Caliper
Corporation

EAST SIDE ACCESS STUDY
FINAL REPORT

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PREFACE

This report was prepared by Caliper Corporation under Long Island Rail Road Contract No. 1243, the East Side Access Study. COMSIS, Inc. provided assistance under subcontract to Caliper Corporation. Caliper Corporation gratefully acknowledges the technical guidance and assistance provided by Steven Lawitts, James Lee, Graham Kerby, Robert Brickman, and Marcellette Wise of the Long Island Rail Road and Janette Barth of the Metropolitan Transportation Authority.

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1. INTRODUCTION AND EXECUTIVE SUMMARY

This report presents the results of a study of the demand for direct LIRR service to Grand Central Station in Manhattan. The service under consideration would supplement service to the existing three LIRR terminals, and provide travelers with an additional terminal choice option on the East Side of Manhattan. The objectives of this study were to 1) determine the size of the potential market for East Side Access 2) estimate utilization of service to Grand Central by existing LIRR riders, 3) estimate diversion from other modes of travel, and 4) identify and describe other potential travel related impacts of the new service.

This study was not intended to provide detailed service planning or scheduling guidance, nor was it intended as a technical, financial, or engineering feasibility study for this capital project. Therefore, no conclusions are offered with respect to the feasibility or cost-effectiveness of LIRR service to Grand Central. Further, the results and conclusions of this study are subject to the assumptions described in Chapter 8 of this report.

Caliper's approach to this study made use of state-of-the-art techniques drawn from several disciplines, and had five major components. In the first phase, qualitative research was used to identify relevant service issues and to provide guidance for the quantitative research. In the second phase, quantitative research was conducted to measure preferences, attitudes, and potential impacts of East Side Access on riders and non-riders. Third, multivariate models of LIRR terminal choice and mode choice were constructed. Fourth, forecasts were produced using network equilibrium assignment for a variety of service plans and forecast years. Finally, the forecasting methodology was incorporated in a user-friendly microcomputer software system that the LIRR can use to address an array of service planning problems that are related to terminal utilization.

The qualitative research involved focus groups with LIRR riders and non-riders, on-board and on-platform interviews with 74 LIRR passengers, and in-depth interviews with representatives of eight regional transportation, planning, and development agencies.

Based on the qualitative research, there is considerable interest in LIRR service among both riders and non-riders. There was clear evidence that the location of the Manhattan trip terminus is the most important factor in terminal choice among existing

LIRR riders, and that location of trip origin and trip terminus are the most important factors for those who currently travel by other modes. Direct service that avoids a transfer at Jamaica is also highly valued, particularly by peak period riders. Among users of existing LIRR terminals, the level of interest in service to Grand Central was greatest for those using the Hunterspoint Avenue terminal, slightly lower for users of Penn Station, and lowest for users of the Flatbush Avenue terminal.

The qualitative research also indicated that introduction of LIRR service to Grand Central would have minimal impacts on real estate development, housing demand, and real estate values, principally due to the increased economic independence of Nassau and Suffolk counties from the Manhattan CBD. Other major LIRR capital improvements, particularly those involving electrification, are perceived by experts as likely to have greater impacts on the region.

The quantitative research involved on-board surveys with more than 1900 LIRR passengers, telephone interviews with 400 Long Island residents (including 243 regular Long Island-Manhattan commuters), and on-board surveys with 137 express bus riders. Each of these survey efforts included specialized conjoint choice experiments that facilitated analysis of terminal choice and mode choice behavior. The principal findings from the survey research are described below.

Current LIRR riders expressed a great deal of interest in service to Grand Central. Almost half of those surveyed on branches running through Jamaica (47.8 percent) and 36.6 percent of Port Washington line riders would have considered making the trip on which they were surveyed through Grand Central Station instead of their current terminal. Interest was greatest among current Hunterspoint riders (87.0 percent), substantially lower among Penn Station riders (42.3 percent), and lowest among Flatbush riders (11.9 percent).

Interest in service to Grand Central dropped to 42.9 percent (branches through Jamaica) and 32.7 percent (Port Washington) for a trip to Grand Central that took five minutes longer than riders' current trips. A fare surcharge of $0.90 per trip to Grand Central lowered interest more substantially, to 22.2 percent (branches through Jamaica) and 17.4 percent (Port Washington). A similar reduction in interest resulted if a transfer at Jamaica was required for service to Grand Central--interest dropped to 21.3 percent for riders on branches through Jamaica.

Most LIRR riders preferred Grand Central to Penn Station with respect to attractiveness, safety, cleanliness, crowding, and quality of the surrounding neighborhood. Riders slightly preferred Penn Station with respect to subway connections. Hunterspoint riders had consistently higher ratings of Grand Central than users of other LIRR terminals; this is probably due,

at least in part, to greater familiarity with Grand Central among members of this group.

LIRR riders were asked their current mode of egress and the mode of egress they would use if they were to travel through Grand Central. Currently, 60 percent of the survey respondents reach final destinations by subway; this includes 48.9 percent of peak Penn Station commuters, and 93.3 percent and 82.5 percent of Hunterspoint and Flatbush commuters, respectively. Walk egress was reported by 46.6 percent of Penn Station riders. If service to Grand Central were used instead, many current Hunterspoint users and a small percentage of additional Penn Station users would be able to reach their final destination on foot instead of by transit. Most subway egress from Grand Central would take place via the Lexington Avenue lines, as would be expected.

Current LIRR riders indicated a willingness to make additional LIRR trips as a result of the introduction of service to Grand Central. Over one-third said they might use the railroad for trips they make now on other modes. Over one-fourth indicated that the new service might result in entirely new trips to Manhattan.

LIRR riders were asked to respond to the possibility of a fare surcharge equivalent to the one-way subway fare on trips to or from Grand Central Station. This surcharge would be based on the notion that the Grand Central service was a premium service providing improved access to the East Side, and enabling riders to avoid having to transfer to the subway to reach their destination. LIRR riders objected to the imposition of such a fare surcharge. Only 26 percent of riders said fares that vary by terminal would be fair, while 42.7 percent said they would not be fair.

Non-riders of the LIRR also expressed significant interest in service to Grand Central. The majority of commuters that were surveyed elect not to use the LIRR for commutation because it is too far from their home or their final destination. Grand Central is conveniently located with respect to the destination of a large number of these trips, so the new service is more attractive to many non-riders than the current service. Over 25 percent of telephone survey respondents and 30 percent of express bus survey respondents said they would consider commuting via the LIRR's proposed Grand Central service.

For LIRR fare and travel times that were exactly equal to those for respondents' current modes of travel, the LIRR Grand Central service received a likelihood of use rating of 38 percent. For service that required a change of trains at Jamaica, likelihood of use dropped to under 25 percent and down to about 10 percent for current express bus riders. For service that was 15 minutes faster and cost $1.00 more per day than the current mode of travel, interest was about 25 percent. For service 5 minutes

slower and $1.00 per day less expensive than the current mode, likelihood of use increased to about 40 percent. Current subway and express bus commuters gave consistently higher likelihood of use ratings than current automobile commuters.

Both commuters and non-commuters said that they might travel more frequently as a result of the new service. Twenty percent of commuters and 32 percent of non-commuters said that they might make new offpeak trips to take advantage of the increased accessibility of Grand Central.

Multivariate analysis of the ratings of service alternatives was used to model destination terminal choice by LIRR riders and mode choice by non-riders. The models were logit models that were estimated with Caliper's proprietary software. These models of terminal and mode choice were then used to derive monetary values for various aspects of LIRR service to riders and non-riders.

Peak period LIRR riders value travel time at an estimated $4.50 per hour and egress time at an estimated $2.94 per hour. The average value to peak period riders of avoiding a transfer at Jamaica is $0.65; the value for avoiding transit egress is $0.41. In the offpeak, these valuations were generally lower--$3.72 per hour for travel time, $0.75 per hour for egress time, $0.17 for avoiding the Jamaica transfer, and $0.44 for avoiding transit egress.

Mode shift models developed for non-riders indicated that egress time and access time would be among the most important determinants of the choice to use LIRR service to Grand Central. Auto and subway travelers valued egress time and access time at $8.16 and $4.80, respectively. Differences in travel time were valued at only $1.32 per hour, a result of the insensitivity of travelers to the range of travel time differentials among terminal choice options that were used in the surveys. For express bus riders, egress time and access time were valued at $8.40 and $16.80, respectively, indicating a strong preference for a trip that requires no transfer to or from another mode for egress or access.

Demand forecasts for Grand Central were based on application of a stochastic user equilibrium network assignment algorithm. This approach insures that interactions between supply and demand are taken into account, as well as capacity constraints and interactions among overlapping alternative routes. Other forecasting methodologies ignore these important equilibrium effects and can produce forecasts that are unreasonable. The stochastic user equilibrium assignment procedure is performed using proprietary software algorithms developed by Caliper Corporation.

The forecasting methodology explicitly accounts for fare and travel time differentials among the four LIRR terminals,

allocation of train capacity to the various branches and terminals, base levels of LIRR passenger flow, and the presence or absence of several system capital improvements. Forecasts were produced for four scenarios that had varying levels of service to Penn Station and Grand Central, and for three forecast years, each having a different base level of LIRR passenger demand.

Under all four scenarios, forecast travel volumes at Grand Central were capacity constrained. In other words, travel volume was exactly equal to the passenger carrying capacity of trains serving Grand Central. The 1985 AM peak passenger volume at Grand Central under the four scenarios ranged from 36,192 up to 68,952. In the absence of any capacity limitations, 1985 AM peak passenger volume at Grand Central would slightly exceed 74,500.

Under the scenario in which highest levels of service are provided to Grand Central, 31.0 percent of AM peak Penn Station riders would be diverted to Grand Central, along with 60.0 percent of Hunterspoint riders and 28.3 percent of Flatbush riders. High levels of diversion occur at Flatbush in spite of the low levels of interest expressed in the survey by current Flatbush riders primarily because of the high level of accessibility of Grand Central to East Side destinations (via walk egress) and to downtown destinations (via subway), and because of the high levels of train capacity serving Grand Central.

New LIRR passengers who formerly used other modes of travel account for over 31,500 AM peak period trips. More than 25,500 subway riders would switch to the LIRR, along with more than 2,000 express bus riders and more than 7,500 automobile commuters.

LIRR riders on trains to Grand Central would experience an increase in line-haul travel time, because this service is assumed to take five minutes longer than service to Penn Station. However, these riders would also experience reductions in egress time that exceed the increases in line-haul travel time. These egress time reductions are a result of better accessibility of Grand Central to the employment locations of LIRR riders. As a result of these egress time reductions, the average peak period LIRR rider would experience a reduction in total travel time of 1.2 minutes as a result of the introduction of service to Grand Central.

In addition, several thousand riders who now reach final destinations by transit would be able to reach their final destination on foot as a result of the new service, thereby avoiding an undesirable transfer to the subway or a local bus. Depending upon the service scenario, the number of standees and the number of passengers who would transfer at Jamaica might increase or decrease.

New LIRR riders, most of whom would board at stations in Queens, would probably experience high levels of congestion on Grand Central-bound trains, and most would have to stand. The large increase in boardings at LIRR stations in Queens would be likely to place severe pressure on parking and feeder bus capacity at these stations.

As a consequence of increases in LIRR peak period mode share, an annual increase in LIRR fare revenue of $35.5 million could result, with annual decreases in TA and TBTA fare and toll revenues of $13.0 million and $2.8 million, respectively. This results in a net revenue gain to the MTA of $19.7 million. (Caluculations based on fare and toll levels in effect in October, 1985).

Offpeak demand forecasts of Grand Central passenger volumes are 9,640 inbound and 16,550 outbound on an average weekday, with potential additional demand of up to 50 or 100 percent of this amount due to new offpeak travel and offpeak travel diverted from other modes of transportation.

A fare surcharge at Grand Central equivalent to the price of a subway trip would reduce passenger demand by as much as 40 percent. Capital improvements currently proposed (or underway) to reduce egress and transfer time at Penn Station and Hunterspoint Avenue would reduce the shift of existing LIRR riders to Grand Central, allowing additional travelers who currently use other modes to shift to the LIRR and take advantage of the Grand Central service.

The forecasting software developed as part of this study will permit the LIRR to produce forecasts of terminal utilization under alternative fare/service scenarios. In addition, because the terminal choice model can be used without the Grand Central option, the software can be used for a wide array of service planning tasks.

The remainder of this report describes the methodology and results of the East Side Access Study. Chapter 2 provides an overview of the methodological approach that was employed in this research project. Chapter 3 presents the results of qualitative research with LIRR riders and non-riders. Chapter 4 describes the regional impact assessment research and results. Chapters 5 and 6 present the results of the LIRR rider and non-rider surveys, respectively. Chapter 7 outlines the procedures used and the results of the development of terminal choice and mode choice models. Chapter 8 describes the forecasting methodology, input data, assumptions, and scenario definitions, and presents the forecasting results. Finally, Chapter 9 presents the conclusions of the study.

2. STUDY APPROACH

This chapter presents the study approach used in evaluating the potential market response to the introduction of LIRR service to Grand Central Station. The focus of the study was on predicting the share of LIRR riders and other travelers to Manhattan that would prefer LIRR service to Grand Central Station to their current means of travel. To this end, an extensive program of data collection and analysis was performed.

The first section of this chapter provides an overview of the study approach. The remainder of the chapter describes each element of the study approach in further detail.

OVERVIEW OF THE STUDY APPROACH

The overall objective of this study was to forecast the likely travel and related impacts of providing direct access for LIRR trains to Grand Central Station. Because there is currently no means of direct LIRR access into and out of the East Side of midtown Manhattan, opening Grand Central as an LIRR terminal is expected to have significant and wide ranging impacts on many travelers within the New York Metropolitan Region.

Current riders, depending upon their individual circumstances, preferences, ultimate destinations, and available options may well choose to travel through Grand Central instead of the terminal they now use. Impacts on those shifting their travel behavior in this way are likely to include travel time savings and user benefits due to improvements in other level of service characteristics. Individuals who currently use the LIRR may also increase their travel frequency due to the increased service coverage and level of service improvements.

Because the attractiveness of the LIRR would increase to those who currently use other modes of travel to and from New York City, diversion from auto, express bus, subway, and taxi is also likely to occur. These individuals might increase their travel frequencies as well. Furthermore, if shifts from these modes to the LIRR are of sufficient magnitude, decreases in congestion may possibly result for travelers who do not shift from these other modes.

In view of the increased accessibility that would result from the opening of Grand Central as a terminal for the LIRR, changes in relative attractiveness of employment locations and residence locations are also likely to occur. While these impacts are likely to take a longer period of time to become manifest, the research also investigated the increased attractiveness of Long Island residence locations to Midtown workers.

Caliper's approach to this study made use of state-of-the-art techniques drawn from the fields of marketing research, travel demand analysis, and network equilibrium analysis. The approach consisted of the following major steps:

1. Qualitative Survey Research - In depth open-ended interviews and focus groups were conducted with LIRR passengers and non-passengers to determine their attitudes toward LIRR Service at Grand Central Station, and to identify key factors to be included in the quantitative survey research. In addition, in-depth interviews were conducted with eight individuals from various local and regional planning authorities and private development agencies to solicit their opinions on regional impacts that might result from East Side Access.

2. Quantitative Survey Research - An extensive program of quantitative research was conducted as the basis for statistical analysis and forecasting of the travel impacts of making Grand Central Station directly accessible on the LIRR. The quantitative research entailed four separate survey efforts:

    * An on-board survey of LIRR passengers to measure their travel patterns, perceptions of alternative travel modes and routes, and preferences for Grand Central and other LIRR destination terminals under alternative fare and service scenarios. The survey included an application of Caliper Corporation's Preference Analysis System to obtain accurate measurements of the magnitude and significance of the determinants of route and destination terminal choice.

    * A telephone survey of Long Island residents to measure the possible impact of direct service to Grand Central on their use of the LIRR. This survey effort addressed residents of Long Island who commute regularly to Midtown by means other than the LIRR, and residents of Long Island who do not necessarily work in Midtown but who travel to Manhattan regularly for other purposes.

    * A self-completion survey of express bus riders to supplement the LIRR non-rider information collected in the telephone survey.

    * A clipboard survey of individuals in Midtown Manhattan to explore the impact of Grand Central service on residential housing location choice.

3. Travel Demand Modeling - Disaggregate travel demand models were developed to explain and predict travelers' choice of LIRR destination terminal for their peak and offpeak travel. These models were implemented using state-of-the-art econometric techniques and took the form of discrete choice models drawn from the multinomial logit family. Supporting models were developed to forecast modal diversion to the LIRR.

4. Demand Forecasting and Impact Assessment - The travel demand models were applied to predict the volume of LIRR traffic at Grand Central Station and all other terminals under key scenarios and time frames of interest. Key impacts and measures of performance were also estimated. The travel demand models were applied in the framework of network equilibrium analysis. A stochastic user equilibrium formulation was used to assign passengers to the LIRR network under specified service scenarios. This methodology made it possible to take account of flow-dependent effects on level of service (such as congestion and crowding), capacity constraints, and alternative network paths in the analysis, thus greatly increasing the realism and accuracy of the forecasts produced.

5. Microcomputer Applications Software - The forecasting methodology was implemented in the form of a user-friendly microcomputer program that runs on an IBM Personal Computer. Documentation for the forecasting software appears in a separate report.

Each of these components of the study approach is described more fully below.

QUALITATIVE RESEARCH APPROACH

The qualitative research had four major components: focus groups with Midtown employees; on-board, open-ended discussions with LIRR riders; interviews with LIRR riders at terminals; and interviews with regional development and planning staff. The first three of these qualitative research efforts were intended to facilitate the identification of factors concerning service to Grand Central that are relevant to individuals who might be affected by the service.

Focus groups with Long Island residents who work in Midtown Manhattan were arranged by contacting large employers in Midtown Manhattan and asking them to organize group sessions as a public service on behalf of the LIRR. Approximately one dozen Midtown employers were contacted, along with several employers located in other sections of Manhattan. Most of the employers contacted were located between 34th and 58th streets and between Park and 6th Avenue, in the area where service to Grand Central is likely to have greatest appeal. Most employers were asked to arrange

two group sessions, one with current LIRR commuters, and one with Long Island residents who currently commute to Manhattan by some other mode of transportation. Employers located outside the Midtown area were asked to arrange only one group session with current LIRR commuters.

Two firms agreed to participate in the qualitative research. Manufacturer's Hanover Corporation (located at Park and 51st) agreed to schedule two focus groups, which were conducted on June 25, 1985. American Express (located at South Ferry at the southern tip of Manhattan) agreed in principle to schedule one focus group with current LIRR commuters; at the LIRR's direction this focus group was not scheduled.

In addition to the group sessions, it was considered important to hold one-on-one discussions with LIRR riders to discuss the potential impacts of the new service. As a result, on-board open-ended interviews were conducted with a significant number of LIRR passengers. These open-ended interviews were conducted on board LIRR trains traveling between Jamaica station or Great Neck station (on the Port Washington line) and their New York City terminal station.

To insure that adequate information was obtained from users of all three of the existing LIRR New York City terminals, additional open-ended interviews were conducted with LIRR riders boarding or alighting at Penn Station, Hunterspoint, and Flatbush. These "platform" interviews were originally intended to take place on station platforms rather than on board trains, but were more easily completed on the trains themselves as passengers boarded or alighted at the terminals.

On-board and platform interview respondents were selected at random from riders on selected trains by specially trained interviewers who were familiar with the new service and the wide range of likely impacts. Interviewers obtained basic information on the rider's current trip, and asked a variety of questions concerning his/her interest in and likely impacts of new service to Grand Central Station.

A total of 74 open-ended and platform interviews were conducted between June 25 and June 27, 1985. Interviews were distributed among the three terminals, between the inbound and outbound directions, and between peak and offpeak periods. LIRR riders were very responsive to the research effort; not a single rider refused to cooperate with the field staff in discussing their current trip or their feelings concerning the new service.

As an additional step in the qualitative research, several informal "straw polls" were conducted with peak period riders destined for the three terminals to estimate the level of their interest in service to Grand Central.

Finally, the qualitative research included a regional impact assessment effort, in which lengthy discussions were conducted with knowledgeable individuals in regional and local planning boards, transit agencies, and real estate development firms. The purpose of these discussions was to assess the likely impacts of the new commuter rail service on development and the economy of the region. These in-depth conversations provided additional insight into the possible long term effects of the proposed capital project.

QUANTITATIVE RESEARCH APPROACH

Four separate quantitative research efforts were implemented as part of the East Side Access Study. The approach, sampling methodology, and implementation of each of these survey efforts is described below.

On-Board Survey of LIRR Riders

The principal purpose of the on-board survey was to collect information on LIRR riders' travel characteristics and on the way that they would respond to the introduction of direct LIRR service to Grand Central Station. The on-board survey also addressed the potential for existing riders to make additional trips on the LIRR as a result of the new service to Grand Central.

Surveys were distributed to LIRR riders by trained interviewers who briefly described the purpose of the research and solicited participation in the study. Interviewers remained on board to answer questions and to collect completed forms. When trains reached their destination terminal, interviewers remained on the station platform to collect any remaining questionnaires as passengers alighted.

The survey was a self-completion instrument consisting of four major sections. The first section asked riders about the characteristics of their current trip, including trip purpose, frequency, payment method, and access and egress modes and travel times. The second section asked riders how interested they would be in service to Grand Central, and asked how they would get from Grand Central to their final destination. The third section consisted of a conjoint tradeoff exercise in which respondents ranked and rated six different terminal options that varied by terminal location, travel time, fare, and whether or not a transfer at Jamaica was required. The fourth and final section of the questionnaire consisted of demographic questions.

Participation rates for the survey were extremely high. While no formal measurements were conducted, the refusal rate was estimated by fieldwork staff to be under 15 percent. The vast majority of forms that were distributed were returned and at

least partially completed; less than 5 percent of forms distributed were not returned. Over 60 percent of surveys from peak riders were complete enough to be used in the modeling exercise described in Chapter 7, a retention rate that was more than satisfactory.

The sampling plan for the on-board survey was choice-based, with higher sampling of riders who were most likely to be interested in the LIRR's Grand Central service. Sampling rates were highest on trains serving Hunterspoint Avenue, slightly lower on trains serving Penn Station, and lowest on trains serving Flatbush Avenue. Peak period surveys were distributed among the various branches roughly in proportion to peak ridership on those branches, and were distributed also throughout the AM peak period and on trains of varying service characteristics (e.g., flyers, express and local trains, etc.). Offpeak surveys were distributed during midday and afternoon hours as well as on weekends. Interviewers boarded westbound trains at the last stop before the train reached its destination terminal, and distributed questionnaires until the train was 10 minutes from the terminal. This allowed riders sufficient time to complete the bulk of the questionnaire before alighting.

Four distinct versions of the survey were developed, each of which included slight variations in levels of service and fare attributes in the trade-off exercise. One of the four versions was tailored specifically for Port Washington line riders; the conjoint exercise and the survey itself were modified to omit references to transfers at Jamaica which, of course, do not apply to riders on the Port Washington line. The other three survey variants were used randomly on all other LIRR lines. The surveys themselves were printed on heavy card stock to make them easier for respondents to complete. Copies of the on-board survey appear in Appendix A of this report.

A total of 1907 surveys were completed with LIRR riders, including 1543 peak and 364 offpeak completions. These sample sizes allowed estimates of survey means to be accurate to nearly 5 percent at a 95 percent confidence level in the offpeak and provided very high levels of accuracy in peak periods.

Telephone Survey of Long Island Residents

A telephone survey was conducted with 400 residents of Long Island to investigate whether travelers to Manhattan who currently use other modes of transportation might switch modes and use the LIRR's Grand Central service.

Telephone numbers were randomly generated in active exchanges in Queens, Nassau, and Suffolk counties, in proportion to the number of households in each of the three counties. When a household was contacted, interviewers first attempted to identify and complete an interview with a member of the

household who commuted regularly to Manhattan, but did not commute via LIRR. If no such individual existed, interviewers attempted to identify and complete an interview with any household member who traveled to Manhattan once a month or more by some mode other than the LIRR. If no such individual was identified, the number was removed from the sample. In all, 243 interviews were completed with commuters, and 157 with non-commuters.

Commuters were questioned extensively about their current commutation travel behavior, including trip frequency, modes used, and cost and travel time. They were also asked why they chose not to commute via LIRR, and what the characteristics of their trip would have been had they elected to commute by rail. Then, commuters were told about the potential new service to Grand Central and were asked to rate the likelihood that they might use the LIRR to commute to Grand Central under four fare/travel time scenarios.

Both commuters and non-commuters were asked to respond to a series of questions about non-commuting trips to Manhattan. These questions included an inventory of trips by mode, an explanation of why the LIRR was not used for these trips, and an assessment of what percent of these trips might have been made via LIRR if service to Grand Central were available. Finally, all telephone survey respondents were asked several standard demographic questions. A copy of the telephone survey appears in Appendix B of this report.

Express Bus Survey

One key goal of the telephone survey effort was to identify sufficient numbers of commuters using other MTA facilities to be able to evaluate the potential impacts of Grand Central service on these facilities. To insure that sufficient express bus riders were surveyed a self-completion version of the telephone survey, tailored specifically for express bus riders, was developed and administered. The purpose of the express bus survey was to measure the likely impacts of the introduction of service to Grand Central on the commutation mode choice of current express bus users.

The express bus surveys were printed on the front and back of a single card, and were distributed to riders on Queens-bound buses as they boarded buses in Manhattan between 4:30 and 6:00 PM. Postage-paid return envelopes were attached to each survey. A total of 400 questionnaires were distributed at bus stops in Midtown Manhattan; 137 were returned complete, for a response rate of slightly over 34 percent. The express bus survey is reproduced in Appendix C.

Clipboard Survey of Individuals in Midtown

In order to test the possible impacts of LIRR service to Grand Central on residential location decisions, a very brief personal interview (clipboard) survey was conducted with individuals who do not currently live on Long Island but who do pursue activities in Midtown Manhattan.

Interviewers intercepted individuals in the Grand Central area and administered a one minute interview with qualifying respondents. Respondents were asked where they lived, how they got to Manhattan, and whether or not the institution of direct commuter rail service from Long Island to Grand Central might impact their future residential location choice. Screening was performed to eliminate Long Island residents and current LIRR passengers from this sample. A total of 400 clipboard surveys were completed.

TRAVEL DEMAND MODELING

Simple tabulations of responses to the on-board, telephone, and express bus surveys described above might have been sufficient to develop a rough estimate of demand for Grand Central. However, this simple form of analysis would ignore equilibrium effects, and make it impossible for the LIRR to understand how the demand for Grand Central varies as the various related service parameters change.

Therefore, a set of disaggregate demand models were estimated from the survey data to explain diversion of trips to the LIRR from alternative modes and traveler's choice of destination terminal on the LIRR. The methodology and approach used in model estimation is described in Chapter 7 of this report.

DEMAND FORECASTING AND IMPACT ASSESSMENT

The travel demand models described above were applied within the framework of network equilibrium analysis. In this context, equilibrium forecasting refers to procedures that explicitly account for interrelationships between the level of service on a facility and the volume of persons using that facility.

In describing the network equilibrium approach, a route, or path, is defined as a set of movements connecting an origin to a destination. In the context of this study, a route is the manner in which an individual travels from his home on Long Island to Manhattan or vice versa. The cost of using a particular route or path is a generalized cost or disutility, and refers to a combination of all of the factors relevant to using that route. In this case, these factors include out-of-pocket expense, line-haul travel time, egress time, and measures of attractiveness for

particular terminals. The costs were derived from the multivariate behavioral models described in the preceding section.

The equilibrium approach to forecasting demand at Grand Central requires an iterative solution, according to the following general procedure:

1. Make an initial estimate of the cost of all available routes between traveler's origins and destinations.

2. Based on the estimate of costs from Step 1, assign travelers to the various routes on the basis of the relative cost or disutility of each path.

3. Based on the results of the assignment of passengers in Step 2, re-evaluate the costs on the various routes available to travelers. These may be different from the initial estimates, because of congestion or capacity constraint effects on trains serving various line-terminal combinations.

4. Based on the revised estimates of cost from Step 3, re-assign travelers to the various routes on the basis of the relative generalized cost of each route.

5. Repeat steps 3 and 4 until the level of demand and the level of service and cost reach equilibrium.

There are two common methods for network equilibrium analysis - deterministic user equilibrium and stochastic user equilibrium. The traditional, deterministic approach is based on three key assumptions, all of which imply that travelers are perfectly rational in their decisionmaking. First, it is assumed that link travel times do not vary. Second, all travelers are assumed to have perfect information concerning the characteristics of alternative routes. Finally, it assumes that all travelers choose the least cost route to their destination.

Each of these assumptions is, of course, unrealistic, and reliance on these assumptions leads to the following property of the flows assigned to the network: all used paths between a given origin and a given destination have identical costs, and all unused paths have a higher cost. This property is, however, unrealistic. Empirically, many travelers make alternative choices and travel on routes that have higher costs than other available alternatives.

Stochastic user equilibrium avoids these restrictive assumptions about traveler behavior. Under stochastic user equilibrium, travelers are assigned to paths as a function of the costs on all links making up that path. Random variation in the cost of each link is explicitly taken into account. Therefore, variation in

the level of service experienced by individuals is explicitly accounted for, as is variation in the relative importance of service characteristics to each traveler.

Additionally, stochastic user equilibrium is the technically correct solution to network equilibrium problems when demand is specified by disaggregate demand models based on discrete choice models such as logit and probit. In this respect, it permits complete integration of the travel demand models and network analysis.

The stochastic user network equilibrium solution was developed on a microcomputer using proprietary software and algorithms developed by Caliper Corporation. The network forecasting methodology was also integrated with a file manager, data editor, and user-friendly interface to produce a self-contained demand forecasting system. Detailed specifications for the East Side Access Study network appear in Chapter 8 of this report.

3. QUALITATIVE RESEARCH

This chapter of the report presents the results of qualitative research conducted as part of the East Side Access Study. The purpose of the qualitative research, as described in Chapter 2, was to determine attitudes of LIRR passengers and non-passengers towards LIRR service at Grand Central Station and to identify key factors to be included in the quantitative survey research.

This chapter is organized into four sections. The first and second sections present the results of the LIRR rider and non-rider focus groups, respectively. The third section documents the results of the on-board and platform interviews with LIRR riders. The final section presents the key conclusions from the qualitative research.

RESULTS OF THE LIRR RIDER FOCUS GROUP SESSION

The Participants

The LIRR rider focus group consisted of nine individuals, all of whom had been commuting by the railroad for more than ten years. These individuals' primary workplace was located either at 47th and Park Avenue or at 51st and Park Avenue, with the exception of one individual whose principal work location was downtown.

Current Use of the LIRR

All of the participants were regular LIRR commuters, and all have deeply ingrained commuting habits. Six of the focus group respondents regularly travel through Penn Station, two through Hunterspoint, and one (the individual working principally downtown) through Flatbush. The Penn station commuters use a variety of egress modes to complete their trip, including walking, local buses, subways (both the E train and the 7th Avenue with a transfer to the Grand Central Shuttle), and shared ride taxicabs. There was general agreement among Penn station riders that surface transportation was not a viable access/egress mode in the afternoon peak, so that most of the individuals who used the bus in the morning either walk or take the subway back to Penn station in the afternoon. The subway was generally considered as far more reliable than the bus in the afternoon

peak. The two Hunterspoint users regularly use the Flushing (#7) line to get back and forth to Grand Central, and walk between Grand Central and their final destinations. One of these individuals mentioned that he occasionally returns home via Penn Station. The Flatbush commuter occasionally uses service through Hunterspoint when he has meetings in Midtown in the early morning or late afternoon. Like the regular Hunterspoint commuters, he also uses the #7 line between Queens and Manhattan and walks between Grand Central and his final destination (or origin).

Participants were asked to comment on their use of terminals other than the one they use most often. Several of the Penn Station/Hunterspoint riders had used the Flatbush terminal on occasion, mostly as a result of service disruptions at Penn Station, while one of the Penn Station commuters had at one time worked downtown and commuted regularly via Flatbush. There was a consensus that, at least during peak periods, the connections between the LIRR and the subway at Flatbush were fairly fast and convenient; there was equally a consensus among these individuals that the subway ride between Flatbush and midtown Manhattan was a nightmare of the highest order, largely due to congestion on the subway trains. Riders also commented on unpleasantly congested conditions at Flatbush because of the large number of available subway connections. Offpeak connections at Flatbush were perceived to be far less convenient and frequent, and the terminal itself was considered a more dangerous place in the offpeak.

None of the regular Penn Station commuters had tried the Hunterspoint terminal, principally because they all have direct train service to Penn Station on trains that either do not stop at Jamaica or that do not require a change of trains at Jamaica. These individuals saw no reason to change at Jamaica to a Hunterspoint train that would then require another transfer (to the #7 line) to reach Manhattan.

Of the two Hunterspoint users, one had previously commuted through Penn Station, but tried Hunterspoint to avoid construction at Penn Station. He found that he preferred the Hunterspoint service, and plans to continue using it. The Hunterspoint users both commented on the relative "creature comfort" and low crowding levels on the refurbished diesel cars, and stated a preference for these cars over the electrics serving Penn Station. In addition, they commented on the more civilized boarding of passengers at Hunterspoint as compared with the "rat maze" of Penn Station. Both Hunterspoint users commented upon the Flushing line reconstruction and stated that they had noted a deterioration in connecting subway service.

None of the focus group participants regularly changes trains at Jamaica, although all of them at times have been required to do so for various reasons. Overall, transferring at Jamaica was

considered a major inconvenience, particularly in bad weather or when the originating train was late and missed a scheduled connection. One rider mentioned the changing of track assignments as an additional nuisance.

Most of the group participants were generally satisfied with LIRR service, and seemed to agree that the morning commute was faster and more comfortable than the return trip in the afternoon. Three individuals noted that they perceived a marked improvement in the overall quality of service in recent years. The most common complaint concerning the railroad was voiced by four individuals concerning difficult parking situations at their home station. Two board at stations that have unrestricted parking and complained that individuals from other towns cause congestion at their lot; one individual commented that he had no flexibility to commute later in the morning because he would be unable to find a space in the lot at his home station. This person stated that he was willing to rent an outdoor parking space located three blocks away from the station for $30 per month to insure that he would have a space available without having to arrive early.

In other general comments, one Babylon Branch rider complained about evening trains (the 5:39 and the 6:04) that sit in Penn Station with their doors closed for five or ten minutes, resulting in a wild rush for seats when the doors open for boarding. Another individual commented that LIRR schedules need to be revised to reflect a shift towards commuting earlier in the morning, particularly during summer hours. Comments were also made about severe crowding on Monday mornings and Friday afternoons during the summer for riders on trains traveling to and from Fire Island and the Hamptons. One individual complimented the LIRR on its handling of the Penn Station construction, referring to it as a "non-event event."

Reaction to Service at Grand Central

In general, focus group participants reacted positively to the notion of direct service to Grand Central Station. Each and every one of the nine riders said that they would probably use the service if it were available, because Grand Central is so convenient to their office.

While riders were enthusiastic about the new service and the convenience it might provide them, they were also aware of some of the limitations of such a major project. One rider stated that as long as the new service involved additional train capacity, the clear benefit of the new service is that it would divide up the crowd between the two Manhattan terminals, reducing congestion and increasing riders' chances of getting a seat. He also said that there would be significantly less advantage if the new service simply involved a shift of trains from one terminal to the other. Another rider argued as follows:

> "If you had enough seats on the train so that no one at Penn Station had to worry about getting a seat, and through the [Penn Station] construction you increased the access to the second level as well as the ventilation, [then] you have gone a long way to addressing a number of the concerns that most people who ride the railroad have, and the Grand Central [service] would add only [greater convenience for certain riders]."

There was a general sense, however, that additional capacity was vital to the future of the LIRR. One individual commented on the rapid pace of construction of new office space on the East Side, and stated to general consensus the importance of increased LIRR service not only to existing railroad riders but to subway riders and other commuters as well.

Comparison of Penn Station and Grand Central

When asked to compare Penn Station and Grand Central Station, there was mixed response, with a slight preference for Grand Central. All of the riders were familiar with both terminals, and generally perceived Grand Central to be more spacious and less crowded. One rider commented that Penn Station was bigger, but not the LIRR area of Penn Station:

> "[Penn Station] downstairs is always very, very crowded... the LIRR Station at 32nd Street...is a very, very tiny station...[Grand Central] is certainly a much bigger station."

One of the Hunterspoint riders who passes through Grand Central after transferring from the LIRR to the #7 line said that he had to assume that introduction of LIRR service to Grand Central would involve reconfiguration of the terminal to alleviate current congestion. His experience with Grand Central is limited to the highly congested exit from the Flushing line subway, where "you have to wait in line to get out of the station."

None of the participants thought Grand Central a safer place to be than Penn Station. The one female in the group session said the following:

> "[You can] get mugged no matter where you go...I've been commuting for thirty years and I've never had a problem at Penn Station."

There were, however, a variety of disparaging remarks about Penn station concerning broken escalators, poor ventilation and extreme heat during the summer months, and poorly lit station platforms.

Use of Grand Central with a Jamaica Transfer

Focus group participants' reactions to the Grand Central service were quite different when the possibility of a transfer at Jamaica was mentioned. Only about half of the respondents would have any interest in the service if a change at Jamaica were required. Most of these individuals said that their use of the service would then depend on the characteristics of the transfer. An across-the-platform transfer was acceptable to some persons; others thought that a transfer would be acceptable only if a seat were available on the train to which they transferred. Nearly everyone agreed that weather and other considerations might be relevant factors in their travel decision on a given day.

Currently, only one of the nine focus group participants transfers at Jamaica; the rest have adjusted their schedules so as to use flyers or direct trains that do not require a transfer. All said that they would try to avoid changing at Jamaica if at all possible. According to one person:

> "...as long as I do get a seat and I have a lot of reading to do, or I'm tired, or I have a lot of work to do, I'd rather not start gathering up all my work and getting into another train...[particularly if that train had no seats available]"

The individual who currently transfers at Jamaica said the following:

> "I've heard some war stories about transfers [at Jamaica]... Sometimes I get off my train and the connection never gets in...the later you get into Jamaica [and as you get closer to 8:00 AM] the [greater] the possibility of something going wrong..."

If only one direct train were available, riders unanimously stated that they would adjust their schedule to use that train as long as it would get them to work at the same time or earlier than their current arrival time. Riders would not adjust their schedules to use a direct train to Grand Central if it got them to work later than their current train; these riders would instead continue to use their current terminal station and egress mode.

The pretest of the conjoint exercise for the the on-board survey prompted some additional debate concerning the Jamaica transfer, with at least one respondent arguing that a change at Jamaica is fine if the overall trip length is reduced as a result. This person stated that he would be content to change at Jamaica to reduce his overall travel time by five minutes. Another respondent countered by assigning a relatively large risk to the Jamaica transfer. Specifically, this rider noted that the

Jamaica transfer would likely entail the loss of a seat, which in the event of a breakdown or delay was a severe inconvenience.

