Determination of Priorities for Station Improvements on Commuter Rail System

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There are numerous criteria that cover a wide range of concerns that could be used to evaluate the relative importance of rail station rehabilitation needs among the many stations of a large commuter rail network. Consideration of policy factors and other elements of the economic and political environment inherent to New Jersey allowed the selection of a smaller and simpler set of priority factors, such as degree of unsatisfactory conditions, level of ridership, degree of community interest, potential for ridership growth, and potential for urban redevelopment. Application of these factors yielded a priority ranking for each station of the New Jersey commuter rail system, which facilitated the programming of a statewide multiyear station-modernization project in an equitable manner.

During the latter part of the 1970s, the State of New Jersey significantly increased its involvement in the improvement of its commuter rail system. As part of this increasing commitment, a number of studies were undertaken to formulate plans for improving facilities and operations. One such study was the New Jersey Rail Station and Bus Terminal Modernization Study (Modernization Study), funded in part by the Urban Mass Transportation Administration. This study had the objectives of developing an inventory of and a modernization program for active commuter rail stations and bus terminals in New Jersey. One of the more difficult and sensitive tasks in the formulation of the modernization program was the ranking of rail stations that would permit the organization of a multiyear capital program. The task was considerable given that the commuter rail system includes 170 stations in New Jersey and Pennsylvania Station in New York City. This paper discusses the process by which the station priority designations were assigned.

BACKGROUND

The existing commuter rail system in New Jersey is what remains of the extensive network of intercity and commuter passenger rail lines constructed during the last century-and-a-half. The system now exists mainly to transport riders to and from two major urban job centers--Newark, New Jersey, and New York City. Thus, the use of the system has become more limited than originally intended. Large stations, at one time designed to handle intercity travelers, their baggage, and, to an extent, freight shipments, now are needed only for ticket sales and a waiting area. Because stations no longer served a substantial and productive function, the declining and bankrupt railroads deferred normal station maintenance practices.

Between 1976 and 1979, the New Jersey Department of Transportation (NJDOT) exercised its 900-day options, provided for under the Regional Rail Reorganization Act of 1973, to purchase most of the rail passenger station properties in the state. The ownership of the stations and corresponding planning responsibilities were transferred in 1979 to the newly formed New Jersey Transit Corporation (NJ TRANSIT), a public agency charged with overseeing and improving bus and rail services throughout the state. Completion of the station-modernization program was one of the earliest actions of NJ TRANSIT to meet this responsibility. The program includes recommendations for station facility renovation, replacement, or expansion, designed to overcome the years of deferred maintenance as well as to provide a level of facilities appropriate to current and projected ridership.

Priorities were not developed for all rail stations. The historic Hoboken Terminal, a major station and service terminus of the New Jersey rail system, had been undergoing significant rehabilitation and restoration for several years and was thus not included in this phase of the Modernization Study. Also excluded were several National Railroad Passenger Corporation (Amtrak) stations located on the Northeast Corridor line, which were scheduled for improvements under the federally funded Northeast Corridor Line Improvement Program. Therefore, the number of stations ranked through the process described here totaled 164.

PRIORITY SYSTEM DEVELOPMENT

At the onset, a large number of considerations were suggested that might be used in ranking stations for the formulation of New Jersey's rail station capital-improvement program. These considerations, which provided a starting point for the development of the priority system, are as follows:

1. Improve poor or unsatisfactory conditions,
2. Positive impact on surrounding community,
3. Favorable cost/benefit ratio,
4. Reduced operating cost,
5. Stations with minimum facilities,
6. Improvement of stations that can serve as prototypes,
7. Stations where parking can be expanded to satisfy parking demand,
8. Walk-in and feeder-bus opportunities,
9. Positive safety and image,
10. Opportunity to reuse surplus space,
11. Opportunity for historic preservation,
12. Regional distribution of improvements,
13. Access for elderly and handicapped,
14. Ease of implementation,
15. Improvement will result in increased ridership, and
16. High-ridership stations.

Although the above list provided a wide range of criteria that could be used for evaluating stations, there are probably variations of these, as well as additional ones, that could be added. Also, a number of them are overlapping, some would be difficult to measure, and some are of greater importance than others. Recognizing these difficulties, it was evident that the ultimate selection of priority considerations required an understanding of the factors and constraints that would affect the process for developing and implementing a station-improvement program in New Jersey. One source of guidance was found in the contract provisions between the Tri-State Planning Commission and NJ TRANSIT for the Modernization Study work program, which stated the following: "Those measures required to avert an emergency...will be given highest priority. The amount of station usage and cost estimates of repairs will be among the major variables used to establish the next highest priority. Purely aesthetic improvements will receive the next priority." Other factors and constraints are described below.

