A Geographic Evaluation of Gloucester County Commuter Rail Corridor Options

Summer 2006

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Abstract

This analysis examines and compares the geographic characteristics for the commuter transit alternatives currently proposed for Southern New Jersey. The DRPA has proposed three alternative routes for a future commuter rail system, **NJ-1** utilizing the Route 42 median to Williamstown, **NJ-2** utilizing the Route 55 median to Glassboro, and **NJ-3** utilizing the existing Conrail rail line to Glassboro. In addition to these high-speed *heavy rail* options under consideration, this analysis also examines a fourth option (**NJ-3b**) a *light-rail* mode on the same Conrail corridor that would consist of an extension of the Trenton to Camden River Line. This fourth option was added to the study to provide a cost/benefit comparison to the heavy-rail PATCO type system proposed by DRPA. Utilizing Geographic Information Systems (GIS), the study measured the road network distance of each proposed rail line station to individual residences countywide as well as to selected destinations including: schools, restaurants, libraries among others. The results demonstrate that the various routes have substantially different geographic accessibility characteristics and thus different transportation service potentials. All four options provide regional accessibility to Philadelphia. The best performing configuration for residential accessibility was **NJ-3b** (extension of the RiverLINE on Conrail) with 10% of Gloucester County's population within ½ mile of the proposed stations. The 2nd, 3rd, and 4th configurations were **NJ-3**, **NJ-1** and **NJ-2** respectively with 7%, 2% and 1% of Gloucester County's population within ½ mile. Accessibility to destinations also favored **NJ-3b** with 369 destinations within ½ mile followed by **NJ-3**, **NJ-2**, and **NJ-1** with 145, 16 and 9 destinations respectively within the half mile distance. The study found that accessibility to places of employment favored the Conrail option with Gloucester County's two largest employers (Rowan University and Underwood Hospital), Woodbury (the county seat), and numerous town centers benefiting from location directly on the line. While the RT 55 and RT 42 option would serve some of the newer developing subdivisions within the county with park-n-ride service, a rail line location within the highway median would provide little walk-on ridership substantially diminishing the alternate transportation benefits and thus reducing potential system usage. Furthermore, a Conrail corridor system (**NJ-3** & **NJ-3b**) would better serve the established town-centers of the county fostering economic revitalization while providing a substantial and viable option for non-auto travel to within-county destinations. The study concludes that the Conrail corridor options (**NJ-3** & **NJ-3b**) will most efficiently and cost effectively accomplish widest number of transportation, revitalization and land management goals for Gloucester County in comparison to a system based along the RT 55 or RT 42 highway corridors. Finally, the report discusses the geographic advantages of a *light-rail* system extension of the RiverLINE and recommends that this option be added to the public discourse regarding a Gloucester County Commuter Rail system.

Introduction

South Jersey, despite its relatively small population in comparison to North Jersey, is not without growing pains. Traffic in the Philadelphia metro region continues to increase as inflow migration and new development persist in the suburban fringe. Once the heart of New Jersey's peach growing region, Gloucester county has become one of the fastest developing counties in the state. Traffic congestion is expected to worsen as the pace of continued development increases the pressure on Gloucester County's road network.

In order to address the growing transportation challenges, a number of commuter rail systems have been proposed for southern New Jersey over the past several decades. In the mid 1990's a *light-rail* system was proposed by NJ Department of Transportation from Glassboro to Mount Holly via Camden. Two options were suggested for the routing of the Glassboro leg, one following an existing functional freight rail corridor, and the other following the highway median of highway RT 55. The Glassboro/Mount Holly proposal was tabled due to considerable local opposition. Subsequently the funding was reallocated to a more northerly route connecting Camden with Trenton. The Camden to Trenton *light-rail*, dubbed "RiverLINE" has been in service since February, 2004 and has demonstrated better than predicted ridership which has continued to increase since its opening.

Recently, a new proposition for a Gloucester County commuter rail system has been put forward by the Delaware River Port Authority (DRPA) who have owned and operated the PATCO Lindenwold to Philadelphia High Speed Line for the past 30 years. Some have described the Lindenwold line as one of the most successful commuter rail systems in the country. The DRPA proposals for a new Gloucester County line follows 3 possible routes, two that are the same alignment as originally proposed by NJ Transit (Highway RT 55 median and the Conrail tracks), as well as a third option that follows the median of Highway RT 42 and the Atlantic City Expressway.

The three systems have been labeled **NJ-1** (RT 42 corridor), **NJ-2** (RT 55 corridor) and **NJ-3** (Conrail corridor). Each of these commuter rail corridors being proposed is for a modified version of PATCO, a high-speed *heavy-rail* commuter train compatible with the Lindenwold Line. The Conrail corridor (**NJ-3**) is conceived as either fully grade separated or partially grade separated. Grade separation would entail substantial reconstruction to raise or lower the existing Conrail track bed.

This analysis adds a variation to the Conrail corridor option as an extension of the RiverLINE *light-rail* system. This additional option (dubbed **NJ-3b** in this report) was included in order to evaluate costs and benefits of a *light-rail* system compared to the three *heavy rail* systems being proposed by DRPA.

While public emotions are often stirred by large projects such as commuter rail, the decision making process should be guided by an objective, science-based analysis that focuses on the transportation functionality, efficiencies and inherent costs and benefits of various proposed system routes. Success of commuter rail will hinge on geographic factors, most importantly the location of the potential users as well as the desired location of destinations. Analyzing the accessibility to residential population and potential destinations of the alternate corridors provides important insight to the potential for success or failure of each proposed corridor. This study provides such a geographical analysis of accessibility by utilizing geographic information systems (GIS) technology and advanced analytical methods to evaluate the functional connectivity of each proposed route.