Response to a Grand Central Surcharge

Riders were asked to discuss their willingness to pay a small surcharge for service to Grand Central, a subject which generated extensive debate. When asked about a hypothetical $1.00 per trip surcharge, initial responses varied widely:

> "It's worth it if you can guarantee a seat..."
> "The public will take this as a rip-off..."
> "It's probably worth an extra $20 or $30 a month..."
> "[It's unfair because] people in Nassau and Suffolk pay the biggest taxes in the country..."

Most riders agreed that, from their own standpoint, they would be happy to pay a surcharge if it were less than or equal to the amount they would save by avoiding a transfer to the subway. Therefore, riders who use subway or bus connections both in the morning and the afternoon were personally willing to pay an additional $1.80 a day for service to Grand Central (based on the $0.90 subway fare then in effect); riders who used transit egress only in the morning (and walked back to Penn Station in the evening) were personally willing to pay $0.90 per day for service to Grand Central. One rider, in fact, was willing to pay an additional surcharge over and above his cash savings from the subway or bus for the convenience the new service would offer.

In spite of these practical considerations, most of the riders objected in principle to the establishment of a surcharge for Grand Central users. Several, in fact, were quick to point out that while they could use Grand Central and save the subway or bus fare, that many other riders who might benefit from service to Grand Central would continue to require a transfer to a connecting subway and/or bus route, and would therefore have no incentive to agree to pay a surcharge to travel into or out of Grand Central.

One of the group members said that a surcharge would make him "resentful" for a different reason:

> "If you are implying that there would be an increase in fare [only] for those trains into Grand Central, that implies that only the people who are going to Grand Central reap the benefits [of the project]. This is not the case because [congestion and lack of available seats would be alleviated at Penn Station as well]..."

It was also pointed out that there are many people within walking distance of Penn who are not required to pay a surcharge, so that a similar surcharge at Grand Central could not be justified.

Another rider pointed out that his willingness to pay a premium for service to Grand Central was closely tied both to the frequency of direct service and to the method through which the surcharge would be applied. He believed that it was worth a surcharge to travel direct to Grand Central, but was concerned that if the surcharge were applied through a higher monthly ticket price, he would in effect be paying extra money and reaping no service benefits on those days on which he was unable to take advantage of the direct Grand Central service. He was suspicious that this might occur frequently if there were a limited number of direct trains serving Grand Central.

Other Impacts of Grand Central Service

Riders were also asked about other potential travel impacts of service to Grand Central. Specifically, they were asked to state whether or not they might make additional offpeak, evening, or weekend trips as a result of the new service, or if they might change their current time of travel or work trip frequency. None of the respondents said that their offpeak travel would be affected in any way, and only one mentioned that he might commute to work a little later in the morning because his egress time would be reduced by the new service.

Investment Worthiness of the Grand Central Project

As a final discussion point, respondents were asked if they thought the Grand Central project was a worthwhile investment, or whether the money might be better spent improving Penn Station. Generally, the Grand Central project received a positive response:

> "I think it's [an investment] that has to be made...Long Island is being so built up [and] people are moving out [to the Island]...they've got to have another means of getting into the city..."
>
> "I think there is also a limit to how much you can expend on Penn Station to rectify the [current] situation...I think it has gotten to the point where you don't have enough room in which to work with the crowd that masses [there]. I have been taking [the LIRR] for eleven years...ridership on the Babylon line has increased tremendously over the eleven year period, and, I would venture to say, on some of the other lines as well...You've got more people coming into this rather small terminal...You can only make this [conference] room accommodate so many people, and then you've got to change this room."

Two of the focus group respondents stated their support for paying for the project through increased or new tolls on river crossings from Long Island, because they felt the basis of the project, to a large extent, was to encourage use of public transportation and discourage use of private automobiles.

RESULTS OF THE NON-RIDER FOCUS GROUP SESSION

The Participants

The non-rider focus group consisted of eight individuals, all of whom commute from Long Island into Manhattan on a daily basis by some means other than the LIRR. These individuals' primary workplace was located either at 47th and Park Avenue or at 51st and Park Avenue.

Current Commuting Behavior and Use of the LIRR

The eight group participants use a variety of travel modes, including express bus, regular bus, subway, and combinations of these modes. The modes of commutation selected by these individuals and their reasons for not using the LIRR are documented below. In addition, each individual's stated probability of using the LIRR's proposed Grand Central service instead of their current mode of commutation is also listed.

* The first of three Forest Hills residents commutes exclusively via express bus because of the speed of service and convenience. This respondent finds the LIRR inconvenient to use and has never used it for commuting purposes. This respondent rated likelihood of use of Grand Central at 60 percent, depending upon the train schedule.

* A second Forest Hills resident uses the express bus in the morning and the subway in the evening, because the afternoon express bus receives no preferential treatment and is therefore very slow. The LIRR alternative would be inconvenient and require the respondent to pay three separate fares - local bus to access the station, the LIRR ticket, and the subway to get from Penn Station to work. This respondent rated the likelihood of use of Grand Central service as 75 percent.

* The third Forest Hills resident commutes using the E or F subway trains in both directions. This individual does not want to be tied to a fixed schedule and cannot justify the higher cost of the LIRR/subway alternative. With direct service to Grand Central, this respondent would switch to the LIRR with a probability of 50 percent.

* A New Hyde Park resident formerly commuted via the LIRR but now drives to the subway at 179th Street in Jamaica to avoid being tied to a fixed schedule. This respondent would use the LIRR Grand Central service with a probability of between 20 and 30 percent.

* A Nassau county resident uses the Nassau bus to 179th Street in Jamaica, and then transfers to the subway, but is "fed up" with the service and would like the convenience of direct access to Grand Central. He occasionally returns home on the LIRR (Mineola station), and would use the railroad regularly except that access and egress are inconvenient. He would use the Grand Central service for his return trip with a probability of 90 percent, but would probably continue to use the bus/subway combination for his morning trip because of difficulty accessing the LIRR station.

* A Queens Village area resident normally commutes via Queens buses and the F train, but occasionally uses the LIRR to return home when he finds himself on the West Side. This person would use the LIRR more regularly except for a preference not to be tied to a schedule and because of the inconvenience and length of time required to get from Penn Station to work. He would use the Grand Central service with a probability of 75 percent.

* A former Oyster Bay line (East Williston) commuter gave up on the railroad (in spite of its close proximity to his home) because of the infrequent service, the change at Jamaica, and the need to pay the additional subway fare. Now, he drives to 179th Street in Jamaica and takes the subway. Assuming an improvement in Oyster Bay service, he would use the Grand Central service with a probability of 70 percent.

* The final group member takes a local bus to the Flushing line, and prefers not to use the railroad because an additional subway/train trip would be required to reach work. This respondent lives 10 minutes by foot away from the LIRR and said he would use the Grand Central service with a probability of 90 percent.

Reasons for Non-use of the LIRR

Respondents were asked to comment in more detail on factors that discouraged them from using the LIRR. When asked the relative importance of fare in their current commuting mode choice decision, and whether high LIRR fares (particularly for Queens residents) were a deciding factor in non-use of the railroad, most agreed that the impact of fare by itself was very low.

> "I pay $55 a month for parking and approximately another $40 a month for the subway...I'd have to pay $97 or $98 for a monthly commutation [ticket, so the two options are] just about even."
>
> "The bucks are about the same..."

A dissenting non-rider stated that the LIRR fare structure is unfair to Queens residents, and that these residents were forced to subsidize long commuting trips by residents of Nassau and

Suffolk counties. To this individual the absolute LIRR fare he would need to pay was reasonable, but he resented the inequities he felt existed in the current structure.

Others singled out the schedules and frequency of service. Many of the group members stated that they did not want to have to cut work short to run for a train, and hence found subway service less restrictive. Others had a clear modal preference:

> "[Express bus is] the most civilized way to travel..."

Interestingly, none of the focus group participants commuted directly into Manhattan by automobile, and none knew anyone else either at work or in their neighborhood who commuted by car during normal peak periods.

Interest in Service to Grand Central

As indicated by the high probabilities of use for the individuals in the focus group, there was substantial interest in the possibility of direct service to Grand Central.

The former Oyster Bay rider stated:

> "If I got better treatment and the schedule was more to my liking, and it [the service] comes into Midtown, [then] sure, I'd take the LIRR."

Some of the interest in Grand Central was motivated by the construction and related service disruptions on the Flushing subway line.

> "If you were going to implement [Grand Central service] in the relatively near future...we know that the #7 line has a four and one-half to five year down time. I know there are many people in my area...who are getting tired of the #7 line...I would say you have a ripe population [for using the new service]..."

There was also a general preference among the focus group respondents for Grand Central over Penn Station, although the perceived differences between the two stations were not large. Most respondents thought that Grand Central was (as expected) much more convenient, while a few thought it was "less sleazy" and one expressed a greater feeling of safety at Grand Central compared to to Penn Station.

Almost all of the respondents agreed that if they were to switch to the railroad, they would switch over completely and use the LIRR almost exclusively. The lone exception was the individual who had no convenient means of accessing the LIRR station in the morning peak. All of the group members said that they would walk

between their workplace and Grand Central station, and all agreed that the time of day at which they commute would not change, except to the extent required by revised train schedules.

Effect of a Change at Jamaica

The effect of a change at Jamaica on demand for service to Grand Central appears to be quite large, judging from the focus group responses. If a transfer at Jamaica were required, at least one of the subway riders said that he would continue to use the subway because he nearly always gets a seat (at least in the morning) and the cost was so low relative to the LIRR. He assumed that Grand Central LIRR trains would be crowded (just as Penn Station trains are today), and that transfering at Jamaica would very likely result in his having to stand between Jamaica and Grand Central.

Among some LIRR non-users, there was clearly a lack of understanding of the significance of changing at Jamaica:

> "I'd like to ask something because it's a continuous topic of conversation...I go out to the Hamptons each weekend and I'm fortunate enough to drive out [while] most of my friends [take the LIRR]...there is some psychological importance... to this changing at Jamaica...People will do anything - they'll be on the phone jimmying their schedules all week long so that on Friday night they don't have to change at Jamaica...I've never quite understood it because I've only had to do it once and I was lucky enough to walk from here to there and there was the train..."

Former LIRR riders in the group had strong reactions to this question:

> "there is something called surprise day at Jamaica...It [happens] probably about four or five days a week, or at least it used to..."

> "You're in a zoo when you reach Jamaica...you go to get off [the train]...you want to get out of the car and you're pushed back in it - I've seen people get their foot caught between [the train and] the platform - it's a zoo, and you wonder if [your fellow riders] are human beings."

There was some discussion concerning the importance of the frequency of direct versus indirect service to Grand Central. The proposed service was described as having one direct train to all branches in the peak hour, with other trains providing convenient transfers at Jamaica. This was generally considered adequate, although one group member responded that a convenient change at Jamaica "seems like a contradiction in terms." Another respondent said that he would require direct service every 30

minutes in the peak, while another would be satisfied only by twenty minute headways during rush hour. One person admitted:

> "It's hard for me to imagine that you could make [the service] more frequent with that many lines coming in... that doesn't sound practical..."

When given a choice of changing at Jamaica or traveling 30 minutes earlier than would otherwise be convenient to get a direct train, respondents were equally divided in their preferences. All of the group members with LIRR experience preferred to travel earlier than to change at Jamaica.

Response to a Grand Central Surcharge

It was generally agreed that if there was a surcharge for trips to Grand Central, it should be less than $0.90 or it would clearly be unfair. The impact of such a surcharge would vary widely among the group members; most admit to having a reasonably low level of sensitivity to price, but the current daily commuting cost varies from as little as $1.80 up to $3.90 for these travelers. Those at the low end of this range seemed slightly less inclined to be willing to pay a surcharge for Grand Central Service.

Two of the group members disagreed with the concept of a surcharge, and agreed with the earlier statement concerning inequities in the current fare structure. They thought that it was unfair to charge less for Penn Station riders, and one of the individuals pointed out that the East Side is closer to Long Island and should logically have a lower fare than Penn Station.

Non-Work Travel Impacts of Service to Grand Central

Only three of the non-rider focus group participants ever use the LIRR for non-work travel. One uses the LIRR occasionally on weekends, another rides the railroad with his family during the holiday season; while a third uses the LIRR to get to events at Madison Square Garden. The participants unanimously agreed that service to Grand Central would have absolutely no impact on their use of the LIRR for non-work trips.

Worthiness of the Investment in Service to Grand Central

Several group members agreed that it made sense to increase the LIRR's passenger capacity, commenting on the tremendous rate of office space construction on the East Side. At least one person thought that there were better investments for the railroad:

> "Get rid of the grade crossings...I can live without this thing [Grand Central], it's not going to bother me...[take care of] the grade crossing problems."

When asked how the project should be funded, one respondent suggested that the state trade in Westway funds. While most other group members reserved judgment, at least one former LIRR rider strongly supported some general funding mechanism that did not place the burden solely on users of the new Grand Central service.

> "The way MTA funds have been used in the past, and I'm going to put this very charitably, hasn't been to the best advantage of the public. And then to say, because they've wasted that money one way or another, [to] come back to the consumer and say to us hey, you [the consumer] are going to subsidize this [new service] because of what we've done for you, Mr. Consumer...that isn't right."

ON-BOARD/PLATFORM OPEN ENDED INTERVIEW RESULTS

The on-board and platform interviews generally supported the results of the focus groups, and provided additional support for the critical effect of destination location on terminal choice. Overwhelmingly, individuals making a trip to locations on the East Side stated that they would prefer to travel through Grand Central Station, while lower Manhattan and West Side riders would prefer to continue using their current terminal. Exceptions to this general rule are Hunterspoint Avenue commuters, who appear to be highly sensitive to the specific characteristics of the new Grand Central service and for a variety of reasons appear to prefer their current commuting route.

In the following three subsections we discuss the likely impacts of Grand Central service on existing riders classified by their current LIRR terminal. The final subsection presents some general results and attitudes concerning the proposed service that appeared largely independent of current terminal choices.

Current Penn Station Travelers

Sixteen Penn Station commuters were interviewed on peak period trains between Penn Station and Jamaica; another 6 commuters were interviewed on peak period Port Washington trains between Penn Station and Great Neck. The vast majority of these respondents were regular commuters. On offpeak trains, a total of 32 persons were interviewed between Penn Station and either Jamaica or Great Neck. Of the peak riders, 10 (out of 22) said that they would have traveled through Grand Central had that service been available; roughly 15 out of 32 offpeak travelers would have traveled through Grand Central.

The vast majority of individuals who would change terminals would do so because of increased convenience to their destination. All but three of the "switchers" were traveling to an East Side destination, with the vast majority of destinations between 3rd and 5th Avenues and between 40th and 57th streets. One individual was traveling further uptown on the East Side (96th and Lexington), while the three West Side travelers included one destined for 6th Avenue and 48th Street; both of these destinations would be well served by Grand Central LIRR service and appear to represent rational choices by the interview respondents. The other two West Side travelers who said they would switch to Grand Central were destined for 8th Avenue and 57th Street and for Broadway and West 70th Street; both of these offpeak travelers, who appear to be making somewhat irrational decisions in changing destination terminals, said that they would walk from Grand Central to their final destination.

Of the individuals who stated that they would continue to use Penn Station for their LIRR travel, almost all were clearly destined for West Side or Lower Manhattan destinations, with a few exceptions. One commuter destined for 5th Avenue and 52nd Street said that she might switch terminals, but admitted that she didn't really know which one was more convenient for her. An individual commuting to 6th Avenue at 46th Street said that he would not switch unless the Grand Central service consisted of an express train with a running time comparable to that he currently experiences. A commuter to 5th Avenue and 52nd Street said that she would continue to travel through Penn Station because the E train from Penn Station let her off inside her office building, thereby resulting in a more convenient trip than that which would be available through Grand Central. Of the offpeak travelers only one appeared to be making an illogical terminal choice; he was destined for 6th Avenue and 45th, and might have reduced his egress time by switching terminals. This individual also admitted, however, that he did not really know which of the two Manhattan terminals was more convenient to his destination.

Approximately 7 out of 22 peak period riders and 6 out of the 32 offpeak riders said that service to Grand Central might encourage them to make additional offpeak trips using the LIRR. While many of these individuals declined to estimate the number of additional trips, the average seemed to be between 1 and 1-1/2 additional trips per month.

Of those persons willing to shift to Grand Central, a great many were willing to pay extra for the service. Eight out of twelve commuters were willing to pay a surcharge, with three willing to pay an additional $5.00 per month, one willing to pay an additional $10.00 per month, three willing to pay $20.00 per month, and one willing to pay as much as $36.00 per month ($1.80 per day) extra. Of the four who refused to pay a surcharge, three were adamantly opposed to the notion that Grand Central

riders should be expected to pay more than Penn Station riders. Two of the four pointed out (as was done in the focus groups) that Grand Central is closer to Long Island, and, if anything, should be a less expensive trip.

Current Flatbush Travelers

A total of thirteen interviews were conducted with travelers to or from Flatbush Avenue, two in the peak period and eleven on offpeak trains. Two of the offpeak travelers were regular commuters traveling off of their regular schedule, so a total of four interviews were conducted with regular commuters.

Of the thirteen respondents, five were headed for Brooklyn destinations, with all but one of the rest (including the four commuters) destined for Wall Street or other lower Manhattan destinations. Only one of these individuals (an offpeak traveler destined for the Waldorf Astoria) would have traveled to Grand Central for their current trip, although several others said that they might use the service for other trips that they make. One of the four commuters normally travels into Manhattan via Flatbush and returns home through Penn Station. He refuses to travel through Flatbush at night, and said that he might consider switching to Grand Central for his return trip if the service were convenient.

One peak rider and four offpeak riders said that they might use the railroad more often as a result of the institution of service to Grand Central, and two of these people said that they would be willing to pay an additional $0.50 or $1.00 for trips to Grand Central. Several other respondents were strongly opposed to a fare differential. One said it was unfair given that Grand Central is only eight blocks from Penn, and another said that the railroad charges too much already. Two of the offpeak riders mentioned that they would find connections at Grand Central to AMTRAK and the Metro North very convenient, particularly for some of their weekend trips.

Of those individuals who were not interested in service, one was strongly opposed to the project, saying that the service would not be utilized sufficiently to justify its cost, and that it would serve only a small "special interest" group. Another stated that in spite of her lack of interest that it would be a worthwhile service to provide.

Current Hunterspoint Travelers

Interviews were conducted with a total of five regular Hunterspoint Avenue commuters. Three of these were conducted on peak period trains into Hunterspoint, while the other two were conducted on trains leaving from Penn Station. Four out of the five had workplaces in Midtown Manhattan, at 3rd Avenue and 51st

Street, 6th Avenue and 51st Street (Rockefeller Center), 3rd Avenue and 39th Street, and right at Grand Central Station. The last two of these individuals stated that they would definitely use the Grand Central service 100 percent of the time, even if there was a $1.00 per trip surcharge.

The other two respondents said that their use of Grand Central would depend on specific characteristics of the service. One of these persons said, "If it [the Grand Central service] comes out to the same price and the same time, I'll use it." Therefore, he was willing to pay an extra $0.90 per trip (his savings from not transferring to the subway) for the service. The Rockefeller Center commuter (who commutes from Port Jefferson) agreed that Grand Central would be a more convenient terminal location than either Hunterspoint or Penn Station, but did not think he would use the service if the fare were different or if a transfer at Jamaica were required. Additionally, he said that congestion on the new service might prompt him to continue using the Hunterspoint service. Both of these individuals commented on the relatively comfortable conditions on the diesel cars between Jamaica and Hunterspoint when compared to the severe crowding on trains into Penn Station.

One of the five Hunterspoint commuters works at Hunterspoint Avenue in Queens, and would therefore be unlikely to use the Grand Central service. This respondent stated, however, that she was seeking a new job and was currently confining her search to the immediate Penn Station area. If direct service were available to Grand Central, she stated that she would be able to consider a much wider variety of job options.

General Comments Concerning Grand Central

Comments received in the on-board and platform interviews generally confirmed the response of the focus group participants with respect to the relative preferences for Penn and Grand Central stations. A significant number of respondents were unfamiliar with Grand Central and declined to comment or considered the two terminals as being about the same in most respects. The remainder generally preferred Grand Central, citing the East Side terminal as being cleaner, nicer, more spacious, and less crowded. Other individuals commented that Grand Central was "more romantic" and had better food than Penn Station. One woman commented that Grand Central did not have "dirty bums" like those she was used to seeing at Penn Station. Very few persons thought that Grand Central was significantly safer than Penn Station. Two individuals preferred Penn Station to Grand Central, one on the grounds that Penn Station was safer, and the other because of excessive peak period crowding at Grand Central.

Straw Poll Results

A straw poll was conducted with riders to each of the three LIRR terminals to estimate the rough proportion who would consider diverting their trips to Grand Central. The straw polls for the Penn Station and Flatbush terminals were conducted on trains traveling between Jamaica and the two terminals; the Hunterspoint poll was conducted with LIRR riders as they walked to make a connection to the #7 Flushing line.

Of 63 Penn Station travelers, 26 (35.6 percent) said that they would have traveled to Grand Central had service been available. Only 2 out of 69 Manhattan-bound Flatbush commuters who participated in the straw poll said that they would have used Grand Central for their commuting trip. This is a much lower level of interest than that indicated by the network equilibrium forecast of diversion from Flatbush to Grand Central, and was probably due at least in part to the manner in which the straw poll was conducted. In contrast, 24 out of 41 Hunterspoint commuters said that they would prefer to take the LIRR directly into Grand Central Station, although a significant number stated that a final decision would have to be based on the specific schedule and service characteristics.

Factors Influencing Use of Grand Central

As stated earlier, the overwhelming majority of riders interviewed in the on-board and platform interviews based their decision on using Grand Central on the location of their Manhattan destination. Congestion, transfers at Jamaica, fare, travel time, and frequency of service were each considered very important to some riders, but unimportant to others. Transfers at Jamaica appeared to have the most dramatic effect on the likely use of Grand Central service for a major segment of riders. Those riders who currently transfer believe that avoiding one would significantly improve their commuting trip; those who do not currently transfer believe that imposition of a transfer would be a major nuisance.

Fare and travel time were two consistently important factors cited by many of the respondents. Frequency of service, though important to many riders, did not appear to be a significant determinant of demand. For the most part, riders thought that the proposed service frequencies of one direct peak train with a variety of other available connections were sufficient to meet their service requirements. Only a few thought these frequencies insufficient, and most of the concern centered upon the need to transfer at Jamaica if the schedule of the direct train could not be accommodated. The importance of frequency seemed greater to riders on lines that currently have more frequent service, as might be expected. It could be expected that these riders will naturally receive more frequent service to Grand Central as well,

so that the expectations of riders on all lines may be met to a roughly equal extent.

Congestion on LIRR trains seemed to be relatively unimportant, except as it was associated with the loss of a seat when changing trains at Jamaica. Current Hunterspoint riders have a clear appreciation for the low level of crowding they experience west of Jamaica, but few other riders seemed to treat crowding as a major consideration. Similarly, congestion and crowding on connecting subway lines was relatively widely accepted as a fact of life, and does not appear to be a major consideration in riders' attitudes towards service to Grand Central.

Miscellaneous Comments

One on-board interview was conducted with a Long Island businessman who felt that the most significant impacts of the new service would be business related. He believes that many Midtown businesses with clients located on Long Island have problems scheduling and traveling to and from meetings, and that direct LIRR service to Grand Central will greatly facilitate this process. His own business, and several others of which he is aware, was founded on Long Island specifically to serve Long Island corporate clients who were not being well-served by companies located on the East Side. He thought that this effect would be most noticeable in the advertising industry, in which a large number of firms are located on Madison Avenue.

CONCLUSIONS FROM THE QUALITATIVE RESEARCH

Based on the qualitative research, there is considerable interest in LIRR service to Grand Central Station on the part of current LIRR riders. The interviews that were conducted strongly support the proposition that the location of the Manhattan trip terminus, along with the fare and service characteristics associated with East Side Access, will be the principal determinants of the size of the Grand Central market. Direct service is highly valued, particularly by peak riders. Among users of the three existing LIRR terminals, the level of interest in service to Grand Central was greatest at Hunterspoint Avenue, slightly lower at Pennsylvania Station, and lowest at Flatbush Avenue, a conclusion later validated in both the quantitative research and the application of demand forecasting models.

4. REGIONAL IMPACTS OF EAST SIDE ACCESS

Among the possible impacts of the introduction of East Side Access to the LIRR system is greater pressure for development of both residential and business property on Long Island. To investigate these impacts, in-depth interviews were conducted with individuals who are involved with planning and development on Long Island in both the public and private sectors. In addition, a clipboard survey was conducted with Midtown Manhattan employees to discover whether or not East Side Access might affect their housing decisions. This chapter of the report summarizes the results of this research. The first section presents conclusions from the in-depth interviews; the second section describes the clipboard survey results.

ASSESSMENT OF REGIONAL IMPACTS OF EAST SIDE ACCESS

In-depth interviews were conducted with the following individuals as part of the East Side Access Study:

Lee Koppleman, Suffolk County Planning Board
Jeff Zupan, Director of Development Planning, NJ Transit
Boris Pushkarev, Regional Plan Association
Arthur Kunz, Suffolk County Planning Commission
Wilbur Breslin, Breslin Realty
Lorne Birch, Hempstead Planning & Economic Development Department
Ray Fedelem, Long Island Regional Planning Board
Fred Bender, Economic Development Office of Suffolk County

The general consensus of these experts was that East Side Access would have large benefits to travelers to Manhattan, but a relatively small impact on regional development and Long Island as a whole.

It was thought by all persons interviewed that service to Grand Central would have beneficial impacts for current commuters to Manhattan, particularly those working on the East Side. Current LIRR riders working on the East Side would experience a reduction in egress time and many would avoid the need for subway or bus transfers from Penn or Hunterspoint. Rail riders destined for other areas of New York City would experience reduced congestion on trains destined for the other LIRR terminals. Several of the

individuals who were interviewed noted that existing travel patterns demonstrate the need for East Side access, because of the high cost and inconvenience that travelers to the East Side were currently willing to incur. Additionally, it was noted that existing auto travel patterns clearly indicate the need for improved transit access to the East Side. One person described the Manhattan employment "center of gravity" as being located just northeast of 42nd Street and Fifth Avenue, in the area that would be best served by Grand Central.

In terms of the overall impact on Long Island Rail Road riders, however, most of those interviewed thought that the impact of LIRR service to Grand Central would be relatively small, particularly when compared with the potential impacts of other capital improvements that are currently underway or under serious consideration. These other improvements include electrification of the Main Line to Ronkonkoma and operational improvements at Jamaica, each of which would result in major reductions in travel time to Manhattan and potential increases in capacity as well. By contrast, most of the experts believed that service to Grand Central offers a relatively limited benefit for a small subset of commuters.

Many of those interviewed emphasized the relatively low (and decreasing) reliance of the Nassau and Suffolk County economies on Manhattan. Only one-third of the Nassau County labor force and less than 15 percent of the Suffolk County labor force are employed in Manhattan, and these percentages have been and will continue to drop. In addition, Nassau and Suffolk Counties are experiencing a labor shortage, and are seeking to import labor from Queens, Brooklyn, and Manhattan. Therefore, the importance of access to Manhattan is declining somewhat, while increased accessibility to and within Long Island, particularly with respect to reverse commuters, is becoming a more predominant concern. As a result, access to Grand Central was perceived to be of limited importance.

Nassau County, particularly those portions that are within the LIRR commuter territory, is essentially saturated, with limited room for growth in either the residential or business/industrial sectors. Most development is limited in-filling of already developed areas. The only significant subdivisions currently being developed in Nassau County are in the northeast portion of the county, in the Oyster Bay area, where LIRR service improvements are likely to have the smallest impact due to the limited service that is currently provided.

Suffolk County has room for additional development, but most residential development is limited in size and density by zoning restrictions, and most commercial/business development is locally oriented and independent of the Manhattan economy. As a result, there is little opportunity for East Side Access to bring about any significant development impacts in Long Island.

Additionally, the real estate market is and has for several years been very strong in Nassau and Suffolk counties, with rapid increases in real estate values. As a result, additional premiums that may accrue to Long Island property as a result of increased accessibility to Manhattan were considered by most of those interviewed to be relatively insignificant. Had the new service to Grand Central been introduced five years ago, when the real estate market was relatively slow, the impact would have been far greater.

Minor impacts that were mentioned by various individuals included potential impacts on other regions of the New York metropolitan area. Most of these were acknowledged to be of secondary or, in some cases, minimal importance. Currently, New Jersey residents are helping to support the growth in Manhattan employment. The increased accessibility of the East Side to Long Island, according to one individual, might shift some of this growth to Long Island, thereby having a marginal impact on growth in travel between New Jersey and Manhattan.

CLIPBOARD SURVEY RESULTS

One potential impact of East Side Access is an increase in the demand for residential housing on Long Island as a result of increased accessibility to Midtown Manhattan. To supplement the in-depth interviews described above, a brief "clipboard" survey was conducted with 400 individuals in Midtown Manhattan to determine whether East Side Access might have any effect on their housing location choice. Individuals who currently work or pursue other activities in the Midtown area are most likely to be affected by service to Grand Central, so these individuals were expected to react more positively to the new service than individuals who do not currently pursue activities in Manhattan.

Almost half of those interviewed (49.0 percent) had reached Manhattan by subway, with most of the rest traveling into the city by express bus (14.3 percent), NJ Transit (9.7 percent), or Metro North Commuter Rail (7.5 percent). Other modes that were used included local bus (6.3 percent), walk (5.8 percent), and automobile (5.1 percent). (Note that some of these individuals were residents of Manhattan and could therefore reach Midtown on foot or using local buses.) Over 80 percent of those interviewed were employed in Midtown Manhattan; the remainder were in Midtown for some other purpose.

Survey respondents were asked two questions to obtain an indication of possible impacts of East Side Access on their interest in moving to residential locations in Long Island. First, they were asked if they were very, somewhat, or not likely

to move to Long Island in the next few years. The vast majority (83.7 percent) were not likely to do so, with 3.2 percent very likely and 13.1 percent somewhat likely.

Next, respondents were told about the introduction of LIRR service to Grand Central, and asked whether or not this new service would make them more likely to consider moving to a residence on Long Island than they are now. Overall, 80.3 percent said No, while 6.1 percent and 13.6 percent said Yes and Maybe, respectively. However, many of those who said that East Side Access would have have an impact were those who said earlier that they were likely to move to Long Island in any case. Among those who were very or somewhat likely to move to Long Island, 28.4 percent said that East Side Access would make them more likely to consider moving to Long Island. Among those who were not likely to move to Long Island, only 1.7 percent would change their likelihood as a result of East Side Access. Based upon this limited survey it appears that East Side Access will not result in any substantial increase in housing demand in Long Island.

5. LIRR RIDER SURVEY RESULTS

This chapter presents the results of the on-board survey of 1,907 LIRR riders that was conducted as part of the East Side Access Study. This chapter is organized in three sections. The first section describes the characteristics of survey respondents and the trips they make. The second section describes the interest of riders in LIRR service to Grand Central Station. The third and final section describes the demographic characteristics of survey respondents.

The on-board survey also included a series of trade-off exercises intended to measure LIRR riders' preferences for various characteristics of LIRR service including destination terminal. The results and analysis of these data are presented in Chapter 7 of this report.

For the most part, results in this chapter are presented for three key segments. The first segment consists of AM peak riders on all branches except the Port Washington line. These riders are referred to as "peak main line branch riders" throughout this chapter. The second segment consists of peak Port Washington line riders. These riders, as described in Chapter 2, answered a somewhat different questionnaire than riders on the other lines, principally because questions and trade-offs relating to the Jamaica transfer were irrelevant to this group. The third segment discussed frequently in this chapter consists of offpeak riders on all lines except the Port Washington line (referred to as "offpeak main line riders"). Insufficient offpeak Port Washington line riders were surveyed to justify separate analysis for this group. Appendix A to this report presents complete tabulations of the on-board survey for these three rider segments. Where appropriate, other segmentations of riders are used to highlight important findings.

GENERAL CHARACTERISTICS OF SURVEY RESPONDENTS

The on-board survey sample included a total of 1907 respondents, 1622 on the main line branches (including 1272 peak and 350 offpeak), and 285 on the Port Washington line (including 271 peak and 14 offpeak). The sample included riders from 109 LIRR stations, with Hicksville and Babylon stations having the highest representation at 112 and 100 riders, respectively.

Most riders access LIRR stations by car, particularly on the main line branches. As shown in Figure 5-1, 54 percent of peak riders on these branches drive and park at the LIRR station; another 8.5 percent drive and park on street. About 17 percent walk to the station, another 17 percent are dropped off by car. On the Port Washington line, station and on-street parking are used by 17.9 and 16.4 percent of riders, respectively, while 32.1 percent of peak riders walked and another 25 percent are dropped off. This greater reliance on non-auto access modes reflects the relatively high residential density at each station and the relatively severe parking constraints that exist along the Port Washington line. Mean access time to the station was about 9 minutes.

Of main line passengers, 28 percent change trains at Jamaica. In the peak only 23 percent change trains at Jamaica, compared to almost 46 percent in the offpeak. The vast majority of survey respondents were seated during their trip; 91.4 percent of peak riders on the main line were seated east of Jamaica, while 90.9 percent were seated west of Jamaica. Almost 98 percent of offpeak riders were seated throughout their trip. On the Port Washington line, 92.6 percent of peak riders were seated.

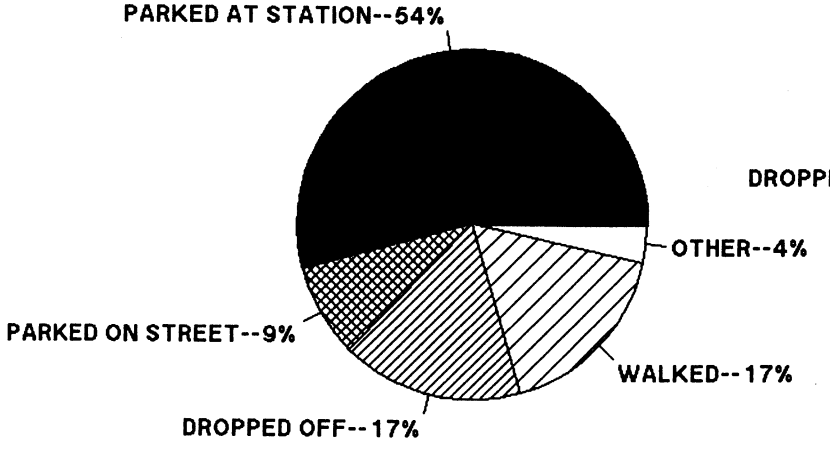
Penn Station was the predominant destination of riders surveyed during both the peak and offpeak. (Note that since the on-board survey was stratified by destination terminal, this distribution of the sample reflects the sampling plan, and not the distribution of riders). Over 60 percent of peak main line riders were destined for Penn, while another 24.8 percent and 13.2 percent were destined for Hunterspoint and Flatbush, respectively. As expected, virtually all (99.3 percent) of peak Port Washington riders were destined for Penn. Penn Station also dominated offpeak rider destinations, with 84.0 percent compared to 14.0 percent for Flatbush.

Penn Station appears to be used predominantly by regular riders, while Flatbush and Hunterspoint attract more occasional riders. Five out of eight (62.5 percent) of main line branch survey respondents who report using Penn Station for <u>some</u> of their trips use it for <u>100 percent</u> of their trips, compared to only 28.5 percent at Flatbush and 33.9 percent at Hunterspoint.

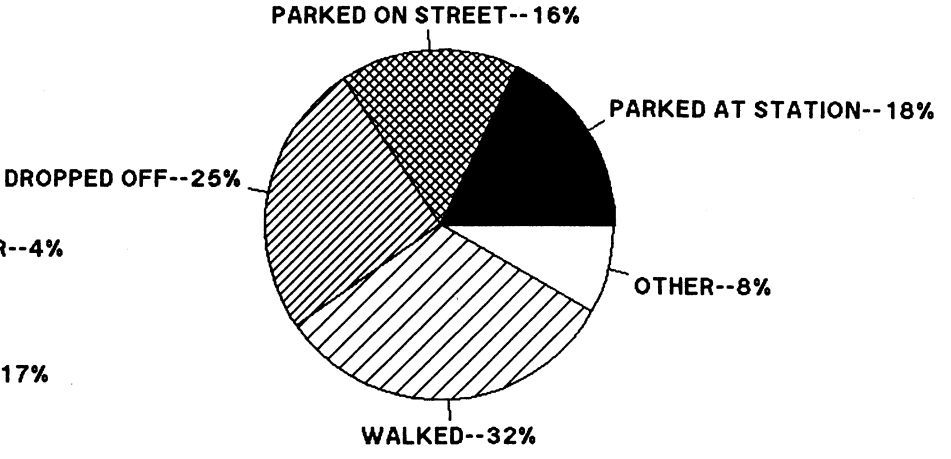
To get a better understanding of terminal choice behavior, LIRR riders were asked how they make their trip if their current destination LIRR station were closed. The results are shown in Figure 5-2. Most current peak main line riders to Penn would continue to travel via LIRR; 35.8 percent said they would travel via Hunterspoint, 22.9 percent via Flatbush, 6.5 percent via Woodside, and 4.5 percent via some other station. Twenty percent would make their trips by some mode other than the LIRR; 13.9 percent by auto, 3.8 percent by subway or bus, and 2.3 percent by express bus. The remaining 10.2 percent of peak main line Penn riders said they would not have made their trip had their

FIGURE 5-1

PEAK PERIOD ACCESS MODE OF LIRR RIDERS



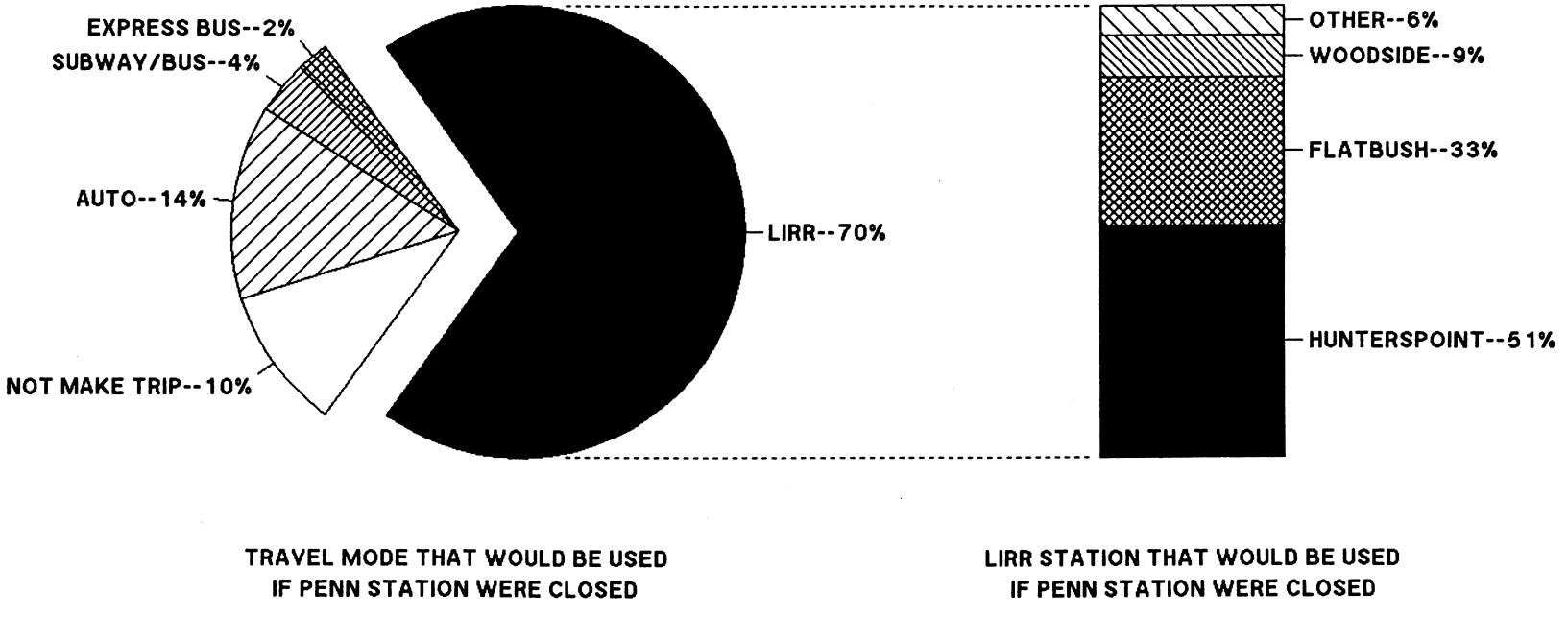
MAIN LINE BRANCHES



PORT WASHINGTON LINE

FIGURE 5-2

HOW PEAK PERIOD PENN STATION COMMUTERS WOULD MAKE THEIR TRIPS IF PENN STATION WERE CLOSED (MAIN LINE BRANCHES)



TRAVEL MODE THAT WOULD BE USED IF PENN STATION WERE CLOSED

LIRR STATION THAT WOULD BE USED IF PENN STATION WERE CLOSED

destination station been closed. Over three quarters of peak main line riders currently using other LIRR terminals would use the Penn Station terminal if their current terminal were closed; only 6.2 percent and 11.8 percent of Hunterspoint and Flatbush riders, respectively, would switch to a different mode of travel; 0.7 percent and 4.3 percent of Hunterspoint and Flatbush riders, respectively, would not have made their trip.