Station-Improvement Process and Statewide Station Needs

The statements of needs for each station developed under the Modernization Study indicate that a varying, but generally substantial, amount of improvement must be undertaken at all stations. In most cases, all elements--platforms, canopies, station buildings, track crossings, information systems, parking, and access--require improvements. Although station elements were separated for the sake of analysis, they are generally closely related and integrated in a physical sense. Considering this, it is likely that the positive impact of the improvement of only selected station elements would be negated by the unimproved condition of other parts of the facility. In addition, experience has shown that improvements beyond very basic maintenance require a considerable level of effort. Appropriate documentation and funding applications, detailed plans and specifications based on extensive field surveys, and careful monitoring of construction are required for the implementation of any improvements. Thus, in undertaking the improvements of a station, it will usually be necessary to address all elements as a package at one time. The correction of emergency or safety-related problems is by nature not subject to the above approach.

NJ TRANSIT Station Leasing Policy

NJ TRANSIT has adopted a policy whereby rail stations are to be leased to municipalities. The leasing program is designed, in part, to develop local, improved maintenance efforts to protect the existing and proposed station investments. A set of guidelines that deal with the lease operation and management of stations was developed with the following objectives:

1. Encouragement of local pride and involvement of local talent in the station improvements,
2. Improvement of the standards of maintenance and security,
3. Balancing and sharing of station costs, and
4. Retention by NJ TRANSIT of limited control to ensure full access to the commuter rail system.

Initial discussions with many municipalities revealed that they would be unwilling to lease stations unless appropriate repairs and improvements are made. Therefore, if stations are improved by the capital program in consultation with the interested municipality, it is likely that the implementation of the leasing policy could be expedited, and benefits realized by all concerned parties.

The leasing guidelines state that subject to the availability of funds, NJ TRANSIT will attempt to make required improvements to stations and, as a first priority, undertake those improvements that are a part of a station's operational facility plan. This plan will include improvements required when necessary to restore the existing structures or space within the structures required for continued commuter services (station building, shelter, platforms, canopies, parking) to a condition equivalent to the condition these structures would be in if they were properly maintained on a continuing basis.

Ongoing Station Maintenance Efforts

The Consolidated Rail Corporation (Conrail) (the commuter rail operator), or the municipalities that own or lease stations, is responsible for regular maintenance and the correction or emergency conditions. Therefore, in the course of renovating and improving stations, the capital-improvement program will address poor or unsatisfactory conditions but not usually emergency conditions. At many stations, due to poor conditions that result from extensive deferred maintenance, regular maintenance efforts have been intensified. For many stations, regular maintenance will include improvements necessary to restore facilities as called for by the station operational facility plan. It is expected that intensified maintenance efforts will be concentrated at those stations being leased to municipalities.

Station Ranking Method

Anticipating that most capital funding will be provided in lump sums, which would be adequate for addressing groups of stations concurrently, it was decided that stations on each rail line should be rated separately and placed in three categories of priority: high, medium, and low. This would avoid the difficulty of putting each individual station on a statewide list that is based on limited current information that may change as funds become available. Instead, stations were compared only against others on the same line. The different conditions found from line to line will not affect the priority ranking, thus giving most of the state's 11 rail lines some high-priority stations. With this system of ranking stations, groups of stations on each rail line could be improved from the highest level of need to the lowest as funds become available. Taking together the suggested priority considerations and the significant factors that affect the development and implementation of the station-improvement program, it was evident that a distillation of the more important points into a simple priority system would be most comprehensible and usable. As a result, the following five priority considerations were chosen.

1. The improvement of poor or unsatisfactory conditions was recognized as an important consideration in the Modernization Study's work program and in all discussions on the priority system. In general, stations with significant deficiencies were subjected to the policy of deferred maintenance for many years. In some cases, deterioration has been so severe that rehabilitation is not economically feasible with respect to transportation needs. In most instances, however, early attention will enable preservation of valuable structures that are essential to the continuance of passenger service. In addition to physical deterioration, poor conditions are found where inadequate facilities exist to serve current passenger demand.
2. The improvement of stations with high ridership appeared to be an outstanding consideration for the formulation of the improvement program. An obvious goal of the capital-improvement program is to benefit and improve the quality of service for the largest number of passengers. With recognition for the desirability of fully improving those stations that are included in the program, it was evident that high-ridership stations should be favored in order to benefit the largest number of passengers. Ridership was initially determined by passenger counts taken by Conrail conductors.
3. Community interest in leasing stations was recognized as a vital factor in maintaining the usefulness and integrity of stations for the long term. Considering the benefits of leasing stations to municipalities, those stations that will be leased would receive priority in the development of the improvement program. Community interest in leasing was determined by a questionnaire sent by NJDOT to all affected municipalities in 1978.

