New Jersey Transit Light Rail Transit Initiatives

Jerome M. Lutin, Richard Hernon, Michael Magdziak, and
James Schwarzwalder, *New Jersey Transit*

New Jersey Transit currently has four light rail transit initiatives under way in the state of New Jersey: the Newark City Subway rehabilitation, the Hudson-Bergen Light Rail Transit System, the Newark-Elizabeth Rail Link, and the Burlington-Camden-Gloucester Transit Corridor. An overview of each of the prospective light rail systems is presented along with comparative information of interest to the professional transit community. Physical descriptions of each corridor and line are given, and the unique conditions that pertain to each project are discussed. Efforts to coordinate the planning of all four initiatives in the interest of achieving agencywide consistency on such issues as operations and safety, engineering and design standards, standardized equipment (including vehicles), procurement procedures, and documentation are discussed.

New Jersey Transit (NJ Transit) is a statewide agency created in 1979 to provide public transit service for the state of New Jersey. NJ Transit carried 173 million passenger trips in 1994 and serves an area of 5,325 mi^2 (13 792 km^2). NJ Transit rail service encompasses 12 commuter rail lines, 464 mi (747 km) of track, 157 stations, and a fleet of 715 rail cars. The agency operates 1,843 buses over 152 bus routes. In addition it provides 848 buses to an additional 110 private bus operators. Included in the bus operations figures is NJ Transit's only light rail transit operation, the Newark City Subway, a 4.3-mi (7.0-km) line that is the last vestige of the 800-mi (1290-km) streetcar system operated by Public Service Coordinated Transport, portions of which remained into the 1950s.

NJ Transit has four major light rail transit initiatives under way in 1995. These initiatives are the modernization of the Newark City Subway and acquisition of a fleet of low-floor light rail vehicles (LRV)s, the Hudson-Bergen Light Rail Transit System, the Newark-Elizabeth Rail Link, and the Burlington-Camden-Gloucester transit project.

Newark City Subway Modernization Project

The Newark City Subway was constructed between 1930 and 1935 through the city of Newark in the bed of the then-abandoned Morris Canal. It runs in subway for 1.3 mi (2.1 km) and in open cut for the remaining 3 mi (4.9 km) (see Figure 1). The subway was originally conceived as a trunk route to reach Newark's Penn Station and accommodated, in addition to the Number 7 City Subway service, surface trolley lines operated by Public Service Coordinated Transport including the Numbers 21 Main Street, 23 Central Avenue, and 29 Bloomfield. By 1952 only the Number 7 line remained in place, and arrangements were being made to pur-

