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Market segmentation analysis of potential inter-city rail travelers

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Abstract. This paper reports on one aspect of a study conducted to support the analysis of the performance of a proposed intercity rail passenger service in the Piedmont region of North Carolina. In particular, this paper describes a market segmentation study of potential rail travelers on the basis of the responses of 333 participants in a computer-based, mall-intercept, market research survey.

The paper overviews the design and implementation of the computer-based survey of potential rail travelers and discusses the approach used in the identification and interpretation of the market segments. The five identified traveler groups are characterized and the implications of the market segmentation results are discussed. These five segments are: (1) functional traveler, (2) day tripper, (3) train lover, (4) leisure-hedonic traveler, and (5) family traveler.

The five groups identified in the market segmentation analysis provide a rich description of the potential rail market in the study corridor. The composition and characteristics of these groups indicate that the intercity rail travel market may have a complex structure that would be masked by the traditional business/non-business dichotomy. The characterization of the intercity rail travel market by the five identified segments provides rail service managers with very useful information for service planning and marketing.

Introduction and background

The 'Carolinian' passenger train service operated in the Charlotte-Greensboro-Raleigh corridor of the Piedmont region of North Carolina during the period October 1984 to September 1985. This service, which was operated by Amtrak and sponsored jointly by Amtrak and the State of North Carolina, provided through service to the Northeastern United States, as well as local service within North Carolina.

Following the termination of the 'Carolinian' service in the fall of 1985, officials of the State of North Carolina sought to restore rail passenger service through the Piedmont of North Carolina. The research described in this paper is drawn from a study designed to support the analysis of the operation of intercity rail passenger service in the Piedmont region of North Carolina. At the time the study was designed, the Public Transportation Division (PTD) of the North Carolina Department of Transportation (NC DOT) was considering

the possibility of operating a local train service in the Charlotte-Raleigh-Rocky Mount corridor. As a result, the study focussed on the ridership in this corridor, which is hereafter referred to as the study corridor.

The overall goal of the study was to examine the demand for intercity rail passenger service in the study corridor. Specifically, the major objectives of this study were as follows. First, to develop a demand forecasting tool that could be used to estimate the ridership and revenue for alternative rail services that might be provided in the study corridor. Second, to characterize the market for intercity passenger rail service in the corridor of interest. This paper focusses on the latter of these objectives, while Pas et. al. (1991) provide a detailed account of the complete study.

An important concept in marketing research is that a consumer market can be divided into identifiable groups sharing similar tastes, preferences and/or behaviours with respect to a particular product or service. These segments are based on similarity among the members of a given group and differences between the members of different groups. This approach to understanding the market, termed *market segmentation*, has been used extensively in market research over a long period of time (see, for example, Engel et. al. 1972; Dickson & Ginter 1987; Hauser & Simmie 1981; Yankelovich 1964). Market segmentation has also been used in a variety of transportation studies in the past 15 years, one of the first applications being a public transit study by Lovelock (1975).

The basic idea of market segmentation analysis is that there are groups of consumers that are similar to one another, yet different from other consumers. Further, if one can identify such groups (or market segments) one will have a better understanding of the structure of the market for some product or service and therefore be able to do a better job of designing, operating, and marketing the product or service.

As part of the effort to understand the market for intercity passenger rail service in the study corridor, the study team conducted a market segmentation analysis of potential travelers on the planned rail service. The purpose of this paper is to describe this aspect of the overall study, including the approach used and the results obtained, as well as an examination of the implications of the results.

The remainder of this paper is organized as follows. In the second section, we present the design of the study from which the results reported in this paper are drawn, and we describe the methodology used in deriving and interpreting the market segments. In the third section we present, interpret, and discuss the results of the market segmentation analysis. The final section summarizes the paper and presents our conclusions.