The AM peak results for this question were very different for riders on the Port Washington line who, of course, have direct access only to the Penn Station terminal. Only 26.9 percent of these riders would be retained by the LIRR (compared to 69.7 percent of AM peak main line branch riders), most of whom would use Woodside as the terminus of their LIRR trip. Exactly two thirds of those surveyed on the Port Washington line would switch to other travel modes: 28.2 percent to auto, 19.7 percent to subway or bus, and 18.8 percent to express bus. The remaining 6.4 percent said that they would not have made their trip.

Among offpeak riders, one fourth of those destined for Penn would not make their trip if Penn Station were closed. Another 26.7 percent would use other LIRR terminal points, while 46.7 percent would switch to other modes.

Average travel time for LIRR main line riders was 67.0 minutes, with slightly longer mean travel time in the peak than in the offpeak (68.6 minutes versus 60.5 minutes, respectively), reflecting the differences in travel patterns between the peak and offpeak. As would be expected, average travel time on the Port Washington line was significantly shorter at about 38 minutes.

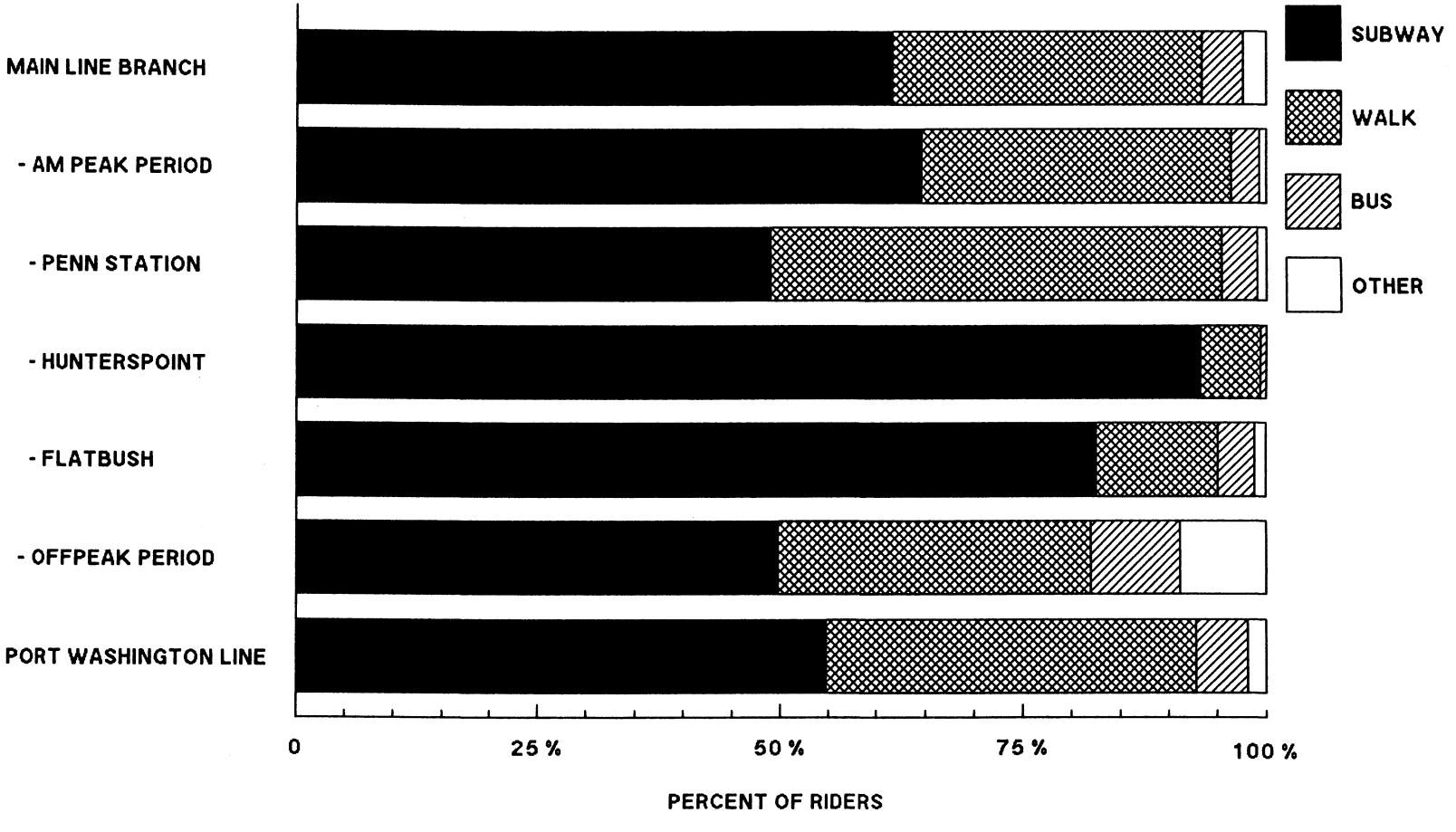
Riders were asked to identify their mode of egress from their LIRR terminal to their final destination. While the questionnaire (and the tabulations in Appendix A) allowed multiple responses, we also derived a distribution of principal egress mode, with the results shown in Figure 5-3. Over 60 percent of LIRR main line riders reported using the subway as an egress mode, with an average subway ride of 14.9 minutes. Percent reaching their final destination via subway varied from 64.6 percent in the peak down to 49.7 percent in the offpeak. The proportion of riders using subway egress varied widely by LIRR terminal; subway egress was used by 48.9 percent of peak Penn Station commuters, 93.3 percent of peak Hunterspoint commuters, and 82.5 percent of peak Flatbush commuters. On the Port Washington line, 54.5 percent of peak riders reported using subway egress.

Bus egress was reported by only 2.8 percent and 9.3 percent of peak and offpeak main line branch riders, respectively. Bus egress was also reported by 5.3 percent of Port Washington line riders.

Walk egress was reported by 31.9 percent and 32.2 percent of peak and offpeak main line riders, respectively. As expected, walk

FIGURE 5-3

EGRESS MODES FOR CURRENT LIRR RIDERS



egress was much more common at Penn Station (46.6 percent of peak main line riders) than at Hunterspoint (6.1 percent) or Flatbush (12.7 percent). Walk was the principal egress mode for 38.1 percent of Port Washington line riders.

Egress modes other than subway, bus, and walk were significant only in the offpeak at Penn Station, where 10.1 percent of riders reported using other egress modes (principally taxicabs).

For those reaching their final destination by subway, the subway line used varied principally due to the destination LIRR terminal. Overall, the Flushing, Seventh Avenue, and Eighth Avenue subway lines were identified most often by main line riders, mentioned by 30.3, 28.8, and 20.6 percent of subway riders, respectively. The Lexington Avenue lines were mentioned by 13.8 percent, with the Broadway and Sixth Avenue lines mentioned by 5.5 and 5.3 percent, respectively. For Port Washington line riders, the Seventh and Eighth Avenue subway lines were used most commonly for egress, mentioned by 46.2 percent and 32.5 percent of subway riders, respectively. The preponderance of these two subway lines results from the fact that nearly all Port Washington line riders terminate at Penn, while main line riders terminate at all three existing LIRR terminals which are collectively served by a greater variety of subway lines.

As expected, most LIRR riders were commuters. Ninety-three percent of peak main line riders and 85.8 percent of peak Port Washington line riders were commuters, with other work/business trips making up most of the remaining for both groups. In the offpeak, 34.1 percent of trips were work trips, with 25.9 percent of trips identified as "personal/visit with friends," 10.4 percent as "other," 9.8 percent as trips returning home, and 9.5 percent work/business trips.

Monthly tickets dominate the fare payment method used for trips reported in the survey; monthly tickets accounted for 89.7 percent and 36.6 percent of peak and offpeak main line trips, respectively. In the peak period, weekly tickets and one-way tickets accounted for the bulk of the remainder, with 5.0 and 3.8 percent, respectively. In the offpeak, one-way offpeak tickets were used for 32.6 percent of trips, while 16.9 percent of those surveyed reported using one-way peak tickets (this is probably a reporting error). On the Port Washington line, monthly tickets (80.9 percent) and one-way peak tickets (10.7 percent) once again were the principal fare payment options utilized by peak period riders.

Unweighted trip frequency for peak riders was 20.9 trips per month for the main line branches and 20.7 trips per month for the Port Washington line. Offpeak main line riders reported an unweighted mean trip frequency of 13.3 trips per month, reflecting the relatively high level of commuting travel that takes place on the LIRR during offpeak periods.

INTEREST IN GRAND CENTRAL

On-board survey respondents expressed a great deal of interest in LIRR service to Grand Central Station. Overall, 47.8 percent of main line branch survey respondents and 36.6 percent of Port Washington line survey respondents said that they definitely would have considered Grand Central service for their current trip. Interest was slightly higher in the peak than in the offpeak; 49.7 percent versus 40.3 percent for main line branch riders. Interest was also higher than average for riders currently using the Hunterspoint terminal, and lower than average for riders currently using Flatbush; of AM peak main line travelers, the percentages of interested riders were 87.0, 42.3, and 11.9 at Hunterspoint, Penn, and Flatbush, respectively. The ratings of interest for the various groups of respondents are shown in Figure 5-4.

When asked if they would consider Grand Central if the trip were longer, if it was more expensive, or if a change of trains was required, interest in Grand Central decreased by varying amounts. Interest among peak main line branch riders would be reduced from 49.7 percent to 42.9 percent if Grand Central service were to take five minutes longer; interest among Port Washington line riders would drop from 36.6 percent to 32.7 percent for this scenario. No significant variations in response were noted for riders classified by current terminal.

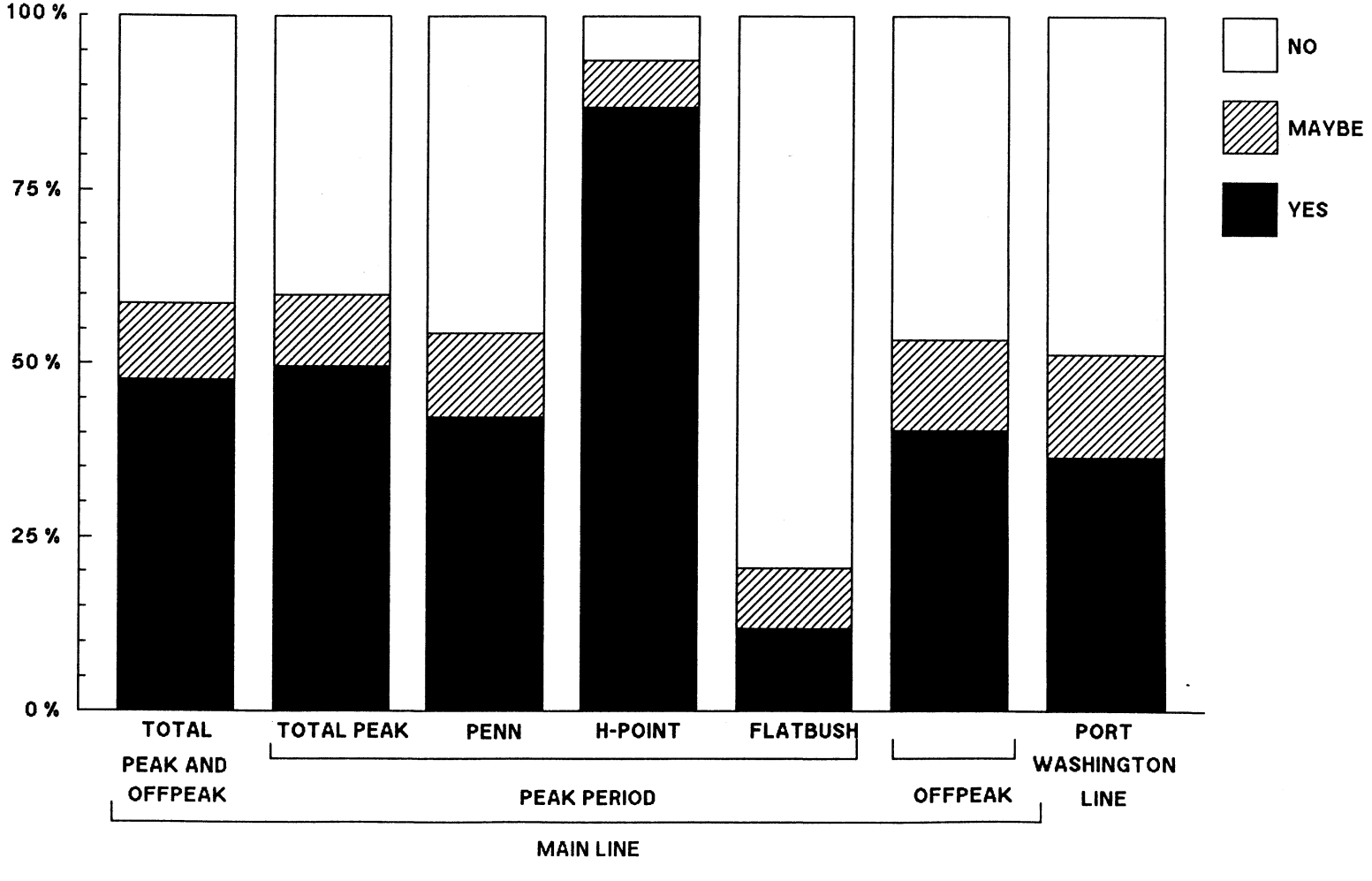
If a fare surcharge equivalent to the one-way subway fare were applied to the Grand Central service, on the grounds that many riders would avoid a subway transfer, interest among peak main line riders would be reduced to 22.2 percent, while interest among peak Port Washington line riders would drop to 17.4 percent. In this case, there was substantial variation by terminal, as might be expected. Interest among peak main line riders destined for Penn would drop by almost two thirds, from 42.3 percent to 15.9 percent. On the other hand, interest among those currently destined for Hunterspoint (most of whom already pay an additional 90 cents for a subway transfer) would drop by less than half, from 87.0 percent to 45.6 percent.

If a change of trains at Jamaica were required, the percentage of riders interested in service to Grand Central would drop from 49.7 percent to 21.3 percent. This lessening of interest would be less severe in the offpeak--from 40.4 percent to 26.5 percent. This is probably due to the higher percentage of offpeak riders who currently must transfer at Jamaica. As a result, the requirement of a Jamaica transfer to obtain service to Grand Central appears less onerous to this group.

Survey respondents were asked to compare Penn Station and Grand Central Station along several dimensions including cleanliness,

FIGURE 5-4

PERCENTAGE OF LIRR RIDERS WHO WOULD CONSIDER USING GRAND CENTRAL STATION



crowding, safety, attractiveness, the quality of the surrounding neighborhood, and the convenience and availability of subway connections. Overall, respondents preferred Grand Central to Penn Station, as shown in Figure 5-5. About half of main line branch and Port Washington branch riders thought Grand Central was more attractive and located in a better area than Penn Station, with only about ten percent favoring Penn Station on these characteristics. Riders also thought that Grand Central was cleaner, less crowded, and safer than Penn Station.

With respect to subway connections, opinions were mixed. Less than one of four (24.3 percent) main line branch riders thought that subway connections at Grand Central were superior to those at Penn; 24.0 percent thought the opposite, while 21.3 percent thought they were about the same. On the Port Washington line, riders preferred the subway connections at Penn, 32.0 percent to 19.5 percent.

Also of note was the relatively high percentage of riders who responded with "don't know," indicating a lack of familiarity with one or the other terminal. Between 30 and 40 percent of Penn riders were unfamiliar enough with Grand Central to make it impossible to compare the two; between 9 and 22 percent of Hunterspoint riders were unfamiliar enough with either Penn or Grand Central to make it impossible for them to compare.

Interestingly, current Hunterspoint riders had consistently higher opinions of Grand Central than riders at the other two terminals, as shown in Figure 5-6. The figure indicates the percentage of peak main line riders to each terminal rating Grand Central as preferred along each dimension. As indicated, the percent preferring Grand Central is consistently and significantly higher for Hunterspoint riders. The most notable differences are in safety ratings, where 41.3 percent of Hunterspoint riders preferred Grand Central to Penn (compared to only 16.6 percent of Penn Station riders), and in convenience of subway connections, where 49.6 percent of Hunterspoint riders preferred Grand Central (compared to only 18.1 percent of Penn Station riders). These higher ratings are generally due to the greater familiarity of Hunterspoint riders with Grand Central; far fewer "don't know" responses were recorded for Hunterspoint riders than for Penn Station riders.

Riders were asked to identify their likely egress mode if they were to travel via Grand Central. The results are shown in Figure 5-7. As before, the subway egress mode dominated all other egress modes with 50.9 percent of main line respondents and 52.4 percent of Port Washington line respondents. Of current peak main line branch riders, the percentage who would use subway egress was higher for current Penn Station users (47.3 percent) than for current Hunterspoint users (30.2 percent). This is not surprising, given the large number of current Hunterspoint riders destined for locations within easy walking distance of Grand Central.

FIGURE 5-5

LIRR RIDER COMPARISONS OF GRAND CENTRAL AND PENN STATION

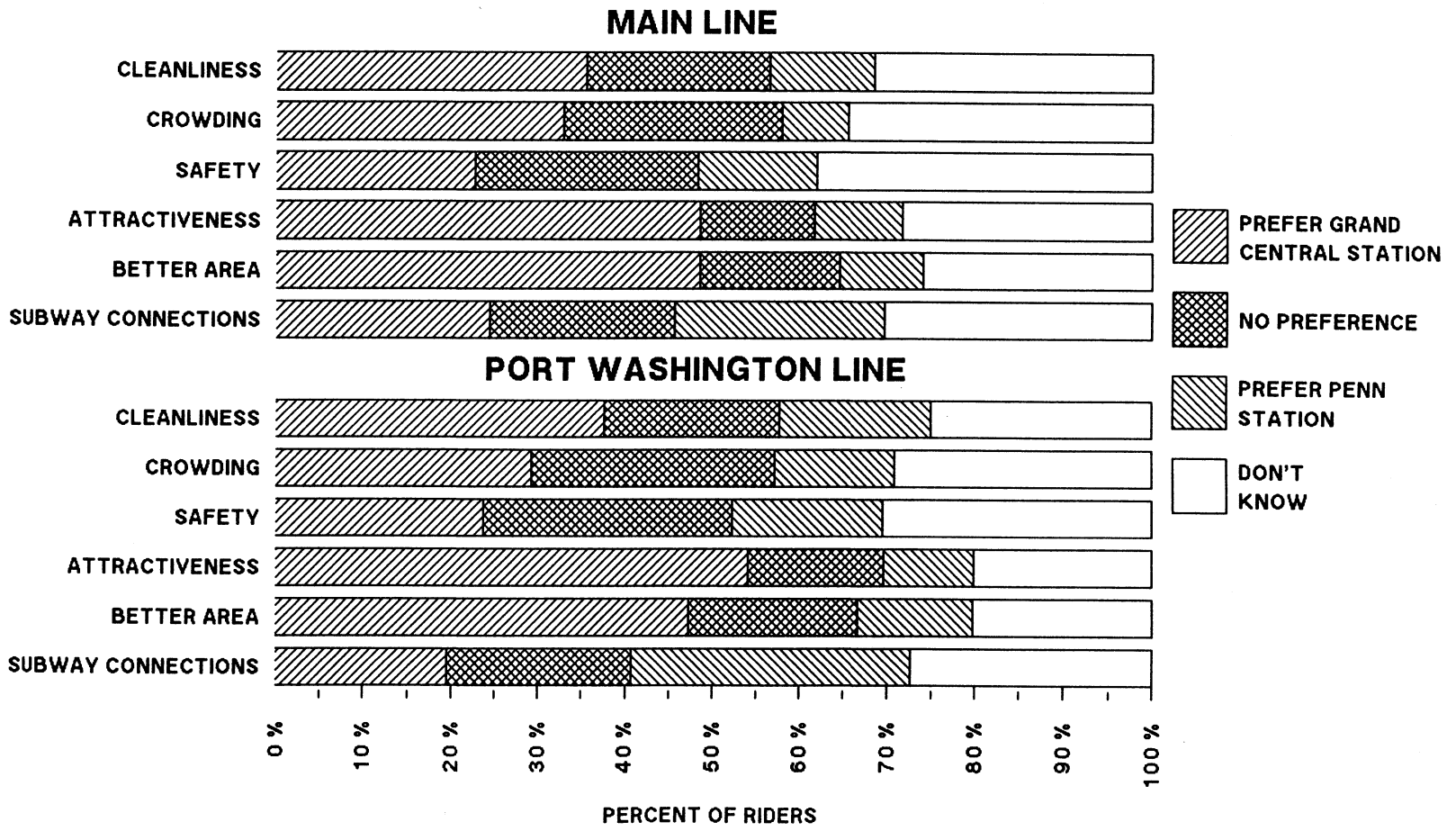


FIGURE 5-6

GRAND CENTRAL RATINGS BY CURRENT TERMINAL

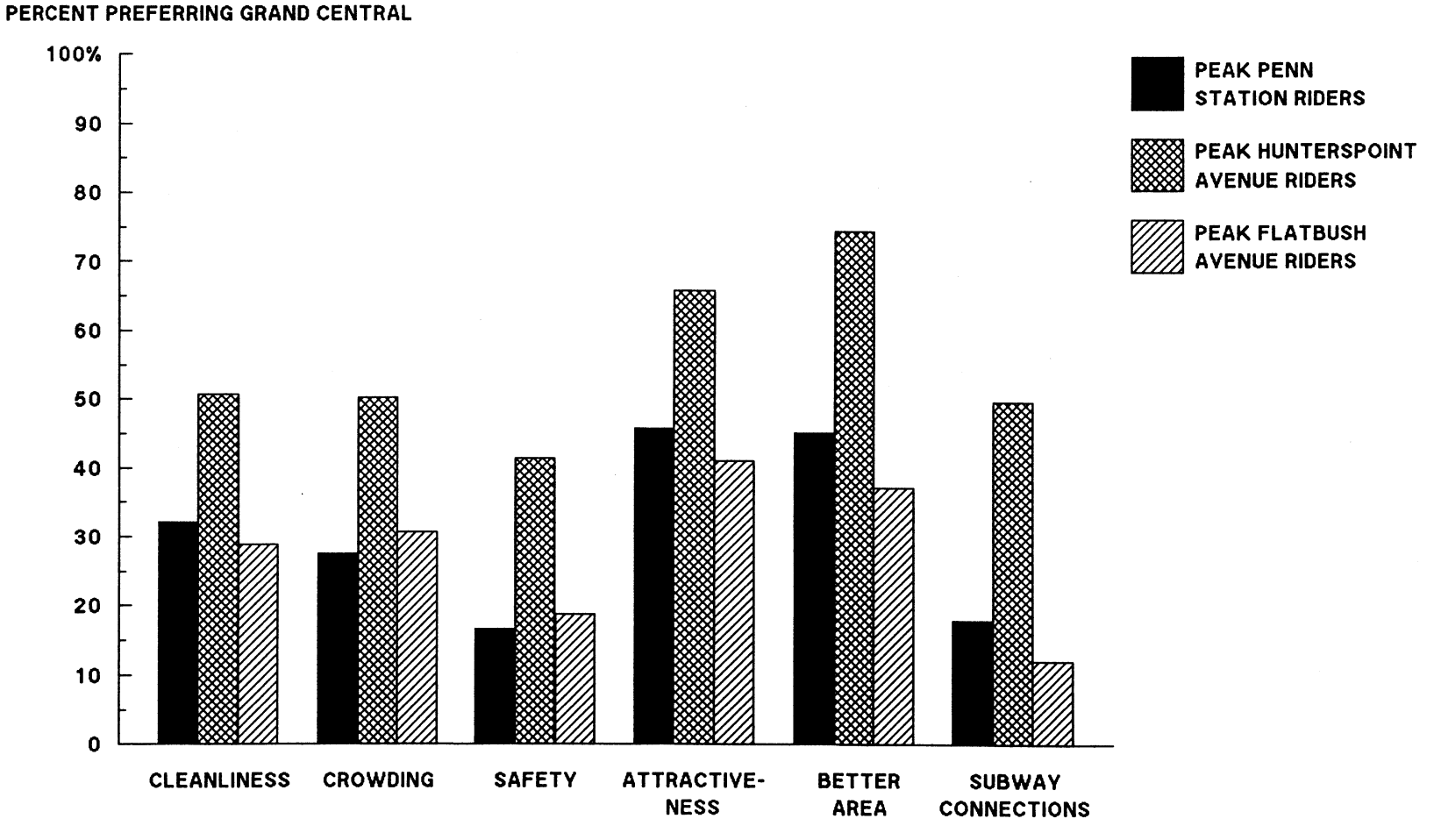
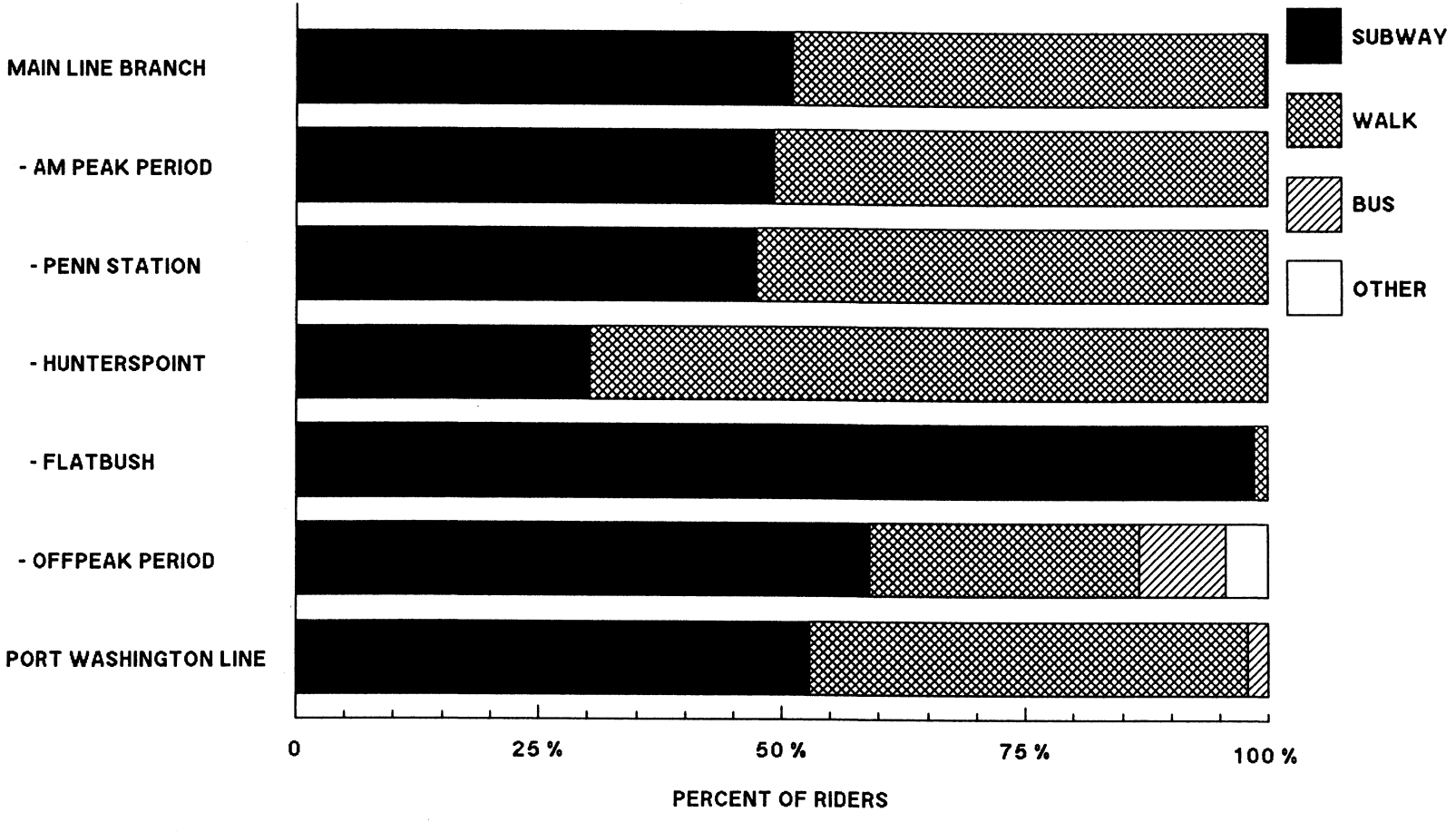


FIGURE 5-7

EGRESS MODE FROM GRAND CENTRAL STATION FOR CURRENT LIRR RIDERS



Walk was reported as the principal egress mode by 48.8 percent and 45.1 percent of main line and Port Washington line respondents. As expected, walk was the principal Grand Central egress mode for 72.6 percent of current Hunterspoint peak riders, compared to only 54.6 percent for current main line branch Penn Station riders. Bus egress was reported by only 4.0 percent and 5.2 percent of main line and Port Washington line riders, respectively.

Of those reporting that they would travel to their ultimate destination from Grand Central by subway, the Lexington Avenue lines were reported most frequently, as would be expected. These lines were mentioned by 47.4 percent of main line branch respondents, compared to 14.4 percent for the Flushing line. Well over half (56.8 percent) of Port Washington line respondents mentioned the Lexington Avenue subway, compared to 12.2 percent for the Times Square shuttle.

Current LIRR riders also expressed a willingness to make additional LIRR trips as a result of the introduction of service to Grand Central. Over one-third of peak riders (35.5 percent on the main line branches, 38.2 percent on the Port Washington line) said that if Grand Central service were available today, they would use the LIRR for some trips to Manhattan that they now make using other modes. Riders were asked to estimate the number of additional trip that they would make, but provided responses that appeared to be unreliable. For example, many current commuters said that they would increase the number of LIRR trips they make by 40 trips per month, indicating clearly that they did not correctly interpret the question. As a result, responses to this question were not used in the analysis.

Slightly over one-quarter of peak riders (25.6 percent on the main line branches, 27.9 percent on the Port Washington line) expressed a willingness to make new trips to Manhattan as a result of the Grand Central service. Once again, the estimates of the number of additional trips that would be made appeared unreliable and were not used.

Finally, only a small percentage of LIRR riders thought that ticket prices which varied by LIRR terminal would be fair. Of respondents in the main line sample, 25.4 percent said it would be fair to have different ticket prices for the terminals, while 32.0 percent said it might be fair and 42.7 percent said it would not be fair. Port Washington line riders seemed to object less strenuously; 30.0 percent said yes, 43.3 percent said maybe, and only 26.7 percent said no to this question.

DEMOGRAPHIC CHARACTERISTICS OF SURVEY RESPONDENTS

Table 5-1 summarizes the demographic characteristics of survey respondents for the main line branch and Port Washington branch

TABLE 5-1

DEMOGRAPHIC CHARACTERISTICS OF LIRR PASSENGERS

	Main Line Branches			Pt. Wash. Branch
	Total	Peak	Offpeak	Peak
Number of cars, vans, and light trucks available to household...	2.08	2.03	1.87	1.85
Percent with drivers' license...	94.1%	96.3%	85.3%	95.1%
Mean household size.....	3.33	3.35	3.23	3.00
Mean age.....	37.0	37.4	35.2	37.3
Percent Male.....	61.9%	64.4%	52.0%	63.1%
Percent Female.....	38.1%	35.6%	48.0%	36.9%
Income distribution:				
Up to $15,000 per year.....	2.5%	1.2%	7.8%	0.9%
$15,001 to $25,000 per year...	6.9%	6.0%	10.4%	3.6%
$25,001 to $35,000 per year...	11.3%	10.0%	16.4%	11.2%
$35,001 to $50,000 per year...	25.0%	25.0%	25.0%	17.9%
$50,001 to $75,000 per year...	28.2%	30.2%	20.1%	22.4%
$75,001 to $100,000 per year..	13.2%	14.1%	9.7%	13.9%
Over $100,000 per year.....	12.9%	13.5%	10.4%	30.0%

peak survey respondents and for main line branch offpeak survey respondents. As indicated in prior survey research, LIRR riders are predominantly male, have high levels of auto ownership and drivers licenses, and high household income levels compared to the typical transit user.

6. LIRR NON-RIDER SURVEY RESULTS

This chapter describes the results of surveys conducted with travelers from Long Island to Manhattan who do not use the LIRR to assess their interest in and likely response to the introduction of direct commuter rail service to Grand Central Station. The results presented in this chapter come from two surveys: the telephone survey of Long Island residents, and the survey of express bus riders.

The telephone and express bus surveys contained several questions intended to facilitate the development of multivariate models explaining travelers' likely response to East Side Access; the results and analysis of these data are described in Chapter 7 of this report.

For the most part, telephone survey results are discussed separately for two major segments of travelers--commuters to Manhattan, and non-commuters who nevertheless travel regularly to Manhattan. In addition, some of the results in this chapter pertain to travelers with specific modes of commutation. This chapter is organized in four sections. The first section describes the travel behavior of Long Island residents who commute to Manhattan. The second section describes the travel behavior of persons who do not commute to Manhattan, but make other trips to Manhattan on a regular basis. The third section describes the response of commuters and non-commuters to the introduction of LIRR service to Grand Central. The fourth and final section describes the demographic characteristics of telephone and express bus survey respondents.

COMMUTER TRAVEL BEHAVIOR

Over three-fifths (60.8 percent) of telephone survey respondents are daily commuters to Manhattan. Of these 243 individuals, the vast majority (56.8 percent) commute to Manhattan by subway 5 days per week or more. The second most frequently used mode was drive-alone auto, with 13.2 percent of commuters. Express bus was used by 4.9 percent of telephone survey respondents, with 2.9 percent and 1.6 percent commuting regularly by bus or in a carpool, respectively. A large proportion of commuters (17.7 percent) do not depend on a single mode but instead use several modes for their commuting trips. Return trips from Manhattan are

similarly distributed, as shown in Figure 6-1. Almost all of the express bus survey respondents are commuters; 89.0 percent commute on a daily or more frequent basis; another 6.6 percent commute four days per week.

Among automobile commuters, most cross the East river via the Queens Midtown tunnel (30.0 percent in the AM, 35.1 percent in the PM), the Queensboro Bridge (28.3 percent in the AM, 26.3 percent in the PM), and the Triboro Bridge (13.3 percent in the AM, 12.3 percent in the PM). Auto commuters pay an average of $8.47 per week for tolls and $18.06 per week for parking, and have an average one-way trip length of 22.9 miles.

Most subway commuters use the F train, the Flushing (#7) line, and the E train, with these lines mentioned by 25.7 percent, 21.8 percent, and 13.4 percent of subway commuters, respectively. Also frequently mentioned were the RR (6.7 percent), the A (5.0 percent), and the N and M trains (4.5 percent and 3.4 percent, respectively). Express bus and regular bus riders use a wide variety of bus companies and routes.

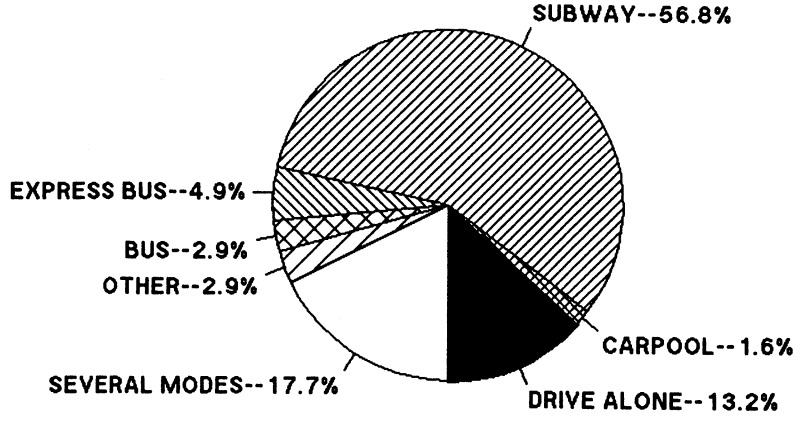
The average transit commuter in the telephone survey pays $3.05 to commute to and from work each day, with an average travel time of 56.4 minutes inbound and 62.1 minutes outbound. Express bus survey respondents report an average door-to-door travel time of 62.0 minutes.