Past Commuter Rail Successes and Failures

A review of literature reveals a substantial body of research documenting the successes and failures of various commuter-rail systems. Over ninety commuter *light-rail* systems have been constructed in the U.S. and Western Europe since 1970 (Taplin 1997, 2006). While some of these systems have been remarkably successful, many others have fallen far short of their ridership expectations and/or dramatically exceeded their expected costs (Mackett and Edwards 1998). Often the image appeal of a high-tech rail solution has led to construction of poorly conceived and highly priced systems that are ultimately underutilized.

In contrast, there are also many examples of *light-rail* systems have been very popular which have achieved a measure of success in accomplishing the intended goals. While many factors are involved in the functionality of any given transportation system, the success and failures of these systems are largely determined by geography and the ability of a system to connect the location of where people live to where they desire to travel. The most viable systems connect significant numbers of people from their place of residence to there desired destination in the most efficient and cost-effective manner.

A number of studies provide insight into the components of success and failure for commuter rail. One report examined 17 *light-rail* systems and found common factors (Table 1) shared by many of the most successful projects in cities such as Vancouver, Calgary, Portland and St Louis. The study found lack of those factors in many of the systems deemed less than successful such as Miami and Baltimore (Mackett and Babalik Sutcliffe, 2003).

Table 1: Factors and Policies that Influence Light-rail Success (from Mackett and Babalik Sutcliffe 2003)

- Physical characteristics of the developed areas
- Socio-economic characteristics of the urban areas
- Route location
- Cost
- Operating policies
- Transportation planning policies
- Urban planning policies

Whether or not a system is well-utilized depends on very specific factors such as the ease of accessibility to the stations; the population within a walking service area of a station; the possible destinations available through the system; cost; etc. Another recent study (Kuby et al, 2004) looked at aspects influencing *light-rail* boardings in a number of US cities. The researcher found 12 factors of significance (Table 2) utilizing regression analysis on weekly boardings for 268 stations in nine cites. The authors were able to explain most of the boardings by these factors.

Another aspect necessary to evaluate the success of a commuter transit systems is defining what is meant by success. According to Macket and Babalik Sutcliffe (2003), clarity of the stated goals for a *light-rail* system is directly related to its degree of success. Systems with clearly delineated goals and specific measures for evaluating those goals were more apt to result in success. The authors summarized a wide variety of goals of various *light-rail* systems into five main categories: 1) to have high patronage, 2) to build and operate the system cost-effectively, 3) to increase public transportation usage, 4) to reduce traffic congestion and environmental problems, 5) to improve the land use and urban growth pattern.

Table 2: Factors Influencing Light-rail Station Boardings in the US (from Kuby et al., 2004)

- Land use
- Accessibility
- Employment
- Population
- Percent renters within walking distance
- Connecting bus lines
- Park-and-ride parking spaces available
- Centrality
- Terminal and transfer stations
- International borders
- Extreme weather conditions (negatively correlated)

The studies of existing commuter rail systems demonstrate that their success or failure depend on specific geographic factors including the locations of users, the location destinations, land use patterns, comprehensive planning, feasibility of available transit options as well as the culture of the potential user population. An objective analysis of the costs and benefits and clear delineation of the goals should guide the determination of what commuter rail will best serve Gloucester County. Accessibility is one of the most often cited factors that determine success of transportation systems. The following analysis employs a GIS analysis of accessibility for each of the four Gloucester County commuter-rail schemes utilizing advanced geospatial modeling techniques.

Accessibility Modeling

Many previous transportation accessibility studies have employed simple circular buffers around stations and estimates of the populations and workers within those buffers by proportionate overlap of the population within the census block. This method of accessibility measure has substantially limited accuracy and precision due to the geography of roads, geographical barriers and building locations (Upchurch et al 2004). The advanced development of GIS geospatial computer modeling techniques allow for a more sophisticated, detail and accurate evaluation of transportation modeling. Techniques for disaggregating zonal data such as census tracts, to finer grain spatial units allow for a more realistic modeling environment. These spatial disaggregation techniques were utilized to evaluate the proposed Gloucester County corridors.

Evaluating Gloucester County Rail Corridor Options for Accessibility

A Gloucester County commuter transit system will have the best chances of meeting with success by identifying and modeling the locations of users and the locations of potential destinations and determining how well a prospective system will connect these locations.

This study performed a geospatial accessibility analysis on the three alternate routes proposed Delaware River Port Authority (DRPA): ***NJ-1*** utilizing the Route 42 median to Williamstown; ***NJ-2*** utilizing the Route 55 median to Glassboro; and ***NJ-3*** utilizing the existing Conrail rail line corridor to Glassboro. In addition, this analysis also examines a fourth option (designated ***NJ-3b***) which also utilizes the Conrail corridor but employs a *light-rail* system as an extension of the Trenton to Camden RiverLINE. This fourth option was added to the study in order to evaluate possible cost and benefit advantages of a *light-rail* system over a *heavy rail* PATCO type train. The DRPA originally considered connecting to the RiverLINE but abandoned this option at an earlier phase of their study due largely to lack of direct connection to Philadelphia. This analysis recommends reconsideration of that option.

Figure 1: Four evaluated corridor options

Figure 1 provides a graphic representation of the four evaluated corridor options. The routes and their prospective station locations were identified from routing maps provided to the community outreach sessions by the DRPA. (figures 2 through four). The two highway median options **NJ-1** and **NJ-2** both share the northern four stations stops including, *Morgan Boulevard, Nicholson Road, Leaf Avenue* and a Park-n-Ride adjacent to the intersection of RT 55 and RT 42. The Conrail PATCO corridor (**NJ-3**) takes a more south-westerly route than the first two options but also shares a stop at Morgan Boulevard in Camden. North of Morgan Boulevard all three DRPA routes eventually meet with the existing PATCO Lindenwald line and on to Philadelphia. The **NJ-3b** option added by the authors is routed on the Conrail tracks on through to the Camden river front to eventually connect with the terminus of the RiverLINE adjacent to the Tweeter Center. The **NJ-3b** option utilizes the station stops originally proposed for the Glassboro line by NJ Department of Transportation during preliminary evaluation in the early 1990's (figure 5). The analysis only compares stations from Morgan Boulevard southward.