Study design and methodology

A computer-based survey of potential rail travelers was conducted at shopping malls in the four largest cities in the study corridor in order to develop an understanding of the needs and preferences of potential riders in this corridor. This computer-based survey had two specific objectives: first, to obtain estimates of the sensitivity of potential travelers to changes in rail travel time, travel cost, service frequency, food service, and seating type. This information was needed for the incremental demand forecasting model that was to be developed. The second objective of the survey was to provide insight into the characteristics of potential rail travelers in the study corridor. In particular, we sought information that would be helpful in the marketing and operation of the rail service. The survey procedures we employed in this study are described in some detail below, but readers interested in more detail are referred to the report on the overall study (Pas et. al. 1991).

There are two aspects of the study methodology that warrant elaboration here; namely, the determination of consumer preferences, and the identification and interpretation of the intercity rail traveler market segments. These two aspects are discussed separately below.

Determination of consumer preferences

The computer-based market research survey of potential train riders in the study corridor was conducted between August and October, 1989 in shopping malls in the four largest cities along the study corridor (Charlotte, Greensboro, Durham & Raleigh). Potential respondents were approached at a mall and were disqualified from participating in the survey if they were either under 18 years of age or if they indicated that they would never ride on the proposed train service (thus, we refer to the respondents as "potential" rail travelers). Therefore, the sample disproportionately includes those who are potential rail travelers and who shop in the selected malls. While it is possible to project our data to the population in general, the main purpose of the consumer preference study was to get detailed reactions to the rail service from likely riders and thereby help fashion a service that would appeal to these potential riders.

After being screened, the respondent was led to a room in which the interview was completed on a personal computer. This interview collected a variety of information from respondents, including their attitude toward and experience with riding an intercity train, the characteristics (origin, destination, purpose, frequency, etc.) of the train trip the respondent would most likely take, and the sociodemographic characteristics of the respondent and his/her household. In addition, a major component of the survey was designed to obtain

information about each respondent's preferences for a variety of transportation service attributes.

The rail service and related transportation system attributes included in the study were determined through discussions with the staff of the PTD of the NC DOT. These discussion identified two sets of attributes. First, those variables that were of primary concern to the PTD of the NC DOT in terms of rail service design. As these variables were to be included in the demand forecasting model, we required estimates of the sensitivity of ridership (and revenue) to changes in these variables. These sensitivities were determined using conjoint (or trade-off) analysis, as described below.

A second, much larger, set of characteristics of the transportation environment was also identified. These characteristics were of great interest from a policy and management standpoint, but were too numerous to be included in the demand forecasting model. Therefore, we only attempted to gauge the relative importance of each of these secondary attributes for rail ridership.

The five primary rail service attributes that were included in this study are listed in Table 1. This set includes three rail service attributes that are commonly accepted as being important to rail travelers; namely, rail travel time, cost, and number of departures per day. The other two attributes in this set, food service and seating type, are generally not considered to be primary factors affecting mode choice, but they might be relatively important in the context of the type of service examined in this study. Further, these characteristics were actively being examined by the staff of the PTD of the NC DOT. In particular, at the time the survey was being planned, the NC DOT was considering the purchase or lease of rail cars and they wished to know how much difference the type of seating and food service would make to rail ridership and revenue. Thus, the food service and seating attributes were considered primary attributes in this study for policy reasons.

Table 1. The primary rail service attributes included in the study.

Attribute	Levels
Rail travel time	Base time, base time ± 10%
Rail fare	Base cost, base cost ± 15%
Number of daily departures	1, 2, 3 trains per day
Food service	None, vending machine, snack bar
Seating	Commuter seats, airline seats

The sensitivity of potential rail travelers to changes in the five attributes listed in Table 1 was examined using the approach known as conjoint (or trade-off) analysis. The trade-off information is provided by respondents in the context of hypothetical choices, therefore this approach falls into the class

of data acquisition and analysis generally referred to in the recent transportation literature as *stated preference* techniques. The latter are distinguished from *revealed preference* techniques in which the respondent is assumed, through actual choices made, to reveal his/her preferences for various attributes. That is, in revealed preference studies one infers the trade-offs being made among the attributes by observing the actual choices that consumers have made. A brief introduction to conjoint analysis is given below primarily to introduce the unfamiliar reader to the terminology used in connection with this technique.