Commuters were asked to explain why they elect not to use the LIRR for their commuting trips. Among telephone survey respondents the most common reason, mentioned by 34 percent of respondents, was that the LIRR station was too far from their home. Twenty percent said that the LIRR was too expensive, while another 17 percent said that the LIRR was "too far away," without specifying whether their home station was too far from their residence or whether the LIRR terminal was too far from their commuting destination. Other frequently mentioned reasons were that the railroad was inconvenient (9 percent) and that the subway was preferred (8 percent). Responses were similar in the express bus survey sample; the most common were that the LIRR station was too far from home (40 percent), the LIRR was too far from the destination (25 percent), and that the LIRR was inconvenient (19 percent). High cost and the need for additional connections were each cited as reasons for not using the LIRR by 9 percent of express bus riders.

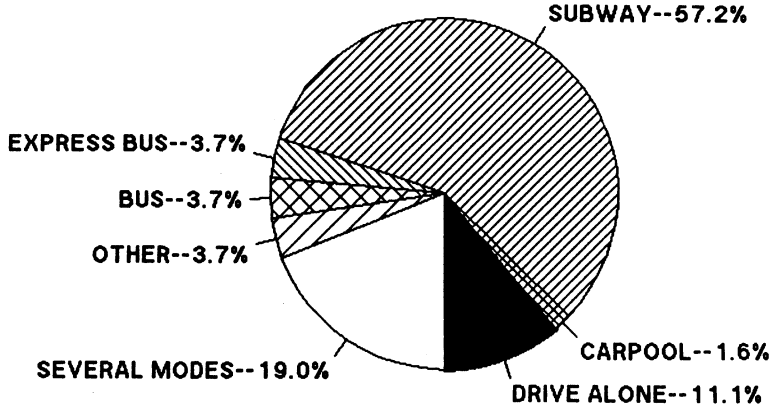
Commuters identified in the telephone survey were asked which station they would use if they were to use the LIRR for commutation. Woodside was mentioned most often, by 25 respondents. Forest Hills and Flushing were both mentioned by 20 respondents, and Bayside was mentioned by another ten. In the express bus sample, Bayside was the station mentioned most frequently (39 responses), followed by Flushing (23 mentions) and Forest Hills (12 mentions).

FIGURE 6-1

MODE OF COMMUTATION FOR NON-USERS OF THE LIRR



INBOUND



OUTBOUND

In the telephone survey sample, most respondents said that they would access the LIRR on foot (34.3 percent), with bus and auto access mentioned by 29.1 percent and 20.9 percent, respectively. Current express bus riders would be most likely to access the LIRR by bus (38.3 percent), with 32.0 percent and 12.5 percent specifying auto and walk access, respectively. Current auto commuters were much more likely than others to access the LIRR by car; 34.1 percent would access the LIRR by car, with another 34.1 percent accessing the LIRR on foot, and the remainder evenly split between bus and subway.

Most commuters (65.7 percent of the telephone sample and 68.0 percent of the express bus sample) would travel on the LIRR to Penn Station. Among telephone survey respondents, 8.7 percent and 7.0 percent specified the Hunterspoint and Flatbush terminals, respectively. In the express bus sample, 6.4 percent selected the Hunterspoint terminal while another 4.0 percent selected Woodside. Mean expected access time, LIRR travel time, and egress time were 14.9 minutes, 32.8 minutes, and 22.2 minutes, respectively, for the telephone survey; for the express bus sample these numbers were 15.5 minutes, 32.4 minutes, and 23.5 minutes, respectively.

Commuters were asked two questions concerning the impact of parking at railroad stations on their use of the LIRR. These questions were designed to assist in a separate research project, the LIRR Access Mode/Parking Demand Study. First, respondents were asked what percentage of their trips to Manhattan they would make via LIRR if free parking were available at their preferred station. The mean response was 16.3 percent, indicating a potentially significant mode shift. This high percentage probably results from the high proportion of respondents residing in Queens (discussed below), where very little station parking is currently available. When asked what proportion of their Manhattan trips they would make via LIRR if parking were available for $2.00 per day at their preferred station, the mean response was 9.4 percent.

Commuters were also asked the frequency of non-work trips into Manhattan and the likely impact of service to Grand Central on these other trips. Commuters made an average of 4.5 non-commuting trips per month into Manhattan. Slightly under 30 percent make no non-commuting trips into Manhattan, another 49 percent make between one and five trips per month. Almost half of these trips (46.3 percent) were made by automobile, while another 39.9 percent were made by subway. The LIRR was used for 8.1 percent of non-commuting trips, with only 3.5 percent made by bus. The most common reasons for not using the LIRR for these trips were that an automobile was preferred (11 percent), the LIRR station was too far from the home (10 percent) or "too far away" without specific reference to the home or the destination (9 percent). Another 9 percent thought that the LIRR was too expensive; 7 percent thought the LIRR was inconvenient to use.

NON-COMMUTER TRAVEL BEHAVIOR

Interviews were conducted with 157 individuals who do not commute to Manhattan, but nevertheless travel to Manhattan once per month or more for some other purpose. On the average, these travelers make 4.18 trips per month into Manhattan. Most travelers make fewer trips than this; 26.6 percent and 24.7 percent make an average of one or two trips to Manhattan each month, respectively. Only 22.1 percent reported making 5 or more trips per month into Manhattan. Most of these trips are made by automobile (46.6 percent) or by subway (37.0 percent); bus accounts for another 11.7 percent of these trips.

The two most common reasons for not using the LIRR for these trips were that an automobile is preferred (27 percent), and that the LIRR station is too far from the home (24 percent). Other frequently mentioned reasons were that the LIRR is too expensive (13 percent), there is no need to use the LIRR (10 percent), the subway was preferred (10 percent), the LIRR is inconvenient (10 percent), and that the LIRR is "too far away" from the home or the destination (9 percent).

Most respondents said that if they were to use the LIRR they would access the station by car (49.1 percent), with walk and bus access mentioned by 18.2 percent and 15.5 percent, respectively. Mean expected access time was 12.0 minutes.

When asked what percentage of their trips to Manhattan they would make via LIRR if free parking were available at their preferred station, the mean response was 20.3 percent, indicating a potentially significant mode shift. When asked what proportion of their Manhattan trips they would make via LIRR if parking were available for $2.00 per day at their preferred station, the mean response was 10.4 percent.

INTEREST IN GRAND CENTRAL

Commuters were asked if they would consider using the LIRR for commuting if service to Grand Central were available. Over one fourth of telephone survey respondents (27.6 percent) said yes; another 14.0 percent said maybe. In the express bus survey, 30.8 percent said yes, another 30.1 percent said maybe, indicating a somewhat higher level of interest for this group. Among auto commuters 33.5 percent responded affirmatively; among subway commuters 41.0 percent said yes.

Both the telephone and express bus surveys included five detailed questions that were intended for use primarily in the mode choice modeling exercise. These questions asked how likely (on a scale of 0 to 100) each commuter would be to use the LIRR's service to Grand Central under specific service and fare scenarios. The response to these questions are shown in Figure 6-2.

When travel time and fare were identical to that of the mode currently used, the mean response was 37.3 from the telephone survey, and 39.6 from the express bus survey. While these responses seem very high, it must be kept in mind that for most individuals the LIRR represents a more expensive, slower alternative than the currently selected mode of travel.

With travel time and cost the same as the currently selected mode, but with a required change of trains at Jamaica, the mean response dropped to 24.3 from the telephone survey and 10.9 from the express bus survey. The express bus riders are clearly more sensitive to the need to change trains at Jamaica, probably because they are accustomed to the convenience of direct service.

With service 15 minutes faster than the currently selected mode, but a cost of $1.00 more than the current mode, the mean response was 29.7 from the telephone survey and 23.2 from the express bus survey. Express bus survey respondents seem more sensitive to the fare increase, probably because they already pay a very large amount for their commutation trips.

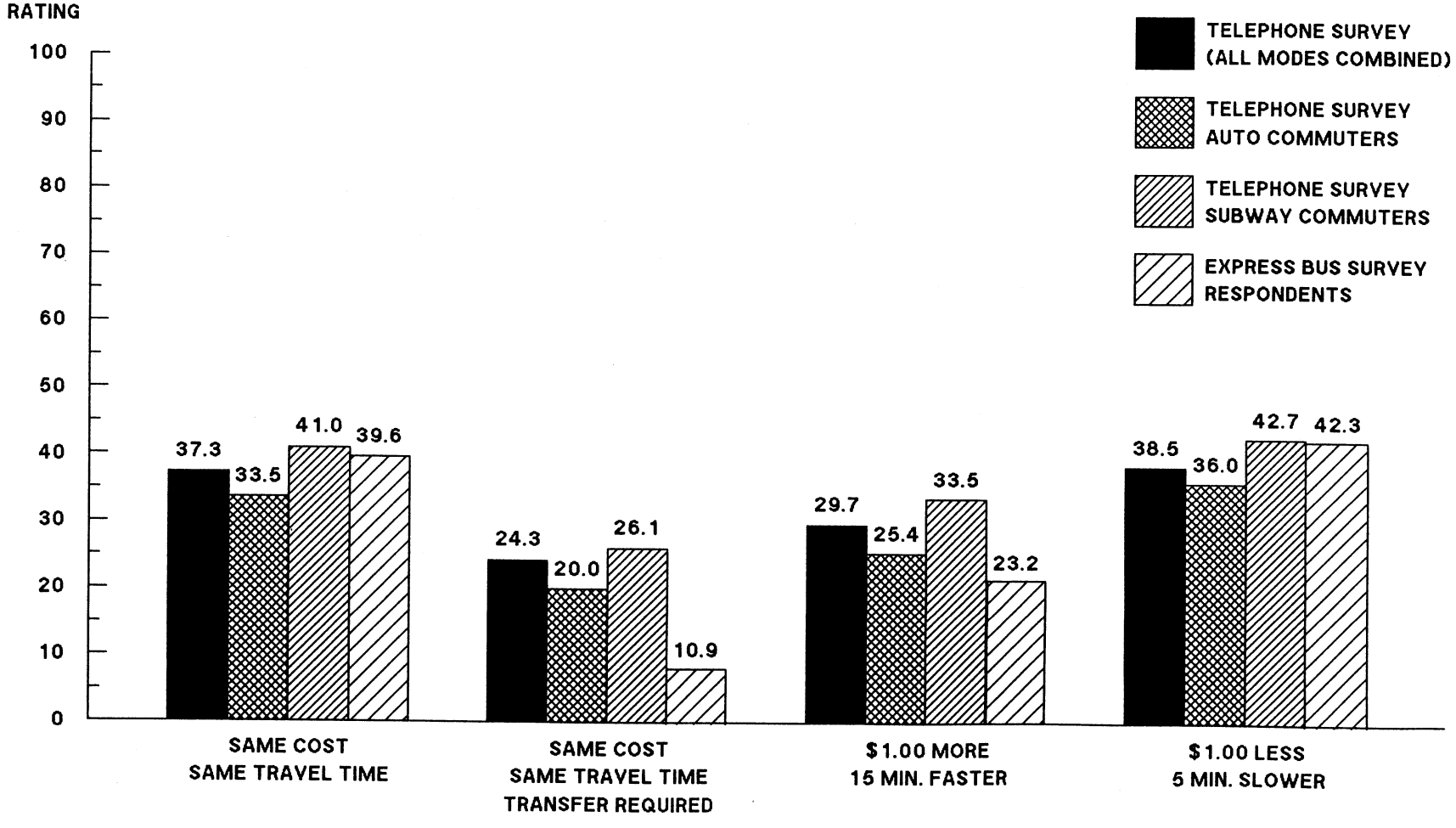
Finally, for service to Grand Central that was five minutes slower but $1.00 per day less expensive than the current mode, the mean response was 38.5 for telephone survey respondents and 42.3 for express bus survey respondents.

In comparing the responses of various subsets of telephone survey respondents, it was apparent that subway commuters consistently responded with higher ratings than auto commuters with respect to likelihood of use of Grand Central. Given these individuals' greater propensity to use public transportation (as exhibited by their current commuting mode choice), this result is not surprising.

Commuters were asked two additional questions about Grand Central service. About one-third (38.3 percent in the phone survey and 32.8 percent in the express bus survey) said that the availability of LIRR service to Grand Central would make them more likely to consider jobs located on the East Side of Manhattan should they decide to think about changing jobs. A significant proportion (30.5 percent in the phone survey and 36.7 percent in the express bus survey) said that LIRR service to Grand Central would make them more likely to consider living near an LIRR station should they decide to consider moving.

FIGURE 6-2

LIKELIHOOD OF USE OF GRAND CENTRAL



Among non-commuters, 38.9 percent said that they would consider using the LIRR for some trips that they now make via other modes as a result of East Side Access, while another 16.6 percent said that they might consider such a change. A total of 17.9 percent of non-commute trips might be shifted to the LIRR. In addition, 40 non-commuters in the telephone survey said they might travel to Manhattan more often as a result of East Side access; the average increase in tripmaking for these individuals was 4.9 trips per month.

DEMOGRAPHIC CHARACTERISTICS OF THE SURVEY RESPONDENTS

The demographic characteristics of telephone and express bus survey respondents are shown in Table 6-1. As might be expected, the income distribution, auto ownership level, and percentage of respondents with drivers' licenses are somewhat lower for the telephone survey sample than for the LIRR rider population (see Table 5-1). This is largely due to the preponderance of Queens residents in the telephone survey sample, which results from the large population of Queens relative to Nassau and Suffolk counties and to the greater propensity of Queens residents to travel to Manhattan. The telephone survey sample also had a relatively high representation of women.

Express bus survey respondents, as might be expected, had slightly higher incomes than the telephone survey sample, but still somewhat below those of LIRR passengers. A very large percentage of express bus riders (69.7 percent) were female, and the average age is slightly above that for the telephone survey sample and that for average LIRR rider.

TABLE 6-1

DEMOGRAPHIC CHARACTERISTICS OF NON-PASSENGERS

	Telephone Survey			Express Bus
	TOTAL	Auto	Subway	Survey
Number of cars, vans, and light trucks available to household.....	1.63	2.22	1.29	1.49
Percent with drivers' license.....	79.5%	92.1%	78.2%	85.7%
Mean household size.....	3.00	3.21	3.53	2.82
Mean age.....	38.5	37.5	36.3	40.5
Percent Male.....	43.3%	41.3%	45.3%	30.3%
Percent Female.....	56.7%	58.7%	54.7%	69.7%
Income distribution:				
Up to $15,000 per year.....				1.6%
$15,001 to $25,000 per year.....				16.4%
$25,001 to $35,000 per year.....				12.3%
$35,001 to $50,000 per year.....				23.8%
$50,001 to $75,000 per year.....				29.5%
$75,001 to $100,000 per year.....				9.0%
Over $100,000 per year.....				7.4%
Above $75,000 per year.....	11.2%	21.1%	8.2%	
Between $50 and $75,000 per year.	20.7%	26.3%	19.1%	
Between $25 and $50,000 per year.	43.6%	44.7%	53.6%	
Between $0 and $25,000 per year..	24.5%	7.9%	19.1%	
County of residence:				
Queens.....	75.7%	68.3%	91.6%	
Nassau.....	13.3%	20.6%	6.7%	
Suffolk.....	11.0%	11.1%	1.7%	

7. TRAVELER PREFERENCE ANALYSIS

An important part of this marketing research and demand forecasting study was measurement of the value attached to service characteristics by travelers. This chapter examines traveler preferences based on discrete conjoint analysis of tradeoffs LIRR travelers make in choosing destination terminals. Also examined are the influence that the characteristics of LIRR service to Grand Central would have upon the mode choice of non-riders. The results of these analyses provided crucial inputs to the supply-demand equilibrium forecasting process that is described in Chapter 8.

METHODOLOGY FOR MEASURING THE PREFERENCES OF LIRR RIDERS

The on-board surveys of peak and offpeak riders contained an exercise in which travelers were asked to rank and rate six travel options for the trip they were making when the interview was conducted. As indicated in Figure 7-1, each option was described in terms of four attributes--a destination terminal, the need for a transfer at Jamaica, the travel time on the LIRR, and the fare. The destination terminal options were the travelers' current destination terminal or Grand Central. The travel time for each option was described in terms of how many minutes faster or slower the trip was compared to the traveler's current trip. Fare was similarly described as costing the same, more, or less than the traveler's current railroad fare. The different levels used for each of the attributes are listed in Table 7-1. Travelers on the Port Washington line for whom the possibility of a transfer at Jamaica was irrelevant were given a variant of this exercise in which the Jamaica transfer did not appear.

In the survey travelers were first asked to indicate which of the options they liked best, second best, and so forth until they had ranked each of the six options from best to that liked least. Then they were asked to rate each on a scale from 0 to 100 in terms of the likelihood they would use that option if they had to choose between that option and their current train trip. These ratings formed the basis for modeling traveler preferences for service to Grand Central under alternative service and fare scenarios.

FIGURE 7-1
EXAMPLE OF THE TRAVEL OPTIONS PRESENTED TO ON-BOARD SURVEY RESPONDENTS

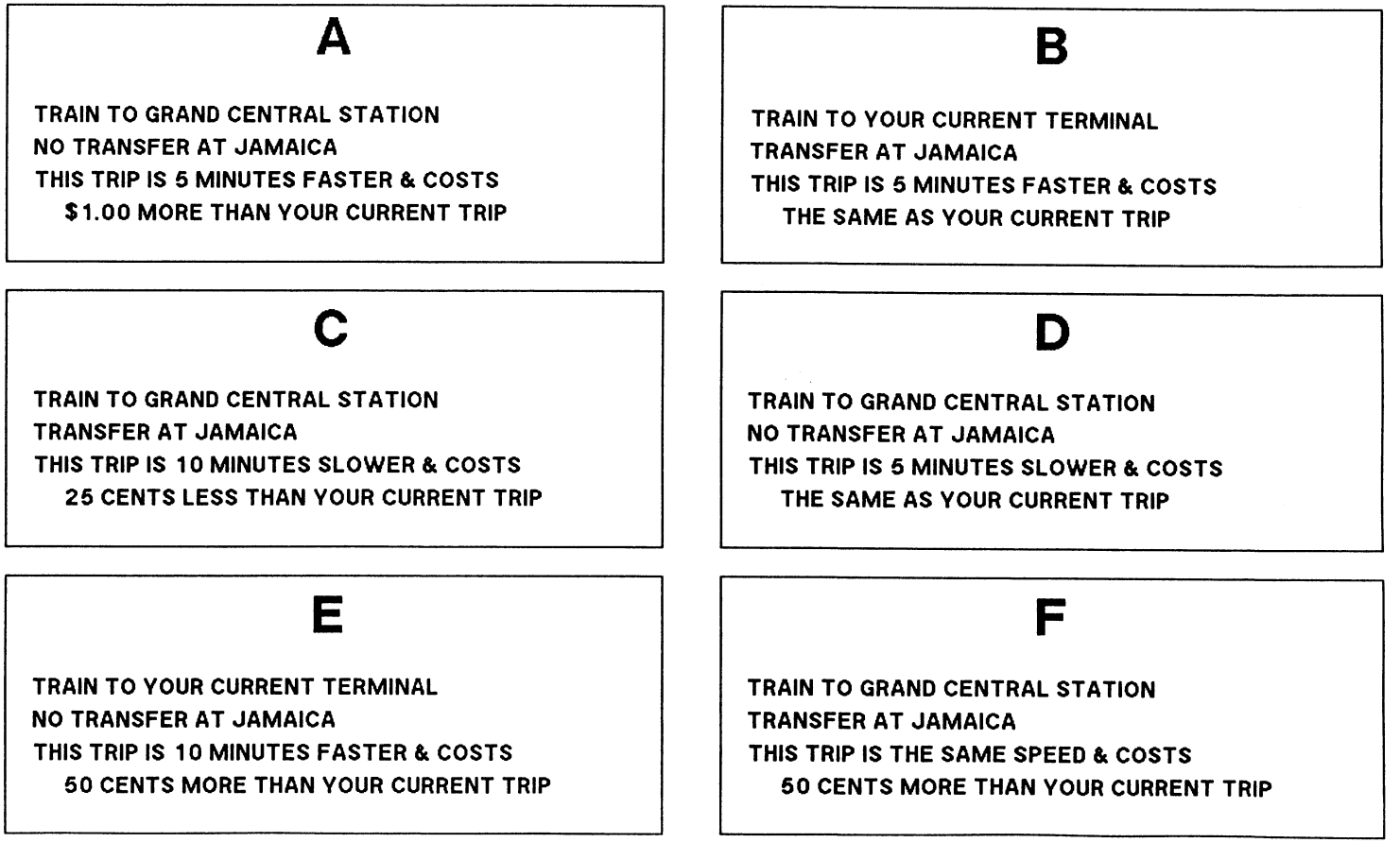


TABLE 7-1

CONJOINT SURVEY ATTRIBUTE LEVELS

Destination Terminal:

Train to Grand Central Station
Train to your Current Terminal

Transfers:

No transfer at Jamaica
Transfer at Jamaica

Travel Time:

10 minutes faster than your current trip
5 minutes faster than your current trip
The same speed as your current trip
5 minutes slower than your current trip
10 minutes slower than your current trip

Fare:

$1.00 more than your current trip
50 cents more than your current trip
25 cents more than your current trip
The same as your current trip
25 cents less than your current trip

Explanatory variables for the models included not only the option attribute levels but three other measures from the survey that were also relevant to explaining travelers destination choice. One of these variables was the egress time from the option's terminal to the traveler's ultimate destination. Another variable that proved to be significant was a dummy variable for use of transit as a mode of egress. In the survey, travelers were asked what their egress mode was for their current choice of destination terminal and what their preferred mode of egress would be for Grand Central. The other variables included were dummy variables for the specific current LIRR terminals. For each traveler, the current terminal options were represented as being the appropriate LIRR destination terminal. These additional variables are clearly relevant as contributory factors to travelers' evaluation of alternative routes to destinations.

Demand equations were developed for peak and offpeak LIRR riders. These demand equations express the likelihood of using each terminal (i.e. Grand Central or the current terminal) as a function of the relative fare and service characteristics of these alternatives, represented as described above.

Because each individual's likelihood of use rating is necessarily bounded from below by zero and above by 100 percent, it was necessary to use a model appropriate for limited dependent variables. The model utilized was the well-known binary logit model. The functional form of the binary logit model is shown below.

$$\text{Likelihood of Use} = 1/[1 + e^{-(a+BX)}]$$

where X is a matrix of explanatory variables, a is a constant, B is a matrix of parameters to be estimated, and e is the base of the natural logarithms. The parameters of the models were estimated by the method of maximum likelihood utilizing some proprietary software that Caliper has developed for this purpose.

A two-stage estimation procedure was used to estimate common coefficients for all peak-period riders for travel time, egress time, and egress mode. Separate values for Jamaica transfers and destination terminal dummies were computed for all riders except those who ride the Port Washington line. Port Washington riders, both in the sample and in the LIRR origin-destination matrix, traveled only to Penn Station and did not face a transfer at Jamaica.

Results

The final estimation results for peak-period riders are shown in in Table E-1 in Appendix E. The first equation in the table is estimated on all observations except for those from Port Washington riders. This equation provides the estimate of the

marginal rate of substitution between Jamaica transfer and fare. A new variable was then constructed to reflect the utility of the terminal dummies and the Jamaica transfer; this variable replaced the constant for the non-Port Washington riders in the second equation from which marginal rates of substitution were computed for travel time, egress time, and transit egress mode dummy.

As is evident from inspection of Table E-1, with the exception of the dummy variables for the destination terminals all of the other variables were of the correct (negative) sign and were statistically significant. In other words, destination terminal options are less attractive when their travel time, egress time, and fare levels are higher.

The principal purpose of estimating the demand equations was to obtain the value of service characteristics and fare as determinants of terminal choice. The value of an incremental change in a service characteristic, i. e. the marginal rate of substitution, is calculated by dividing the service coefficient by the price coefficient in the demand function. This gives the precise tradeoff between price and service at which the utility of travel options is constant. These calculated values, which were used to construct the generalized cost of network links, are shown graphically in Figure 7-2.

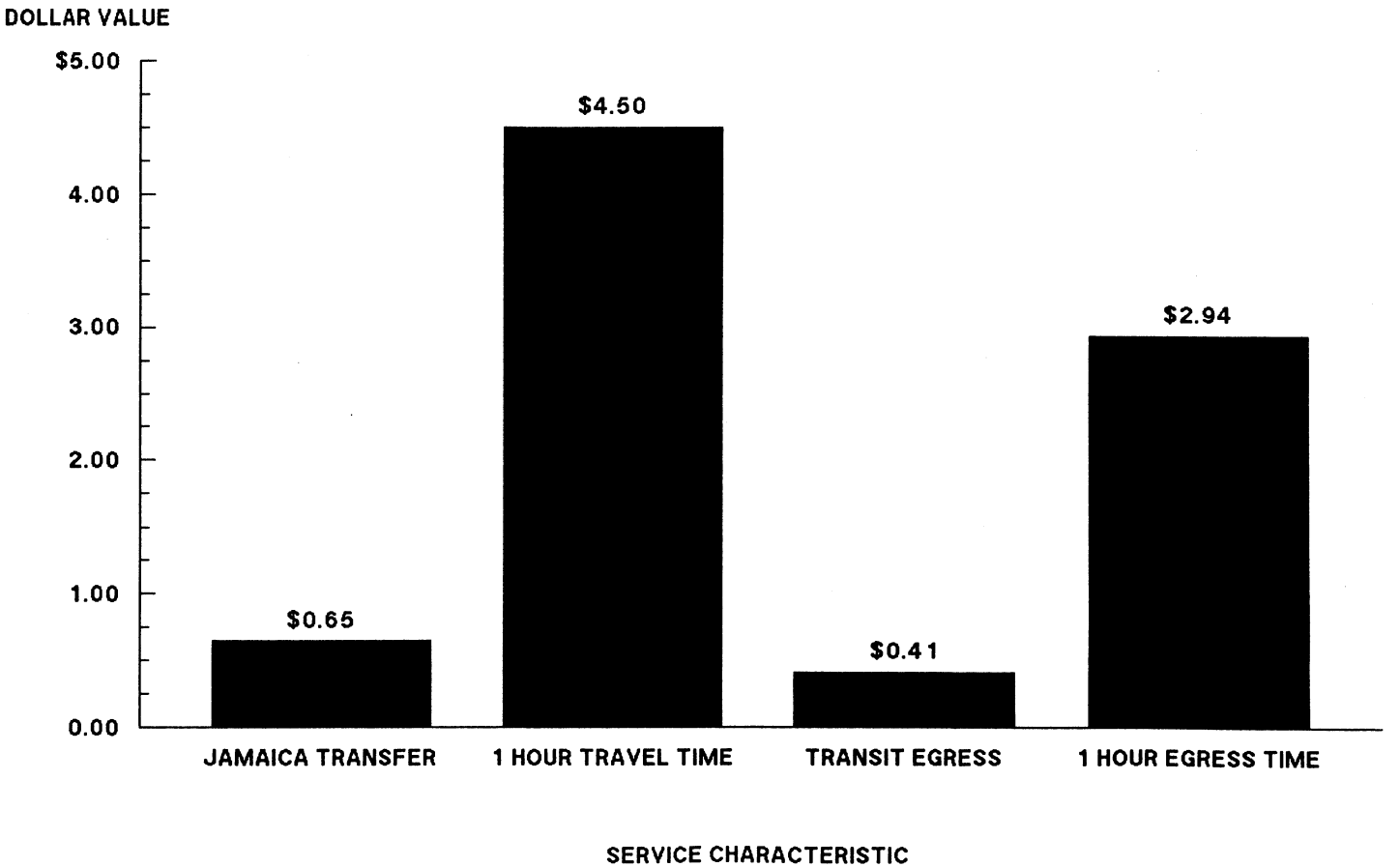
The value of LIRR travel time was assessed at $4.50 per hour. This means that on the average travelers are indifferent between current fares and travel times and a 5 minute improvement in travel time with a fare that is $.37 higher. This value of time is quite reasonable in light of the relatively long trips made by commuters and prior measurements made in other studies for the LIRR. Egress time was calculated to be valued at $2.94 per hour or roughly 5 cents a minute.

Avoiding a Jamaica transfer was calculated to be worth 64.7 cents. A transfer at Jamaica is onerous both because of the inconvenience it causes and also because many individuals do not get a seat when they transfer. This relatively high transfer penalty reflects the importance that direct service has upon travelers' choice of destination terminals.

Finally, the penalty for transit egress is estimated to be 41 cents. Destination terminals that are sufficiently close to commuters' workplaces do not require transit egress and are thus more attractive.

Reference to Table E-1 indicates that the coefficients for Penn Station and Hunterspoint alternatives were not statistically significantly different from zero. This means that overall, travelers had no systematic preference for these terminals that was not accounted for by fare and service differentials. The coefficient for Flatbush was significant and positive. Travelers to Flatbush are less likely to switch to Grand Central,

FIGURE 7-2
DOLLAR VALUE OF SERVICE CHARACTERISTICS FOR PEAK PERIOD RIDERS



presumably because other factors, i.e. those not included in our model, make Flatbush more attractive.

The model results for offpeak users of the LIRR are provided in Table E-2 in Appendix E. Figure 7-3 indicates the value of service characteristics for offpeak travelers.

With the exception of transit egress, the values placed on the other service characteristics by offpeak travelers are lower than those for peak-period commuters. Travel time on the LIRR is valued at $3.72 per hour reflecting the estimate that a 5 minute faster travel time was worth 6.2 cents to the average traveler. Egress time was valued at $.75 per hour. Because many offpeak trips do not have an absolute time deadline for arrival at their destinations, time is expected to be less crucial than it is for commuters, many of whom have fixed work and school start times.

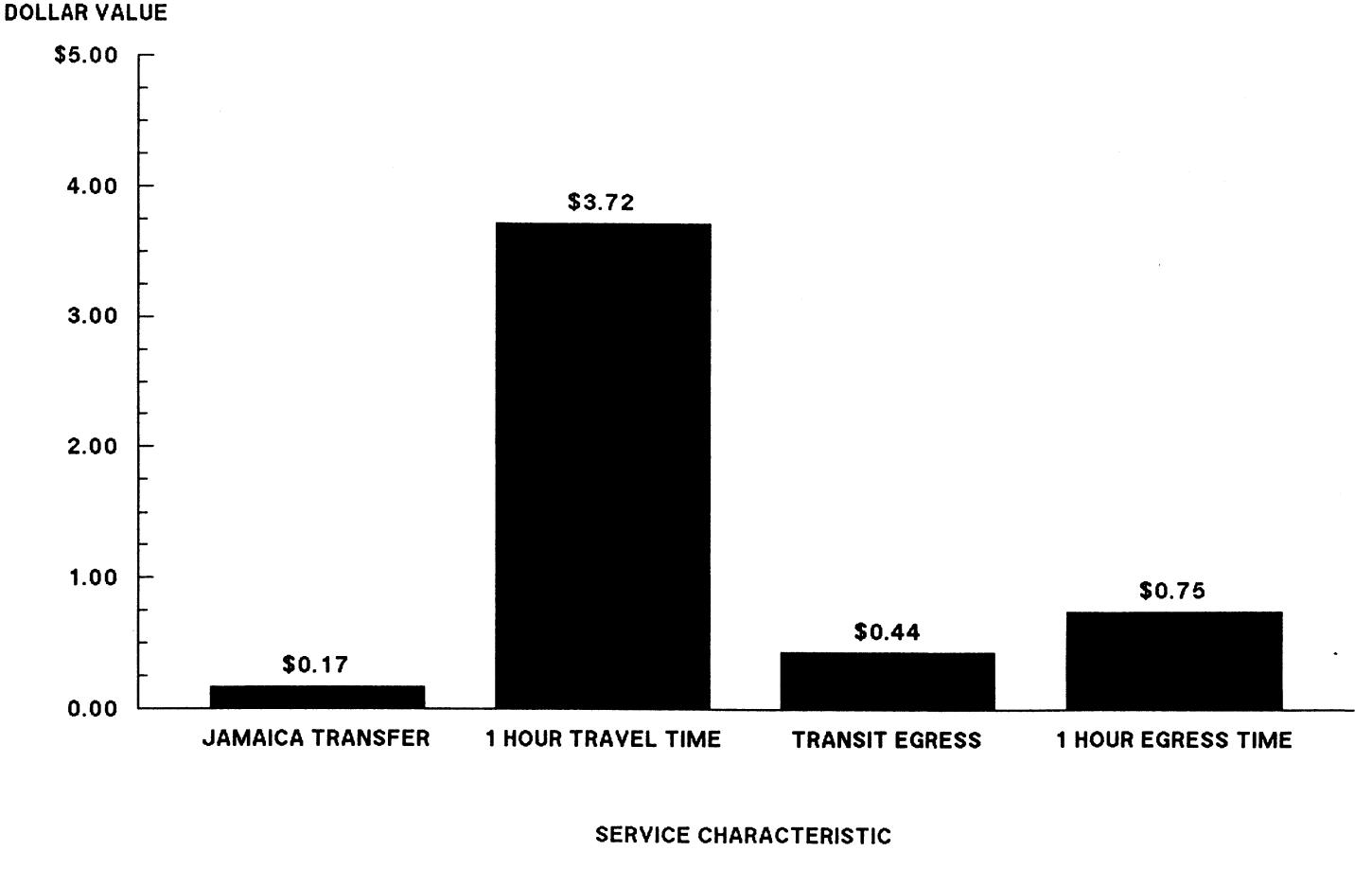
The value of a Jamaica transfer is also much lower than for commuters. In the offpeak, LIRR passengers almost always get a seat when they transfer. Thus, the disutility of the transfer does not reflect the value of a seat for the journey from Jamaica to destination terminals.

Only the Penn Station terminal dummy was statistically significant in the model. Penn Station was valued as worth 46.4 cents more than Grand Central as a destination terminal. This undoubtedly reflects a selection effect whereby current offpeak riders are much more likely to have destinations near Penn Station than elsewhere in Manhattan. This effect may also reflect the proximity of Penn Station to major shopping destinations; this is of relevance because shopping is a major offpeak travel purpose. Retention of this Grand Central penalty in forecasting is conservative in that service to Grand Central would probably attract new offpeak riders with trips to destinations on the East Side.

METHODOLOGY FOR ANALYZING MODE SHIFTS

As discussed previously, institution of Grand Central service would be expected to induce some non-riders to shift to the Long Island Rail Road. In order to quantify this effect, surveys were conducted with travelers to Manhattan using non-LIRR travel modes. These surveys, which were administered by phone and on board express buses, contained questions that obtained measures of respondents' likelihood of use of LIRR service to Grand Central under alternative fare and service scenarios. The scenarios varied in their travel time and cost relative to travelers' current modes. Access and egress time were also used in the statistical model that was developed. These measures were developed from survey data and network characteristics.

FIGURE 7-3
DOLLAR VALUE OF SERVICE CHARACTERISTICS FOR OFFPEAK RIDERS



Results

Separate models were estimated for commuters using auto and subway modes and for express bus riders. The results for the model for the auto and subway commuters are documented in Table E-3 in Appendix E. A dummy variable was included in the model that captured the effect of current mode. The coefficient of this dummy variable for transit use was very high indicating that transit travelers are much more likely to shift to the LIRR than auto travelers. The value of service characteristics as determinants of the choice to shift to LIRR service to Grand Central is discussed below.

The most important factors were egress time and access time. These were valued at $8.16 and $4.80 per hour, respectively. The travel time differential between the LIRR and traveler's current mode had a relatively low value of $1.32 per hour. This low value is due, we believe, to the fact that travelers were relatively insensitive to the range of time differentials that were used in the survey. The implications of these results is that many commuters using non LIRR modes are especially unlikely to shift to the LIRR unless LIRR origin stations and destination terminals are highly accessible.

The results of model estimation for the express bus commuters are shown in Table E-4 in Appendix E. As is indicated there, in the range of the small values of time differences between the LIRR and current modes, the effect of travel time differentials was not significantly different from zero. As in the model for auto and subway commuters, access and egress time are the key service characteristics influencing travelers' willingness to use the LIRR. Access time was valued at $16.80 per hour and egress was valued at $8.40 per hour. These values reflect the added cost and inconvenience of having to use other travel modes in addition to the LIRR for purposes of access and egress. Based on these results only express bus riders that live near LIRR stations and working near Grand Central would have a high probability of using the new service.

8. DEMAND ANALYSIS AND FORECASTS OF UTILIZATION FOR GRAND CENTRAL STATION

This chapter presents the demand analysis procedures and forecasts of the demand for passenger service to Grand Central Station. Forecasts have been developed for three time periods (AM peak, PM peak, and offpeak), for three forecast years (1985, 1995, and 2000), and for four different service scenarios. The demand forecasting procedure consists of the application of the terminal choice demand models in an equilibrium framework. As discussed previously, this approach incorporates important aspects of the interdependence of supply and demand, correlations of terminal choice options due to overlapping routes, and the extremely important restrictions that capacity constraints impose on demand forecasting.

This chapter is organized in three sections. The first describes the input data, assumptions, and scenarios that are used in the forecasts. The second section describes the demand forecasting methodology. The third and final section presents the forecasting results.

INPUT DATA, ASSUMPTIONS AND SCENARIO DEFINITIONS

The demand forecasting procedure is based upon a wide assortment of data provided by the LIRR on ridership patterns and service characteristics. These data, which were further analyzed to develop the required inputs to the forecasting work, are described in this section of the report.

INPUT DATA

The peak period destination terminal forecasting procedure requires four types of input data:

- an origin-destination demand matrix;
- a service file describing LIRR train service;
- a fare file indicating terminal surcharges (if any); and
- a travel time file indicating travel times between Jamaica and each of the four terminals.

Each of these types of data is contained in an input file that is used by the forecasting model. Each of these input files is described below, along with a discussion of the values for inputs that were used in model development and calibration and how these values were derived.

Origin-Destination Demand Files

The origin-destination demand files contain the zone to zone travel demand figures that are the basis of the equilibrium assignment. The zone structure for the East Side Access Study represents origins by LIRR lines, and destinations by aggregations of Manhattan zip codes. The origins are listed below, followed by the range of LIRR stations they represent:

* Port Washington Line (Elmhurst - Port Washington)
* Oyster Bay Line (E. Williston - Oyster Bay)
* Port Jefferson Line (New Hyde Park - Port Jefferson)
* Ronkonkoma Line (Grumman - Ronkonkoma)
* Hempstead Line (Hollis - Hempstead)
* West Hempstead Line (St. Albans - West Hempstead)
* Montauk Line (Bay Shore - Montauk)
* Babylon Line (Rockville Centre - Babylon)
* Long Beach Line (Lynbrook - Long Beach)
* Far Rockaway Line (Locust Manor - Far Rockaway)
* Jamaica Station (Jamaica)
* Queens (Kew Gardens, Forest Hills, Woodside)

The destinations include 19 Manhattan zones, numbered according to the zip codes they represent. These zones are defined as follows:

10023 (includes 10024, 10025, 10026, 10027, 10031, 10032, 10033, 10040, 10034);
10021 (includes 10028, 10029, 10035, 10037, 10030, 10039);
10019;
10020;
10036;
10018;
10001;
10011 (includes 10012, 10014);
10013;
10007;
10006 (includes World Trade Center);
10004;
10005;
10038;
10002 (includes 10003, 10009);
10010;
10016;
10017; and
10022

These zip code zones also incorporate a variety of other zip codes that are used by the U.S. Postal Service to represent particular buildings and/or employers in Manhattan. For example, destination zone 10019 also includes zip codes 10101 through 10107. In addition to the zip code-based Manhattan zones, there are four other destination zones, as follows:

* Brooklyn, representing all destinations in Brooklyn and Staten Island;

* New Jersey, representing all destinations west of the Hudson;

* New York North, representing all destinations in Bronx and in northern New York metropolitan area counties east of the Hudson; and

* Queens, representing all Queens county destinations.