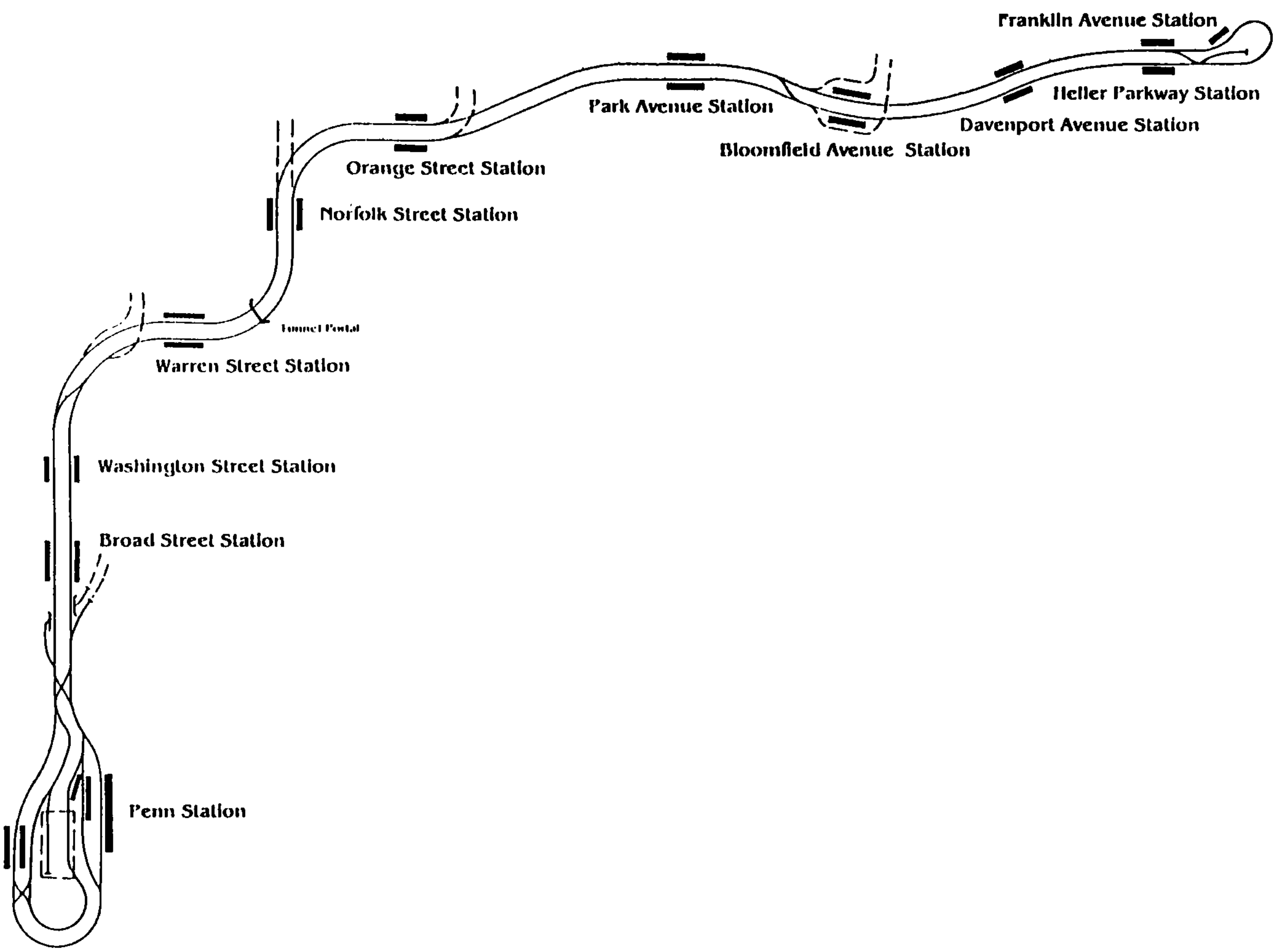

FIGURE 1 Newark City Subway.

chase 30 second-hand PCC cars from Twin Cities Rapid Transit Company to replace obsolete cars.

Currently, the City Subway is operated with the remaining 26 Presidents Conference Committee (PCC) cars, which were built between 1946 and 1949. The subway carries 16,900 weekday passengers over the 4.3-mi (7.0-km) route at headways ranging from 2 min in the peak to 6 min base, to 30 min in late evenings.

A comprehensive engineering study for the subway has been completed that evaluated all elements of the existing system including vehicles, maintenance facility, electrification, signals, track, stations, and operations. Work is currently under way on major improvements needed to continue safe operations and support the procurement of a fleet of modern LRV.

A new sprinkler system to service Penn Station and a dry standpipe system to provide fire protection for the existing 1.3-mi (2.1-km) subway tunnel have been designed, and construction began in December 1994. Also included in the project is a supervisory control and fire alarm network.

In December 1993 a contract was awarded to design a smoke suppression and evacuation system for the existing Penn Station Shop and subway tunnel. This system will provide up-to-date ventilation for the subway tunnel, which currently relies upon surface grates and the "piston effect" of the movement of rail cars to create ventilation.

A contract was awarded in January 1995 to design additional facilities and systems and upgrade the traction power electrification system. The design is expected to include five new substations, feeder and return systems, and a supervisory control and data acquisition (SCADA) system. The upgrade of the existing overhead contact system and support structure will allow voltage to be increased from the existing 600 VDC to 750 VDC to accommodate modern LRVs.

A significant outcome of the modernization study was a recommendation to replace the existing PCC cars with a fleet of modern LRVs. The PCC cars, although exceptionally well maintained, are almost 50 years old. The inevitable corrosion and aging of materials, as well as the scarcity of spare parts, will impose an increasing maintenance burden and reduce service reliability over time. In addition, NJ Transit has an obligation to bring its facilities into compliance with the Americans with Disabilities Act (ADA). Existing ADA standards require that the horizontal gap between rail vehicle and platform cannot exceed 3 in. (76 mm), and the vertical gap cannot exceed 5/8 in. (16 mm). These standards, coupled with the advanced age of the PCC cars, make it impractical to retrofit the existing fleet to achieve ADA access. New cars will be needed.