Conjoint analysis is a way to estimate an individual's preferences for potential or actual products in the market. Conjoint analysis has been in use in the marketing research community since it was introduced over 20 years ago (Green & Rao 1971). Conjoint analysis, sometimes called "trade-off analysis", asks respondents to choose between descriptions of products, or profiles, that differ on one or more attributes. In making their choice, respondents have to trade off between the various attributes.

For example, a respondent might be asked to choose between a train service that took 3 hours and cost $25 versus one taking 2 1/2 hours but costing $35. In effect, the respondent must decide if the 30-minute reduction in travel time is worth the extra $10 in fare. From a number of such questions (in which the levels of the relevant attributes are varied systematically) it is possible to develop a model that allows the analyst to predict what each respondent's preference would be for a profile that is made up of any combination of the attributes tested (Green & Srinivasan 1978).

The above example descriptions (profiles) of a possible train service include two attributes; namely, rail travel time and cost. Further, each attribute in this example is set at one of two discrete levels (fare is set at $25 or $35, and travel time is set at 2 1/2 or 3 hours). In our study, respondents were presented with service descriptions comprising either two or three of the five attributes listed in Table 1. In each profile, each service attribute was systematically set to one of the levels shown for that attribute in Table 1.

Conjoint analysis has been used quite extensively in travel demand analysis and modeling because of its unique ability to estimate market potential for a broad range of possible services. In particular, conjoint analysis has been used to estimate potential travelers' reaction to new transportation services and their preferences for the attributes of such services as high speed rail (see, for example, Hensher et. al. 1989). Analysis of user's reactions to a new service poses a particular problem in that the standard revealed preference approach may not be applicable. In this situation, stated preference techniques are often used; conjoint analysis is the most commonly used stated preference method in transport research. A recent special issue of the *Journal of Transport Economics and Policy* (Bates 1988) contains a series of papers

devoted to the topic of "Stated Preference Methods in Transport Research".

We used conjoint analysis in this study to develop a preference mapping across the five primary rail service attributes listed in Table 1. From the survey data we were able to estimate each respondent's preferences for any combination of these attributes. That is, the survey data allowed us to develop, for each individual, a (linear) utility function in which the parameters reflect the relative importance of each attribute to that individual.

The results from this portion of the survey allow the estimation of a model for the stated probability (p_i) that an individual chooses to ride a train with a given set of service characteristics. This model has the general form:

$$p_i = 1/(1 + EXP - (a_0 + a_1 V_i)) \quad (1)$$

where

V_i is the utility of a particular train service to respondent i,
a_0 and a_1 are parameters estimated by least squares regression, and
EXP is the exponential operator.

The utility to respondent i of a given train service is given by:

$$V_i = \sum_j \sum_k V_{ijk} * X_{jk} \quad (2)$$

where

V_{ijk} is the "part-worth" utility to respondent i of a train service with level k on attribute j, and

$X_{jk} =$ 1 if the train service has level k on attribute j
0, otherwise

The part-worth utilities (V_{ijk}, in Equation 2) and parameters a_0 and a_1 (in Equation 1) are estimated by the computer program employed in this research (see below). The part-worth utilities were obtained for the levels of the five attributes that were presented to each respondent (see Table 1). These part-worth utilities were used as inputs in the procedure to identify the market segments, as explained subsequently.

Our use of conjoint analysis is somewhat different from the typical form of conjoint described in Green & Srinivasan (1978) in two respects. First, we used a commercially available, personal computer form of conjoint called ACA (Adaptive Conjoint Analysis, Sawtooth Software, 1986). This package uses a procedure that combines direct measures of attribute importance with the more typical pairwise judgements on profiles. The attribute importance judgements assess the relative importance of, say, a 30 minute increase

in travel time compared with a $10 decrease in fare. ACA then combines these judgements with paired preference judgements (described below) to develop a preference model (Equation 1) for each respondent. Various aspects of ACA's methodology are discussed in detail in Green, Krieger & Agarwal (1991). Using two forms of questioning enables the procedure to achieve greater reliability for the estimated parameters in the preference model with fewer questions.