Table 1. Rail station scores for priority considerations—Morristown Line.

Station	Unsatisfactory Conditions	High Ridership	Community Interest	Increase Ridership	Support Urban Policy	Total Points
Harrison	2	1	1	1	2	7
Newark/Broad Street	4	4	1	2	3	14
Roseville Avenue	4	1	1	1	2	9
Grove Street	4	1	1	2	2	10
East Orange	2	2	4	2	3	13
Brick Church	2	2	4	2	3	13
Orange	2	2	4	3	3	14
Highland Avenue	2	2	4	1	2	11
Mountain Station	2	2	2	2	1	9
South Orange	2	2	2	2	2	10
Maplewood	2	4	4	1	2	13
Millburn	2	4	1	2	2	11
Short Hills	1	4	4	1	1	11
Summit	4	4	4	2	2	16
Chatham	1	4	4	1	1	11
Madison	2	4	4	2	2	14
Convent Station	1	4	4	1	1	11
Morristown	2	4	4	2	2	14
Morris Plains	2	2	4	4	1	13
Mount Tabor	1	1	4	1	1	8
Denville	3	2	4	3	1	13
Dover	4	2	4	2	3	15

Note: 4 = high-priority rating, 1 = low-priority rating.

4. Increased ridership is one of the ongoing objectives involved in making improvements to the mass transportation system. By increasing the number of users of mass transit systems, particularly at times of excess capacity, the efficiency of such systems is increased. In other words, the objective is to increase use and maximize the mass in mass transit. With respect to the developing scarcity of energy sources for transportation, the maximization of transit ridership can decrease national energy needs and reliance on less-efficient transportation modes. Stations at which there is potential for increasing ridership, if improvements are made, were determined on a judgmental basis.

5. Closely related to item 4, but important in its own right, is the concept of using the public transportation system to reinforce and stimulate urban development. Urban development with concentrated travel patterns requires mass transportation systems to adequately and efficiently serve those movements. Although the quality of transportation is not the sole factor that influences urban development, it is a major support system of urban society. The reverse is also true; without the concentration of activity characteristic of thriving urban areas, mass transit use and its need are diminished. To the detriment of public transit in New Jersey, the course of development in recent years has been toward low-density suburban development, which in most instances has not required, and is not supportive of, mass transit. However, economic and social forces are causing a weakening of this trend. As a part of any urban support policy, the improvement of public transit is a tool in the revitalization of urban areas. Knowledge of New Jersey development patterns was used to determine those stations at which improvements might reinforce and stimulate urban development.

STATION SCORING AND DETERMINATION OF PRIORITY CATEGORY

Among the five selected considerations, it was evident that greater weight should be accorded to the improvement of stations with poor conditions, stations with high ridership, and stations that municipalities are interested in leasing. If these factors are addressed, significant deterioration will be minimized, the largest number of passengers will experience a higher and more acceptable quality of service, and the continued maintenance and preservation of facilities and passenger safety will be ensured by closer attention to the operation and maintenance of stations. Stations were rated for each consideration on a scale from 1 to 3, with 3 corresponding to the highest priority rating. However, to provide greater weight for the three primary considerations, a high-priority rating for those characteristics was given 4 points. On this basis, the following guidelines were used for rating stations within each priority consideration:

1. Unsatisfactory conditions—(a) 4 points for stations with poor conditions or with deteriorating conditions that will become unsatisfactory if not addressed, (b) 2 points for facilities in acceptable condition, but which need improvement, and (c) 1 point for facilities in very good condition.

2. High ridership—(a) 4 points for stations that serve more than 1000 boarding passengers/day, (b) 2 points for stations that serve between 250 and 1000 boarding passengers/day, and (c) 1 point for stations that serve less than 250 boarding passengers/day.

3. Community interest—(a) 4 points for stations that municipalities have indicated strong interest in leasing, (b) 2 points for stations that municipalities have interest in but have not yet decided to lease, and (c) 1 point for stations that municipalities have said they are not interested in leasing or in cases where no response has been received.

4. Potential to increase ridership—(a) 3 points for stations where proposed improvements will significantly improve current conditions that probably deter use of the facility, or where parking will be expanded to accommodate known demand at a station with parking currently filled to capacity; (b) 2 points for stations at which recommended improvements will upgrade the condition of the facility, make it easier to use, and provide a higher quality of service, thus possibly attracting a small number of new passengers; and (c) 1 point for stations at which proposed improvements are minor, so that it is unlikely that an increase in patronage will occur.

5. Reinforce and stimulate urban development—(a) 3 points for stations located in urban areas where it is evident that an improved public transit facility will reinforce activity in and use of the

station area, (b) 2 points for stations in a busy suburban town center or in an urban area that is not a major activity center, and (c) 1 point for stations located in suburban-residential or rural areas.