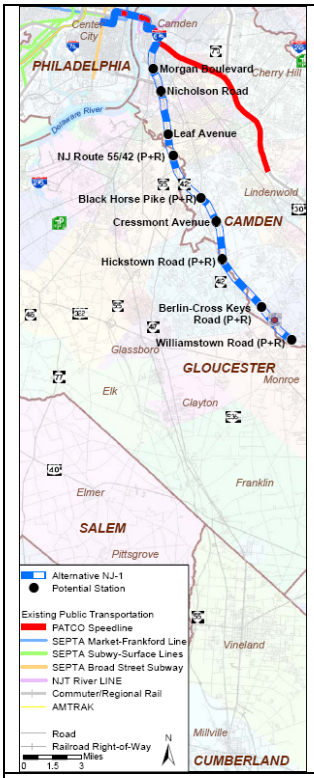


*Figure 2: **NJ-1** Modified PATCO Heavy Rail on the Rt 42 Median corridor*
Source: STV Inc 2005

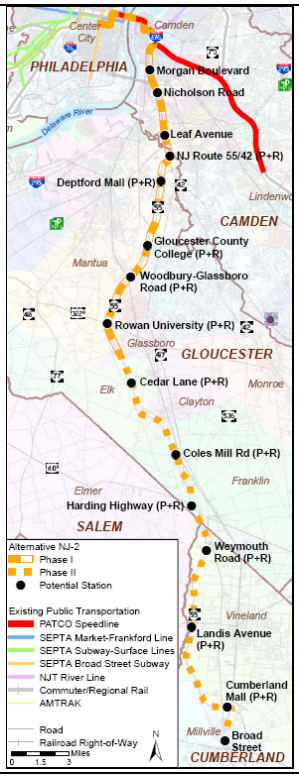


*Figure 3: **NJ-2** Modified PATCO Heavy Rail on the RT 55 Median corridor*
Source: STV Inc 2005

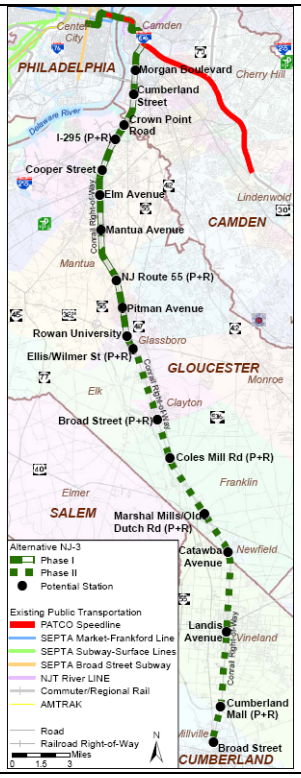


*Figure 4: **NJ-3** Modified PATCO Heavy Rail on the existing Conrail corridor.*
Source: STV Inc 2005

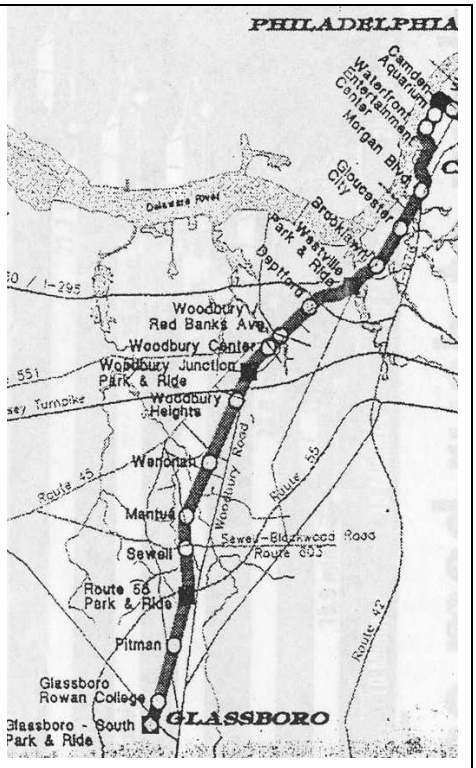


*Figure 5: **NJ-3b** RiverLINE Light-rail Extension on the existing Conrail corridor as originally proposed by NJ DOT in the 1990's*
Source: Gloucester County Time January 26, 1997

Figure 6 depicts the 3 proposed corridors in geographic context with one another. The Conrail corridor is treated twice, once depicting the DPRA proposed stations for a modified PATCO system, and once depicting the NJ Transit proposed stations for a *light-rail* system. The map illustrates the more southwesterly route of the Conrail corridor (**NJ-3** and **NJ-3b**) option. While this study only evaluated from Morgan Boulevard to Glassboro, the existing Conrail tracts continue on through Vineland to terminate in Millville. A future phase of both the RT-55 (**NJ-2**) and Conrail (**NJ-3** and **NJ-3b**) corridors has the potential to service these Cumberland County communities.