A second way in which our application of conjoint differs from most applications of the technique is in the use of customized attribute levels for rail fare and travel time, the two attributes of the rail service that would depend greatly on the origin and destination of the trip. Typically, attribute levels tested during a conjoint study are generic in that they are the same for all respondents. In our case, the attribute levels of rail travel time and fare were individualized depending on which of the 11 cities the respondent identified as the origin and destination for his/her most likely train trip.

The customization of rail travel time and fare was valuable in that it enabled our respondents to focus attention on a concrete trip between a specific pair of cities, and to make trade offs for realistic train service packages contingent upon the particular origin and destination most likely to be used by that respondent (as reported by the respondent). It also allowed us to estimate the impact on ridership of specific changes in travel time (minutes) and fare (dollars), rather than having to rely on more generally specified attributes (e.g., slow train, low fare). A typical trade off question presented to respondents is shown in Table 2. More detail on the conjoint analysis section of the survey is given in Pas et. al. (1991).

Table 2. A typical trade-off question presented to survey respondents.

Which train would you prefer to take for your trip? Type a number on the scale below to indicate your preference									
1 departure time per day								3 departure times per day	
vending machine with microwave								no food service	
2 h and 35 min Charlotte to Durham								2 h and 55 min Charlotte to Durham	
Strongly prefer left	1	2	3	4	Don't Care 5	6	7	8	9 Strongly prefer right

The use of customized attribute levels for rail travel time and fare was made possible by the fact that we integrated the use of the ACA program with the Ci2 (Computer interview 2) software system (Sawtooth 1985) that we used for obtaining all information other than the trade-off information from the respondents. We used a BASIC program to take the origin and destination of the most

likely trip selected by each respondent and to calculate the base travel time and fare for this trip. The BASIC program wrote these attributes to a file that could be used by the ACA software in developing the rail profiles to be presented to each respondent. Our integrated use of the two software packages is depicted in Fig. 1. This diagram also provides a general description of the flow of each interview.

As noted above, we determined the relative importance of a set of 14 rail travel and related transportation environment characteristics in addition to those listed in Table 1. This secondary set of characteristics is listed in Table 3. Some of the attributes included in this set are not under the control of the operator of the train service (for example, highway congestion), yet all these characteristics (as well as some that were not included in the survey) potentially affect ridership on the rail service in the study corridor. The relative impact of each of these secondary factors with respect to rail ridership was estimated by asking each participant to respond to a set of questions asking how that factor (e.g. the availability of alcohol on board the train) would affect the respondent's likelihood of using the train (see Table 4 for an example question from this portion of the survey).

In addition to the preferences of potential train travelers, the survey obtained information concerning the socio-demographic characteristics of the respondents and their households. These characteristics included each respondent's age, marital status, employment status and occupation. In addition, the following household characteristics were obtained in the survey: number of

Table 3. The secondary rail service and related attributes.

- Train reservations available through Ticketron at an additional cost of $2.00 per ticket
- Free telephone reservations
- Convenient connection with trains heading north to Richmond, Washington, D.C. and New York
- The availability of fold-down work surfaces and telephones
- The availability of beer and wine in special areas on the train
- A major increase in road congestion
- A major rehabilitation of the station in downtown {insert here origin city of the most likely trip}
- Moving the train station from downtown {insert here origin city of the most likely trip} to a suburban location
- A 50 cent per gallon increase in gasoline prices
- Major construction delays on the roads between {origin city of the most likely trip} and {destination city}
- A 50% increase in bus fares
- A "First Class" area of the train costing 50% more with special seats and better views of the countryside
- A train where smoking is not permitted
- Separate smoking and non-smoking areas on the train

Table 4. Example secondary attribute importance question.

How much would free telephone reservations change the *Likelihood* you would take the train?