The Newark City Subway Modernization Study also examined the existing maintenance facility. When the subway was first constructed, cars were maintained at the Roseville Car House. In the 1950s, however, the connection to the car house was severed and all maintenance was conducted under Penn Station, where a running repair facility had been located. Through extraordinary efforts, City Subway staff have been able to use these cramped and substandard quarters to successfully maintain the current fleet.

New cars are expected to be nearly twice as long as the existing PCC cars and are likely to have much roof-mounted equipment. Elevated work platforms, longer inspection pits, and high-capacity lifting equipment will be required to maintain these vehicles. Consequently, the existing Penn Station subway maintenance facility is inadequate to maintain a fleet of replacement LRVs.

New Vehicle Maintenance Facility

A modern LRV maintenance facility for the Newark City Subway would require a level site of about 13 to 15 acres (5.3 to 6.1 ha) to provide adequate space for the maintenance facility, storage yard, and test track. Such sites are scarce in the densely built up area served by the Newark City Subway, and none exists adjacent to the line. A suitable site, however, was located approximately 1/2 mi (0.8 km) from the City Subway on Consolidated Rail Corporation's (Conrail's) Bloomfield Industrial Track, which passes about 400 ft (122 m) from the northern terminal of the City Subway at Franklin Avenue (see Figure 2). By obtaining rights to use the Bloomfield Industrial Track and constructing a link between the two lines, a suitable maintenance facility site could be accessed from the City Subway. The availability of additional vacant land close by the maintenance facility in proximity to Bloomfield Avenue, which serves major feeder bus routes, led to a proposal to construct a new bus transfer and park and ride terminal station for the Newark City Subway at Grove Street and Bloomfield Avenue in Bloomfield, adjacent to the proposed maintenance facility.

Hudson-Bergen Light Rail System

Planning for the Hudson-Bergen Light Rail System began in the mid 1980s when New Jersey's Hudson River waterfront facing Manhattan began a transformation from land use, characterized by decaying piers and abandoned rail yards, to a vibrant new development area with projections of up to 17 million ft^2 (1.58 million m^2) of office space, 2 million ft^2 (186 000 m^2) of retail space, and 30,000 new residences. Bounded on the east by the Hudson River and on the west by steep cliffs, called the Palisades, the Hudson River waterfront is a narrow shelf of land. Transportation access to the waterfront is made difficult by the topography and the pervasive congestion problems created at the major highway crossings into New York City. To achieve its development potential, the waterfront, which spans two counties, would need additional transit capacity.

The Hudson-Bergen System is a proposed independent light rail transit (LRT) system with a planned length of 20.5 mi (33 km). It will not connect with the Newark City Subway. The system, shown in Figure 3, will include a yard and shop at Gateway. Three branches will emanate from Gateway: one to Vince Lombardi park and ride in the north, one to the west to Route 440, and one to the south of 5th Street park and ride at the tip of Bayonne. The 1990 estimated cost of the total system is $775 million with an escalated cost estimate of $1.4 billion.

A decision was made in the late summer of 1994 to implement an initial 10-mi (16-km) operating system, using a turnkey procurement. It is envisioned that this procurement will include private funding, design, construction, operation and maintenance. The estimated cost of this initial system is about $800 million including all soft costs, such as engineering, administration, insurance, startup, and the like.

Preliminary engineering and preparation of the environmental impact statement are under way. In addition, to expedite the project the property acquisition process has been initiated. All project activities leading to securing a turnkey contract are scheduled to be completed by mid-1996. On the current schedule, it is hoped to begin LRT operations in 1999.

The total system will have five regional park and rides with over 5,000 parking spaces. There will be four major intermodal transfer points—Exchange Place [Port Authority Trans Hudson (PATH) service and