The origin-destination matrix developed previously by the LIRR ignored destinations other than the three major terminals, and therefore was not used in the East Side Access study. In its place, a new origin-destination matrix was developed, using the origin and destination zone system described above. This matrix was derived as follows:

1. The station counts that were the basis of the existing LIRR O-D matrix were assumed to be correct, and were aggregated into the twelve origins described above.

2. Sample weights were derived for the LIRR's on-board O-D survey, where the weight for each survey was equal to the number of passengers boarding at stations on that line (as aggregated from station counts in Step 1) divided by the number of surveys completed by passengers from that line.

3. Using the weighted O-D survey, origin and destination zones as defined above were cross-tabulated to produce the final O-D matrix.

This procedure was repeated for both the morning and afternoon peak periods. The resulting AM and PM peak origin-destination demand matrices are shown in Tables 8-1 and 8-2. Note that the Queens and Jamaica origins do not generate any LIRR riders because no reliable LIRR counts were available.

AM and PM peak demand matrices were also developed for the years 1992 and 2000. These matrices were developed by applying the Charles River Associates LIRR ridership model. It was assumed that real LIRR fare and real automobile tolls will remain constant, so that Manhattan employment is the sole determinant

TABLE 8-1

AM PEAK PERIOD ORIGIN-DESTINATION MATRIX

	Origin Line/Zone												
Dest. Zone	Port Wash	Oyster Bay	Port Jeff	Ronk.	Hemp.	West Hemp.	Montauk	Babylon	Long Beach	Far Rock.	Jamaica	Queens	TOTAL
10001	2,318	204	2,361	525	678	110	404	3,057	807	1,097	0	0	11,561
10002	245	15	329	140	82	49	86	535	133	105	0	0	1,719
10004	669	116	1,116	360	368	86	206	1,369	299	347	0	0	4,936
10005	513	145	1,065	311	380	86	129	1,397	203	378	0	0	4,607
10006	550	95	1,112	299	275	55	172	1,425	191	285	0	0	4,459
10007	683	116	1,399	366	368	116	120	1,498	343	353	0	0	5,362
10010	542	87	834	232	339	67	138	1,143	184	378	0	0	3,944
10011	238	29	470	140	146	24	77	627	165	198	0	0	2,114
10013	230	29	346	128	64	55	60	585	146	167	0	0	1,810
10016	1,100	204	1,493	281	304	116	258	1,927	496	626	0	0	6,805
10017	1,746	305	3,191	891	795	214	490	3,596	826	893	0	0	12,947
10018	1,649	124	1,283	305	245	80	112	2,111	476	831	0	0	7,216
10019	1,107	124	1,655	439	456	80	232	2,181	496	440	0	0	7,210
10020	416	73	766	153	210	67	146	890	241	186	0	0	3,148
10021	319	15	312	122	105	37	95	447	140	87	0	0	1,679
10022	1,337	175	1,929	445	339	122	249	2,457	591	521	0	0	8,165
10023	230	36	316	92	88	37	43	406	121	124	0	0	1,493
10036	1,092	109	1,463	378	391	122	146	2,208	521	545	0	0	6,975
10038	238	73	885	171	263	86	138	1,042	222	229	0	0	3,347
Queens	364	65	761	372	164	12	241	825	146	74	0	0	3,024
Brooklyn	0	109	727	220	321	86	180	1,185	235	260	0	0	3,323
N.J.	52	15	73	18	47	0	0	106	32	6	0	0	349
NY North	7	0	21	6	12	6	9	51	32	6	0	0	150
TOTAL	15,645	2,263	23,907	6,394	6,440	1,713	3,731	31,068	7,046	8,136	0	0	106,343

TABLE 8-2

PM PEAK PERIOD ORIGIN-DESTINATION MATRIX

	Destination Line/Zone												
Origin Zone	Port Wash	Oyster Bay	Port Jeff	Ronk.	Hemp.	West Hemp.	Montauk	Babylon	Long Beach	Far Rock.	Jamaica	Queens	TOTAL
10001	1,846	148	1,974	493	508	93	367	2,449	671	882	0	0	9,430
10002	195	11	275	132	61	41	78	428	111	85	0	0	1,418
10004	532	85	933	338	276	72	187	1,097	248	279	0	0	4,048
10005	408	106	891	292	284	72	117	1,119	169	304	0	0	3,763
10006	438	69	930	281	206	46	156	1,141	158	229	0	0	3,654
10007	544	85	1,169	344	276	98	109	1,201	285	284	0	0	4,395
10010	432	63	697	218	254	57	125	916	153	304	0	0	3,219
10011	189	21	393	132	109	21	70	502	137	159	0	0	1,735
10013	183	21	290	120	48	46	55	469	122	135	0	0	1,489
10016	875	148	1,248	263	228	98	234	1,544	412	503	0	0	5,554
10017	1,390	222	2,668	836	595	180	445	2,881	687	717	0	0	10,623
10018	1,313	90	1,073	286	184	67	102	1,692	396	668	0	0	5,870
10019	881	90	1,384	412	341	67	211	1,747	412	354	0	0	5,900
10020	331	53	640	143	158	57	133	713	201	149	0	0	2,578
10021	254	11	261	115	79	31	86	358	116	70	0	0	1,380
10022	1,065	127	1,613	418	254	103	227	1,969	491	418	0	0	6,685
10023	183	26	265	86	66	31	39	325	100	100	0	0	1,221
10036	870	79	1,223	355	293	103	133	1,769	433	438	0	0	5,697
10038	189	53	740	160	197	72	125	835	185	184	0	0	2,741
Queens	290	48	637	349	123	10	219	661	122	60	0	0	2,518
Brooklyn	0	79	608	206	241	72	164	949	195	209	0	0	2,724
N.J.	41	11	61	17	35	0	0	85	26	5	0	0	281
NY North	6	0	18	6	9	5	8	41	26	5	0	0	123
TOTAL	12,458	1,645	19,992	6,003	4,822	1,443	3,390	24,893	5,859	6,541	0	0	87,046

of future LIRR ridership. Employment figures currently used by the MTA show Manhattan employment as follows:

1985 - 2,509,000
1992 - 2,600,880 (interpolated)
2000 - 2,680,600

Application of the CRA model using these employment figures results in 1992 LIRR volumes that are 8.2 percent above 1985 levels, and 2000 volumes that are 15.6 percent above 1985 levels. Alternative demand assumptions and models can easily be accommodated by the forecasting software.

LIRR AM and PM Peak Service Files

The forecasting methodology and software incorporate capacity constraints associated with the allocation of direct trains from each of 10 origin lines to each of the four terminals (Penn, Flatbush, Hunterspoint, and Grand Central). The model therefore requires as an input the amount of capacity available between origin lines and destination terminals. This information was obtained by examining October, 1985 LIRR branch schedules to identify direct trains and by determining the number of passenger cars in these trains from the Spring 1985 ridership book.

Trains that appeared on several of the October, 1985 timetables (e.g., trains #37 and #5, which appear on both the Babylon and Montauk timetables) were allocated to the origin line from which they would be expected to draw the most ridership (in this example, the Montauk line). Scoots and trains that terminate at Jamaica were not included in the calculation of direct capacity.

Table 8-3 shows the current number of AM and PM peak cars providing direct service between the 10 origin lines and the four terminals under the calibration scenario (described below).

Fare File

The fare file contains information on surcharges applied by the LIRR to service at one or more of the four terminals. Surcharge information is expressed in dollars per trip. Currently, there are no surcharges at any terminals, so all values in this file are zero. Zero surcharges were also assumed for each of the forecast scenarios described below.

Travel Time File

This file contains the travel time between Jamaica Station and each of the four terminals. The current values are as follows, taken from current LIRR schedules:

TABLE 8-3

CURRENT AM AND PM PEAK PERIOD CARS SERVING EACH BRANCH/TERMINAL

AM PEAK PASSENGER CARS	Destination Terminal		
Origin Line	Penn Station	H-point Avenue	Flatbush Avenue
Port Washington	166	0	0
Oyster Bay	0	7	0
Port Jefferson	154	64	16
Ronkonkoma	0	41	0
Hempstead	36	0	34
West Hempstead	8	0	12
Montauk	0	14	0
Babylon	262	0	48
Long Beach	66	0	16
Far Rockaway	44	0	22
Total All Lines	736	126	148

PM PEAK PASSENGER CARS	Origin Terminal		
Destination Line	Penn Station	H-point Avenue	Flatbush Avenue
Port Washington	126	0	0
Oyster Bay	0	0	0
Port Jefferson	132	46	14
Ronkonkoma	0	36	0
Hempstead	42	0	18
West Hempstead	0	0	22
Montauk	0	22	0
Babylon	196	0	42
Long Beach	66	0	22
Far Rockaway	32	0	26
Total All Lines	594	104	144

Penn Station: 18 minutes
Hunterspoint Avenue: 17 minutes
Flatbush Avenue: 18 minutes

For Grand Central Station, the assumed travel time from Jamaica is 23 minutes, based on LIRR estimates. This travel time information was used for all calibration and forecasting scenarios.

ASSUMPTIONS

Seating Capacity

The forecasting model assumes that passenger cars have a constant seating capacity of 120 riders per car, and a maximum capacity for planning purposes of 156 riders per car (this is the point at which standees obstruct movement through the car and interfere with fare collection). The model is designed so as to restrict standees east of Jamaica but permit them west of Jamaica, subject to the 156 person per car capacity noted above.

Egress Times

In order to represent the decisions that LIRR riders make among the various terminals, it was necessary to represent in the forecasting system the amount of time required to reach any destination zone from any terminal. For this purpose, engineering estimates were developed of egress time on foot and by transit between Penn Station and Grand Central Station and each of the nineteen Manhattan destination zones. In addition, transit egress times were derived between the Flatbush terminal and the nineteen destination zones.

The following procedure was used to develop these egress time estimates. First, zone centroids were identified for each of the nineteen destination zones. Second, walking distances between Penn Station and Grand Central Station and each of the nineteen zone centroids were measured on a Manhattan map, along the most direct route. For the Flatbush terminal, approximate subway distances to the zone centroids were used.

Walk egress was assumed to take place at a constant 2.5 miles per hour, with an additional penalty (where appropriate) of four minutes for distribution of egress away from the zone centroid. Transit egress was assigned a constant speed of 10 miles per hour, with a 9.8 minute penalty for each required subway transfer, and an average five minute distribution penalty for walking to a final destination from the subway portal.

These assumptions resulted in the estimated egress times shown in Table 8-4. Note that egress times from Hunterspoint are not explicitly defined on the table. This is because Hunterspoint is

TABLE 8-4

EGRESS TIMES FROM TERMINALS TO DESTINATION ZONES

	Walk time (min)		Transit time (min)		
Destination	Penn	GCT	Penn	GCT	Flatbush
10001	8.0	29.3	6.0	22.1	32.3
10002	40.4	53.9	24.9	18.5	22.9
10004	85.5	95.0	26.4	28.8	19.4
10005	83.2	92.7	25.8	28.2	19.4
10006	66.5	88.7	21.6	27.2	19.4
10007	61.4	75.2	20.3	23.8	19.4
10010	25.3	29.3	21.1	11.3	28.8
10011	35.7	51.5	12.9	27.7	26.8
10013	54.6	64.9	18.7	21.2	21.2
10016	22.2	16.7	19.4	8.2	31.3
10017	32.5	9.5	22.9	6.4	35.2
10018	11.1	19.0	6.8	9.8	34.7
10019	30.1	26.1	11.5	21.3	40.2
10020	27.7	15.0	11.9	18.6	37.2
10021	50.7	36.5	27.5	13.1	43.2
10022	34.8	20.6	13.7	9.2	38.7
10023	42.0	42.0	15.5	25.3	43.2
10036	19.0	15.0	8.8	8.8	36.7
10038	69.7	82.4	22.4	25.6	19.4

directly connected to Grand Central via the Flushing (#7) line. Therefore, LIRR riders destined for Hunterspoint have egress times equal to those at Grand Central with an additional time and transfer penalty for the subway trip from Hunterspoint to Grand Central. These penalties are set at 10.7 minutes plus a 9.8 minute transfer penalty, respectively.

Representation of Capital Improvements

Three specific capital improvements are incorporated into the forecasting methodology and software. Ronkonkoma electrification, the first of these capital improvements, is represented in the network by eliminating the transfer between the Ronkonkoma and Port Jefferson lines at Hicksville, and by modifying the service file described earlier to incorporate direct electric service from Ronkonkoma to Penn Station. Transfer improvements at Hunterspoint are represented by a 5 minute reduction in the time required to transfer from the LIRR to the Flushing line. Egress improvements at Penn Station are represented by a 6 minute reduction in the time required to transfer from the LIRR to the subway or to reach the street from the LIRR platform.

SCENARIO DEFINITIONS

Several different scenarios were defined in the course of the East Side Access Study. A scenario is defined by the four files that are used as the input to a forecast. The scenarios used in this study include calibration, base, and four forecast scenarios. Each of these is described below.

Calibration Scenario

The network used in this study was calibrated against current (1985) ridership conditions. The calibration scenario is defined by the AM Peak O-D Demand, Service, Fare, and Travel Time files described earlier in this chapter.

Base Case Scenarios (AM Peak and PM Peak)

In order to evaluate the impact of East Side Access on the LIRR, it was necessary to develop base case scenarios to be used as a basis for comparison with the Grand Central scenarios. One base case scenario was developed for the AM peak, another for the PM peak. The base case scenarios differ from the calibration scenario in that they incorporate other expected changes to the LIRR system. In this study, the key change incorporated into the base case scenario was the expected completion of Ronkonkoma electrification. Therefore, the base case scenarios 1) include Ronkonkoma electrification as a capital improvement; and 2) use revised service files incorporating direct service between the Ronkonkoma Branch and Penn Station, and eliminating direct service between the Ronkonkoma Branch and Hunterspoint Avenue.

Forecast Scenarios

Demand forecasts were produced for four different forecast scenarios. In two of these scenarios (referred to as the low-capacity scenarios), total capacity between Jamaica and the two Manhattan terminals (Penn and Grand Central) was set to 125 percent of the current capacity serving Penn Station. These scenarios assume that increased railroad capacity is available as a result of 1) the availability of a second terminal and associated platform space; and 2) completion of the West Side Storage Yard serving Penn Station. The low-capacity scenarios assume implicitly that the limiting factor on service into Manhattan is congestion at Jamaica. The two low-service scenarios differ only in the allocation of capacity among Penn Station and Grand Central--the first (Scenario 1) assumes that 25 percent of total capacity serving the two terminals serves Grand Central and that 75 percent serves Penn; the second (Scenario 2) assumes that 40 percent of total capacity at the two terminals serves Grand Central and that 60 percent serves Penn.

The two high-service scenarios set total capacity to Manhattan terminals at 150 percent of current capacity to Penn Station. These scenarios assume that improvements at Jamaica are implemented prior to the introduction of service to Grand Central, thereby enabling additional capacity to be assigned to the two Manhattan terminals. As before, the two high-service scenarios differ only in the allocation of capacity among Penn Station and Grand Central--the first (Scenario 3) assumes that 25 percent of total capacity serving the two terminals serves Grand Central and that 75 percent serves Penn; the second (Scenario 4) assumes that 40 percent of total capacity at the two terminals serves Grand Central and that 60 percent serves Penn. The four forecast scenarios are summarized in Figure 8-1.

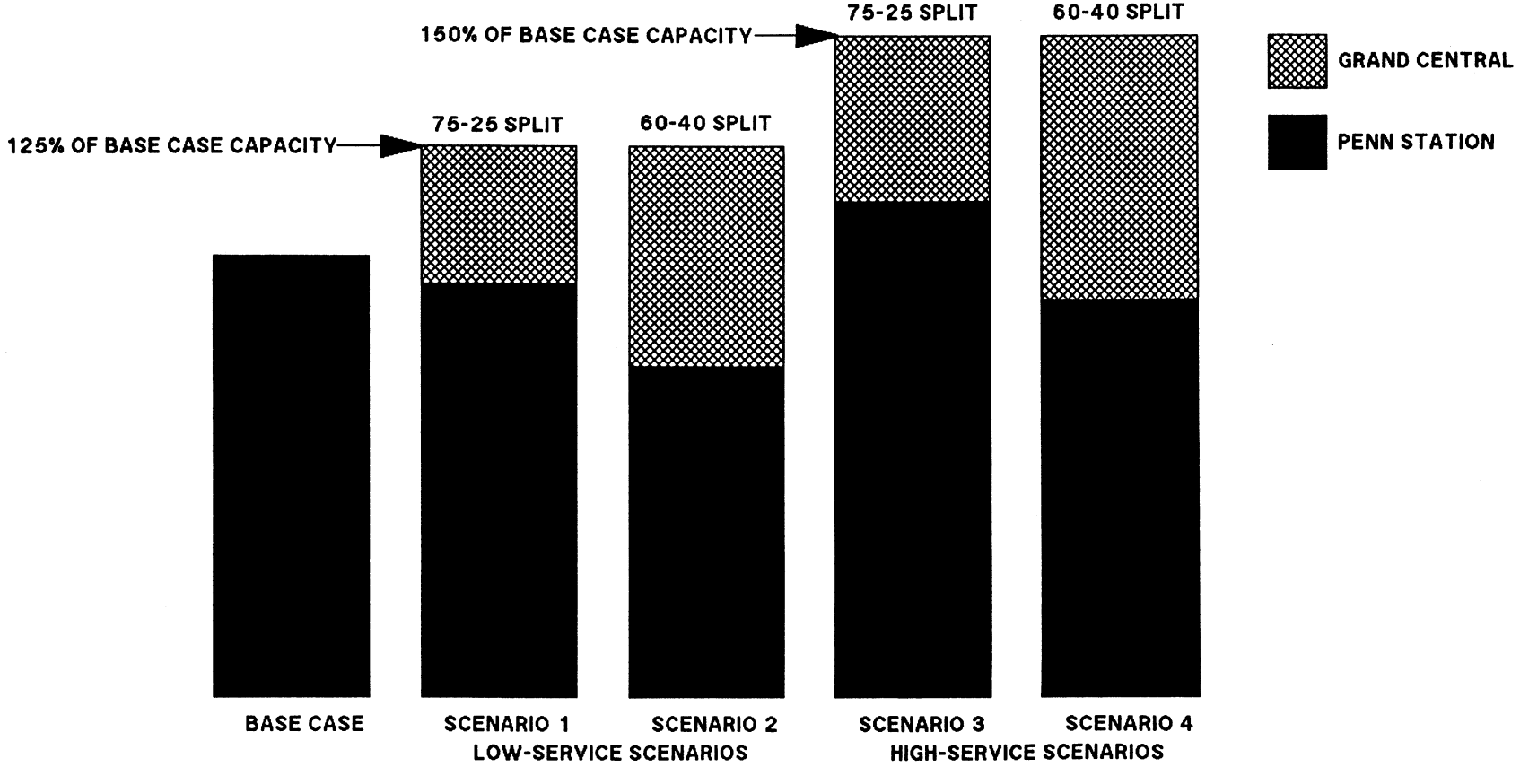
Note that all four of the forecast scenarios assume that Ronkonkoma electrification has been completed, and that Ronkonkoma branch trains serve Manhattan terminals directly instead of serving the Hunterspoint Avenue terminal in Queens. In addition, all of the forecast scenarios maintain the current distribution of capacity by branch. It is likely that other service plans would yield significantly different forecast results.

DEMAND FORECASTING METHODOLOGY

OVERVIEW OF THE PEAK PERIOD FORECASTING PROCEDURE

The peak period forecasting procedure consists of four steps. Each of these steps is described in detail below.

FIGURE 8-2
ALLOCATION OF TRAIN CAPACITY FOR THE EAST SIDE ACCESS FORECAST SCENARIOS



Forecasting Step 1. Estimate Mode Shift to the LIRR Resulting from Service to Grand Central

Based on the logit mode choice model described in Chapter 7, a first estimate is developed of new peak period trips to Grand Central made by current non-users of the LIRR based on expected fares and travel times. These new peak period trips are to be diverted from three other modes of travel--auto, subway, and express bus. This first step of the forecasting procedure calculates new ridership for Grand Central only.

The mode shift forecasting model is applied to a matrix of current peak travel by mode between Long Island and the 19 Manhattan destination zones, shown in Table 8-5. This table was derived from the County to County Travel to Work tables from the 1980 Census of Transportation. Total current ridership by the auto and subway modes was taken to be the sum of riders from Queens, Nassau, and Suffolk counties to New York County. Total express bus ridership was based on an independent estimate by LIRR staff of 15,000 riders per day. The total ridership by mode was then allocated among the 19 Manhattan destination zones using the distributions obtained in the telephone survey.

Other inputs to the mode split model were taken from various sources. Access times were derived from telephone survey responses. Egress times were taken from the engineering estimates described above. Travel time and fare differentials, the only two scenario-specific variables, were taken from the corresponding travel time and fare input files. The mode shift model was then applied for each mode and each destination zone, with the resulting mode shifts summed to yield the expected new demand at Grand Central.

Forecasting Step 2. Estimate Use of Grand Central by Current LIRR Riders using Equilibrium Network Assignment

This step in the forecasting process reassigns current LIRR riders to the network based on the levels of service, fare, and travel time as defined in the input files described above. The equilibrium assignment takes into account capacity constraints and congestion effects not only from existing riders, but also from the new riders estimated to shift to the LIRR's Grand Central service in step 1. This step produces terminal counts of the redistribution of existing LIRR riders.

The LIRR network used in forecasting is shown in Figures 8-2 and 8-3. It is important to distinguish the physical LIRR network, composed of stations with connecting tracks, from the modeled network, which consists of several different types of network constructs representing various aspects of the flow of passengers on the physical network. These include feeder links into and out of the system, links representing transfer options, travel links, etc. Each of these link types has some generalized "cost"

TABLE 8-5

NON-LIRR TRAVEL BY MODE FROM LONG ISLAND TO MANHATTAN DESTINATIONS FROM 1980 CENSUS JOURNEY-TO-WORK

	Mode of Travel			
Dest. Zone	Auto	Subway	Bus	TOTAL
10001	6,626	17,283	1,154	25,063
10002	5,478	8,389	364	14,231
10003	2,802	8,503	443	11,748
10005	2,683	9,577	445	12,705
10006	4,843	13,705	477	19,025
10007	4,756	8,076	314	13,146
10010	3,623	9,423	545	13,591
10011	6,871	11,803	422	19,096
10013	6,543	11,668	467	18,678
10016	9,928	20,350	1,754	32,032
10017	11,859	25,635	2,188	39,682
10018	4,533	13,248	953	18,734
10019	6,919	17,760	1,012	25,691
10020	2,390	6,688	558	9,636
10021	8,204	9,339	569	18,112
10022	7,174	19,062	1,437	27,673
10023	6,093	7,155	431	13,679
10036	7,293	19,377	1,428	28,098
10038	2,050	624	40	2,714
TOTAL	110,668	237,665	15,001	363,334

FIGURE 8-2

CLOSE-UP VIEW OF THE LIRR NETWORK AT JAMAICA

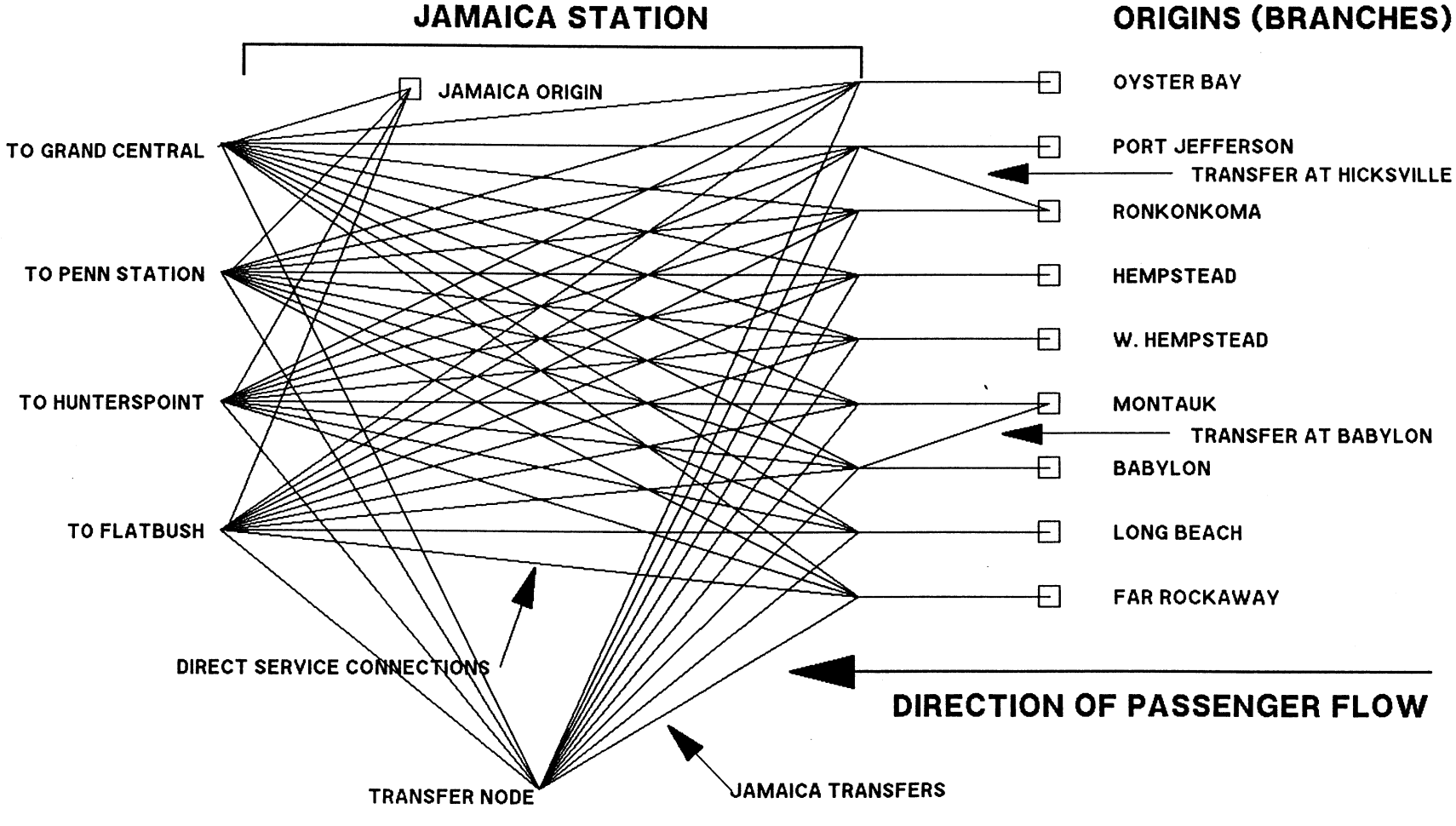
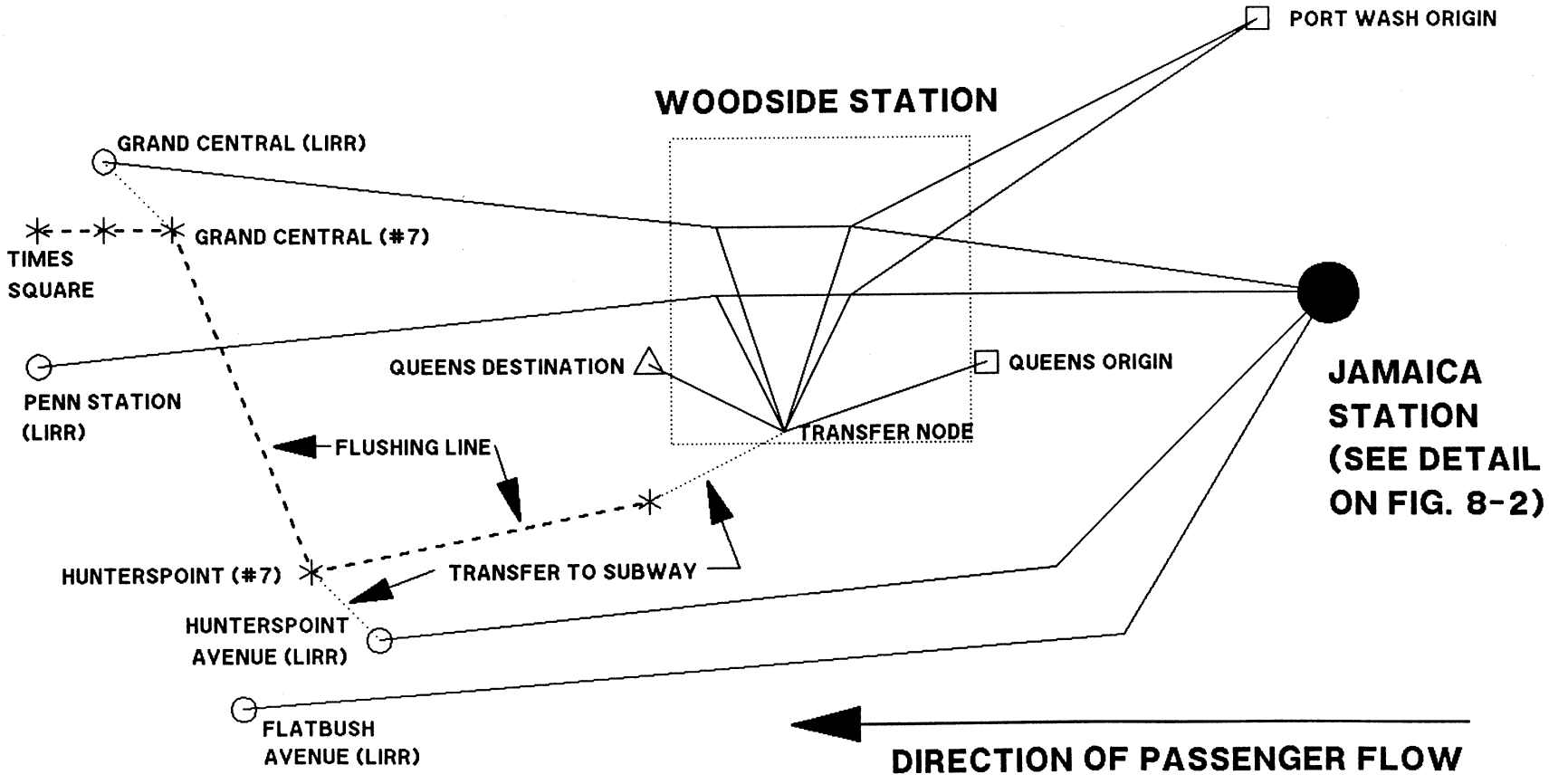


FIGURE 8-3
OVERVIEW OF THE LIRR NETWORK WEST OF JAMAICA
(OMITTING EGRESS LINKS)



associated with it; the cost is normally related to some measure of disutility experienced by an LIRR rider in traversing that link of the network. Some links, for example, may carry a travel time penalty, while others carry a penalty for requiring a transfer at Jamaica or a transfer to some other mode of transportation. Other links, called connectors, have no associated cost and serve only to help define legitimate paths through the system.

The LIRR network is comprised of five major parts: East of Jamaica and Port Washington; Jamaica Station; Queens; LIRR terminals; and final destinations. Each of these parts is described below.

The portion of the Long Island Rail Road east of Jamaica is represented as 9 demand points corresponding to 9 of the LIRR branches. Each branch is described by an origin node, at which travel demand to New York City is generated, and a link connecting it to Jamaica, as shown on the right hand side of Figure 8-2. The links that connect these origin nodes to Jamaica are connector links; there is no disutility associated with them. Two other special connections are also represented east of Jamaica: a transfer link from the Ronkonkoma line to the Port Jefferson line at Hicksville and a transfer link from the Montauk line to the Babylon line at Babylon. The transfer links carry a transfer penalty, representing the disutility to riders of having to change trains. Note that under scenarios in which Ronkonkoma electrification is assumed, the transfer link at Hicksville is automatically removed from the network.

Jamaica Station is represented as a complex sub-network incorporating all possible direct and indirect connections between origin lines and trains leaving towards the LIRR terminals. This sub-network allows the specification of direct seating capacities between each line and each terminal. Links representing direct service are capacity constrained, with the capacity levels determined from the level of service specified by the user. These links carry a very high cost penalty if this capacity level is exceeded, so that the resulting forecasts are consistent with the LIRR's service goal of providing a seated ride to all passengers East of Jamaica. The Jamaica sub-network also models transfers between lines and the associated transfer penalties. There is also a provision in the network for demand originating at Jamaica, which is currently set to zero.

The Queens portion of the network, shown in Figure 8-3, serves as a connection point for the Port Washington line, as a transfer point to the Flushing subway line, and as a valid origin and destination for travel demand. At Woodside it is also possible to transfer between trains going to Penn Station and trains going to the Grand Central terminal. The links leading into and out of Woodside are capacity constrained.

The terminal portion of the network, shown on the left side of Figure 8-3, contains connections to the four terminals: Penn Station, Grand Central, Hunterspoint and Flatbush. Access to Penn, Hunterspoint and Flatbush is via LIRR travel links leading into these terminals, while access to Grand Central is either on an LIRR or a Flushing line travel link. LIRR travel links are capacity constrained, but allow for the presence of standees west of Jamaica. The terminal access links are also characterized by rail travel time and cost differentials derived from inputs by the user. Any one terminal can effectively be eliminated from the network by specifying a service scenario in which zero trains serve that terminal.

The network has 23 destination zones, as described earlier. (For clarity, these destinations are not displayed in the Figure.) Penn Station and Grand Central are connected to each Manhattan destination zone via two egress links: a walk link and a transit link. Flatbush is connected to each Manhattan destination zone via transit links only. Hunterspoint is connected only to Grand Central via a subway link (the Flushing line). Egress links incur an egress time penalty. Transit egress links also incur a transfer-to-transit penalty. Egress to non-Manhattan destinations is via supplemental egress links. The Brooklyn destination is reached via an egress link from Flatbush. The New Jersey destination is reached via an egress link from Penn Station. The New York North destination is reached from either Penn or Grand Central, while the Queens destination is reached by a direct egress link at Woodside.

As described earlier, networks are normally calibrated to match a set of known base flows. In this study, a complete set of base flows on the network were not available. Instead, base flows were known only for some specific links or groupings of links. Available data for calibration included 1) AM peak counts of passengers at the three existing LIRR terminals; 2) the number of AM peak transfers at Jamaica (derived from the 1983 O-D survey); and 3) a recent count of AM peak transfers to the Flushing line at Woodside. These intermediate counts were used to calibrate the East Side Access network. Replication of current flows was achieved within 1 percent.

As described in Chapter 2, the network assignment implementation of stochastic equilibrium is an iterative process. In this second step of the forecasting procedure, the iterative solution of rider choice of destination terminal is performed for each scenario that is analyzed.

Forecasting Step 3 - Revise Mode Shift Forecasts Based on Capacity Constraints

In step 1 of the forecasting process, the expected mode shift from non-riders was calculated. As a practical matter, capacity constraints in the service to Grand Central restrict the number

of travelers who may shift to the LIRR from competing modes. This step of the forecasting process estimates the available capacity at Grand Central and determines the likely mode shift that will occur. This step results in final terminal volume counts.

Forecasting Step 4 - Derive Other Measures of Performance

In addition to total terminal volumes, the network analysis provides a wide variety of other information that can be used to describe the performance of the LIRR system. To facilitate comparisons between the base and forecast scenarios, these measures are derived for current riders of the LIRR, with travel diverted from other modes omitted. These measures include the following:

- Total LIRR travel time west of Jamaica - This number represents the total number of hours that current LIRR riders spend on LIRR trains. Because travel times east of Jamaica are unchanged for current riders by the introduction of service to Grand Central, it is sufficient to measure travel time west of Jamaica for comparison purposes.

- Total cost of terminal surcharges - This number represents the total additional out-of-pocket cost to current LIRR riders resulting from terminal surcharges. If fares were reduced at a particular terminal (for example, if fares at Flatbush and/or Hunterspoint were revised to reflect their location outside of Manhattan) this performance measure might be negative.

- Egress characteristics - The number of current LIRR riders who reach their final destination by transit and on foot is an important indicator of the increased passenger convenience that results from the introduction of service to Grand Central. In addition, the total and average amount of time spent in egress from the LIRR to the final destination is a further measure of these important egress effects.

- Standees - The number of standees on trains destined for each terminal is estimated based on a parametric equation which predicts standees as a function of the ratio of number of peak period passengers to the number of peak period seats, as follows:

$$\text{Proportion of Standees} = \text{MAX}\left\{\begin{array}{l}\text{Zero}\\ (.1965*(\text{Pax Volume}/\text{No. of Seats})-.1347)\\ ((\text{Pax Volume}/\text{No. of Seats}) - 1.00)\end{array}\right.$$

This formula was derived from empirical data contained in the 1985 Spring Weekday Ridership Book, and is illustrated in Figure 8-4. When the volume to seat ratio is under 68.5 percent, the number of standees is equal to zero. When the volume to seat ratio is greater than 68.5 percent, some riders must stand, and the number of riders who stand increases linearly with the number of passengers. Note that there are standees with volume/seat ratios of less than 100 percent because demand is not distributed uniformly throughout the peak period. When the volume to seat ratio is greater than 107.7 percent, the above formula implies that all seats are filled throughout the forecast time period, and that all additional passengers must stand. Note that the maximum allowable loading permitted in the forecasting model is 130 percent of seated capacity (156 passengers per car), which is the maximum capacity used by LIRR staff for planning purposes.