1 *Strongly increase* likelihood to take train
2 Somewhat increase
3 Slightly increase
4 No change in likelihood
5 Slightly decrease
6 Somewhat decrease
7 *Strongly decrease* the likelihood to take train

people, number of children, household income, and number of cars. Each respondent's experience with, and attitudes toward intercity train travel was also obtained in the survey (see Fig. 1).

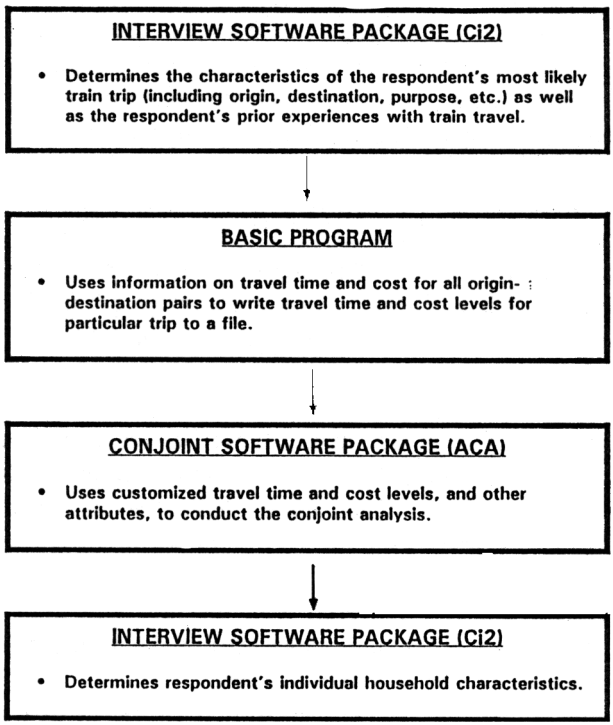

Fig. 1. Linkage between the computer interview (Ci2) and conjoint (ACA) software packages.

Identification and interpretation of the market segments

There are essentially two different approaches to market segmentation. In the first approach, one hypothesizes that certain consumer groups have

different needs and preferences and that they therefore have different behavioral responses. In this approach, the groups are specified *a priori* and the analyst examines the needs, preferences, or behaviors of the members of the various groups to identify any differences among the groups. This approach is termed *a priori market segmentation.*

In this study we examined a number of possible *a priori* segmentation schemes including the traditional business/non-business traveler segments. The latter investigation revealed few systematic differences between business and non-business travelers in this case, despite the fact that it is generally believed that there are considerable differences between business and non-business travelers, especially in relation to their preferences for transportation service attributes. The results reported below show that the intercity travel market in the study corridor has a much more complex structure than would be indicated by a simple business/non-business dichotomy.

In the second approach to market segmentation, the consumer groups are not specified *a priori*, rather they are identified by grouping those individuals having similar needs, preferences, and/or behaviors. Once these groups are identified, the analyst examines these groups to identify whether the differences are interpretable and meaningful. This step involves the examination of the characteristics of the groups using both the variables employed in identifying the groups as well as other relevant attributes.

The general set of techniques that may be used to group entities is known as *cluster analysis* (Everitt 1980) since it identifies groups (or clusters) of observations that are similar with respect to the variables of interest. For example, if one were interested in identifying groups of consumers having similar daily urban travel patterns, one might try to group them on the basis of the number of daily trips they make, as well as the average trip length.

The market segments, regardless of the approach employed in identifying them, are used in a number of ways. For example, they are often very helpful in the development of marketing and service plans. It is also common in the development of choice models to allow the parameters (or a sub-set thereof) to vary across the market segments, with the idea that individuals in the different segments place differential importance on the attributes of the product or service to which the choice model applies.

The purpose of the market segmentation analysis in this study was to identify groups of travelers having similar needs and preferences for the attributes of the planned rail service, so as to assist in the development of service and marketing plans. In this context, one would expect, for example, some travelers to have a strong preference for a fast and frequent rail service, while others might be more concerned about the type of seating and food service on board the train. Such information is invaluable in developing service and marketing plans.