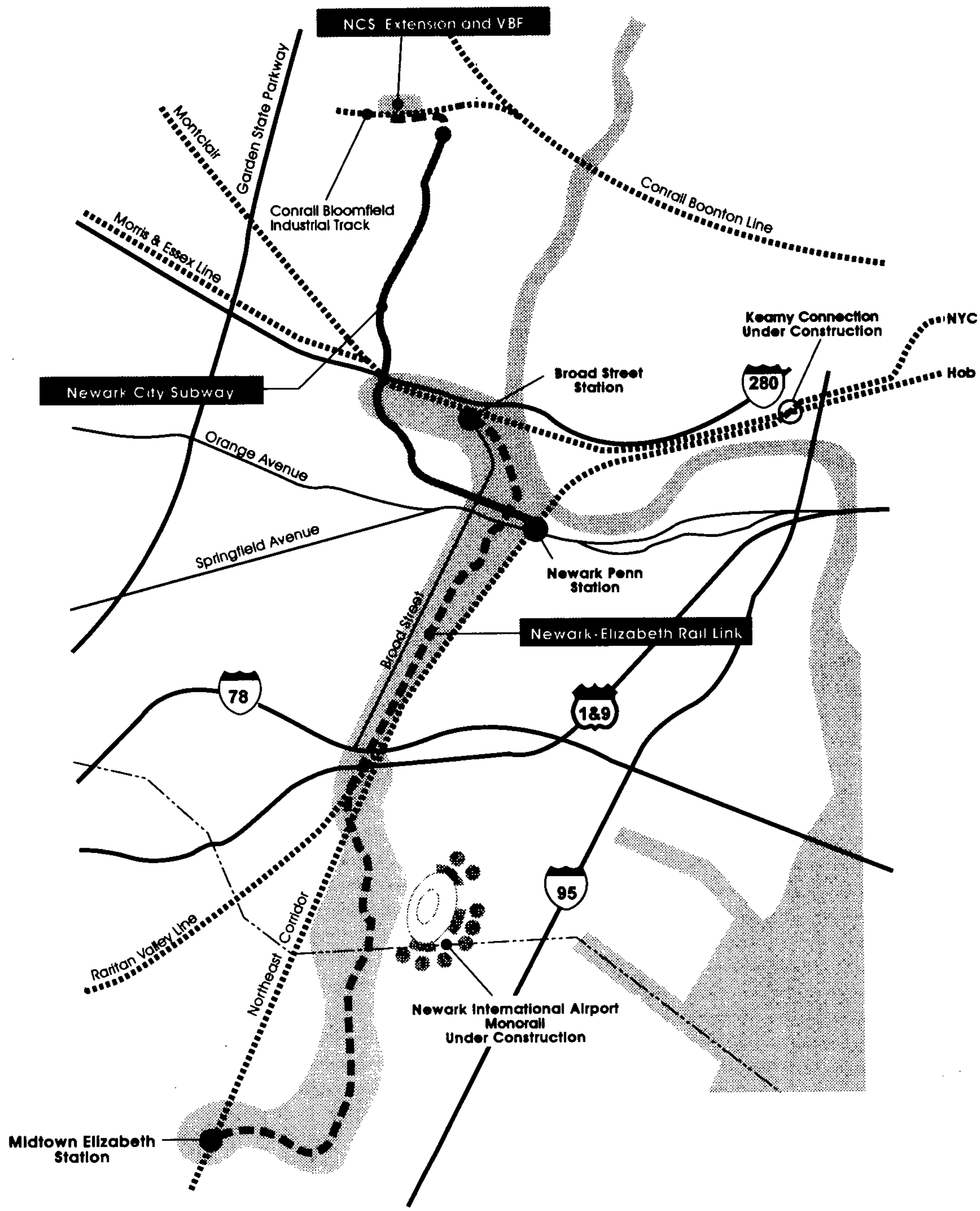

FIGURE 2 Newark-Elizabeth Rail Link and Newark City Subway vehicle base facility.

buses], Pavonia/Newport (PATH), Hoboken (NJ Transit Rail, PATH, bus, and ferry), and Port Imperial (ferry) —to provide for the trans-Hudson commuters who are expected to constitute 50 percent of the LRT riders. The total daily number of trips in 2010 is projected to be about 100,000.

Newark-Elizabeth Rail Link

Planning for the Newark-Elizabeth Rail Link (NERL) began in the mid 1980s when Newark International Airport, located in the cities of Newark and Elizabeth, New Jersey, experienced significant growth. In addition,

