have a sampling error margin of ± 3.3%, while results for GLTC have a sampling margin of error of 9.9%. Weighting factors for CTA and Sun Tran data can be found in Appendix D to this report. Throughout this report, findings cited take into account the possible calculated sampling error for each transit sample.

7D. Customer Satisfaction Benchmark Survey Instrument

An example benchmark questionnaire survey instrument is provided in Appendix F. This interviewing format averages 20 minutes in length.

The Benchmark Survey Instrument contains the following key elements, each of which is measured on a 10-point scale. Those attributes tested are the 46-48 composite elements developed as a result of the qualitative research at each of the three demonstration sites (See Table 3.1).

Benchmark Questionnaire

- overall satisfaction with the service or product (Q61)
- the importance of each service attribute (Q13-Q60)* **
- satisfaction with each attribute (Q62-Q109)**
- whether the customer experienced a problem with each attribute within the past 30 days ("yes", "no") (Q110A-JJ)**
- customer loyalty segment questions (Q129 and Q130)
- open-ended exploration of the one service improvement customers would like to see (Q131)

- transit use and demographic segment questions:

    a. frequency of use (Q1)
    b. transit dependency status (Q2-Q3, Q133)
    c. tenure of transit use (Q4)
    d. trip purpose (Q5-6)
    e. transfer patterns (Q7-Q9)
    f. transit access mode (Q10-Q11)
    g. fare method (Q12)
    h. zip code (QB)
    i. length of residency (Q132)
    j. age (Q134)
    k. employment status (Q135)
    l. income (Q136-Q138)
    m. ethnic group (Q139)
    n. sex (Q140)

Notes:

* *Importance measures are not necessary for factor analysis, multiple regression analysis, or impact scores and it is recommended, in the interest of brevity, that this series of questions be eliminated. For quadrant analysis, importance measures can be derived. An index of importance can be derived by correlating each of the attributes with overall satisfaction. The median of the correlation coefficients can be determined, and each of the correlations can be expressed as a percentage of this median value.*

** *A split sample can be used to test some attributes for importance, satisfaction, and problem occurrence. The purpose of the split sample is to shorten the length of the survey. For example, at each of the TCRP B-11 sites, all respondents were asked to rate the same 30 attributes, then one-third of respondents were asked to complete ratings for an additional 6 attributes, while another one-third were asked to rate a different 6 attributes, and the last one-third of respondents were asked to rate the final 6 attributes. Thus, in total, 48 attributes were tested, but each respondent was asked to rate only 36. Differences in sample sizes must be taken into account when determining statistically significant differences among ratings for impact scores; and factor analysis is unreliable unless all respondents are asked about all attributes.*

For all analyses of results presented in Chapter 8, two of the attributes tested are not included. These are "having a (station) (bus stop) near my home" and "having a (station) (bus stop) near my workplace or destination". These two attributes generally are considered most important to transit customers, are essential to overall satisfaction with service, and have very low rates of reported problem occurrence, primarily because if the convenience of station or stop location is not present, the customer does not use transit.

A trade-off choice series of possible safety improvements at transit stations or stops, or on trains and buses, is included in the Benchmark Survey as an optional investigation (Q111-Q128).