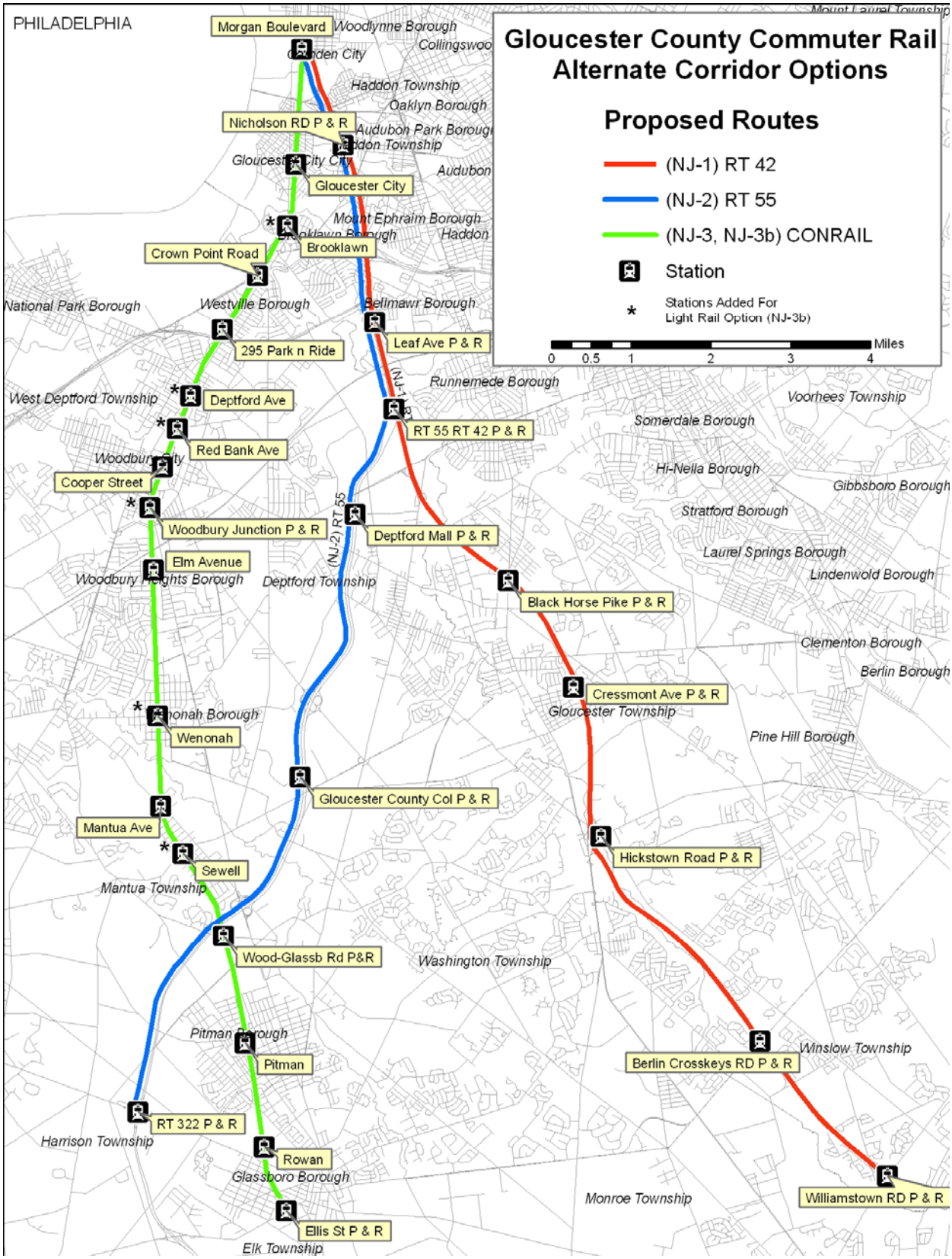


Figure 6. Proposed commuter rail corridors serving Gloucester County and southern Camden County NJ.

GIS Methodology

In order for the accessibility of the various rail corridor scenarios to be adequately modeled, an accurate estimate of actual walking distance from proposed rail stations to residences & destinations is needed. This study takes a more sophisticated approach to modeling accessibility than previous research by calculating the road distance from station locations to each individual residence as well as from station location to a set of selected potential destinations. This methodology produces an estimation of the actual road travel distance from any single residence to the nearest station and the road travel distance from each of a set of destinations to the nearest station.

The residential housing accessibility analysis was conducted by creating a point dataset representing the location of every housing unit within the study area. The housing points were created by synthesizing a number of other datasets into one that best represents housing points utilizing an automated GIS housing location delineation method (Hasse and Lathrop 2003). The data was edited and spatially adjusted for accuracy by heads-up inspection and correction. Also, housing unit locations for the portion of the study area that crossed the boundary with Camden County was screen digitized utilizing 2002 digital aerial photography for the area of interest. The completed combined housing location layer consisted of over 167,000 points representing the location of each house in Gloucester and Southern Camden County in 2002.

A second point layer was created to represent the location of the proposed commuter rail stations. A method of on-screen digitizing was employed utilizing a digital New Jersey road network map produced by the NJ Department of Transportation and orthophotography for Gloucester County. A third point layer was developed for a selected set of indicator destinations that represented public, commercial, civic and recreational points of interest. This layer was developed utilizing several methodologies including on-screen digitizing of county maps, address-matching of retail locations listed in an on-line telephone directory and expert knowledge of the study area. The indicator destination layer includes the destination categories listed in Table 3.

It should be noted that the indicator destination layer is not intended to represent a comprehensive set of all possible destinations, but instead it represents an accessibility index of important destinations in a similar manner as the Dow-Jones index represents the general trend of the stock market by monitoring a set of significant stocks.

Table 3: Selected indicator destinations

LABEL	*TYPE*
• B	Bank
• C	Church
• F	Fire Co
• G	Grocery
• M	Municipal Bldg
• D	Physician
• P	Police
• PO	Post Office
• R	Restaurant
• S	School
• L	Library
• Pk	Park

Generating distance measurements from the proposed station locations employed an on-network/off-network methodology developed by Upchurch (et al. 2004). This method utilizes a raster approach to create an accessibility surface where the distance to the nearest rail is calculated from any point in the county first to the nearest road and then along the road network to the nearest station. The distance surface is then assigned to the housing unit point file providing an accurate calculation of road distance to nearest proposed station for each housing unit within the study region. This distance methodology was separately performed for each of the 4 different proposed route options analyzed in this study.