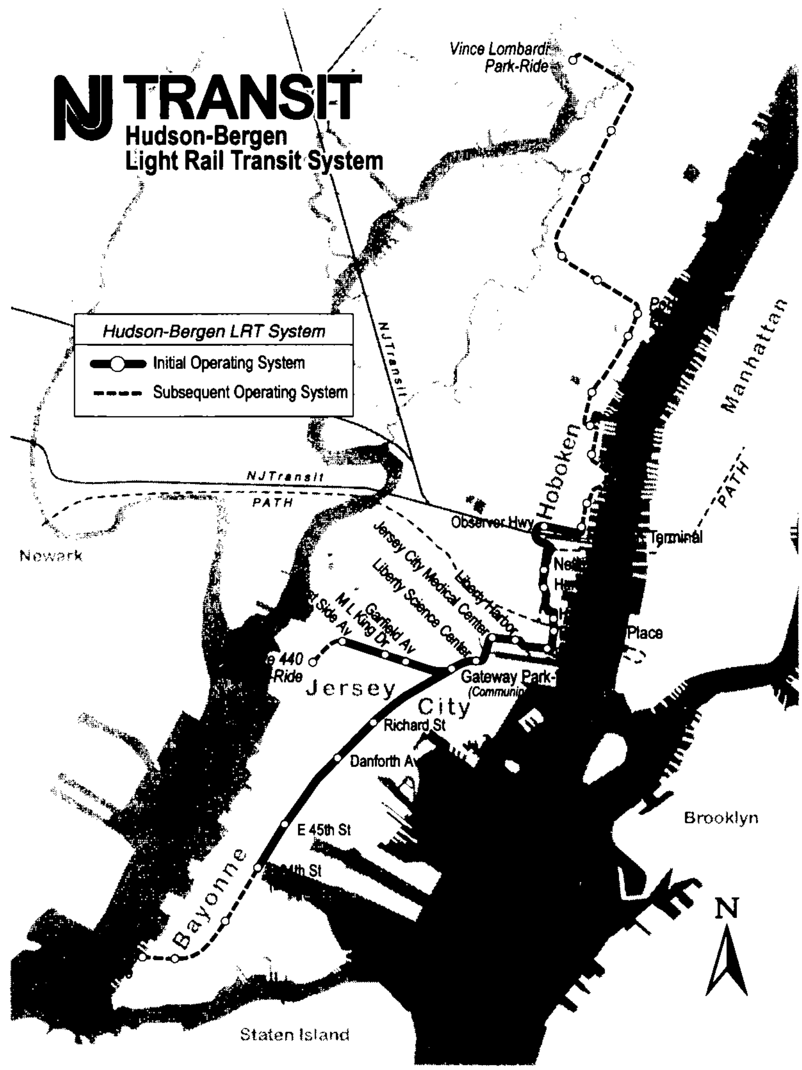

FIGURE 3 Hudson-Bergen LRT System, initial and subsequent operating systems.

a major increase in intermodal container traffic was being experienced at the ports of Newark and Elizabeth adjacent to the airport. Seeking to capitalize on the economic generators of the airport and the port, Newark and Elizabeth began to conceive plans for major office and commercial development in the 9-mi (14.5-km) corridor linking the airport with the downtowns of the two cities.

Their studies, completed in 1989, indicated that a fixed guideway transit system could be implemented in the corridor. It would help achieve economic development goals and provide additional transportation to help relieve the congested highway grid in the project area. Federal grants were earmarked to study transit improvements in the area. The Newark-Elizabeth Rail Link was included along with other projects in the North Jersey Urban Core Program, which received an authorization of $634.4 million in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).

A major planning study for the corridor, the Newark-Elizabeth Rail Link Options Study, was completed in June 1992. The study set the stage for selection of a locally preferred alternative, which included a 9-mi (14.5-km), 12-station LRT line linking Newark to Elizabeth and configured as an extension of the Newark City Subway, shown in Figure 2. By configuring the NERL systems as an extension of the Newark City Subway, it would be possible to share the same fleet of cars and maintenance facility and to offer through-routed service.

The study also concluded that a new rail station on the Northeast Corridor linked within the Newark International Airport by a proposed extension of the on-airport monorail would complement the LRT system and provide for regional access to Newark Airport. During 1994 and 1995, the NERL project conducted preliminary engineering studies and completed a draft environmental impact statement for the project.

When the NERL Core System was introduced to the public in a series of environmental impact statement scoping meetings held in December 1993, many comments were received urging that the project be extended to include rail passenger service to a number of additional communities by restoring existing or abandoned rail lines. In response to those requests, NJ Transit initiated studies to determine the effect of proposed extensions on the core system for documentation in the impact statement (see Figure 4).

At the south end of the proposed rail link, extensions to Plainfield, Summit, and Elizabeth Port were studied. An existing four-track former Central Railroad of New Jersey rail right-of-way between midtown Elizabeth Station and Cranford is not currently used by freight or commuter rail. In addition, an abandoned freight rail line, the Rahway Valley Line, remained largely intact between Cranford and Summit, and was slated for acquisition and preservation by the New Jersey Department of Transportation under a rail preservation bond issue.