OVERVIEW OF THE OFFPEAK FORECASTING METHODOLOGY

The development of offpeak forecasts for use of the proposed Grand Central Terminal was hampered by a lack of offpeak origin-destination data for LIRR riders. The LIRR does not possess sufficient survey or count data to generate offpeak station boarding counts for Long Island stations. As a result, offpeak forecasts were produced based solely on an estimate of offpeak terminal flows combined with the preference and induced travel information expressed by offpeak travelers in the on-board survey. An overview of the offpeak forecasting procedure is as follows:

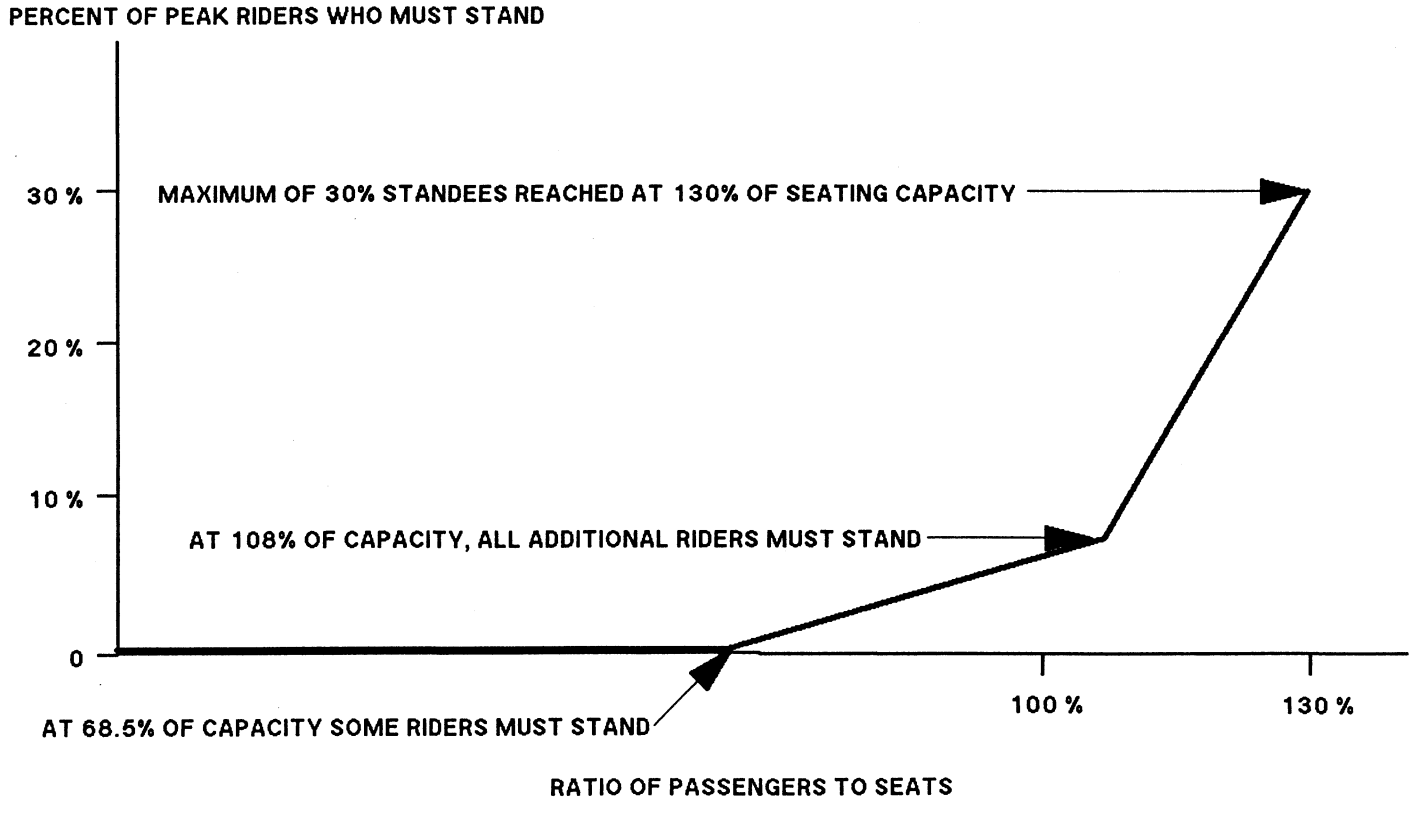
1. Offpeak terminal counts were derived from the LIRR's 1985 Spring Weekday Ridership Book, by summing the number of individuals traveling on offpeak trains to and from each terminal. This method yielded the following weekday offpeak terminal volumes:

	Inbound	Outbound
Penn Station:	20,180	34,950
Flatbush:	3,700	4,300

   These are likely to be slight overestimates of actual offpeak weekday terminal volumes, because some of the passengers counted on trains west of Jamaica are destined for or arriving from intermediate locations in Queens or in Brooklyn. However, these are the best data available with which to estimate terminal volumes.

2. Use of Grand Central by current LIRR riders was derived directly from demand models estimated on the on-board survey data. This demand model was similar to the one estimated for

FIGURE 8-4
STANDEES AS A FUNCTION OF THE RATIO OF PASSENGERS TO SEATS IN THE PEAK PERIOD



peak period ridership, and was described in Chapter 7. It predicts the percent of riders at each existing terminal who will shift to the Grand Central service. Multiplying by the offpeak terminal counts in step 1 yields a volume count for Grand Central.

3. Estimates of new LIRR offpeak trips to Grand Central were made directly from responses to the telephone and express bus surveys. These new offpeak trips include those that are shifted from other modes of transportation and those that are new trips generated as a result of the increased accessibility fof Long Island to Midtown Manhattan. As mentioned earlier, responses to questions concerning increased tripmaking by current riders appeared unreliable and were not used.

FORECASTING RESULTS

This section of the report presents the demand forecasting results for the East Side Access Study. As the detailed results presented below indicate, high utilization of future service to Grand Central is predicted. Grand Central provides very convenient access to Midtown and also to the upper and lower East Side, regions of Manhattan containing a significant proportion of LIRR riders' trip destinations. The LIRR's Grand Central service would also provide better accessibility to the East Side for many commuters who currently travel by subway, auto, and express bus. The convenience and associated reduction in overall travel time that many travelers would experience at Grand Central ensure that the new service will be heavily patronized. In fact, based on the analysis and assumptions stated previously, the capacity of LIRR service to Grand Central will be the controlling factor in determining Grand Central passenger volume.

The detailed results in this section are organized as follows. The 1985 AM and PM peak results are presented first, followed by AM and PM peak results for 1992 and 2000. Offpeak forecasting results for 1985, 1992, and 2000 follow. Finally, several additional scenarios are described and the results presented to indicate the likely impacts of variations in fare and capital improvements that were not among the four tested scenarios.

1985 PEAK PERIOD FORECASTING RESULTS

Table 8-6 summarizes the 1985 AM peak forecast results for the base case and the four Grand Central scenarios. In the base case, AM peak terminal volumes are 82,360 at Penn, 5,984 at Hunterspoint, and 14,026 at Flatbush. Over fourteen thousand riders change trains at Jamaica, and 30,611 hours are spent on LIRR trains by riders west of Jamaica. There are 1,266 standees

TABLE 8-6

TERMINAL VOLUMES AND PERFORMANCE MEASURES

AM PEAK PERIOD, 1985

Forecast Results	Base	Scenario Number 1	2	3	4
Volume - Penn	82,360	63,295	56,856	59,943	56,977
Grand Central	---	36,192	57,408	43,524	68,952
Hunterspoint	5,984	3,045	2,525	2,637	2,392
Flatbush	14,026	11,056	10,309	10,388	10,058
New Riders - TOTAL	---	10,456	23,906	13,302	35,187
Diverted from Auto	---	2,253	5,151	2,866	7,582
Diverted from Subway	---	7,585	17,341	9,649	25,524
Diverted from Bus	---	618	1,414	787	2,081

Performance Measures For Current Riders	Base	Scenario Number 1	2	3	4
Transfers at Jamaica	14,281	14,911	14,958	13,702	13,366
LIRR Passenger Hours	30,611	33,033	33,707	33,432	33,731
Terminal Surcharges	---	0	0	0	0
Standees - TOTAL	1,266	2,217	2,313	1,290	343
Penn	979	1,009	1,931	0	343
Grand Central	0	1,208	382	1,290	0
Hunterpoint	0	0	0	0	0
Flatbush	287	0	0	0	0
Egress on Foot	33,561	35,971	36,366	36,317	36,389
Walk Egress Hours	11,351	10,697	10,531	10,614	10,537
Egress by Transit	65,936	63,526	63,131	63,180	63,108
Transit Egress Hrs	32,931	29,306	28,733	28,852	28,667
Total Egress Time	44,282	40,003	39,264	39,466	39,204
Total Travel/Egress Time	74,893	73,036	72,971	72,898	72,935
Avg. Walk Egress Time	20.3	17.8	17.4	17.5	17.4
Avg. Transit Egress Time	30.0	27.7	27.3	27.4	27.3

(somewhat less than that observed in the Spring, 1985 Ridership Book cordon count), most of whom are on Penn Station-bound trains. Almost two thirds of riders reach their final destination by some form of transit, while the remainder walk to their final destinations. Average egress times between the LIRR terminals and riders' final destinations were 20.3 minutes on foot and 30.0 minutes by transit.

All four Grand Central scenarios result in significant diversion to Grand Central and consequent decreases in AM peak passenger volume at the three existing terminals. Table 8-7 indicates the change in terminal volumes and other measures of performance between each of the four forecast scenarios and the base scenario. Terminal volumes under the base case and four AM peak forecast scenarios are also shown graphically in Figure 8-5. The volume at Penn Station drops from 82,360 to 63,295 under Scenario 1 (low service, 75-25), a drop of 23.2 percent. The greatest drop in Penn Station volume occurs under Scenario 2 (low service, 60-40), in which volume drops by 31.0 percent to 56,856.

Significant number of passengers use the LIRR's Grand Central terminal under each of the four scenarios. Volume counts range from 36,192 under Scenario 1 to as much as 68,952 under Scenario 4. A significant proportion of these riders are new LIRR passengers who have shifted from other modes. As indicated in the table, and as displayed in Figure 8-6, 10,456 of the 36,192 Grand Central users in Scenario 1 have shifted from other modes--an estimated 2,253 from auto, 7,585 from subway, and 618 from bus. These new riders represent 29.5 percent of Grand Central passenger volume. In Scenario 4, 51.0 percent of Grand Central riders are new LIRR riders who have shifted from other modes.

An important result that is not apparent from the tables is that under all four scenarios, the volume of passengers at Grand Central is capacity constrained. In other words, the number of passengers forecast is exactly equal to the number of passenger cars serving Grand Central multiplied by the passenger-carrying capacity of each car (in this case, 156 persons). The principal explanation for this result, and a point that will be discussed extensively later in this chapter, is that there is significant potential for new riders to shift to the LIRR from other modes, particularly from subway lines in Queens.

Travel volumes also fall at both Hunterspoint and Flatbush Avenue under all four scenarios. Hunterspoint Avenue is affected most severely, with 1985 AM peak volume dropping to 3,045 (a 49.1 percent drop) under Scenario 1, and to 2,392 (a 60.0 percent drop) under Scenario 4. These significant declines in Hunterspoint volume are consistent with the qualitative and quantitative research results. At Flatbush, the effect of Grand Central is (once again, as expected), much smaller than at the other two terminals. Under Scenario 1, volume drops by only

TABLE 8-7

INCREASES (REDUCTIONS) IN TERMINAL VOLUMES AND PERFORMANCE MEASURES

AM PEAK PERIOD, 1985

Increases (Reductions) from Base Case Scenario	Scenario Number 1	2	3	4
Volume - Penn	(19,065)	(25,504)	(22,417)	(25,383)
Grand Central	36,192	57,408	43,524	68,952
Hunterspoint	(2,939)	(3,459)	(3,347)	(3,592)
Flatbush	(2,970)	(3,717)	(3,638)	(3,968)

Increases (Reductions) in Performance Measures for Current Riders from Base Case Scenario	Scenario Number 1	2	3	4
Transfers at Jamaica	630	677	(579)	(915)
LIRR Passenger Hours	2,422	3,096	2,821	3,120
Terminal Surcharges	0	0	0	0
Standees - TOTAL	951	1,047	24	(923)
Penn	30	952	(979)	(636)
Grand Central	1,208	382	1,290	0
Hunterpoint	0	0	0	0
Flatbush	(287)	(287)	(287)	(287)
Egress on Foot	2,410	2,805	2,756	2,828
Walk Egress Hours	(654)	(820)	(737)	(814)
Egress by Transit	(2,410)	(2,805)	(2,756)	(2,828)
Transit Egress Hrs	(3,625)	(4,198)	(4,079)	(4,264)
Total Egress Time	(4,279)	(5,018)	(4,816)	(5,078)
Total Travel/Egress Time	(1,857)	(1,922)	(1,995)	(1,958)
Avg. Walk Egress Time	(2.5)	(2.9)	(2.8)	(2.9)
Avg. Transit Egress Time	(2.3)	(2.7)	(2.6)	(2.7)

FIGURE 8-5

BASE AND FORECAST LIRR TERMINAL VOLUMES - 1985 AM PEAK

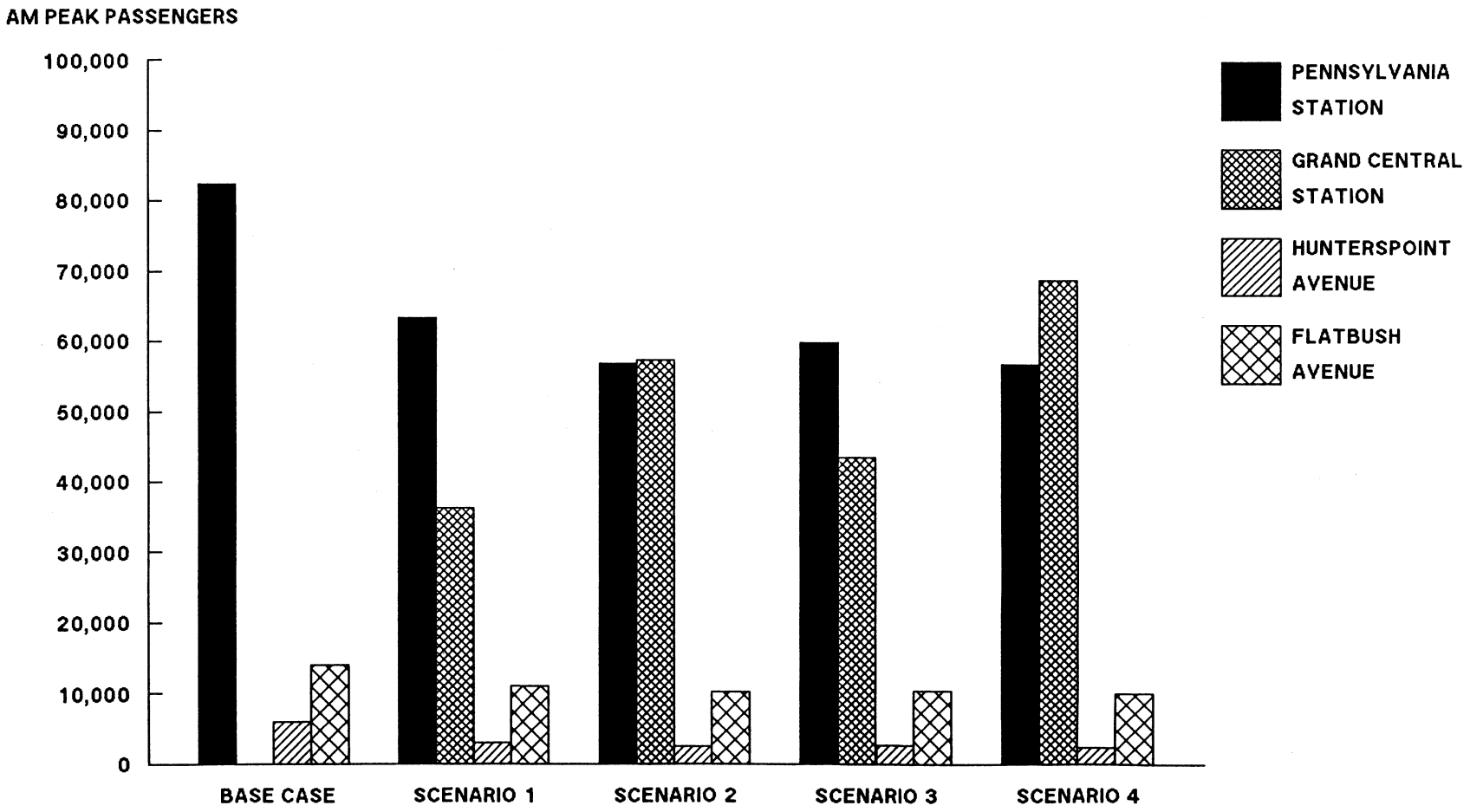
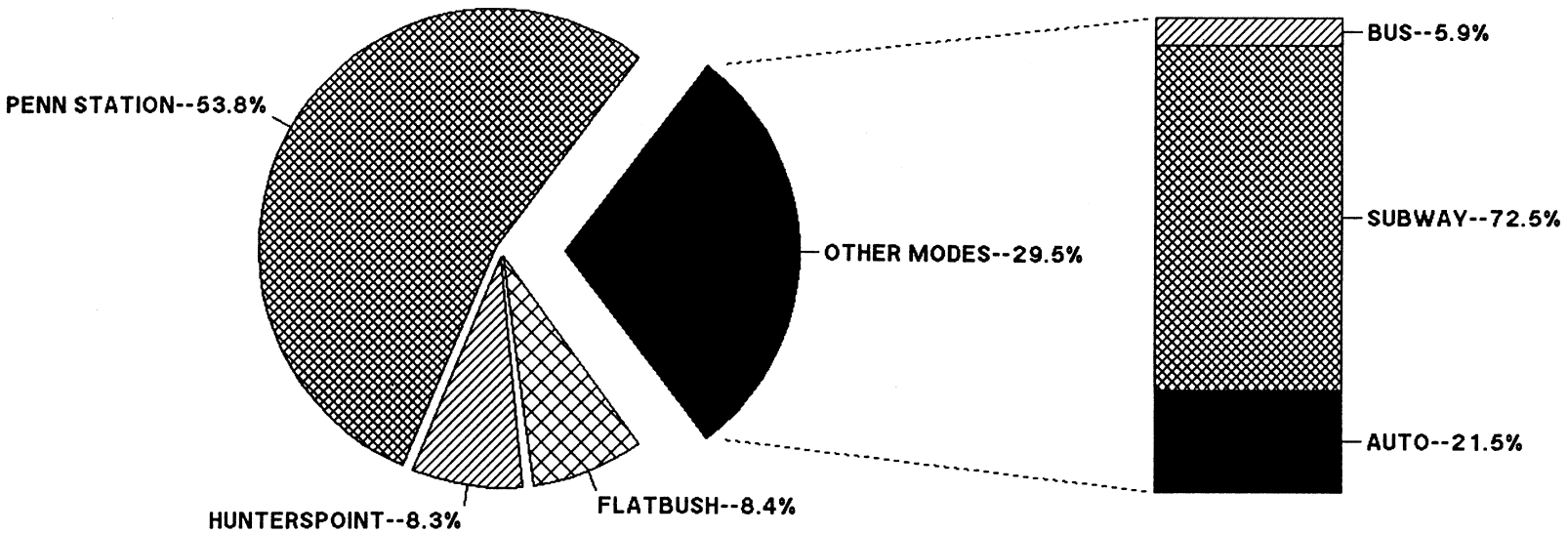


FIGURE 8-6

SOURCE OF GRAND CENTRAL RIDERS UNDER SCENARIO 1 - 1985 AM PEAK



21.2 percent to 11,056 AM peak passengers. In Scenario 4, which has the greatest impact, Flatbush volume drops by only 28.3 percent.

Tables 8-6 and 8-7 also show the other measures of performance for the base case and forecast scenarios. These measures reflect service to existing LIRR riders only, so that changes in their values accurately reflect the impacts of Grand Central service on current LIRR passengers. As indicated, the number of transfers at Jamaica increases under Scenarios 1 and 2 and decreases under Scenarios 3 and 4. This results primarily from a shortage of direct trains to Grand Central under the first two scenarios, resulting in a situation in which some passengers elect to take a seated ride into Jamaica on a train destined for some other terminal, and then transfer at Jamaica to a Grand Central-bound train.

The number of hours spent on LIRR trains by existing riders west of Jamaica increases under all four scenarios. Additional hours spent on trains range from 2,422 hours in the AM peak under Scenario 1 up to 3,120 hours in the AM peak under Scenario 4. These increases are due to the longer travel time between Jamaica and Grand Central station compared to the travel time between Jamaica and the other three terminals. Since no terminal surcharges are applied under any of the scenarios, the values shown in the tables are all zero.

The total number of standees increases under Scenarios 1, 2, and 3, but is reduced under Scenario 4. Standees are eliminated on trains destined for Flatbush under all four scenarios. On Penn Station trains, standees are increased under Scenarios 1, 2 and 3 because of the reduction in service to Penn that is associated with the diversion of trains to Grand Central. Under Scenario 4, sufficient service exists and sufficient riders are diverted away from Penn Station to result in a reduction of standees on Penn-bound trains. At Grand Central, some riders must stand except under Scenario 4, in which sufficient capacity is available for all current riders to remain seated.

Note that the standee counts reported for Grand Central refer only to existing LIRR riders -- that is, under Scenario 1, 1,208 of the current LIRR riders who shift to the Grand Central terminal will be forced to stand. However, there are many Grand Central riders diverted from other modes who will also be forced to stand. The values reported in the table should be used only to assess the impact of Grand Central service on the existing LIRR traveler base.

The introduction of service to Grand Central results in a significant shift in egress modes and average egress times among current riders. Between 2,410 (Scenario 1) and 2,828 (Scenario 4) riders change their egress mode from transit to walk. These individuals can now reach their final destinations on foot but in

the base case preferred to reach their final destination via transit. In addition to this shift, there is also a reduction in the average egress time by each mode. Average walk egress time drops from 20.3 minutes in the base case to about 17.5 minutes, while transit egress time drops from 30.0 minutes to about 27.5 minutes. These changes result in a net egress time savings of between 4,279 hours in the AM peak under Scenario 1 and 5,078 hours in the AM peak under Scenario 4.

In all four scenarios, as shown in Figure 8-7, the egress time savings more than offset the additional on-board travel time, resulting in a net savings in commuting time. This net savings ranges from 1,857 hours under Scenario 1 up to 1,995 hours under Scenario 3. Using the values of travel and egress time reported in Chapter 7, the value of time saved to existing LIRR commuters is $840,600 per year under Scenario 1. Under Scenarios 2, 3, and 4, the value of time saved is $410,500, $732,300, and $444,700 per year, respectively. Of course, there are significant additional benefits that accrue to both current and future LIRR riders as a result of service to Grand Central.

In comparing the results of the four scenarios, it is apparent that the greatest impact on terminal volumes and on generation of new LIRR trips results from Scenario 4, followed in order by Scenarios 2, 3, and 1. This ordering is identical to the ordering of capacity serving Grand Central under the four scenarios. In comparing the effects of each scenario on egress mode and average egress time, the same order is preserved.

In some respects, Scenarios 3 and 4 (the high service scenarios) have more beneficial impacts than Scenarios 1 and 2 (the low service scenarios). Transfers at Jamaica, for example, are reduced as the total amount of service provided increases. The number of standees changes in a similar manner.

Tables 8-8 and 8-9 show the forecast results for the 1985 PM peak period under the base case and four forecast scenarios. For the most part, the results mirror the AM peak period forecasts, although the shorter duration of the LIRR's PM peak (3 hours versus 4 for the AM peak) results in numbers of somewhat lower magnitude. Scenario 1 generally has the smallest impact on travel behavior, and Scenario 4 generally has the largest, as was the case in the AM peak period.

1992 AND 2000 PEAK PERIOD FORECASTING RESULTS

Tables 8-10 and 8-11 show the forecast results for the 1992 AM peak period; Tables 8-12 and 8-13 contain the corresponding PM peak period results. The year 2000 results are shown in Tables 8-14 through 8-17. As mentioned earlier, the 1992 and 2000 scenarios use service levels, fares, and travel times that are identical to those used in 1985; the only change is in the O-D

FIGURE 8-7

CHANGE IN TRAVEL/EGRESS TIME FOR LIRR RIDERS RESULTING FROM INTRODUCTION OF SERVICE TO GRAND CENTRAL

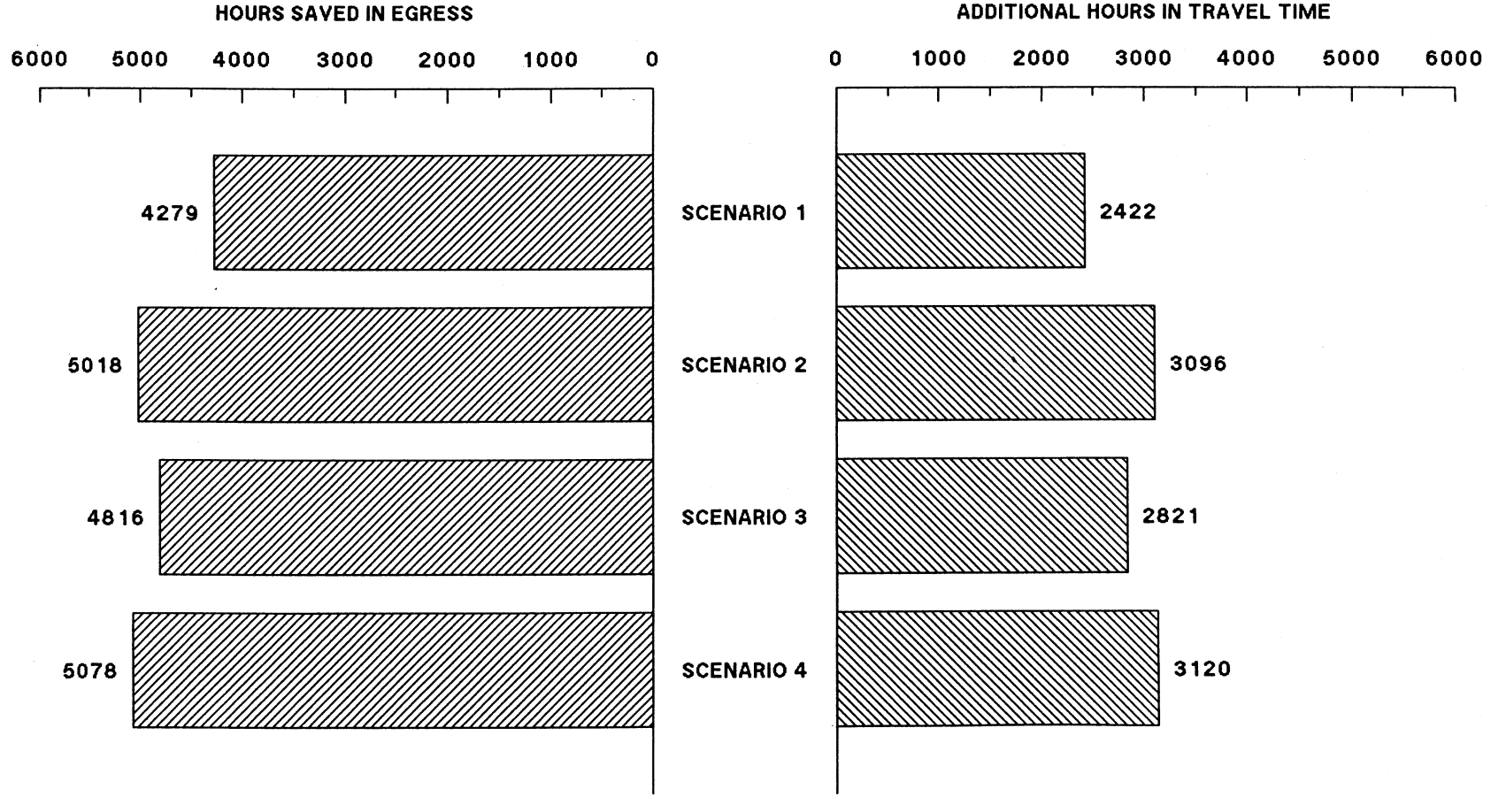


TABLE 8-8

TERMINAL VOLUMES AND PERFORMANCE MEASURES

PM PEAK PERIOD, 1985

Forecast Results	Base	Scenario Number 1	2	3	4
Volume - Penn	67,129	52,911	46,637	49,860	46,492
Grand Central	---	29,016	46,176	34,788	55,536
Hunterspoint	4,820	2,557	2,005	2,204	1,885
Flatbush	11,801	9,442	8,599	8,794	8,387
New Riders - TOTAL	---	9,591	19,003	11,234	27,885
Diverted from Auto	---	2,067	4,095	2,421	6,009
Diverted from Subway	---	6,957	13,784	8,149	20,227
Diverted from Bus	---	567	1,124	664	1,649

Performance Measures For Current Riders	Base	Scenario Number 1	2	3	4
Transfers at Jamaica	12,886	13,331	13,374	12,409	12,132
LIRR Passenger Hours	25,483	27,237	27,905	27,600	27,947
Terminal Surcharges	---	0	0	0	0
Standees - TOTAL	889	1,808	2,111	901	353
Penn	889	1,103	1,686	0	353
Grand Central	0	705	425	901	0
Hunterpoint	0	0	0	0	0
Flatbush	0	0	0	0	0
Egress on Foot	27,342	29,162	29,660	29,620	29,711
Walk Egress Hours	9,254	8,741	8,595	8,720	8,608
Egress by Transit	54,050	52,230	51,732	51,772	51,681
Transit Egress Hrs	27,000	24,183	23,549	23,693	23,467
Total Egress Time	36,254	32,924	32,144	32,413	32,075
Total Travel/Egress Time	61,737	60,161	60,049	60,013	60,022
Avg. Walk Egress Time	20.3	18.0	17.4	17.7	17.4
Avg. Transit Egress Time	30.0	27.8	27.3	27.5	27.2

TABLE 8-9

INCREASES (REDUCTIONS) IN TERMINAL VOLUMES AND PERFORMANCE MEASURES

PM PEAK PERIOD, 1985

Increases (Reductions) from Base Case Scenario	Scenario Number 1	2	3	4
Volume - Penn	(14,218)	(20,492)	(17,269)	(20,637)
Grand Central	29,016	46,176	34,788	55,536
Hunterspoint	(2,263)	(2,815)	(2,616)	(2,935)
Flatbush	(2,359)	(3,202)	(3,007)	(3,414)

Increases (Reductions) in Performance Measures for Current Riders from Base Case Scenario	Scenario Number 1	2	3	4
Transfers at Jamaica	445	488	(477)	(754)
LIRR Passenger Hours	1,754	2,422	2,117	2,464
Terminal Surcharges	0	0	0	0
Standees - TOTAL	919	1,222	12	(536)
Penn	214	797	(889)	(536)
Grand Central	705	425	901	0
Hunterpoint	0	0	0	0
Flatbush	0	0	0	0
Egress on Foot	1,820	2,318	2,278	2,369
Walk Egress Hours	(513)	(659)	(534)	(646)
Egress by Transit	(1,820)	(2,318)	(2,278)	(2,369)
Transit Egress Hrs	(2,817)	(3,451)	(3,307)	(3,533)
Total Egress Time	(3,330)	(4,110)	(3,841)	(4,179)
Total Travel/Egress Time	(1,576)	(1,688)	(1,724)	(1,715)
Avg. Walk Egress Time	(2.3)	(2.9)	(2.6)	(2.9)
Avg. Transit Egress Time	(2.2)	(2.7)	(2.5)	(2.7)

TABLE 8-10

TERMINAL VOLUMES AND PERFORMANCE MEASURES

AM PEAK PERIOD, 1992

		Scenario Number			
Forecast Results	Base	1	2	3	4
Volume - Penn	89,067	69,700	61,594	66,125	61,616
Grand Central	---	36,192	57,408	43,524	68,952
Hunterspoint	6,632	3,636	2,892	3,029	2,621
Flatbush	15,065	12,259	11,317	11,328	10,879
New Riders - TOTAL	---	10,138	21,554	12,354	32,411
Diverted from Auto	---	2,184	4,644	2,662	6,984
Diverted from Subway	---	7,354	15,635	8,961	23,510
Diverted from Bus	---	600	1,275	731	1,917

		Scenario Number			
Performance Measures For Current Riders	Base	1	2	3	4
Transfers at Jamaica	16,424	17,473	17,894	15,403	14,981
LIRR Passenger Hours	33,692	36,061	36,891	36,498	36,953
Terminal Surcharges	---	0	0	0	0
Standees - TOTAL	2,604	3,468	3,849	1,504	1,102
Penn	2,122	2,174	2,958	0	1,077
Grand Central	0	1,282	891	1,504	25
Hunterpoint	0	0	0	0	0
Flatbush	482	12	0	0	0
Egress on Foot	36,361	38,727	39,265	39,234	39,356
Walk Egress Hours	12,297	11,574	11,364	11,543	11,397
Egress by Transit	71,300	68,934	68,396	68,427	68,305
Transit Egress Hrs	35,649	31,892	31,201	31,356	31,044
Total Egress Time	47,946	43,466	42,565	42,899	42,441
Total Travel/Egress Time	81,638	79,527	79,456	79,397	79,394
Avg. Walk Egress Time	20.3	17.9	17.4	17.7	17.4
Avg. Transit Egress Time	30.0	27.8	27.4	27.5	27.3

TABLE 8-11

INCREASES (REDUCTIONS) IN TERMINAL VOLUMES AND PERFORMANCE MEASURES

AM PEAK PERIOD, 1992

Increases (Reductions) from Base Case Scenario	Scenario Number 1	2	3	4
Volume - Penn	(19,367)	(27,473)	(22,942)	(27,451)
Grand Central	36,192	57,408	43,524	68,952
Hunterspoint	(2,996)	(3,740)	(3,603)	(4,011)
Flatbush	(2,806)	(3,748)	(3,737)	(4,186)

Increases (Reductions) in Performance Measures for Current Riders from Base Case Scenario	Scenario Number 1	2	3	4
Transfers at Jamaica	1,049	1,470	(1,021)	(1,443)
LIRR Passenger Hours	2,369	3,199	2,806	3,261
Terminal Surcharges	0	0	0	0
Standees - TOTAL	864	1,245	(1,100)	(1,502)
Penn	52	836	(2,122)	(1,045)
Grand Central	1,282	891	1,504	25
Hunterpoint	0	0	0	0
Flatbush	(470)	(482)	(482)	(482)
Egress on Foot	2,366	2,904	2,873	2,995
Walk Egress Hours	(723)	(933)	(754)	(900)
Egress by Transit	(2,366)	(2,904)	(2,873)	(2,995)
Transit Egress Hrs	(3,757)	(4,448)	(4,293)	(4,605)
Total Egress Time	(4,480)	(5,381)	(5,047)	(5,505)
Total Travel/Egress Time	(2,111)	(2,182)	(2,241)	(2,244)
Avg. Walk Egress Time	(2.4)	(2.9)	(2.6)	(2.9)
Avg. Transit Egress Time	(2.2)	(2.6)	(2.5)	(2.7)

TABLE 8-12

TERMINAL VOLUMES AND PERFORMANCE MEASURES

PM PEAK PERIOD, 1992

Forecast Results	Base	Scenario Number 1	2	3	4
Volume - Penn	72,553	58,150	50,517	55,061	50,310
Grand Central	---	29,016	46,176	34,788	55,536
Hunterspoint	5,359	3,075	2,382	2,491	2,061
Flatbush	12,702	10,409	9,428	9,672	9,072
New Riders - TOTAL	---	9,421	17,173	10,688	25,651
Diverted from Auto	---	2,030	3,700	2,303	5,527
Diverted from Subway	---	6,834	12,457	7,753	18,607
Diverted from Bus	---	557	1,016	632	1,517

Performance Measures For Current Riders	Base	Scenario Number 1	2	3	4
Transfers at Jamaica	14,479	15,112	15,437	13,814	13,449
LIRR Passenger Hours	27,569	29,342	30,155	29,743	30,233
Terminal Surcharges	---	0	0	0	0
Standees - TOTAL	1,952	2,849	3,291	1,034	1,052
Penn	1,828	2,108	2,544	15	970
Grand Central	0	741	747	1,019	82
Hunterpoint	0	0	0	0	0
Flatbush	124	0	0	0	0
Egress on Foot	29,582	31,457	32,039	31,955	32,154
Walk Egress Hours	10,000	9,498	9,281	9,482	9,315
Egress by Transit	58,478	56,603	56,021	56,105	55,906
Transit Egress Hrs	29,254	26,387	25,571	25,773	25,401
Total Egress Time	39,254	35,885	34,852	35,255	34,716
Total Travel/Egress Time	66,823	65,227	65,007	64,998	64,949
Avg. Walk Egress Time	20.3	18.1	17.4	17.8	17.4
Avg. Transit Egress Time	30.0	28.0	27.4	27.6	27.3

TABLE 8-13

INCREASES (REDUCTIONS) IN TERMINAL VOLUMES AND PERFORMANCE MEASURES

PM PEAK PERIOD, 1992

Increases (Reductions) from Base Case Scenario	Scenario Number 1	2	3	4
Volume - Penn	(14,403)	(22,036)	(17,492)	(22,243)
Grand Central	29,016	46,176	34,788	55,536
Hunterspoint	(2,284)	(2,977)	(2,868)	(3,298)
Flatbush	(2,293)	(3,274)	(3,030)	(3,630)

Increases (Reductions) in Performance Measures for Current Riders from Base Case Scenario	Scenario Number 1	2	3	4
Transfers at Jamaica	633	958	(665)	(1,030)
LIRR Passenger Hours	1,773	2,586	2,174	2,664
Terminal Surcharges	0	0	0	0
Standees - TOTAL	897	1,339	(918)	(900)
Penn	280	716	(1,813)	(858)
Grand Central	741	747	1,019	82
Hunterpoint	0	0	0	0
Flatbush	(124)	(124)	(124)	(124)
Egress on Foot	1,875	2,457	2,373	2,572
Walk Egress Hours	(502)	(719)	(518)	(685)
Egress by Transit	(1,875)	(2,457)	(2,373)	(2,572)
Transit Egress Hrs	(2,867)	(3,683)	(3,481)	(3,853)
Total Egress Time	(3,369)	(4,402)	(3,999)	(4,538)
Total Travel/Egress Time	(1,596)	(1,816)	(1,825)	(1,874)
Avg. Walk Egress Time	(2.2)	(2.9)	(2.5)	(2.9)
Avg. Transit Egress Time	(2.0)	(2.6)	(2.5)	(2.8)

TABLE 8-14

TERMINAL VOLUMES AND PERFORMANCE MEASURES

AM PEAK PERIOD, 2000

		Scenario Number			
Forecast Results	Base	1	2	3	4
Volume - Penn	94,901	75,139	65,767	71,791	65,793
Grand Central	---	36,192	57,408	43,524	68,952
Hunterspoint	7,360	4,286	3,356	3,331	2,887
Flatbush	16,103	13,456	12,353	12,344	11,669
New Riders - TOTAL	---	9,897	19,584	11,699	30,004
Diverted from Auto	---	2,133	4,220	2,521	6,465
Diverted from Subway	---	7,179	14,206	8,486	21,765
Diverted from Bus	---	585	1,158	692	1,774