Estimations of populations for each household are made on the census tract level. The total population for each tract is divided by the number of housing units within each tract to provide a normalized estimation of population for each housing unit. This approach of spatial disaggregation substantially increases the accuracy and precision of population accessibility estimates. A similar distance to proposed station methodology was performed for the set of indicator destinations. This approach for measuring transit station

distances facilitates selection and summation of housing units and destination locations at any given distance from the station. Figures 7, 8, 9 & 10 demonstrate several selected rail stations and the geographic residential/destination pattern found around the station. Walking accessibility (1/2 mile) is depicted in green, 1 mile accessibility is depicted in yellow. Housing units are depicted as black dots and index destinations are depicted as larger blue dots. These figures provide a visual comparison of the geographic patterns typical along the various routes.

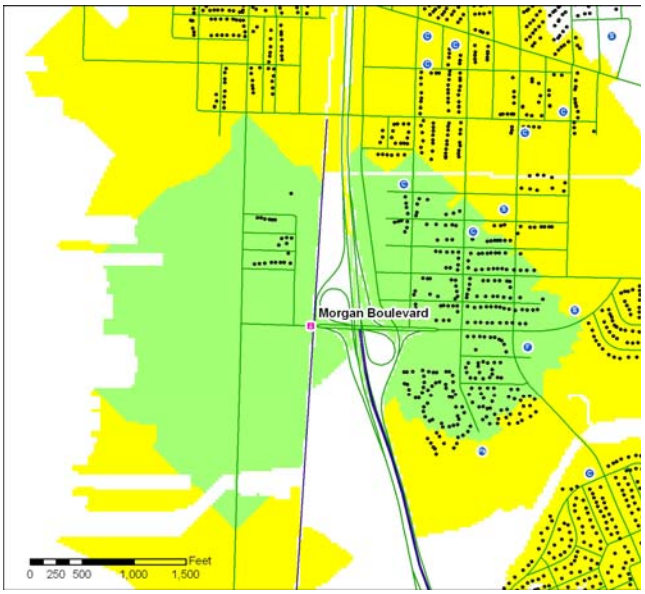


*Figure 7. Morgan Boulevard Station (**NJ-1**, **NJ-2**, **NJ-3** & **NJ-3b**). Walking accessibility (1/2 mile) is depicted in green, 1 mile accessibility is depicted in yellow. Housing units are depicted as black dots and index destinations are depicted as larger blue dots.*

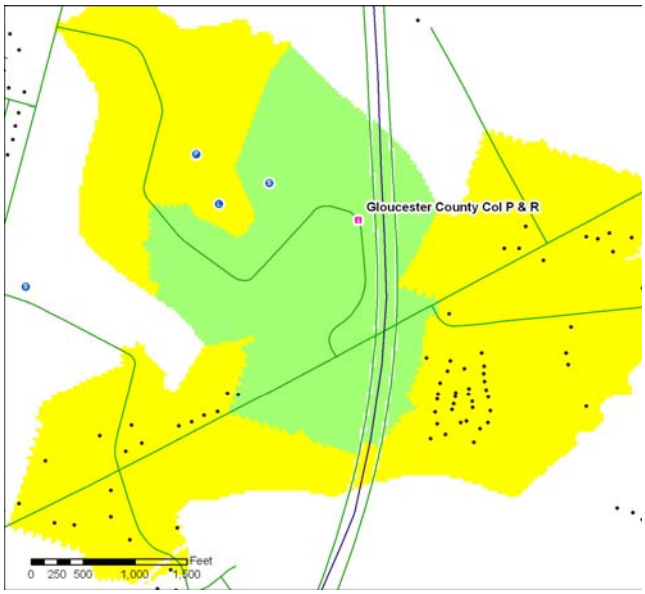


*Figure 8. Gloucester County College Station (**NJ-2**). Walking accessibility (1/2 mile) is depicted in green, 1 mile accessibility is depicted in yellow. Housing units are depicted as black dots and index destinations are depicted as larger blue dots.*

*Figure 9. Pitman Station (**NJ-3** & **NJ-3b**). Walking accessibility (1/2 mile) is depicted in green, 1 mile accessibility is depicted in yellow. Housing units are depicted as black dots and index destinations are depicted as larger blue dots.*

*Figure 10. Berlin Crosskeys RD P & R Station (**NJ-1**). Walking accessibility (1/2 mile) is depicted in green, 1 mile accessibility is depicted in yellow. Housing units are depicted as black dots and index destinations are depicted as larger blue dots.*

Results

Residential Accessibility: The housing to rail station distance was generated and values summarized by *walking* accessibility distance (1/2 mile) and *bicycly/short auto trip* accessibility (1 mile). The 1/2 mile accessibility measure represents a generally accepted distance of pedestrian utilization of transit (Kuby et al. 2004). Table 4 summarizes the number of housing units and associated population for each of the four possible corridors. Figure 11 provides a graphical representation of pedestrian accessibility by station. Appendix A provides the full count of population accessibility numbers by station.

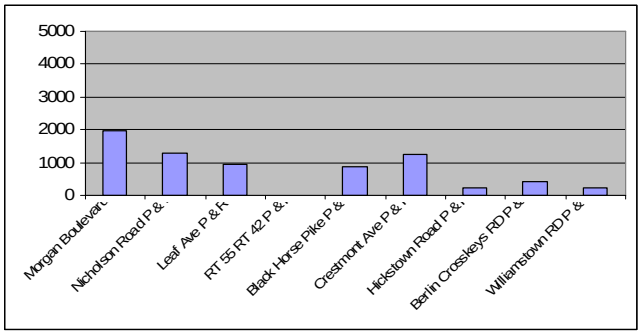
The Conrail corridor options (**NJ-3** & **NJ-3b**) provide the best accessibility for walk-on service with 19,559 and 28,253 residents respectively within ½ mile distance. Although these two options both utilize the Conrail corridor, the *Light-rail* option (**NJ-3b**) is accessible to more residents because there are more stations available (see figure 6) than on the modified PATCO version of the Conrail corridor (**NJ-3**). The RT 42 (**NJ-1**) and RT 55 (**NJ-2**) corridor options are within walking distance to 7,235 and 4,421 residents respectively. Considering that all four options include the *Morgan Boulevard* station which has nearly 2,000 people within the ½ mile distance, meaningful comparison of the proposed routes should compensate for the *Morgan Boulevard* numbers. With *Morgan Boulevard* removed and the numbers normalized for the total population of Gloucester County, pedestrian access to stations for each of the proposed routes represents approximately 2% for **NJ-1**; 1% for **NJ-2**; 7% for **NJ-3**; and 10% for **NJ-3b** of the total population of Gloucester County[1]. The Conrail corridor options serve substantially more walk-on riders than the RT-42 (**NJ-1**) and RT 55 (**NJ-2**) options. Furthermore, lack of pedestrian infrastructure in the locations of the RT 42 and RT 55 highway corridor will substantially reduce the number of residents within the half mile distance who will actually be able to safely walk to a station.