At the northern end of the proposed NERL system, two extensions were examined. One extension would begin at the proposed NCS vehicle maintenance facility

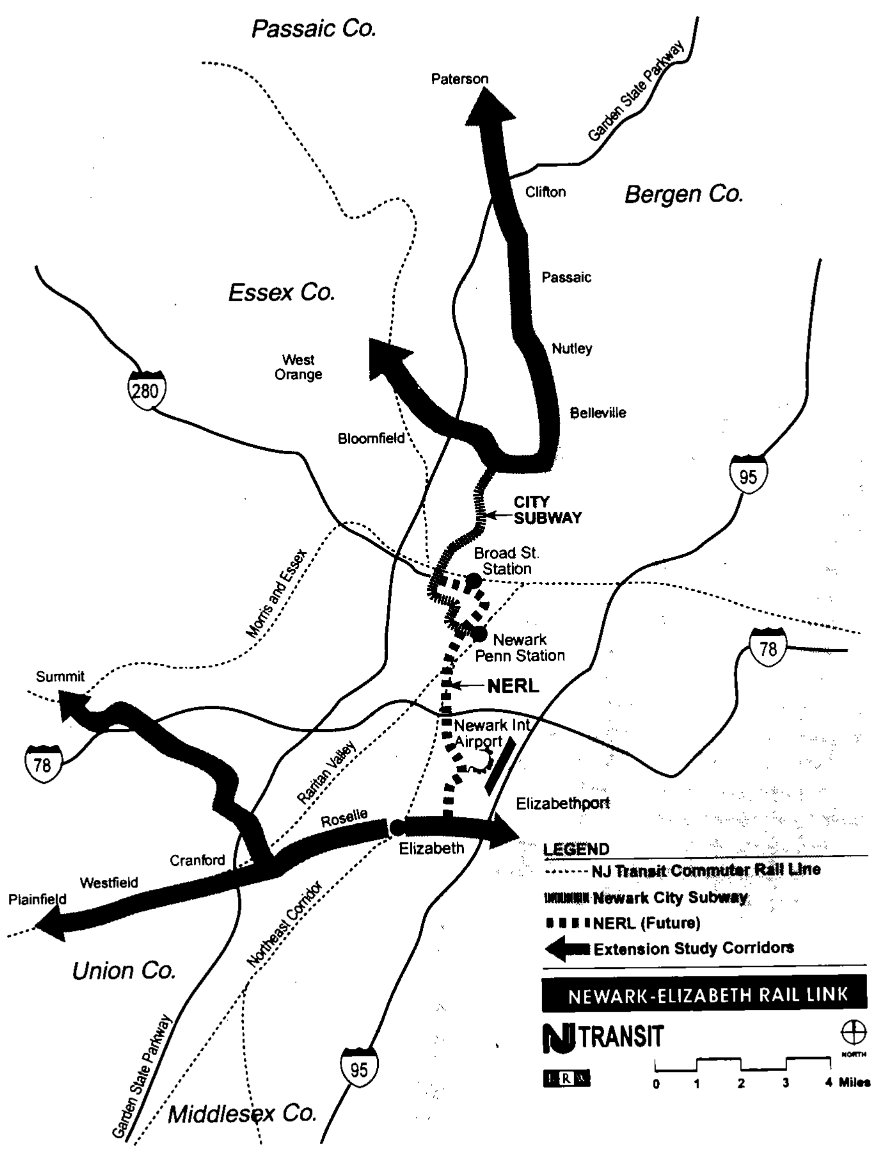

FIGURE 4 Future candidate extensions.

in Belleville and Bloomfield and continue west along the former Erie Orange Branch to West Orange. The second extension would begin at the current Newark City Subway terminus at Franklin Avenue and continue east along the Orange Branch to connect with Conrail's Boonton Line. There, the right-of-way would continue north using Conrail's Newark Industrial Track, which extends through Belleville, Nutley, Passaic, Clifton, and Paterson.

The extension studies were designed to determine if the rail lines under study are available for use. Workshops were held with local officials and interested citizens to identify issues and concerns in each corridor. Specific transit alternatives were defined including station locations, park and ride lots, and the operating characteristics of each extension and associated feeder bus routes. Ridership estimates were prepared, and operating and maintenance costs were calculated. The results of the extension studies will lead to assessments of extending the proposed NERL core system along each of the potential corridors. If the extensions are determined to be feasible and cost-effective, subject to approval from local state and federal authorities, major investment studies may be undertaken in one or more of the corridors.