		Scenario Number			
Performance Measures For Current Riders	Base	1	2	3	4
Transfers at Jamaica	18,732	20,027	20,759	17,165	16,882
LIRR Passenger Hours	35,997	38,375	39,371	38,871	39,472
Terminal Surcharges	---	0	0	0	0
Standees - TOTAL	3,999	4,845	5,267	2,228	2,202
Penn	3,247	3,316	3,972	547	1,829
Grand Central	0	1,338	1,271	1,658	373
Hunterpoint	52	0	0	0	0
Flatbush	700	191	24	23	0
Egress on Foot	38,822	41,186	41,945	41,859	42,072
Walk Egress Hours	13,102	12,361	12,150	12,389	12,180
Egress by Transit	76,204	73,840	73,081	73,167	72,954
Transit Egress Hrs	38,166	34,424	33,426	33,588	33,201
Total Egress Time	51,268	46,785	45,576	45,977	45,381
Total Travel/Egress Time	87,265	85,160	84,947	84,848	84,853
Avg. Walk Egress Time	20.2	18.0	17.4	17.8	17.4
Avg. Transit Egress Time	30.1	28.0	27.4	27.5	27.3

TABLE 8-15

INCREASES (REDUCTIONS) IN TERMINAL VOLUMES AND PERFORMANCE MEASURES

AM PEAK PERIOD, 2000

Increases (Reductions) from Base Case Scenario	Scenario Number 1	2	3	4
Volume - Penn	(19,762)	(29,134)	(23,110)	(29,108)
Grand Central	36,192	57,408	43,524	68,952
Hunterspoint	(3,074)	(4,004)	(4,029)	(4,473)
Flatbush	(2,647)	(3,750)	(3,759)	(4,434)

Increases (Reductions) in Performance Measures for Current Riders from Base Case Scenario	Scenario Number 1	2	3	4
Transfers at Jamaica	1,295	2,027	(1,567)	(1,850)
LIRR Passenger Hours	2,378	3,374	2,874	3,475
Terminal Surcharges	0	0	0	0
Standees - TOTAL	846	1,268	(1,771)	(1,797)
Penn	69	725	(2,700)	(1,418)
Grand Central	1,338	1,271	1,658	373
Hunterpoint	(52)	(52)	(52)	(52)
Flatbush	(509)	(676)	(677)	(700)
Egress on Foot	2,364	3,123	3,037	3,250
Walk Egress Hours	(741)	(952)	(713)	(922)
Egress by Transit	(2,364)	(3,123)	(3,037)	(3,250)
Transit Egress Hrs	(3,742)	(4,740)	(4,578)	(4,965)
Total Egress Time	(4,483)	(5,692)	(5,291)	(5,887)
Total Travel/Egress Time	(2,105)	(2,318)	(2,417)	(2,412)
Avg. Walk Egress Time	(2.2)	(2.9)	(2.5)	(2.9)
Avg. Transit Egress Time	(2.1)	(2.6)	(2.5)	(2.7)

TABLE 8-16

TERMINAL VOLUMES AND PERFORMANCE MEASURES

PM PEAK PERIOD, 2000

		Scenario Number			
Forecast Results	Base	1	2	3	4
Volume - Penn	77,424	62,769	54,155	59,883	53,815
Grand Central	---	29,016	46,176	34,788	55,536
Hunterspoint	5,880	3,583	2,653	2,796	2,246
Flatbush	13,525	11,387	10,244	10,455	9,713
New Riders - TOTAL	---	9,273	15,637	10,349	23,721
Diverted from Auto	---	1,998	3,369	2,230	5,111
Diverted from Subway	---	6,727	11,343	7,507	17,207
Diverted from Bus	---	548	925	612	1,403

		Scenario Number			
Performance Measures For Current Riders	Base	1	2	3	4
Transfers at Jamaica	16,294	17,222	17,840	15,345	15,134
LIRR Passenger Hours	29,456	31,248	32,182	31,668	32,295
Terminal Surcharges	---	0	0	0	0
Standees - TOTAL	3,081	3,900	4,495	1,818	1,985
Penn	2,782	3,128	3,449	724	1,615
Grand Central	0	772	1,046	1,094	370
Hunterpoint	41	0	0	0	0
Flatbush	258	0	0	0	0
Egress on Foot	31,651	33,488	34,214	33,974	34,352
Walk Egress Hours	10,699	10,147	9,893	10,119	9,946
Egress by Transit	62,443	60,606	59,880	60,120	59,742
Transit Egress Hrs	31,276	28,358	27,394	27,696	27,167
Total Egress Time	41,975	38,505	37,287	37,815	37,113
Total Travel/Egress Time	71,431	69,753	69,469	69,483	69,408
Avg. Walk Egress Time	20.3	18.2	17.3	17.9	17.4
Avg. Transit Egress Time	30.1	28.1	27.4	27.6	27.3

TABLE 8-17

INCREASES (REDUCTIONS) IN TERMINAL VOLUMES AND PERFORMANCE MEASURES

PM PEAK PERIOD, 2000

Increases (Reductions) from Base Case Scenario	Scenario Number 1	2	3	4
Volume - Penn	(14,655)	(23,269)	(17,541)	(23,609)
Grand Central	29,016	46,176	34,788	55,536
Hunterspoint	(2,297)	(3,227)	(3,084)	(3,634)
Flatbush	(2,138)	(3,281)	(3,070)	(3,812)

Increases (Reductions) in Performance Measures for Current Riders from Base Case Scenario	Scenario Number 1	2	3	4
Transfers at Jamaica	928	1,546	(949)	(1,160)
LIRR Passenger Hours	1,792	2,726	2,212	2,839
Terminal Surcharges	0	0	0	0
Standees - TOTAL	819	1,414	(1,263)	(1,096)
Penn	346	667	(2,058)	(1,167)
Grand Central	772	1,046	1,094	370
Hunterpoint	(41)	(41)	(41)	(41)
Flatbush	(258)	(258)	(258)	(258)
Egress on Foot	1,837	2,563	2,323	2,701
Walk Egress Hours	(552)	(806)	(580)	(753)
Egress by Transit	(1,837)	(2,563)	(2,323)	(2,701)
Transit Egress Hrs	(2,918)	(3,882)	(3,580)	(4,109)
Total Egress Time	(3,470)	(4,688)	(4,160)	(4,862)
Total Travel/Egress Time	(1,678)	(1,962)	(1,948)	(2,023)
Avg. Walk Egress Time	(2.1)	(2.9)	(2.4)	(2.9)
Avg. Transit Egress Time	(2.0)	(2.6)	(2.4)	(2.8)

demand matrix, which reflects an 8.2 percent increase in ridership between 1985 and 1992, and a 15.6 percent increase between 1985 and 2000.

The four service scenarios have relatively similar effects regardless of the forecast year. In all forecast years, Scenario 4 has the greatest impact, followed by Scenarios 2, 3, and 1. There are some variations in this ordering, but these are mostly due to differences that are very small in absolute magnitude.

Terminal volumes at Penn, Hunterspoint, and Flatbush are higher in 1992 than in 1985, and higher still in 2000. The total volume of passengers at Grand Central is identical in all three forecast years--this is because, as mentioned earlier, Grand Central trains are filled to capacity under all four scenarios. With the higher levels of demand in the 1992 and 2000 LIRR O-D demand matrices, the "current" LIRR riders take up more of the available space in the Grand Central trains in 1992 and 2000, reducing the extent to which shifts from other modes can occur. As a result, the number of new LIRR riders forecast for 1992 is lower than that forecast for 1985, and number of new riders is lower still in 2000. Figure 8-8 illustrates this result graphically, comparing demand at Grand Central for the four scenarios for 1985, 1992, and 2000.

Generally, the number of standees increases as the magnitude of the O-D matrix increases; therefore, the number of standees is highest in 2000 and lowest in 1985. Scenarios 4 and 3 result in the fewest standees regardless of the forecast year.

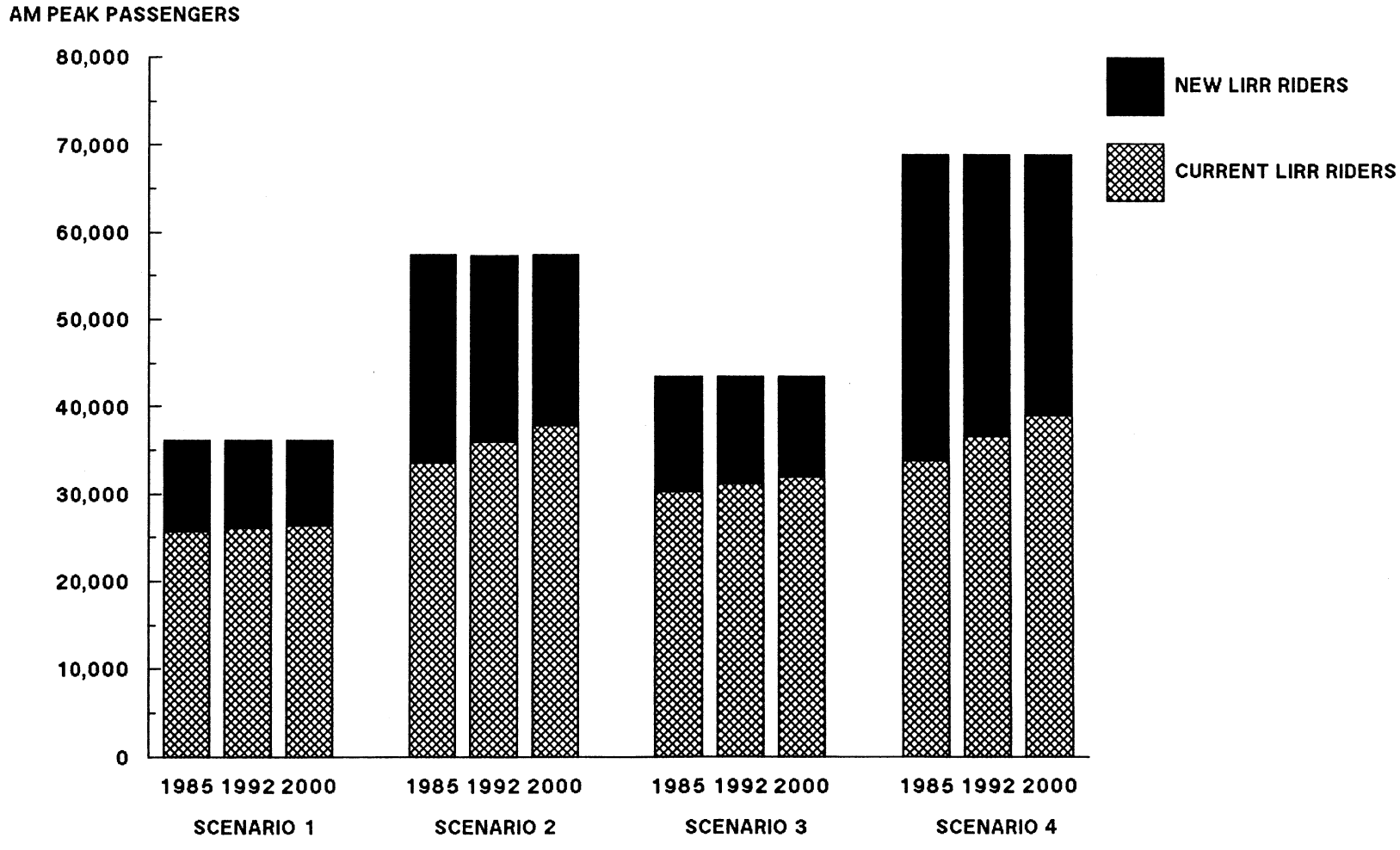
Egress times are reduced by all four scenarios in each of the three years for which forecasts were produced. However, the magnitude of the egress time reductions is smaller in 1992 than in 1985, and is smaller still in 2000. As total LIRR travel volume increases, there is more congestion on the LIRR system, and some riders are forced away from their preferred terminal by capacity constraints to a less desirable option. These less desirable options usually require a longer egress time; hence, the slight increase in egress time for all scenarios in moving from 1985 to 1992 and then to 2000.

DISCUSSION OF MODE SHIFT FORECASTING RESULTS

The peak period forecasts for each of the three forecast years indicate that trains serving Grand Central Station are filled to capacity under all four service scenarios. This section discusses this result in greater detail.

As described earlier, there are a large number of travelers who are likely to shift from other modes of transportation to the LIRR if service to Grand Central Station becomes available. Under all four of the service scenarios that were tested, the

FIGURE 8-8
ALLOCATION OF GRAND CENTRAL DEMAND AMONG CURRENT AND NEW LIRR RIDERS



number of travelers willing to shift modes is more than sufficient to insure that all trains to Grand Central are filled to capacity. To identify the maximum likely diversion from other modes, a forecast based on the availability of unlimited service to Grand Central was produced. This unlimited service forecast for the 1985 AM Peak is shown in Table 8-18, alongside the 1985 AM Peak Scenario 4 forecast.

As the table indicates, the estimated maximum diversion of riders from other modes is 41,584 in the AM Peak, with the majority (30,165) being diverted from the Transit Authority subway. Scenario 4 comes fairly close to this maximum level of diversion, with 35,187 AM Peak travelers shifting to the LIRR. Table 8-19 shows the distribution of diverted travel for each mode by destination zone in Manhattan. As indicated, diversion is the greatest in zone 10017 (the zone in which Grand Central resides), and is next highest in zones adjacent to Grand Central (10016, 10036, 10022, and 10018). Diversion is also significant in zone 10018, which is well served by the Lexington Avenue subway.

Examination of NYMTC's 1982 Hub-Bound Travel report indicates that approximately 240,000 subway passengers entered Manhattan on subway lines from Queens between 7:00 and 10:00 AM. Based upon this figure, the potential diversion resulting from LIRR service to Grand Central represents 12.5 percent of Queens subway commuters. This significant diversion merits some additional discussion, particularly with respect to the practical and fiscal implications of such a shift in demand.

The majority of subway diversion would likely occur from the E, F, N, and #7 lines. Riders on these lines would most likely board the LIRR at Jamaica, Kew Gardens, Forest Hills, Woodside, and at Flushing Station on the Port Washington line. As reported earlier, a substantial proportion of travelers who currently use other modes (34.3 percent) would expect to access the LIRR on foot. However, a significant proportion expect to access the LIRR by bus (29.1 percent) or by parking their car on-street or at the station (20.9 percent). Therefore, for the forecast mode shifts to take place, it would have to be presumed that parking spaces and feeder bus service were available to those travelers who wanted them. This is very likely not to be the case--if 35,000 travelers shift to the LIRR, and 20.9 percent expect to drive to the station, over 7,000 additional parking spaces would be required, most of which would need to be located at LIRR stations in Queens. Similarly, over 10,000 spaces on peak period buses would be required to carry new LIRR riders to their boarding station.

These access demand levels are likely to exceed parking and feeder bus capacities, and have several critical implications for consideration of the introduction of LIRR service to Grand Central:

TABLE 8-18

TERMINAL VOLUMES AND PERFORMANCE MEASURES
AM PEAK PERIOD, 1985

UNLIMITED SERVICE SCENARIO

Forecast Results	Scenario 4 (From Table 8-6)	Unlimited Service
Volume - Penn	56,977	56,039
Grand Central	68,952	74,551
Hunterspoint	2,392	3,583
Flatbush	10,058	10,613
New Riders - TOTAL	35,187	41,584
Diverted from Auto	7,582	8,960
Diverted from Subway	25,524	30,165
Diverted from Bus	2,081	2,459

Performance Measures For Current Riders	Scenario 4 (From Table 8-6)	Unlimited Service
Transfers at Jamaica	13,366	8,638
LIRR Passenger Hours	33,731	34,067
Terminal Surcharges	0	0
Standees - TOTAL	343	0
Penn	343	0
Grand Central	0	0
Hunterpoint	0	0
Flatbush	0	0
Egress on Foot	36,389	36,451
Walk Egress Hours	10,537	10,506
Egress by Transit	63,108	63,046
Transit Egress Hrs	28,667	29,000
Total Egress Time	39,204	39,506
Total Travel/Egress Time	72,935	73,573
Avg. Walk Egress Time	17.4	17.3
Avg. Transit Egress Time	27.3	27.6

TABLE 8-19

DIVERSION OF NON-LIRR TRAVEL TO THE LIRR'S GRAND CENTRAL SERVICE BY MODE AND BY MANHATTAN DESTINATION ZONE

	Mode of Travel			
Dest. Zone	Auto	Subway	Bus	TOTAL
10001	5.29%	8.55%	9.80%	7.74%
10002	6.33%	10.13%	11.63%	8.71%
10003	3.75%	6.15%	7.05%	5.61%
10005	3.87%	6.34%	7.27%	5.85%
10006	4.07%	6.66%	7.64%	6.03%
10007	4.85%	7.88%	9.03%	6.81%
10010	8.95%	13.99%	16.17%	12.74%
10011	3.97%	6.50%	7.45%	5.61%
10013	5.53%	8.92%	10.23%	7.77%
10016	10.32%	15.95%	18.50%	14.34%
10017	18.55%	26.72%	32.66%	24.61%
10018	9.59%	14.92%	17.27%	13.75%
10019	5.50%	8.88%	10.19%	8.02%
10020	6.29%	10.09%	11.58%	9.23%
10021	8.22%	12.94%	14.92%	10.86%
10022	9.86%	15.30%	17.72%	14.01%
10023	4.49%	7.32%	8.39%	6.09%
10036	10.04%	15.55%	18.03%	14.25%
10038	4.42%	7.21%	8.27%	5.12%
TOTAL	8.10%	12.69%	16.39%	11.45%

* The availability of LIRR service to Grand Central will place severe pressure on parking availability at LIRR stations in Queens, and may have additional and perhaps severe traffic congestion impacts in the immediate vicinity of these stations;

* The availability of LIRR service to Grand Central may result in heavy congestion on bus routes feeding into LIRR stations in Queens, with subsequent impacts on local bus travel demand; and

* Actual mode shifts to the LIRR may be less than those predicted here because of physical limitations on auto and feeder bus access.

The financial implications of mode shifts are also difficult to estimate because of complicated interaction effects. Nominally, highest mode shift (Scenario 4) of 35,187 travelers to the LIRR would significantly reduce MTA revenue on East River toll crossings and on the TA subway lines and express buses. A simple estimate of revenue loss would be $63,559 per day, based on fare and toll levels in effect as of October 1, 1985. This estimate is derived as follows: $45,943 per day for the TA subway (25,524 persons at $1.80 per day); $11,373 from auto toll facilities (7,582 persons, about half of whom use MTA toll facilities at $3.00 per day); and $6,243 from express bus riders (2,081 riders, about half of whom use TA express buses at $6.00 per day). This calculation results in a revenue loss to the MTA of approximately $15.9 million annually. Of course, the MTA would generate substantial new revenue from these new LIRR riders; 35,187 zone 3 LIRR riders to Manhattan would generate $35.5 million in LIRR revenue.

These estimates somewhat oversimplify the revenue effects of service to Grand Central. In the first case, many current subway commuters are two-fare riders who must pay for both a bus and a subway portion of their trip. As a result, the revenue loss to the Transit Authority may be somewhat higher than the estimate reported above. Second, capacity constraints on LIRR service into Grand Central will limit the actual mode shift to well below the maximum possible impact. Forecast mode shifts are as low as 9,900 (under Scenario 1 for the year 2000), a figure that would result in revenue loss to the TA (and gains to the LIRR) of less than one-fourth of these maximum amounts. Third, these estimates ignore equilibrium effects on the highway and subway network. It is very likely that shifts in demand from the subway or from East River automobile toll facilities to the LIRR will bring about secondary new utilization of these other facilities. This would tend to reduce still further the potential revenue loss to the TA and TBTA.

OFFPEAK DEMAND FORECASTS FOR 1985, 1992, AND 2000

As mentioned earlier, offpeak forecasts were developed based on direct application of terminal choice models to the offpeak survey sample, because no offpeak origin-destination matrix was available. Direct application of the offpeak demand model results in diversion of 46.5 percent of current Penn Station travel and 6.9 percent of Flatbush travel to Grand Central. The resulting weekday offpeak demand at Grand Central, based on the 1985 terminal counts reported earlier in this chapter, is 9,640 inbound passengers and 16,550 outbound passengers. There is no basis to predict any variation from these demand levels in the other two forecast years.

In addition to diversion of current LIRR travel, there is evidence that additional trips to Grand Central will come from trips switched from other modes and as a result of entirely new trips that are made as a result of the new service. From the telephone survey, 38.5 percent of commuters and 55.4 percent of non-commuters said that they might use the LIRR for some of their existing offpeak trips. A slightly smaller percentage (34.1 percent of commuters; 31.8 percent of non-commuter) said that they might make additional new trips to Grand Central. These new trips would result in substantial additional travel to Grand Central, resulting in terminal volumes of 50 to 100 percent above those reported in the previous paragraph.

EFFECTS OF FARE DIFFERENTIALS AND CAPITAL IMPROVEMENTS

The scenarios described earlier were all similar in that 1) there were no fare differentials between any of the four LIRR terminals; and 2) Ronkonkoma electrification was assumed to be complete, but no other capital improvements were assumed. In this section, 1985 AM Peak forecasts are presented for three other scenarios to identify the impacts of fare surcharges and capital improvements.

A fare surcharge might be applied to Grand Central service on the grounds that it allows travelers to reach East Side destinations without transfering to the subway or bus, and therefore provides a premium level of service. Table 8-20 shows the results of Scenario 4 with the addition of a $1.00 surcharge on LIRR service to Grand Central. These results are compared with the results of Scenario 4 without the fare surcharge.

As indicated, the $1.00 surcharge results in a marked lessening of demand for the new service. Demand at Grand Central is reduced from 68,952 without the surcharge to 41,634 with the surcharge. While some of this drop in demand is due to a reduction in riders diverted from other modes (3,663), the bulk of the difference is in existing LIRR riders who elect to

TABLE 8-20

TERMINAL VOLUMES AND PERFORMANCE MEASURES
AM PEAK PERIOD, 1985

$1.00 SURCHARGE ON TRIPS TO GRAND CENTRAL

Forecast Results	Scenario 4 (From Table 8-6)	$1.00 Surcharge to GCT
Volume - Penn	56,977	75,283
Grand Central	68,952	41,634
Hunterspoint	2,392	4,790
Flatbush	10,058	12,735
New Riders - TOTAL	35,187	31,524
Diverted from Auto	7,582	6,690
Diverted from Subway	25,524	23,012
Diverted from Bus	2,081	1,822

Performance Measures For Current Riders	Scenario 4 (From Table 8-6)	$1.00 Surcharge to GCT
Transfers at Jamaica	13,366	15,297
LIRR Passenger Hours	33,731	32,095
Terminal Surcharges	0	$10,109
Standees - TOTAL	343	3,936
Penn	343	3,857
Grand Central	0	0
Hunterpoint	0	0
Flatbush	0	79
Egress on Foot	36,389	34,708
Walk Egress Hours	10,537	10,895
Egress by Transit	63,108	64,789
Transit Egress Hrs	28,667	30,981
Total Egress Time	39,204	41,876
Total Travel/Egress Time	72,935	73,971
Avg. Walk Egress Time	17.4	18.8

continue using other terminals rather than pay the surcharge at Grand Central.

Planned LIRR capital improvements include egress improvements at Penn Station and possible LIRR-to-subway transfer improvements at Hunterspoint Avenue. To test the effects of these improvements, two additional 1985 AM Peak forecasts were developed--one for Scenario 4 with Penn egress improvements, and one for Scenario 4 with both Penn and Hunterspoint egress improvements. The results of these forecasts are shown in Table 8-21.

As indicated in the table, both of these scenarios result in slightly reduced demand at Grand Central. Demand increases at Penn Station for both scenarios, and demand increases at Hunterspoint for the scenario incorporating Hunterspoint improvements, much as would be expected. Demand at Grand Central does not suffer compared to Scenario 4 without the capital improvements because additional travelers are diverted to the new service from other modes to take up the excess capacity. In fact, under both of these capital improvement scenarios, diverted travel reaches its maximum value of 41,584 AM peak riders. Also, as would be expected, the improvements in egress result in major reductions in egress time, both on foot and via transit, when compared with the case in which these capital improvements do not exist.

SUMMARY

This chapter of the report has presented detailed demand forecasts for a wide variety of service scenarios and forecast years. The next chapter summarizes these forecasting results and integrates them with the results of qualitative and quantitative research, and presents the major conclusions of the East Side Access Study.

TABLE 8-21

TERMINAL VOLUMES AND PERFORMANCE MEASURES
AM PEAK PERIOD, 1985

EGRESS IMPROVEMENTS AT PENN AND HUNTERSPOINT

Forecast Results	Scenario 4 (From Table 8-6)	Penn Station Egress Improvements	Penn & Hpoint Egress Improvements
Volume - Penn	56,977	65,916	65,403
Grand Central	68,952	68,269	67,905
Hunterspoint	2,392	1,814	2,741
Flatbush	10,058	8,841	8,792
New Riders - TOTAL	35,187	41,584	41,584
Diverted from Auto	7,582	8,960	8,960
Diverted from Subway	25,524	30,165	30,165
Diverted from Bus	2,081	2,459	2,459

Performance Measures For Current Riders	Scenario 4 (From Table 8-6)	Penn Station Egress Improvements	Penn & Hpoint Egress Improvements
Transfers at Jamaica	13,366	13,074	13,378
LIRR Passenger Hours	33,731	33,582	33,536
Terminal Surcharges	0	0	0
Standees - TOTAL	343	1,852	1,755
Penn	343	1,852	1,755
Grand Central	0	0	0
Hunterpoint	0	0	0
Flatbush	0	0	0
Egress on Foot	36,389	35,918	36,003
Walk Egress Hours	10,537	8,374	8,388
Egress by Transit	63,108	63,579	63,494
Transit Egress Hrs	28,667	24,459	24,546
Total Egress Time	39,204	32,833	32,934
Total Travel/Egress Time	72,935	66,415	66,470
Avg. Walk Egress Time	17.4	14.0	14.0

9. CONCLUSIONS

This chapter presents the principal conclusions of the East Side Access Study. These conclusions are based on extensive qualitative and quantitative research and on the application of advanced demand analysis techniques and network forecasting algorithms. Study findings are based upon the assumptions and scenarios described in Chapter 8 of this report. The forecasts and results of this study are also based upon the assumptions that there will be no major changes in 1) the transportation infrastructure and service levels on Long Island and Manhattan, 2) population and employment levels in Long Island and Manhattan, and 3) the underlying travel behavior of individuals, with the exception of such changes that are specifically referenced herein.

There is a very large potential market for direct LIRR service to Grand Central Station. Significant numbers of existing LIRR riders, particularly those who are now using the Penn Station and Hunterspoint Avenue terminals, would elect to travel via Grand Central Station if that option were available. In addition, large numbers of peak period travelers who now use other modes would prefer the LIRR's proposed Grand Central service to their current means of travel.

Demand forecasts were produced for four scenarios with a range of service levels to the four LIRR terminals. Under all four scenarios tested, peak period passenger volume at Grand Central was equal to the train capacity provided, indicating that the demand for service at the assumed fare and service levels exceeded the level of service provided. Forecast 1985 AM peak period passenger volume at Grand Central ranged from 36,192 passengers in the lowest service scenario up to 68,952 in the highest service scenario. If there were no capacity constraints of any kind, 1985 AM peak passenger volume at Grand Central could be as high as 74,551 passengers.

Forecasts for 1992 and 2000 (which use a higher base of existing LIRR ridership) result in identical passenger volumes at Grand Central. In these other forecast years demand continues to exceed supply, so that passenger volumes are controlled by the capacity of trains serving Grand Central.

The high level of demand at Grand Central would be accompanied by drops in passenger volume at other LIRR terminals and by significant diversion of Long Island travelers from other modes.

Under scenarios in which high levels of service are provided to Grand Central, 31.0 percent of Penn Station riders would be diverted to Grand Central, along with a 60.0 percent of Hunterspoint riders and 28.3 percent of Flatbush riders.

The greatest volume of diverted travel from other modes would be likely to come from subway riders in Queens; diversion to the LIRR would exceed 25,000 peak passengers (12.7 percent) from current subway riders under the highest-service Grand Central scenario. Diversion from express bus would be highest in percentage terms; 16.4 percent of express bus riders, representing over 2,000 peak passengers, would switch to the LIRR's Grand Central service. Approximately 8.1 percent of automobile commuters (representing 7,582 peak passengers) would be diverted to the LIRR under the highest-service Grand Central scenario. These high levels of diverted travel would, for the most part, generate new LIRR riders at stations in Queens, and would be contingent upon the availability of sufficient means of access to this limited subset of LIRR stations.

There are significant potential travel time savings to LIRR riders and non-riders that would result from the introduction of direct commuter rail service to Grand Central. Existing LIRR riders would experience an increase in rail travel time because service to Grand Central is assumed to take longer than service to the other LIRR terminals. However, LIRR riders would significantly reduce their egress time, because the Grand Central Station location is closer and more convenient to their ultimate Manhattan destinations. These egress time savings would more than offset the increases in line-haul travel time, resulting in a likely average savings in total trip time of 1.15 minutes per peak passenger under the highest-service Grand Central scenario.

Existing LIRR passengers would be likely to reap other benefits in travel and egress. Standees and transfers at Jamaica would be reduced under some of the Grand Central Scenarios, although they might be increased if substantial passenger capacity is shifted away from Penn Station. An increased number of peak passengers (as many as 2,828 under the highest-service scenario) would reach final destinations on foot instead of by transit, eliminating the LIRR-subway or LIRR-bus transfer and additional fare payment.

Many travelers who currently use other modes of travel would benefit from the direct accessibility of East Side destinations via the LIRR's Grand Central service. New LIRR passengers to Grand Central would experience a wide variety of changes (both increases and decreases) in fare, travel time, and egress and access modes and times, depending upon their current mode of travel and the exact locations of their origins and destinations. Most of these travelers do not use the LIRR because it is inconvenient either to their home or their

destination. For those travelers whose destinations are on the East Side, the new service would provide a highly desirable alternative if access to the railroad is feasible.

It is likely that most new passengers would board the LIRR in Queens, and would experience high levels of congestion on Grand Central trains. Most of these riders will be forced to stand throughout their LIRR trip. These new riders might also experience difficulty in accessing and egressing from the LIRR station depending upon the adequacy of parking and feeder bus services.

Rough estimates of the fare revenue impacts of Grand Central service indicate that there would be a large net fare revenue gain for the MTA. Under the highest-service Grand Central scenario, LIRR peak fare revenue could increase by up to $35.5 million annually; TA subway and express bus fare revenues could drop by $13.0 million annually, while TBTA toll collections could drop by $2.8 million annually.

By far the principal determinant of an individual's likelihood of using the Grand Central service is the location in Manhattan of his or her ultimate destination. A second variable that has significant impacts on demand for Grand Central is the availability of direct service. Transfers at Jamaica are clearly undesirable, as indicated by the 65 cent value of avoiding a transfer to existing riders. Low levels of direct service are likely to have major negative impacts on the demand for Grand Central service. This is particularly true for many Hunterspoint riders, who seem particularly sensitive to the service characteristics of the Grand Central option in making their travel decisions.

Offpeak demand forecasts indicate the potential for significant diversion of current travelers to Grand Central. The analysis indicates that 46.5 percent of current Penn travelers and 6.9 percent of Flatbush travelers would be diverted, yielding offpeak Grand Central passenger volumes of 9,640 inbound and 16,550 outbound average weekday passengers. New trips and offpeak travel diverted from other modes could increase this figure by as much as 50 to 100 percent.

Attitude questions posed to existing LIRR riders indicate that Grand Central is an appealing destination for reasons other than its location. Grand Central was perceived to be more attractive, cleaner, less crowded, safer, and in a better area than Penn Station. Riders perceive subway connections to be better at Penn Station, but there were clear indications that many riders were unfamiliar with the connections available at Grand Central.

Imposition of a fare surcharge for service to Grand Central would have significant impact on demand for the new service, reducing likely passenger volumes at Grand Central by 40 percent, and substantially reducing the egress time and transfer reduction

impacts of the new service. Both qualitative and quantitative research respondents disliked the idea of a surcharge for this new service, because it imposed additional cost only on Grand Central riders while yielding benefits to other LIRR riders and non-riders as well. Travelers whose commutation cost would remain the same using Grand Central with a surcharge (principally those who potentially might avoid transit egress) were generally willing to pay a surcharge, but these riders represent a minority of potential Grand Central users.

While potential users of the new service said that a single hourly train providing direct service to Grand Central in peak periods would be sufficient, the overall demand projections make it clear that the LIRR would have to provide significantly higher levels of direct service to satisfy demand. The forecasting software that was delivered to the LIRR as part of this study has the capability to project the demand impacts of alternative service scenarios.

The impacts of East Side Access on the Long Island region are expected to be small; much smaller, in fact, than those that are expected to result from other planned LIRR capital improvements. While LIRR service to Grand Central would to some extent make Long Island a more desirable place to live, the decreasing reliance of Nassau and Suffolk counties on Manhattan offsets this impact so that effects of the project on real estate development or on real estate values in Long Island are judged by experts as likely to be minimal.

Most individuals interviewed in the course of the project supported the goals of the East Side Access project, citing the need for increased commutation system capacity. However, it is clear that many riders, non-riders, and transportation professionals feel that there are other projects that should take priority for the LIRR. These other efforts include electrification, capacity improvements at Jamaica, and terminal and platform improvements at Penn Station. Additionally, many individuals thought that the cost of the project should be shared by all those who would benefit, including travelers who currently use other modes of commutation.

This study has shown that there is considerable interest in use of Grand Central by current LIRR riders and prospective new riders. Whether or not East Side Access is feasible from an engineering point of view and cost-beneficial as an investment of public funds are questions that were outside the scope of this study.

The study also provided useful insight for service planning independent of East Side Access. The terminal choice models that were developed in this study apply to the LIRR system without Grand Central, so the forecasting software may also be used to produce forecasts of the likely impacts of service and fare changes on demand at the existing three LIRR terminals.

APPENDIX A

ON-BOARD SURVEY AND TABULATIONS

ON-BOARD SURVEY TABULATIONS - WHITE FORMS (MAIN LINE)

BASE - TOTAL=1622 PEAK=1272 OFF-PEAK=350

From what zip code did you start your trip today:__ __ __ __ __

At what station did you board the LIRR?

Hicksville	112	Ronkonkoma	31
Babylon	100	Wantagh	31
Baldwin	62	Freeport	29
Bellmore	54	Smithtown	27
Massapequa	52	Bay Shore	26
Huntington	44	Syosset	26
Lindenhurst	39	Westbury	25
Rockville Ctr	38	Islip	25
Massapequa Pk	37	Valley Stream	25
Merrick	34	Rosedale	23
Mineola	33	Seaford	23
Bellerose	31	Sayville	23
Northport	31	Port Jeff	20
Kings Park	31		

How did you get to that station?

	TOTAL	PEAK	OFF-PEAK
Drove and parked at station	48.3%	54.2%	26.7%
Drove and parked on street	8.6	8.5	8.7
Dropped off by car	19.0	16.7	27.3
Other	0.4	0.2	1.5
Walked	18.5	17.1	23.8
Took a bus	1.9	1.3	3.8
Took a cab	3.3	2.0	8.1

How many minutes did it take you to get from your home (or other starting point for this trip) to the station?

Mean (S.D.): TOTAL = 8.83 minutes (6.0)
PEAK = 8.53 minutes (5.1)
OFF-PEAK = 9.94 minutes (8.5)

(Percent responding yes)	TOTAL	PEAK	OFF-PEAK
Did you change trains at Jamaica on this trip?	28.1%	23.2%	45.9%
Did you have a seat on your way to Jamaica?	92.9%	91.4%	97.9
Do you have a seat now?	92.4%	90.9%	97.9

At what New York station are you getting off the LIRR?

	TOTAL	PEAK	OFF-PEAK
Pennsylvania Station	65.9%	61.0%	84.0%
Hunterspoint Avenue	19.5	24.8	0.0
Flatbush Avenue	13.4	13.2	14.0
Woodside	1.1	0.9	1.7
Other	0.1	0.1	0.3

If for some reason that station were closed today, how would you have made this trip?

	TOTAL	PEAK	OFF-PEAK
LIRR to Pennsylvania	28.3%	32.7%	12.6%
LIRR to Hunterspoint	17.4	21.3	3.2
LIRR to Flatbush	13.0	13.8	10.3
LIRR to Woodside	7.2	7.6	6.0
LIRR to a different station	3.0	3.0	2.9
Express Bus	1.7	1.7	1.8
Subway or Local Bus	4.7	2.8	11.8
Private car, van or truck	13.8	10.1	27.4
Other mode	0.5	0.3	1.2
I would not have made trip	10.2	6.7	22.9

How long does it generally take you to travel from your home station to your LIRR terminal station?

Mean (S.D.): TOTAL = 67.0 minutes (24.0)
PEAK = 68.6 minutes (22.4)
OFF-PEAK = 60.5 minutes (28.8)

After you get off the LIRR, how will you get to your final New York City destination? (Check and fill in all that apply)

	TOTAL	PEAK	OFF-PEAK
Percent transfering to subway:	61.5%	64.7%	49.7%
Mean subway time:	15.3 min	14.9 min	17.3 min
Percent transfering to bus:	4.7%	3.2%	10.4%
Mean bus time:	18.9 min	16.9 min	21.6 min
Percent using walk egress:	43.7%	44.7%	39.9%
Mean walk time:	11.5 min	11.3 min	12.3 min
Percent using other egress:	2.5%	0.8%	8.9%
Mean egress time:	16.5 min	13.6 min	18.0 min

Subway lines used by transferees (multiple responses permitted):

Flushing	30.3%	M/J	0.4%
Sixth Ave	5.3	L	0.5
Seventh Ave	28.8	IRT	9.8
Eighth Ave	20.6	BMT	1.2
Lexington	13.8	IND	2.5
Broadway	5.5	PATH	0.3
Shuttle	2.6		

What is the ZIP Code of your New York destination? __ __ __ __ __

What is the nearest intersection to your destination?
_____ and _____
(Example: 5th Avenue and 42nd Street)

What is the purpose of this trip? (Check one)

	TOTAL	PEAK	OFF-PEAK
Commuting to work	81.0%	93.2%	34.1%
Traveling to School	2.3	1.2	6.4
Work/business (not commuting)	5.8	4.9	9.5
Personal/Visit with friends	5.8	0.6	25.9
Other	2.2	0.1	10.4
Shopping	0.8	0.0	4.0
Medical	0.0	0.0	0.0
Entertainment	0.0	0.0	0.0
Returning home	2.0	0.0	9.8

What type of ticket do you usually use when you ride the LIRR? (check one)

	TOTAL	PEAK	OFF-PEAK
monthly	78.7%	89.7%	36.6%
weekly	5.1	5.0	5.4
other	0.8	0.6	1.9
one-way off peak	7.2	0.5	32.6
senior citizen	1.7	0.4	6.6
one-way peak	6.5	3.8	16.9

How many times per month do you use the LIRR to travel **from** Long Island **to** New York?

Mean (S.D.): TOTAL = 19.4 times (8.3)
PEAK = 20.9 times (7.0)
OFF-PEAK = 13.3 times (10.1)

On what percent of your LIRR trips to New York do you get off at...