Short-trip accessibility (less than 1 mile), also favors the NJ Transit Conrail corridor with 73,537 residents within 1 mile of **NJ-3b** (*light-rail*) and 51,494 residents within 1 mile of the modified PATCO (**NJ-3**) option. The RT 42 corridor (**NJ-1**) was within 1 mile of 30,377 residents and the RT 55 (**NJ-2**) corridor option was within 1 mile of 15,594 residents. Short trip accessibility represents likelihood for bicycle utilization as well as the likelihood that a station will be utilized for a drop off/pick-up station (sometimes called *kiss and ride*). Beyond a 1 mile distance a commuter is more likely to utilize a *park and ride* function.

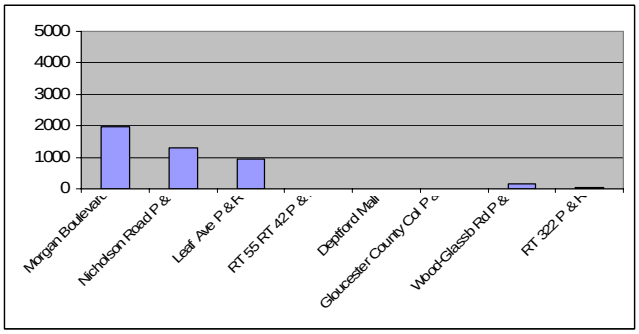
[1] While the proposed routes will serve some Camden County residents, normalizing by the population of Gloucester County provides a measure of magnitude for the regional population served.

Table 4 Residential accessibility to each proposed rail corridor option (Morgan Boulevard removed).

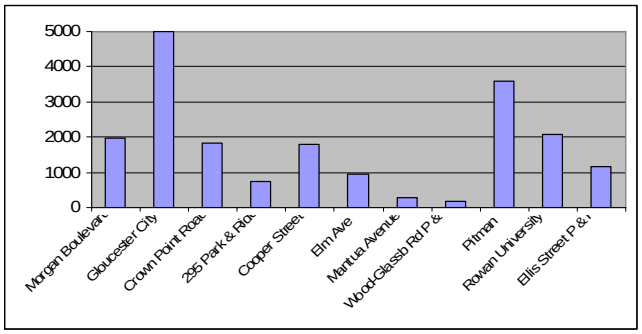
Residential Accessibility	**NJ-1 RT 42**	**NJ-2 RT 55**	**NJT-3 Conrail (PATCO)**	**NJ-3b Conrail [RiverLINE extension]**
Walking Distance (1/2 mile)				
Estimated population within ½ mile	5,253	2,439	17,577	26,271
% of Gloucester Co Pop within ½ mile[1]	2%	1%	7%	10%
Biking Distance (1 Mile)				
Estimated population within 1 mile	27,236	12,456	51,232	65,371
% of Gloucester Co Pop within 1 mile[1]	9%	3%	17%	26%



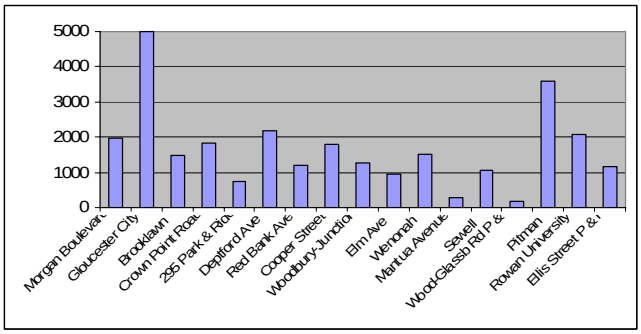
***NJ-1** (RT 42)*



***NJ-2** (RT 55)*



***NJ-3** CONRAIL (PATCO)*



***NJ-3b** CONRAIL (RiverLINE light-rail extension)*

Figure 11 Number of residents within walking accessibility (1/2 mile) to each station on the four evaluated routes.

Destination Accessibility: Like the residential accessibility, analysis of destination accessibility demonstrates the advantages of the Conrail (**NJ-3** & **NJ-3b**), corridor options. Table 5 presents the number of destination nodes accessible to each rail route option. The Conrail *light-rail* option (**NJ-3b**) was within 1/2 mile walking distance to 369 selected accessibility index destinations whereas the Conrail PATCO (**NJ-3**), RT 55(**NJ-2**) and RT 42 (**NJ-1**) corridors were within 1/2 mile to 145, 16 and 9 destinations respectively. The destination accessibility measure indicates that the Conrail corridor allows demonstrably better pedestrian accessibility to more accessibility destinations than the RT 55 or RT 42 corridor options. It can be assumed that other destination types not included in the index also would follow a similar pattern.