Burlington-Camden-Gloucester Transit Project

In 1968 the Delaware River Port Authority constructed a 14.2-mi (23-km) state-of-the-art rail rapid transit system, the Port Authority Transit Corporation (PATCO) High Speed Line, between Philadelphia, Pennsylvania, and Camden and Lindenwold, New Jersey. In its 25 years of operation, the PATCO line has become regarded as a highly successful transit operation. A number of extensions have been proposed for the line.

Most recently NJ Transit began planning for an improved rail transit system for Burlington, Camden, and Gloucester counties. Included in the most recent study are several rail alternatives, including extending PATCO, constructing a commuter rail operation, building busways, and constructing LRT (see Figure 5).

Two variations of LRT service are being considered. In one, a conventional light rail line would be constructed that would operate within existing rail rights-of-way and a short segment of city street in Camden, and would connect to PATCO via a transfer at the Walter Rand Transportation Center in Camden. This option would provide intracounty transit connections and serve the developing Camden waterfront, as well as af-

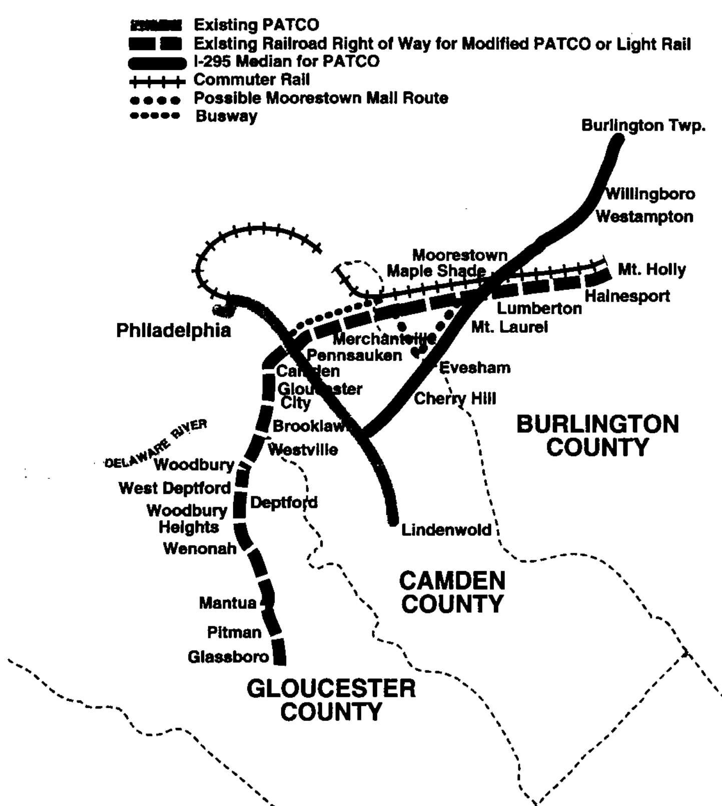

FIGURE 5 Burlington-Camden-Gloucester transit study area and possible alignments.

fording the opportunity to reach Philadelphia by PATCO or bus.

An additional option under study would be to develop a modified PATCO system, which would operate within existing rail rights-of-way at-grade similar to light rail but would merge with the existing PATCO line in Camden to provide service to Philadelphia without a transfer.

The latter option would require a vehicle capable of drawing power both from a third-rail system that PATCO uses and from an overhead catenary system required for use in areas of at-grade operation. The vehicle would conform to PATCO vehicle dimensions, which are not the same as typical light rail cars.

The study of Burlington-Camden-Gloucester transit alternatives is currently being advanced as a major investment study (MIS) under the newly established guidelines promulgated by the Federal Transit Administration. At this stage, analysis is still under way, and no major conclusions can yet be drawn as to the nature of the alternatives to be ultimately advanced into subsequent stages of engineering.

Coordination of NJ Transit Light Rail Projects

Light rail projects span three functional departments at NJ Transit: Bus Operations, New Rail Construction (NRC), and Planning. Within these departments are the LRT Operations Division (within Bus Operations, responsible for the Newark City Subway), the Hudson-Bergen LRT Division (within NRC), the Newark-Elizabeth Rail Link Division (within Planning), and the Project Planning Division (within Planning, currently responsible for the Burlington-Camden-Gloucester Transit Project). At the conclusion of the MIS for the Burlington-Camden-Gloucester Transit Project, that project will transfer to NRC.