The market segments described in the following section were identified by performing a cluster analysis on the part-worth utilities (see Equations 1 and 2) for the attributes in Table 1 and the importance weights for the attributes in Table 3. The groups identified by the cluster analysis were interpreted by examining personal and trip characteristics of the members of each group as well as identifying the rail service features that are important or unimportant to the 9 members of the group. The characterization of each group was accomplished by comparing the members of each group to the sample as a whole, and identifying those characteristics that distinguish the members of each group from the rest of the sample.

The following section reports on and discusses the results of the market segmentation study.

Results and interpretation

Cluster analysis

The objective of the cluster analysis was to identify groups of potential rail travelers in the study corridor having similar needs, preferences, dislikes, etc. for rail and related intercity travel services. To accomplish this objective, we grouped the respondents on the basis of their sensitivities to the 5 primary rail service attributes shown in Table 1 (measured by the part-worth utilities), and the importance of each of the 14 other rail service and related attributes included in the survey. That is, the groups were identified based on each respondent's "score" on the 19 variables in these two sets.

Prior to performing the cluster analysis, we standardized the variables in each of the 2 sets, within each observation, to a zero mean and unit standard deviation. This standardization procedure is described by Equation (3), and was performed for each of the two sets of variables.

$$s_{ij} = (r_{ij} - \bar{r}_i) / \sigma_i \qquad (3)$$

where

- s_{ij} is the standardized score for individual on variable j
- r_{ij} is the score of individual i on variable j
- $\bar{r}_i$ is the mean score of individual i on the variables in the set, and
- σ_i is the standard deviation of individual i's scores on the variables in the set.

Following the standardization shown in Equation (3), each of the 19 variables

was scaled across the 333 respondents to obtain a zero mean and unit standard deviation for each variable.

The 19 variables, normalized within and across respondents as described above, were used as input to the FASTCLUS procedure in the SAS package (SAS, 1985). FASTCLUS is a non-hierarchical, agglomerative cluster analysis algorithm that is patterned after Hartigan's (1975) leader algorithm and MacQuenn's (1967) k-means algorithm.

Clustering techniques define the members of each cluster, based on the use-specified input data, for a given number of clusters. That is, once one specified the dimensionality of the solution, the cluster analysis defines the group memberships. Often, however, the analyst does not have a preconceived notion of how many clusters will be appropriate in a given case. In this situation, one can examine the solution for different numbers of groups and select the appropriate solution(s) to be examined in more detail.

In selecting the appropriate number of clusters, one tries to balance two conflicting considerations. On the one hand, if a given number of entities is grouped into a small number of clusters, the groups will tend to be heterogeneous and difficult to interpet. On the other hand, if there are too many clusters, two issues arise – one or more clusters may be too small to be meaningful, and the benefit of the clustering diminishes (in the extreme we are back where we started, as each entity is a cluster of one member).

On the basis of an initial investigation of various groupings , we decided to examine the five cluster solution in detail. The primary criterion for selecting the number of groups was the interpretability of the various solutions, while consideration was also given to group size. Table 6 shows the distribution of the 333 observations across the five clusters. We should stress here that because of the sampling technique employed in conducting the survey of potential travelers, we do not believe that one can infer too much about the relative sizes of these groups in the population at large, although Groups A and B are likely to be larger than Groups D and E (see group descriptions and sizes in Table 6).

Characterization of the identified market segments

In order to characterize each of the five groups identified by the cluster analysis, we examined differences between the members of the groups along six dimensions. These dimensions, listed in Table 5, range from the personal and household characteristics of the travelers in the group to the attributes of alternative travel modes that would encourage train use by the members of the group.

Each group is characterized by those variables comprising each of the six

dimensions that distinguish the respondents in that group from the respondents in the other groups. Table 6 shows the variables on which the members of that group appeared to be different from the rest of the sample. In some cases the differences would be found to be statistically significant, while in other cases they would not. Table 6 groups the distinguishing variables under each of the dimensions identified in Table 5. The important consideration is that the characteristics of each group shown in Table 6 are those on which the group's members tend to be different from the rest of the sample. For example, in examining the personal characteristics of Group A as reported in Table 6, the reader should interpret this as indicating that the members of the group labelled here as the "functional traveler" tend to have a higher income and tend to have a higher proportion of people employed full-time, in comparison with the rest of the sample.