It's interesting to note the considerable difference in destination accessibility between **NJ-3** and **NJ-3b** since they share the same travel corridor. While **NJ-3** and **NJ-3b** utilize the same tracks, the dramatically larger number of destinations for the **NJ-3b** compared with the **NJ-3** are due to additional stations proposed for **NJ-3b** which are somewhat skewed by the accessibility index destination types. For example, the proposed station in Woodbury on Cooper Street for the **NJ-3** (modified PATCO) option is further than ½ mile to Underwood Hospital whereas the **NJ-3b** (RiverLINE *light-rail*) route has an additional stop at Red Bank Avenue, 1 block east of the hospital. Since *physicians* are one of the 16 accessibility indicator destinations, the results are boosted by the large number of doctors based at or near the hospital. Destination accessibility as demonstrated through this analysis strongly favors the Conrail corridor (**NJ-3** and **NJ-3b**) (figure 12).

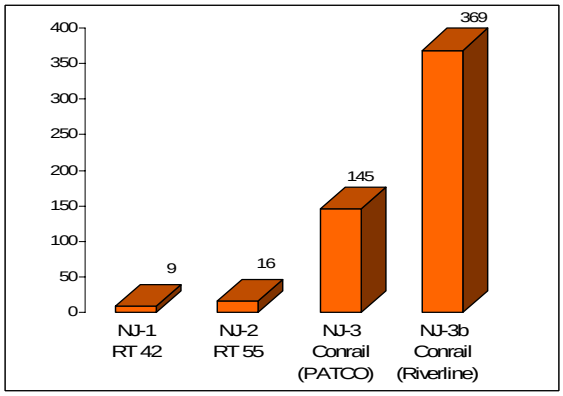


***Figure 12. Destination Accessibility –** graph depicts the number of selected destinations that are within pedestrian accessibility (1/2 mile) to proposed route stations.*

Table 5 – Half mile accessibility (walking distance) to selected index destinations.

DESTINATION TYPE	**NJ-1** RT42	**NJ-2** RT55	**NJ-3** Conrail PATCO	**NJ-3b** Conrail RiverLINE extension
Schools	1	2	8	13
Parks	0	0	1	3
Post offices	1	1	4	6
Libraries	0	0	2	2
Municipal Hall's	0	0	4	6
Grocery store's	0	0	6	9
Restaurant's	0	9	30	42
Churches	2	1	28	48
Physicians	3	1	43	210
Fire Hall	1	1	5	10
Police	1	1	5	7
Banks	0	0	8	12
Total Index Destinations	**9**	**16**	**145**	**369**

Discussion

In this study we focus specifically on how the physical location of stations, residents and destinations would be connected by construction of each of the analyzed routes. While all four options for commuter rail would provide a regional commuter rail connection from Southern New Jersey to center city Camden and Philadelphia, they perform very differently on their ability to serve other transportation and public policy goals. The highway-median – based proposed systems (**NJ-1** and **NJ-2**) will primarily serve as a park-and-ride system to Philadelphia. To access a system on these routes you must first drive to a station and then you must desire a destination in center city Philadelphia.

In contrast, the Conrail corridor (**NJ-3** and **NJ-3b**) accomplishes a multitude of public transit goals because the geography of the route facilitates walk-on walk-off traffic for a significant population to a significant number of regional destinations. The Conrail corridor is the only of the three routes that will function as a viable within-county system of transportation because significant numbers of people can walk to the stations and from the stations to a substantial number of destinations. According to the DRPA's own analysis (p. 3-15), 85% of trips in the Gloucester-Camden study area were "intra-corridor" meaning that they originate and end within the Gloucester-Camden study area. The geographic juxtaposition of each route indicates that only the Conrail corridor will serve this intra-corridor transportation need.

Furthermore, since the analysis only calculated road distance and did not factor whether or not there are safe walking corridors along these roads (ie. sidewalks, crosswalks, ramps, etc.), it is likely that the results of this study over estimate the RT 55 (**NJ-2**) and RT 42 (**NJ-1**) pedestrian accessibility. The poor geographic context for pedestrian access on these routes will necessitate their design as a primarily *park-n-ride* system. Park-n-ride stations are less effective at reducing automobile usage because you must drive to them compared to a walk and ride stations.

While the RT 42 (**NJ-1**) and RT 55 (**NJ-2**) based systems will primarily serve the center city Philadelphia-bound travelers, this model of employment commuting may dramatically change in the coming decades. The major trends of job growth in recent decades have been in the surrounding suburbs while the Philadelphia job base has stagnated. Over the last centennial census, Philadelphia lost more population than any other major city in America (US Census, 2006), and although there has been a recent resurgence in center city housing demand, an out-dated transit model that primarily serves suburban bedroom commuters to center city jobs may be of questionable value. Even the PATCO high speed line has seen a recent drop in Philadelphia commuters in recent years suggesting a reduction in the center city commuting demand from South Jersey.

In contrast, the Conrail corridor will serve multiple transportation functions, connecting residents with a viable non-automobile option, not only for Philadelphia commuting, but many other intra-corridor destinations. Users of a Conrail-based corridor could potentially walk from rail stations to destinations such as libraries, parks and restaurants along the entire line. Unlike the highway corridors, many of the towns through which Conrail traverses actually have the pedestrian infrastructure of sidewalks already in place to safely walk or ride a bike. The cul-de-sacs and winding roads of newer subdivisions which are typical near RT 55 (**NJ-2**) and RT 42 (**NJ-1**) corridors are antithetical to pedestrian accessibility. While the

Conrail corridor (**NJ-3** & **NJ-3b**) would be largely pedestrian accessible within the town centers that it serves, it should be noted that the Conrail corridor would not necessitate being solely a walk-on, walk-off system. Like the RiverLINE, there are several proposed major *park-n-ride* stations that would provide access to the automobile commuter at significant locations such as RT 55 and RT 295. The geographic analysis reveals that due to its location, the Conrail corridor (**NJ-3** & **NJ-3b**) will serve multiple purposes, modes and destinations providing a viable town to town connection link as well as a Camden-Philadelphia commuting link.