An LRT Technical Coordinating Committee was created to facilitate interchange of information and to serve as a forum for discussion of design issues that would affect LRT standardization. Comprising representatives of each of the units mentioned above, the committee meets monthly. Consultants working on the various projects also participate in the meetings. One of the main functions performed by the committee was to review design criteria developed by the consultant team for the Hudson-Bergen LRT System. Because that project had been in existence longer than the other initiatives and was further along in development, its design criteria and specifications became the baseline for development of agencywide standards and documentation for LRT projects. The committee also spawned the vehicle concept evaluation team discussed below.

Standardized Light Rail Vehicle Configuration

To determine appropriate design parameters for LRV for the various projects, NJ Transit assembled an evaluation team of senior level managers from NJ Transit and experts from three consulting firms under contract to NJ Transit for each respective LRV project.

It was concluded that a single standardized vehicle type would be desirable to serve all of NJ Transit's current light rail initiatives. Adoption of a single vehicle type would result in cost savings to NJ Transit through economies of scale in vehicle procurement, standardized operator and maintenance training, and efficiencies in ordering and stocking spare parts.

NJ Transit's evaluation team concluded that a vehicle configuration that would best fulfill the agency's requirements for a standardized light rail transit vehicle would be an articulated six-axle car with approximately 70 percent of the passenger compartment floor at a level approximately 14 in. (350 mm) above top of rail. Motorized trucks at both end of each vehicle would provide motive power at sufficient levels to provide 55-mph (90-kph) running speeds. Floor levels over the power trucks would be up to 39 in. (1000 mm) above top of rail. These areas of the cars would be accessed by interior steps or ramps. The center truck, beneath the articulation joint, would utilize special technology to allow the low floor to continue through the articulated center section. The selected vehicle configuration is referred to as the 70 percent low-floor LRV.

All four NJ Transit light rail transit projects discussed in this paper are considering some form of joint operations with rail freight lines and some operations in urban areas on-street. The 70 percent low-floor design offers the greatest flexibility in adapting to the planned operating environment. This design allows for low platforms, simplifies station designs in urban areas, and simplifies requirements for joint freight and light rail operations in areas where freight service operates past LRT stations.

Boarding and Fare Collection

One of the primary reasons for constructing LRT lines in New Jersey is the need to accommodate high volumes of passengers at greater levels of operating efficiency than can be achieved with buses. Light rail vehicles typically have three to four pairs of double width doors on each side, which facilitate more rapid loading of passengers than is possible with buses.

To make optimum use of multiple doors, most North American light rail systems operating at-grade have selected a proof-of-payment system. The analysis that led to selection of a low-floor vehicle assumed that a proof-of-payment system will be adopted for all NJ Transit light rail systems, and that vehicle operators will not be required to participate in inspection or collection of fares onboard the vehicle. That assumption simplified the evaluation of vehicle options, because by making the assumption of proof-of-payment, fare collection ceased to be a factor in the comparative analysis of potential vehicle configurations.

The study of proof-of-payment also involves an agencywide coordination effort. Initial coordination meetings organized by the Planning Department involved the Corporate Affairs Division, External Affairs Department, Bus Operations, Rail Operations, Law Department, Procurement, Business Planning, Engineering Development and Construction, Marketing and Communications, and the NJ Transit Police. Ultimately, responsibility was passed to the Senior Director of Corporate Affairs for drafting legislation authorizing the issuance of citations, assessment of fines, and indemnification of personnel involved in fare inspection and enforcement. The LRT Operations Division, assisted by the Communications and Revenue Services Division and the Newark-Elizabeth Rail Link Division, initiated a competitive procurement of consulting services to assist in developing and conducting a proof-of-payment pilot test in the Newark City Subway.

Conclusion

As can be seen from the foregoing project descriptions, NJ Transit has an ambitious program under way to examine light rail transit in a number of corridors throughout the state, although many of the projects described remain in the planning stage, and funding remains a thorny issue. The efforts currently under way represent a major commitment to advancing public transportation.

Through the broad-based efforts to involve all concerned units within NJ Transit in the light rail projects early in the planning phases, the agency has adopted an approach that would make the most of the opportunity for agencywide standardization among its several light rail transit initiatives.