Table 5. Dimensions used in characterizing the identified groups.

Personal & household characteristics
Characteristics of the most likely train trip by the respondent
Important positive features (travelers need/care about these attributes)
Important negative factors (travelers do not want these characteristics)
Attributes that are not important (i.e. attributes where poor service would be tolerated)
Factors that would encourage train use (problems with other modes that would encourage train ridership)

Most of the characteristics of the travelers in each group, as well as their needs, likes and dislikes, are consistent with prior expectations or they are easily understood as reasonable. There are however, some unexpected, yet meaningful results to be found in Table 6. The insights gained from these results are highlighted in the discussion of each group below.

Discussion and interpretation of the cluster analysis results

The rail service is more likely to be successful if it can capture riders from a number of market segments, and therefore the characteristics of the different segments need to be borne in mind in developing service and marketing plans. This can best be done by tailoring promotional strategies to the needs and preferences of each segment. The major characteristics of each of the five identified groups are summarized below.

Group A: the functional traveler

As the name indicates, the members of this group would travel by train if the service met their functional needs. That is, they would use the train for

Table 6. Descriptions of the five identified market segments.

Group A: the functional traveler (94)[1]
Personal/household characteristics: employed full-time, higher income less positive about the train service idea
Trip characteristics: Travels alone, not riding the train for fun
Needs/cares about: fast and frequent train service
Does not want: first class area on the train
Will accept: poor food service
Would use train to avoid: congestion/other highway hassles
Group B: the day tripper (87)
Personal/household characteristics: male, younger, and single
Trip characteristics: travels with one other person shorter trips, returns same day
Needs/cares about: frequent service
Will accept/does not care about: road congestion
Would use train to avoid: higher bus fares
Group C: the train lover (70)
Personal/household characteristic: higher income, larger household very positive about train service idea has traveled by train previously
Trip characteristics: riding the train is the purpose
Needs/cares about: low fare, food service
Does not want: separate smoking/non-smoking areas

Table 6 (continued)

Will accept/does not care about: slow trains, poor seats
Would use train to avoid: higher gas prices
Group D: the leisure (or hedonic) traveler (51)
Personal/household characteristics: lower income, 2-person household zero or one car
Trip characteristics: long trips, away more nights not for business
Needs/cares about: reservations, nice seats alcohol served on board
Does not want: smoking prohibited
Will accept/does not care about: infrequent service, slow trains highway hassles
Group E: the family traveler (31)
Personal/household characteristics: female, larger household fewer cars
Trip characteristics: longer stay away travel with others (especially under 12) not to visit friends/relatives
Needs/cares about: fast trains reservations, food service fold-down work table, phone
Does not want: alcohol served on board
Will accept/does not care about: higher fares

the numbers in parentheses indicate the group sizes.

business, for sightseeing/vacation, or to visit friends or family, if fast and frequent train service were provided. In particular, this group would tend to use the train to avoid highway hassles.

Group B: the day tripper
This group of travelers, in contrast with the functional travelers, is not motivated to use the train by a desire to avoid highway congestion. This group does appear to be sensitive to train service frequency, probably because of the desire to make shorter trips (both in terms of distance traveled and in terms of returning home the same day). The members of this group also appear sensitive to increased bus fares.

Group C: the train lover
This group comprises those persons who would ride the train for the fun of it. That is, the primary or secondary purpose of their most likely trip tends to be "ride [the] train". These travelers tend to care about the fare, in spite of the fact that they tend to have higher incomes than the sample as a whole. This is not surprising when one recognizes that since the train is being ridden purely for pleasure, these folks don't want to spend too much money on the ride. The train lover puts greater emphasis than other respondents on the availability of food and the type of food service on board the train, probably as a way to mingle with others and savor the trip.