Penn:_____ percent - 622 persons report over 0%
Flatbush:_____ percent - 231 persons report over 0%
H-point:_____ percent - 117 persons report over 0%
Woodside:_____ percent - 43 persons report over 0%
Other:_____ percent - 9 persons report over 0%

62.5% of persons using Penn use it 100% of the time
28.5% of persons using Flatbush use it 100% of the time
33.9% of persons using Hunterspoint use it 100% of the time

The LIRR is considering introducing service from Long Island to Grand Central Station, located at Park Avenue and 42nd Street. This direct service would be in addition to existing service to Penn Station, Flatbush, and Hunterspoint Avenue.

If you had taken a train to Grand Central today, how would get from Grand Central to your final New York City destination? (Check and fill in all that apply)

	TOTAL	PEAK	OFF-PEAK
Percent transfering to subway:	51.1%	49.2%	59.4%
Mean subway time:	19.3 min	18.6 min	21.8 min
Percent transfering to bus:	4.1%	2.8%	9.6%
Mean bus time:	20.0 min	20.6 min	19.1 min
Percent using walk egress:	48.8%	53.7%	28.5%
Mean walk time:	9.7 min	9.2 min	13.6 min
Percent using other egress:	2.2%	0.4%	9.3%
Mean egress time:	16.9 min	18.8 min	15.4 min

Subway lines used by transferees (multiple responses permitted):

Flushing	14.4%	M/J	0.3%
Sixth Ave	5.0	L	0.6
Seventh Ave	19.1	IRT	14.7
Eighth Ave	5.3	BMT	0.6
Lexington	47.4	IND	2.1
Broadway	2.4	PATH	0.0
Shuttle	9.4		

How would you compare Grand Central and Pennsylvania Station? Which one is...

	Grand Central	Penn Station	Same	Don't Know
cleaner.....	35.4%	12.1%	20.9%	31.6%
less crowded.....	32.7	7.6	25.1	34.8
safer.....	22.6	13.6	25.6	38.2
more attractive..	48.5	10.1	13.0	28.4
in a better area.	48.5	9.6	15.9	26.0
better for subway connections...	24.3	24.0	21.3	30.4

If service to Grand Central were available today, would you have considered using it for your current trip?

	TOTAL	PEAK	OFF-PEAK
Yes	47.8%	49.7%	40.3%
Maybe	11.0	10.3	13.5
No	41.3	40.0	46.1

Would you have considered it...
If the trip took five minutes longer?

	TOTAL	PEAK	OFF-PEAK
Yes	42.6%	42.9%	41.6%
Maybe	14.5	14.3	15.1
No	42.9	42.8	43.3

If it cost an extra 90 cents?

	TOTAL	PEAK	OFF-PEAK
Yes	21.0%	22.2%	16.2%
Maybe	16.1	15.3	19.3
No	62.9	62.5	64.5

If you had to change at Jamaica?

	TOTAL	PEAK	OFF-PEAK
Yes	22.4%	21.4%	26.6%
Maybe	19.2	18.7	21.0
No	58.4	59.9	52.4

If LIRR service to Grand Central were available today, would you use the railroad for some of the trips that you currently make to Manhattan by some other means of transportation?

	TOTAL	PEAK	OFF-PEAK
Percent saying Yes	36.8%	35.5%	42.0%

If LIRR service to Grand Central were available today, would you use the railroad to make new trips to Manhattan?

	TOTAL	PEAK	OFF-PEAK
Percent saying Yes	26.9%	25.6%	32.4%

Do you think it is fair for the LIRR to have different ticket prices for Grand Central, Penn Station, Flatbush, and Hunterspoint?

	TOTAL	PEAK	OFF-PEAK
Yes	25.4%	24.3%	29.6%
Maybe	32.0	30.7	37.1
No	42.7	45.0	33.2

The following information will help us serve you better, and will remain completely confidential.

	TOTAL	PEAK	OFF-PEAK
How many cars, vans, or light trucks are available to your household?	2.08	2.03	1.87
Do you have a valid driver's license?	94.1%	96.3%	85.3%
How many persons (including you) live in your household?	3.33	3.35	3.23
How many persons under 18 years of age live in your household?	0.9	0.9	0.8
What is your age?	37.0	37.4	35.2
Percent male	61.9%	64.4%	52.0%
Percent female	38.1	35.6	48.0

What is the approximate total annual income of all persons in your household?

	TOTAL	PEAK	OFF-PEAK
Up to $15,000 per year	2.5%	1.2%	7.8%
$15,001 to $25,000 per year	6.9	6.0	10.4
$25,001 to $35,000 per year	11.3	10.0	16.4
$35,001 to $50,000 per year	25.0	25.0	25.0
$50,001 to $75,000 per year	28.2	30.2	20.1
$75,001 to $100,000 per year	13.2	14.1	9.7
Over $100,000 per year	12.9	13.5	10.4

If at some time in the future we have a few additional questions, may we contact you by telephone?

77.8% No
22.2 Yes

Thank you very much for your assistance, and have a pleasant trip.

ON-BOARD SURVEY TABULATIONS - YELLOW FORMS (PORT WASH. LINE)

BASE - TOTAL=285 PEAK=271 OFF-PEAK=14 (not shown)

From what zip code did you start your trip today:__ __ __ __ __

At what station did you board the LIRR?

Great Neck	56	Douglaston	12
Port Washington	51	Flushing	9
Bayside	46	Plandome	8
Manhasset	45	Other	4
Little Neck	24		

How did you get to that station?

	TOTAL	PEAK
Drove and parked at station	17.4%	17.9%
Drove and parked on street	15.6	16.4
Dropped off by car	25.2	25.4
Other	0.7	0.7
Walked	33.7	32.1
Took a bus	5.7	5.6
Took a cab	1.8	1.9

How many minutes did it take you to get from your home (or other starting point for this trip) to the station?
Mean (S.D.): TOTAL = 8.99 minutes (6.0)
PEAK = 9.05 minutes (6.1)

(Percent responding yes)	TOTAL	PEAK
Are you currently seated?	93.0%	92.6%

At what New York station are you getting off the LIRR?

	TOTAL	PEAK
Pennsylvania Station	99.3%	99.3%
Woodside	0.4	0.4
Other	0.4	0.4

If for some reason that station were closed today, how would you have made this trip?

	TOTAL	PEAK
LIRR to Pennsylvania	3.6%	3.8%
LIRR to Hunterspoint	3.6	3.8
LIRR to Flatbush	1.8	1.9
LIRR to Woodside	18.3	19.2
LIRR to a different station	4.3	4.5
Express Bus	16.1	16.5
Subway or Local Bus	19.7	18.0
Private car, van or truck	25.8	25.2
Other mode	1.1	1.1
I would not have made trip	5.7	6.0

How long does it generally take you to travel from your home station to your LIRR terminal station?

Mean (S.D.): TOTAL = 37.8 minutes (14.9)
PEAK = 38.4 minutes (15.0)

After you get off the LIRR, how will you get to your final New York City destination? (Check and fill in all that apply)

	TOTAL	PEAK
Percent transfering to subway:	53.5%	54.5%
Mean subway time:	16.0 min	15.9 min
Percent transfering to bus:	6.7%	6.0%
Mean bus time:	20.8 min	18.5 min
Percent using walk egress:	50.7%	51.5%
Mean walk time:	12.0 min	12.0 min
Percent using other egress:	2.1%	1.9%
Mean egress time:	11.3 min	11.3 min

Subway lines used by transferees (multiple responses permitted):

Flushing	3.4%	M/J	0.0%
Sixth Ave	0.9	L	1.7
Seventh Ave	46.2	IRT	11.1
Eighth Ave	32.5	BMT	0.9
Lexington	5.1	IND	3.4
Broadway	6.0	PATH	0.0
Shuttle	2.6		

What is the ZIP Code of your New York destination? __ __ __ __ __

What is the nearest intersection to your destination?
_____ and _____
(Example: 5th Avenue and 42nd Street)

What is the purpose of this trip? (Check one)

	TOTAL	PEAK
Commuting to work	83.3%	85.8%
Traveling to School	2.8	2.6
Work/business (not commuting)	10.0	10.5
Personal/Visit with friends	1.8	0.7
Shopping	2.1	0.4

What type of ticket do you usually use when you ride the LIRR? (check one)

	TOTAL	PEAK
monthly	79.0%	80.9%
weekly	5.3	5.6
other	0.4	0.4
one-way off peak	2.8	0.7
senior citizen	1.8	1.9
one-way peak	10.7	10.5

How many times per month do you use the LIRR to travel from Long Island to New York?

Mean (S.D.): TOTAL = 20.3 times (9.1)
PEAK = 20.7 times (8.9)

On what percent of your LIRR trips to New York do you get off at...
Pennsylvania station: 93 Percent of riders make 100% of their trips through Penn Station

The LIRR is considering introducing service from Long Island to Grand Central Station, located at Park Avenue and 42nd Street. This direct service would be in addition to existing service to Penn Station, Flatbush, and Hunterspoint Avenue.

If you had taken a train to Grand Central today, how would get from Grand Central to your final New York City destination? (Check and fill in all that apply)

	TOTAL	PEAK
Percent transfering to subway:	52.4%	52.3%
Mean subway time:	17.9 min	17.8 min
Percent transfering to bus:	5.2%	5.5%
Mean bus time:	15.0 min	15.0 min
Percent using walk egress:	46.8%	46.8%
Mean walk time:	11.0 min	11.0 min
Percent using other egress:	1.6%	1.3%
Mean egress time:	11.7 min	11.7 min

Subway lines used by transferees (multiple responses permitted):

Flushing	8.1%	M/J	0.0%
Sixth Ave	2.7	L	4.1
Seventh Ave	14.9	IRT	12.2
Eighth Ave	6.8	BMT	1.4
Lexington	56.8	IND	0.0
Broadway	4.1	PATH	0.0
Shuttle	12.2		

How would you compare Grand Central and Pennsylvania Station? Which one is...

	Grand Central	Penn Station	Same	Don't Know
cleaner.....	37.6%	17.3	20.0	25.1
less crowded.....	29.2	13.8	27.9	29.2
safer.....	23.7	17.3	28.5	30.5
more attractive..	54.1	10.2	15.6	20.1
in a better area.	47.3	13.2	19.3	20.2
better for subway connections...	19.5	32.0	21.2	27.4

If service to Grand Central were available today, would you have considered using it for your current trip?

	TOTAL	PEAK
Yes	36.1%	36.5%
Maybe	16.1	15.4
No	47.8	48.1

Would you have considered it...
If the trip took five minutes longer?

	TOTAL	PEAK
Yes	32.8%	32.7%
Maybe	13.0	12.5
No	54.2	54.8

If it cost an extra 90 cents?

	TOTAL	PEAK
Yes	16.5%	17.4%
Maybe	14.2	12.1
No	69.3	70.4

If LIRR service to Grand Central were available today, would you use the railroad for some of the trips that you currently make to Manhattan by some other means of transportation?

	TOTAL	PEAK
Percent saying Yes	37.6%	38.2%

If LIRR service to Grand Central were available today, would you use the railroad to make new trips to Manhattan?

	TOTAL	PEAK
Percent saying Yes	27.5%	27.9%

Do you think it is fair for the LIRR to have different ticket prices for Grand Central, Penn Station, Flatbush, and Hunterspoint?

	TOTAL	PEAK
Yes	30.0%	29.4%
Maybe	43.3	43.0
No	26.7	27.7

The following information will help us serve you better, and will remain completely confidential.

	TOTAL	PEAK
How many cars, vans, or light trucks are available to your household?	1.87	1.85
Do you have a valid driver's license?	93.0%	95.1%
How many persons (including you) live in your household?	3.02	3.00
How many persons under 18 years of age live in your household?	0.7	0.7
What is your age?	37.8	37.3
Percent male	61.5%	63.1%
Percent female	38.5	36.9

What is the approximate total annual income of all persons in your household?

	TOTAL	PEAK
Up to $15,000 per year	0.9%	0.9%
$15,001 to $25,000 per year	3.4	3.6
$25,001 to $35,000 per year	12.4	11.2
$35,001 to $50,000 per year	18.4	17.9
$50,001 to $75,000 per year	22.2	22.4
$75,001 to $100,000 per year	13.7	13.9
Over $100,000 per year	29.0	30.0

If at some time in the future we have a few additional questions, may we contact you by telephone?

78.9%	No
21.1	Yes

Thank you very much for your assistance, and have a pleasant trip.

APPENDIX B

TELEPHONE SURVEY AND TABULATIONS

TELEPHONE SURVEY AND TABULATIONS

BASE - TOTAL=400 COMMUTERS=243 NON-COMMUTERS=157

Hello. My name is _____, calling from Centrac. We are conducting a study [READ IF ASKED: for the Long Island Rail Road] to help improve transportation in the region. Would you be willing to take a few minutes to help us with our study?

24.7% YES [skip to Q.1]
NO - Why? [enter termination code]
7.1 No time - refused callback
2.3 Communication/Language problem
6.0 Doesn't go to New York
9.8 Doesn't use the Long Island Rail Road
13.6 Unexplained refusal
11.7 Use the Long Island Rail Road
24.8 Doesn't go to Manhattan

1. Do you or does anyone in your household commute into Manhattan on a regular basis [once a month or more], but NEVER use the Long Island Rail Road?
   1. YES [Speak that person and skip to 2]
   2. NO [Skip to 3]

[IF MULTIPLE ELIGIBLE RESPONDENTS, TAKE ONE WITH MOST RECENT BIRTHDAY]

2. Do you commute into Manhattan on a daily basis?
   60.8% YES [Skip to A.1]
   39.2 NO [Skip to B.1]

3. The Long Island Rail Road is considering introducing service to Grand Central Station in addition to its current service. As you probably know, Grand Central Station is located at Park Avenue, between 42nd and 43rd street in Manhattan, with convenient subway transfers to the 4, 5, 6, and 7 lines and the Times Square Shuttle.

4. If this service were available, would you consider traveling to Manhattan more frequently than you do now?
   24.7% YES
   8.7 DEPENDS/NOT SURE/MAYBE
   66.6 NO [Terminate]

5. About how many new trips to Manhattan would you make in an average month using this new service to Grand Central?
   37.4% 1
   29.8 2
   9.9 3
   10.7 4
   6.1 5
   6.1 6 or more

[Terminate]

==========

SECTION A: COMMUTERS

A1. How many days per week do you commute into Manhattan...

In a car by yourself:	13.2%	responded 5 days/week or more
In a carpool:	1.6%	
By subway:	56.8%	
By express bus:	4.9%	
By regular bus:	2.9%	
By Long Island Rail Road:	0.0%	
Other (Specify):	2.9%	

A2. On your return trip, how many days per week do you commute home...

In a car by yourself:	11.1%	responded 5 days/week or more
In a carpool:	1.6%	
By subway:	57.2%	
By express bus:	3.7%	
By regular bus:	3.7%	
By Long Island Rail Road:	0.4%	
Other (Specify):	3.3%	

A3. [For auto driver/passengers only] What bridge or tunnel do you usually use to enter Manahattan? ...to leave Manhattan?

Enter	Leave	
30.0%	35.1%	Queens/Midtown Tunnel
28.3	26.3	Queensboro (57th Street) Bridge
13.3	12.3	Triboro Bridge
1.7	1.8	Brooklyn Battery Tunnel
6.7	7.0	Brooklyn Bridge
5.0	5.3	Manhattan Bridge
3.3	3.5	Williamsburg Bridge
11.7	8.8	Other [Specify]

A4. [For auto drivers/passengers] How much do you pay in an average week...

for tolls? Mean=$8.47
for parking? Mean=$18.06

A5. [For auto drivers/passengers] How many miles is it from your home to where you work? Mean=22.9 miles

A6. [For subway riders] What subway line do you ride?

21.8%	Flushing (Number 7)	6.7	RR train
25.7	E train	4.5	N train
13.4	F train	5.0	IRT
5.0	A train	6.7	IND
3.4	M train	6.1	Other
1.1	J train		

A7. [For express bus riders] Which express bus do you take? _____

A8. [For subway/express bus riders] How much does it cost you per day to commute to and from work?

Mean=$3.05

A9. How many minutes does it take from the time you leave your home until you get to where you work?

Mean=56.4 minutes

A10. How many minutes does it take you to return home?

Mean=62.1 minutes

A11. What is the zip code where you work? __ __ __ __ __
[ENTER 99999 IF NO PRIMARY WORK LOCATION]

A12. What is the nearest intersection to your workplace (for example, Fifth Avenue at fourty-second street)?

_____ Avenue and _____ Street

A13. Why don't you use the Long Island Rail Road to commute to Manhattan?
[TAKE VERBATIM, PROBE FOR MULTIPLE RESPONSES]

83	Station too far from home
50	Too expensive
42	Far from home or destination
22	Inconvenient
19	Prefer subway
14	Takes too long
14	Prefer car
13	Don't need to
11	Far from destination
10	Don't like to transfer
7	Don't know station or schedule
6	Uncomfortable
6	Inconvenient schedule
5	No reason
5	Prefer Bus
4	Does use the LIRR
4	Don't like the LIRR

A14. If you were to use the Long Island Rail Road, what station would you be most likely to use?

25	Woodside
20	Forest Hills
20	Flushing
10	Bayside

A15. How would you get to that station?

18.0%	Drive and park at station
2.9	Drive and park on street
4.1	Get dropped off at station
29.1	Take bus to station
1.7	Take taxicab to station
34.3	Walk
1.2	Don't know
8.1	Subway

A16. About how many minutes would it take you to get from your home to that station?
Mean=14.88 minutes

A17. What station would be your second choice?
3 Broadway

A18. How would you get to that station?
38.8% Drive and park at station
6.1 Drive and park on street
6.1 Get dropped off at station
8.2 Take bus to station
4.1 Take taxicab to station
12.2 Walk
12.2 Don't know
10.2 Subway

A19. Suppose that free parking spaces were readily available at your preferred station. On a scale of 0 to 100, what percentage of your trips to Manhattan would you make using the Long Island Rail Road?

Mean=16.33 percent

A20. Suppose that parking spaces were readily available for $2.00 per day at your preferred station. On a scale of 0 to 100, what percentage of your trips to Manhattan would you make using the Long Island Rail Road?

Mean=9.41 percent

A21. If you were to use the Long Island Rail Road to commute to work, would you use ....[READ LIST - ROTATE RESPONSES 1-4]
1.2% The Flatbush Terminal
8.7 The Hunterspoint Terminal
65.7 Pennsylvania Station
7.0 Woodside Station
4.7 Other [Specify]
9.3 Don't Know
3.5 Wouldn't take the LIRR

A22. About how many minutes do you think it would take to travel from your home station to that terminal?
Mean=32.8 minutes

A23. About how many minutes do you think would it take to get from that terminal to your place of work?
Mean=22.2 minutes

A24. The Long Island Rail Road is considering introducing service to Grand Central Station in addition to its current service. As you probably know, Grand Central Station is located at Park Avenue, between 42nd and 43rd street in Manhattan, with convenient subway transfers to the 4, 5, 6, and 7 lines and the Times Square Shuttle.

If this service were available, would you consider using the Long Island Rail Road to commute to and from work?

27.6% Yes
14.0 Maybe
53.9 No
4.5 Don't Know

[ROTATE QUESTIONS A25a&b, A26, and A27]

A25a. Suppose that Long Island Rail Road service to Grand Central got you to work in the same amount of time and cost the same amount as your current means of travel. On a scale of 0 to 100, how likely would you be to use the Long Island Rail Road service to Grand Central instead of your current means of travel?

Mean=37.25 percent

A25b. Suppose that Long Island Rail Road service to Grand Central got you to work in the same amount of time and cost the same amount as your current means of travel, but a change of trains at Jamaica Station was required. On a scale of 0 to 100, how likely would you be to use the Long Island Rail Road service to Grand Central instead of your current means of travel?

Mean=24.32 percent

A26. Suppose that Long Island Rail Road service to Grand Central got you to work 15 minutes faster but cost $1.00 more per day than your current means of travel. On a scale of 0 to 100, how likely would you be to use the Long Island Rail Road service to Grand Central instead of your current means of travel?

Mean=29.74 percent

A27. Suppose that Long Island Rail Road service to Grand Central got you to work 5 minutes slower but cost $1.00 less per day than your current means of travel. On a scale of 0 to 100, how likely would you be to use the Long Island Rail Road service to Grand Central instead of your current means of travel?

Mean=38.55 percent

A28. If the Long Island Rail Road introduces service to Grand Central Station, all of the trains on the railroad might end up less crowded and more comfortable than they are now. If you could be guaranteed a seat on any Long Island Rail Road train, how likely would you be to use the Long Island Rail Road instead of your current means of travel?

Mean=44.59 percent

A29. If you were to think about changing jobs, would Long Island Rail Road service to Grand Central make you more likely to consider jobs located on the East Side?
38.3% YES
13.2 MAYBE/DEPENDS
41.6 NO
7.0 DK

A30. If you were to think about changing where you live, would Long Island Rail Road service to Grand Central make you more likely to consider living near a railroad station?
30.5% YES
14.4 MAYBE/DEPENDS
49.8 NO
5.4 DK

A31. About how many times per month do you travel into Manhattan for purposes other than commuting?
Mean=4.50 times per month [IF 0 skip to A.36]
78.0% of respondents make 5 or fewer trips/month
29.0% of respodents report 0 trips/month

A32. Of these non-commuting trips per month into Manhattan, about how many do you make using the...

Long Island Rail Road: 10.4% make 1 or more trips/month
Car: 56.7
Bus: 9.8
Subway: 45.1
Taxi: 3.0
Other means: 2.4

A33. Why don't you now use the Long Island Rail Road when you make these trips?
[TAKE VERBATIM, PROBE FOR MULTIPLE RESPONSES]
27 Prefer car
25 Station too far from home
23 Far from home or destination
22 Too expensive
17 Inconvenient
12 Prefer subway
10 Inconvenient schedule
8 Don't know station or schedule
8 No reason
4 Never thought about it
4 Don't need to

A34. If service to Grand Central were available, would you consider using the Long Island Rail Road for some of your non-commuting trips into Manhattan?
40.8% YES
19.7 DEPENDS/NOT SURE/MAYBE
39.5 NO [skip to Q.A36]

A35. About what percentage of your current non-commuting trips into Manhattan would you make using the Long Island Rail Road service to Grand Central?
Mean= 44.7 percent

A36. Would the availability of direct Long Island Rail Road Service to Grand Central Station lead you to make any additional trips into Manhattan?
19.5% YES
65.9 NO [skip to section C: DEMOGRAPHICS]
14.6 DK

A37. About how many new trips per month would you make using the new service to Grand Central?
Mean=3.92 new trips/month

[SKIP TO SECTION C: DEMOGRAPHICS]

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SECTION B: NON-COMMUTERS

B1. About how many times per month do you travel into Manhattan?
Mean=4.18 times per month
26.6 percent of respondents make 1 trip/month
24.7 percent of respondents make 2 trips/month
8.4 percent of respondents make 3 trips/month
14.3 percent of respondents make 4 trips/month
3.9 percent of respondents make 5 trips/month
22.1 percent of respondents make over 5 trips/month

B2. Of these [Q.B1] trips per month into Manhattan, about how many do you make using the...
Long Island Rail Road: 0.0% make 1 or more trips/month
Car: 61.1
Bus: 18.5
Subway: 33.1
Taxi: 1.3
Other means: 1.3

B3. Why don't you use the Long Island Rail Road when you travel to Manhattan?
[TAKE VERBATIM, PROBE FOR MULTIPLE RESPONSES]
42 Prefer car
38 Station too far from home
20 Too expensive
16 Don't need to
16 Prefer subway
15 Inconvenient
14 Far from home or destination
10 Takes too long
8 Prefer bus
7 No reason
5 Uncomfortable
4 Don't like to transfer
4 Don't like the LIRR

B4. If you were to use the Long Island Rail Road, what station would you be most likely to use?
12 Woodside
10 Bayside
6 Patchogue

B5. How would you get to that station?
45.5% Drive and park at station
3.6 Drive and park on street
9.1 Get dropped of at station
15.5 Take bus to station
3.6 Take taxicab to station
18.2 Walk
4.5 Don't know

B6. About how many minutes would it take you to get to the station?

Mean=12.01 minutes

B7. What station would be your second choice?
4 Babylon
4 Syoset

B8. How would you get to that station?
53.5% Drive and park at station
8.6 Drive and park on street
8.6 Get dropped of at station
10.3 Take bus to station
3.4 Take taxicab to station
3.4 Walk
12.1 Don't know

B9. Suppose that free parking spaces were readily available at your preferred station. On a scale of 0 to 100, what percentage of your trips to Manhattan would you make using the Long Island Rail Road?

Mean=20.26 percent

B10. Suppose that parking spaces were readily available for $2.00 per day at your preferred station. On a scale of 0 to 100, what percentage of your trips to Manhattan would you make using the Long Island Rail Road?

Mean=10.37 percent

B11. The Long Island Rail Road is considering introducing service to Grand Central Station in addition to its current service. As you probably know, Grand Central Station is located at Park Avenue, between 42nd and 43rd street in Manhattan, with convenient subway transfers to the 4, 5, 6, and 7 lines and the Times Square Shuttle.

If this service were available, would you consider using the Long Island Rail Road for some of your trips into Manhattan?
38.9% YES
16.6 DEPENDS/NOT SURE/MAYBE
42.0 NO [skip to Q.B13]
2.5 DK

B12. About what percentage of your current trips into Manhattan would you make using the Long Island Rail Road service to Grand Central?
Mean=17.91 percent

B13. Would the availability of direct Long Island Rail Road Service to Grand Central Station lead you to make any additional trips into Manhattan using the new service?
31.8% YES
55.4 NO [skip to Section C: DEMOGRAPHICS]
12.7 DK

B14. About how many new trips per month would you make using the new service to Grand Central?
Mean=4.8 new trips/month

[SKIP TO SECTION C: DEMOGRAPHICS]

==========

SECTION C: DEMOGRAPHICS

C0. Now considering only existing service, would a special Sunday Round Trip Excursion fare make you more likely to ride the Long Island Rail Road?

35.5% Yes
11.8 Maybe
49.3 No
3.5 Don't Know

C00. Would a special off peak family fare in which up to 2 children under 12 travel free with an adult make you more likely to ride the Long Island Rail Road?

27.5% Yes
7.0 Maybe
62.5 No
3.0 Don't Know

Now I'd like to ask you just a few more questions for statistical purposes.

C1. How many cars, vans or light trucks are available to your household? Mean=1.63

C2. Do you have a valid driver's license?
79.5% YES
20.5 NO

C3. How many adults eighteen years of age or older live in your household? Mean=2.37

C4. How many children under eighteen live in your household?
Mean=0.63

C5. How many persons in your household are employed full time?
Mean=1.73

C6. How many persons in your household are employed part time?
Mean=0.25

C7. What is your home zip code? __ __ __ __ __

C8. What town and village do you live in _____

C9. What is the nearest street intersection to your home?

_____ and _____

C10. What is your age? Mean=38.53

C11. Is your total annual household income above or below fifty thousand dollars?
20.5% ABOVE - Is it above or below seventy-five thousand dollars?
6.8% ABOVE
12.5 BELOW
48.3% BELOW - Is it above or below twenty-five thousand dollars?
26.3% ABOVE
14.7 BELOW
31.2% REFUSED

C12. Thank you very much for helping us with this study. If at some time in the future we have a few additional questions, may we call you again?

77.8% YES - Name: _____
22.2 NO
[THANK AND TERMINATE]

C13. Sex: 43.3% MALE
56.8 FEMALE

County Code: 75.7% Queens 13.3% Nassau 11.0 % Suffolk

APPENDIX C

EXPRESS BUS SURVEY AND TABULATIONS

EXPRESS BUS SURVEY TABULATIONS

BASE = 137

This survey is being conducted to help improve transportation in the region. Please help us with our study by taking a few minutes to complete and mail back this survey form. A postage-paid envelope is attached.

1. How many days per week do you take the express bus into Manhattan?

   Mean=4.85 days/week

2. Which express bus do you take?

3. What is the intersection nearest to where you board the bus in the morning?

   _____ and _____

4. How do you usually get to the bus?

   90.6% Walk
   7.2 Drive and park
   0.7 Get dropped off by car
   1.4 Local bus

5. How many minutes does it take from the time you leave your home until you get to where you work?

   Mean=62.04 minutes

6. What is the zip code where you work? __ __ __ __ __

7. What is the nearest intersection to your workplace (for example, Fifth Avenue at Forty-second street)?

   _____ and _____

8. Why don't you use the Long Island Rail Road to commute to Manhattan? [Multiple responses permitted]

   55 LIRR station too far away
   34 LIRR too far away from destination
   26 LIRR not convenient
   13 too expensive
   13 more connections required
   6 no parking at the station
   5 out of the way

9. If you were to use the Long Island Rail Road, at what station would you be most likely to get on the train?

32.5%	Bayside	6.7	Little Neck
19.2	Flushing	5.0	Rosedale
10.0	Forest Hills	4.2	Jamaica

10. How would you get to that station?
    16.4% Drive and park at station
    15.6 Drive and park on street
     7.0 Get dropped off at station
    38.3 Take bus to station
     4.7 Take taxicab to station
    12.5 Walk
     4.7 Don't know
     0.8 Other

11. About how many minutes would it take you to get from your home to that station?
    Mean=15.46 minutes

12. What station would be your second choice?
    15.7 Flushing
    12.9 Jamaica
    11.4 Auburndale
    10.0% Bayside
     8.6 Valley Stream
     5.7 Little Neck
     5.7 Great Neck
     5.7 Douglaston

13. How would you get to that station?
    18.5% Drive and park at station
    24.7 Drive and park on street
     9.9 Get dropped off at station
    22.2 Take bus to station
     7.4 Take taxicab to station
     6.2 Walk
    11.1 Don't know

14. If free parking spaces were readily available at your preferred station, what percentage of your trips to Manhattan would you make using the Long Island Rail Road?
    _____ percent

15. If parking spaces were readily available for $2.00 per day at your preferred station, what percentage of your trips to Manhattan would you make using the Long Island Rail Road?
    _____ percent

16. If you were to use the Long Island Rail Road to commute to work, which LIRR terminal would you use?
     0.0% The Flatbush Terminal
     6.4 The Hunterspoint Terminal
    68.0 Pennsylvania Station
     4.0 Woodside Station
    18.4 Don't Know
     3.2 Other

17. About how many minutes do you think it would take to travel from your home station to that terminal?
    Mean=32.43 minutes

18. About how many minutes do you think would it take to get from that terminal to your place of work?

Mean=23.49 minutes

The Long Island Rail Road is considering introducing service to Grand Central Station in addition to its current service. Grand Central Station is located at Park Avenue, between 42nd and 43rd street in Manhattan, with convenient subway transfers to the 4, 5, 6, and 7 lines and the Times Square Shuttle.

19. If this service were available, would you consider using the Long Island Rail Road to commute to and from work?

30.8% Yes 30.1% Maybe 35.3% No 3.8% Don't Know

20. If Long Island Rail Road service to Grand Central got you to work in the same amount of time and cost the same amount as the express bus, how likely would you be to use the LIRR instead of the express bus?

Mean=39.6 percent

21. If Long Island Rail Road service to Grand Central got you to work in the same amount of time and cost the same amount as the express bus, but a change of trains at Jamaica Station was required, how likely would you be to use the LIRR instead of the express bus?

Mean=10.9 percent

22. If Long Island Rail Road service to Grand Central got you to work 15 minutes faster but cost $1.00 more per day than the express bus, how likely would you be to use the LIRR instead of the express bus?

Mean=23.2 percent

23. If Long Island Rail Road service to Grand Central got you to work 5 minutes slower but cost $1.00 less per day than the express bus, how likely would you be to use the LIRR instead of the express bus?

Mean=42.3 percent

24. If the Long Island Rail Road introduces service to Grand Central Station, all LIRR trains might end up less crowded and more comfortable than they are now. If you could be guaranteed a seat on any Long Island Rail Road train, how likely would you be to use the LIRR instead of the express bus?

Mean=44.8 percent

25. If you were to think about changing jobs, would Long Island Rail Road service to Grand Central make you more likely to consider jobs located on the East Side?

32.8% Yes 22.7% Maybe 34.4% No 10.2% Don't Know

26. If you were to think about changing where you live, would Long Island Rail Road service to Grand Central make you more likely to consider living near a railroad station?

36.7% Yes 31.3% Maybe 25.0% No 7.0% Don't Know

27. About how many times per month do you use the express bus to travel into Manhattan for purposes other than commuting?

Mean=0.47 times per month

28. Why don't you now use the Long Island Rail Road when you make these trips?

23 LIRR station too far away
22 LIRR not convenient
13 too expensive
13 rather drive
12 do use LIRR
5 out of the way
4 LIRR too far away from destination

29. If service to Grand Central were available, would you consider using the Long Island Rail Road for some of your non-work express bus trips into Manhattan?

36.6% Yes 30.9% Maybe 24.4% No 8.1% Don't Know

30. About what percentage of your current non-work express bus trips into Manhattan would you make using the Long Island Rail Road service to Grand Central?

Mean=19.19 percent

31. Would the availability of direct Long Island Rail Road Service to Grand Central Station lead you to make any additional trips into Manhattan?

24.8% Yes - How many trips per month? Mean=3.85/month
75.2 No

32. How many cars, vans or light trucks are available to your household? Mean=1.49

33. Do you have a valid driver's license? 85.7% Yes 14.3% No

34. How many persons (including yourself) live in your household? Mean=2.82

35. How many persons under eighteen live in your household?
Mean=0.39

36. How many persons in your household are employed full time?
Mean=1.86

37. How many persons in your household are employed part time?
Mean=0.26

38. What is your home zip code? __ __ __ __ __

39. What town and village do you live in?
18.3% Flushing
16.0 Bayside
12.2 Whitestone
9.2 Fresh Meadows

40. What is the nearest street intersection to your home?

_____ and _____

41. Are you 30.3% Male 69.7% Female

42. What is your age? Mean=40.51

43. What is the approximate total annual income of persons in your household?
1.6% Up to $15,000
16.4 $15,001-$25,000
12.3 $25,001-$35,000
23.8 $35,001-$50,000
29.5 $50,001-$75,000
9.0 $75,001-$100,000
7.4 Over $100,000

THANK YOU VERY MUCH FOR HELPING US WITH THIS STUDY.

APPENDIX D

CLIPBOARD SURVEY AND TABULATIONS

CLIPBOARD SURVEY TABULATIONS

BASE = 412

Excuse me - I'm doing a survey on transportation in New York.
May I ask you six quick questions?

1. Do you live on Long Island?
   --- YES [Thank and terminate]
   412 NO

2. Do you work in Midtown Manhattan?
   336 YES - What is the zip code of your workplace? __ __ __ __ __
   76 NO

3. What is your home zip code? __ __ __ __ __

4. How did you get to Manhattan today?
   7.5% Metro North Commuter rail
   1.5 PATH Commuter rail
   49.0 Subway
   5.8 Walk
   14.3 Express Bus
   6.3 Local Bus
   5.1 Car, van, motorcycle, etc.
   0.2 Taxicab
   0.2 Bicycle
   9.7 NJ Transit
   0.2 Amtrak

5. Are you very likely, somewhat likely, or not likely to move to Long Island in the next few years?
   3.2% VERY LIKELY
   13.1 SOMEWHAT LIKELY
   83.7 NOT LIKELY

6. The Long Island Rail Road is considering introducing direct service into Grand Central Station in addition to existing service to Penn Station. Would this additional service make you more likely to consider moving to a residence on Long Island than you are now?
   6.1% YES
   13.6 MAYBE/DEPENDS
   80.3 NO

Sex: 62.6% Male 37.4% Female

Estimated Age: Under 25 - 20.3%
25-49 - 75.3%
50 or over - 4.4%

APPENDIX E

TERMINAL AND MODE CHOICE MODEL ESTIMATION RESULTS

TABLE E-1

GRAND CENTRAL TERMINAL DEMAND MODEL

PEAK PERIOD RIDERS

	1st Stage			2nd Stage		
Parameter	Estimate	Std. Error	t Stat	Estimate	Std. Error	t Stat
Constant	1.5030	0.0890	16.89	0.8755	0.0511	17.15
Penn dummy	-0.0718	0.0897	-0.80			
H-point dummy	0.0522	0.1126	0.46			
Flatbush dummy	0.8581	0.1874	4.58			
Travel time	-0.0563	0.0071	-7.91	-0.0563	0.0046	-12.20
Travel cost	-1.3398	0.1034	-12.96	-0.7501	0.0607	-12.35
Jamaica transfer	-0.8665	0.0703	-12.33			
Transit egress	-0.3141	0.0612	-5.13	-0.3076	0.0525	-5.86
Egress time	-0.0518	0.0038	-13.49	-0.0367	0.0028	-12.87
Observations		3702			4496	
Asymptotic R-Squared		0.1494			0.1199	

TABLE E-2

GRAND CENTRAL TERMINAL DEMAND MODEL

OFFPEAK RIDERS

	1st Stage			2nd Stage		
Parameter	Estimate	Std. Error	t Stat	Estimate	Std. Error	t Stat
Constant	0.4719	0.2530	1.87	0.4878	0.1401	3.48
Penn dummy	0.4103	0.2592	1.58			
H-point dummy	0.0000	0.0000	----			
Flatbush dummy	-0.0109	0.5383	-0.02			
Travel time	-0.0331	0.0214	-1.54	-0.0485	0.0129	-3.75
Travel cost	-0.8848	0.3044	-2.91	-0.7881	0.1786	-4.41
Jamaica transfer	-0.1531	0.1950	-0.79			
Transit egress	-0.2778	0.1722	-1.61	-0.3480	0.1576	-2.21
Egress time	-0.0122	0.0082	-1.49	-0.0120	0.0075	-1.60
Observations		448			504	
Asymptotic R-Squared		0.0848			0.0817	

TABLE E-3

GRAND CENTRAL TERMINAL DEMAND MODEL

CURRENT AUTO AND SUBWAY RIDERS

Parameter	Estimate	Std. Error	t Stat
Constant	-0.0332	0.3371	-0.10
Travel cost	-0.3500	0.1808	-1.94
Travel time	-0.0080	0.0052	-1.54
Access time	-0.0185	0.0106	-1.74
Egress time	-0.0478	0.0153	-3.12
Subway dummy	0.8745	0.3066	2.85
Observations		267	
Asymptotic R-Squared		0.0853	

TABLE E-4

GRAND CENTRAL TERMINAL DEMAND MODEL

CURRENT EXPRESS BUS RIDERS

Parameter	Estimate	Std. Error	t Stat
Constant	1.3942	0.3966	3.52
Travel cost	-0.3760	0.1415	-2.66
Travel time	0.0016	0.0053	0.31
Access time	-0.1058	0.0197	-5.37
Egress time	-0.0527	0.0237	-2.22
Observations		301	
Asymptotic R-Squared		0.1868	