To illustrate the rating process, the scores assigned to the stations on one of New Jersey's rail lines, the Morristown Line, are listed in Table 1. The scoring of stations, particularly for the non-quantifiable considerations, was not always clear-cut. As discussions on stations move forward, the ratings should be reconsidered to include additional information and changing conditions.

In general, stations placed in the high-priority category were rated highly for at least two of the three important priority considerations (unsatisfactory conditions, high ridership, and community interest). In addition, in some cases a high score for support of urban policy helped put stations in the high-priority category. Those in the medium-priority category generally serve the middle range of ridership and do not indicate an immediate need

for attention. The low-priority stations have either been recently improved or are in the lower ridership ranges with no outstanding improvement needs. Some stations underwent considerable improvement prior to 1981 and were placed in the low-priority list regardless of the score received. From the totals given in Table 1, the list below indicates the priority classification given to the stations on the sample line:

1. High-priority ranking--Dover, Madison, Morris Plains, Morristown, Newark/Broad Street, Orange, and Summit;
2. Medium-priority ranking--Brick Church, Chatham, Convent Station, Denville, East Orange, Highland Avenue, Maplewood, Millburn, Short Hills, and South Orange; and
3. Low-priority ranking--Grove Street, Harrison, Mountain Station, Mount Tabor, and Roseville Avenue.

Econometric Models for Long Island Railroad

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Three statistical models that explain and predict ridership on the Long Island Railroad (LIRR) under alternative fares were constructed for the New York Metropolitan Transportation Authority. The three models are (a) a ridership model that characterizes short-run responses to fare changes, (b) a ridership model for longer-run responses to fare changes, and (c) a model that predicts the split between the purchase of weekly and monthly tickets. In this paper, the results of 20, 25, and 50 percent fare increases were examined. The short-run model yields a fare elasticity of -0.106, where a 1 percent increase in fares is associated with a 0.106 percent decrease in ridership. This compares with a long-run elasticity of -0.32. The long-run ridership response to a given fare increase should be larger (more elastic) than the short run since people have more options in the long run for finding alternative modes of commuting. For instance, commuters can buy additional or more fuel-efficient automobiles or they can change residence or work locations. The monthly-weekly split model enables us to forecast the split between the purchase of weekly and monthly tickets for alternative fare increases. The split model and the short-run model are used together in estimating ridership and revenues under alternative fares and fare structures. The models incorporate data from 1975 through 1980 for LIRR zones 4-11 (as defined prior to July 1980). Only commuter riders—those buying weekly or monthly tickets—to Pennsylvania Station, Hunterspoint Avenue, or Brooklyn are counted. Because of these restrictions, the elasticity estimates may not match the true systemwide elasticities. Therefore, the forecasts can be viewed as bottom-end estimates, since both one-way ticket buyers and zone 2 and zone 3 riders are probably more sensitive to fare changes.

The project described in this paper was undertaken at the request of the Department of Program Analysis, New York Metropolitan Transportation Authority. We were asked to construct statistical models to explain the effects of various factors on Long Island Railroad (LIRR) ridership. In addition, we forecasted ridership and revenue under alternative fares and fare structures. The models developed can be used on an ongoing basis by the Metropolitan Transportation Authority.

We employed multivariate regression analysis for estimating the models. A multivariate regression has one dependent variable (such as ridership) and many independent variables that are held constant in order to estimate a relation between each independent variable and the dependent variable. The data

cover a six-year period, from January 1975 to December 1980. Variables are stratified by season (three-month quarters), zones (4-11), and branches (divided into four categories).

The LIRR is the nation's largest commuter rail system, providing service primarily between the suburbs of Long Island and New York's central business district. It also serves residents of the New York City Boroughs of Queens and Brooklyn. The system's 9 lines and 140 stations handle about a quarter million passengers on an average weekday. Approximately 80 percent of the riders commute from Nassau and western Suffolk County to Pennsylvania Station, Hunterspoint Avenue, or Brooklyn. The most passenger growth in recent years has been in western Suffolk County.

A zone structure is used in determining fares on the system, which divides Long Island, Brooklyn, and Queens into 15 zones. Several zones were combined in July 1980 when a new fare structure went into effect.

About 70 percent of Long Island residents who work in Manhattan ride the LIRR. One-way fares from zones 4 through 11 to Manhattan range from $2.30 to $7.40. Monthly fares range from $68.25 to $96.25.

DESCRIPTION OF DATA

In collecting data for the models, we attempted to quantify five different categories of variables:

1. LIRR ridership,
2. LIRR fares and automobile commutation costs,
3. LIRR level of service,
4. Demographics, and
5. Dummies to control for season, strikes, and gasoline shortages.

These categories will be discussed below in terms of the level of data aggregation.