Group D: the leisure (or hedonic) traveler
This group tends to be those not traveling for business purposes. They want to have comfortable seats and various amenities that would provide them with an enjoyable trip. They don't want smoking prohibited on board, and in addition to nice seats they want alcohol served on board. Further, the availability of a reservation system is particularly important to them. They also are less likely than the other respondents to use the train in reaction to highway hassles.

Group E: the family traveler
The respondents in this group tend be females who saw their most likely train trip as being with one or more children under the age of twelve. As one might expect from someone traveling with children, the travelers in this group tend to not want alcohol served on board the train. The members of this group also have some desires that, on the surface, are surprising. For example, the members of this group tend to be concerned about train travel time to a greater extent than most other respondents. However, anyone who has traveled with young children knows how restless they can soon become,

so it is understandable that travelers in this group care a great deal about train travel time.

Another unanticipated finding is that the members of the family traveler group tended to care more than the rest of the respondents about the availability of fold-down work surfaces and telephones on board. Our prior expectation was that these on-board amenities would be most important to business travelers. This finding can however also be easily understood – the fold-down work surfaces would be very useful for playing games with children and the telephone would be important for keeping in touch with other family members (including those people expected to meet the traveling party upon their leaving the train).

The main ridership segments suggested by our survey data are the "functional traveler" and the "day tripper"; although (as noted earlier) the nature of the sampling plan we employed does not allow us to be confident about the relative sizes of the ridership segments we identified. In addition, the other three segments are important as well, in that they could provide the additional patronage needed to support the system, especially at times when the train might not otherwise be well utilized.

Special services and pricing mechanisms could be used to attract certain ridership segments. For example, special pricing for families (as the airlines have done so well) will encourage the family traveler, while the leisure traveler can be attracted by tie-ins to sporting and recreational activities. The "train lover" however, can be counted on to ride rather regularly. Further, this type of traveler does not expect a high level of performance from the train service.

Summary and conclusions

This paper describes one aspect of a study conducted to develop an understanding of the demand for intercity rail service in the Charlotte-Raleigh-Rocky Mount corridor of the Piedmont region of North Carolina.

This study appears to be the first use of a computer-based market research survey in a travel-related study in the USA. A particularly interesting feature of our application of this approach is the integration of the Ci2 and ACA packages that allowed us to present each respondent with customized description of the rail service scenarios for which they were asked to provide trade-off information.

The results reported in this paper demonstrate once again the usefulness of market segmentation analysis in understanding the market for passenger transporation service. In particular, the study reported here shows that the

characteristics of the potential riders of an intercity rail passenger service can be much better understood by identifying travelers having similar personal and household characteristics, as well as similar needs, desires and attitudes toward the attributes of the train and competing intercity transportation services.

In particular, the study reported here shows that the commonly-used *a priori* classification of intercity rail trips into business and non-business trips may be an overly simplified representation of the structure of the market for intercity passenger rail. While this conclusion may be particularly true in the case of the type of service investigated here (relatively short distance travel on a relatively low speed, low frequency service), it might also have more general validity. In any case, the results of this study demonstrate that the intercity travel demand market may be a more complex one than previously recognized.

A good example of the benefit of market segmentation as used in this study relates to the question of the importance of travel time to the potential rail travelers who responded to the survey. When we used the common *a priori* segmentation of travelers into business and non-business travelers, we could find little difference between these two groups in terms of their sensitivity to changes in rail travel time. Of course, our prior hypothesis was that business travelers would be found to be considerably more sensitive to changes in rail travel time than non-business travelers, as many previous studies have come to this rather intuitive conclusion. However, our study shows that some people traveling for non-business purposes might also be particularly sensitive to travel time, at least in the context of the type of service examined in this study.

The market segmentation analysis results provide considerable help in marketing the proposed train service. In particular, this analysis leads to the important conclusion that there are a number of potential ridership segments, not just the business and non-business segments of the market that are usually considered. Each of the five ridership segments suggested by our survey data has different preferences and needs, and the success of a train service such as that examined in this study depends of the extent to which the service caters to the needs of these diverse groups.

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