Other Factors – Economic Revitalization, Smart Growth and Discouraging Sprawl

Whereas the technical analysis of this study focused primarily on accessibility, the findings support other factors to be considered including economic revitalization and smart growth development. The high degree of walking accessibility of the Conrail corridor (**NJ-3** & **NJ-3b**) is not due to luck. Many of Gloucester County's small towns were situated along the existing rail line more than a century ago before the automobile became such a dominant mode of transportation in our culture. These towns have an important historical connection to passenger rail service. Once vibrant, many of these small "main street" town centers have been suffering from disinvestments due to sprawl development along the rural periphery. The loss of commuter rail service in the early 1960's is concurrent with the time period that a number of town centers such as Woodbury and Glassboro began to decline. Strip shopping centers and scattered subdivisions undermined the cohesion of the older downtowns. A Conrail-based line would pay tribute to the historic connection of these towns to rail service and serve as an economic force for the revitalization of these communities. Restaurants and small businesses would have access to customers looking for a more authentic community experience than is provided by sprawling shopping malls. The growing success of the RiverLINE demonstrates the economic revitalization potential to the towns along a *light-rail* line.

In contrast, the highway-based routes (**NJ-1** and **NJ-2**) will potentially draw investment dollars away from the town centers and towards primarily low-density sprawling land use patterns that exist along the highways. Utilization of the highway median for a commuter rail route can not support the type of density and mixed use development that New Jersey is striving towards in order to mitigate the problems of continued sprawl. Utilization of the Conrail corridor is the only commuter rail option under consideration that will support New Jersey's smart growth goals.

A number of further considerations also favor the Conrail (**NJ-3** & **NJ-3b**) corridor that are not directly evident in the accessibility analysis but are nonetheless geographic in nature. Most significantly, the Conrail route (**NJ-3** and **NJ-3b**) supports a number vital regional destinations including Gloucester County's first and second largest employers (Rowan University and Underwood Memorial Hospital). Rowan University creates an ideal commuting arrangement because it provides a major destination on the southern end of the line creating demand for an efficient reverse commuting traffic flow. Unlike the PATCO High Speed Line which must send empty trains in the counter rush direction, a Conrail-based system would have a substantial numbers of commuters traveling in both directions during both rush hours. Furthermore, the multiple class periods that occur throughout the day at a college create a more sustained and moderated transit demand lessening the rush hour effect.

The Rowan stop would allow non-driving access to the university from the most populated communities of Gloucester County as well as from the larger Philadelphia metro region, northern New Jersey and New York via the RiverLINE *light-rail*. Rowan's student commuter population would have a viable alternate transportation option to and from the university removing those cars from regional highways and the host community of Glassboro. Many faculty and staff who live within the Conrail corridor or in Philadelphia would benefit from a non-automobile option for commuting. Although the RT 55 (**NJ-2**) option also has a station planned for Rowan at RT 55 and RT 322, this station location is substantially less viable as it would require a 2-mile shuttle bus ride to connect passengers to the main campus via traffic laden Route 322. Walk-on, walk-off access is essential.

Although the highway-based corridors (**NJ-1** and **NJ-2**) perform poorly in accomplishing public transit goals, there are a number of positive aspects to be considered. Since the highway lines would not run near residential neighborhoods, there is less likelihood of the "Not-In-My-Backyard" community reaction that derailed previous attempts for commuter rail connections to the region. These highway median-based systems could also have potentially faster travel speeds. While travel speed is certainly an important factor, it needs to be evaluated in the context of actual door to door travel time for each proposed corridor option. Such an evaluation must incorporate the time necessary to drive from residential locations, the time required for parking and waiting for the train as well as the actually commute time. If the walking access to a Conrail-based station requires substantially less time, then the door to door time may favor a slower *light-rail* train because more residents would actually be closer to stations.

"Utilization of the Conrail corridor (**NJ-3**) is the only commuter rail option under consideration that will support New Jersey's smart growth goals."

Another positive of the highway routes, (**NJ-1** and **NJ-2**) is that there are several significant destinations that would have shuttle bus accessibility to these corridor options. The RT 42 corridor (**NJ-1**) has a station located near Camden County College and the RT 55 corridor (**NJ-2**) has a station planned to service Gloucester County College. Both the RT 42 (**NJ-1**) and RT 55 (**NJ-2**) routes have a proposed stop near the Deptford Mall. Again, a deeper evaluation of these proposed destination stops suggest limited viability. The prospects for a Deptford Mall station are questionable due to the auto-centric design of the mall and the surrounding shopping centers. While a station shuttle would be necessary, a similar shuttle bus has demonstrated lackluster success in connecting the Echelon Mall to the PATCO High Speed Line. Considering the ease of automobile access and abundant free parking, it is questionable how many would-be patrons of the shopping center would endure a drive to a park-n-ride station, a wait for a train, a shuttle bus ride to the store of choice and repeat the process in reverse while carrying shopping bags. Employees may be more inclined to utilize a commuter rail stop at a Mall than shoppers. The viability of intra-corridor travel destination will be limited for **NJ-1** and **NJ-2**.

A commuter rail system along the RT 42 (**NJ-1**) or RT 55 (**NJ-2**) highway median will have few of the geographic advantages of Conrail (**NJ-3** & **NJ-3b**). Our recommended third option (and it's a distant 3rd) is the (**NJ-2**) RT 55 highway median proposal. While it is accessible to only 1% of residents by foot, it nonetheless provides commuter transit to a part of the state in which it is completely absent with potential to be extended to Millville. We place the (**NJ-1**) RT 42 highway median proposal last out of the four options evaluated as it also serves only a limited number of walk-on county residents (2%), while providing access to the fewest destinations along it's path. **NJ-1** has the further disadvantage of relatively close proximity to the PATCO Lindenwold line creating public transit redundancy in a limited region of Southern New Jersey while leaving other areas of the region without any commuter rail option. The RT 42 (**NJ-1**) and RT 55 (**NJ-2**) corridor options are least desirable because they support sprawling low-density growth and do little to lessen traffic within communities.

Why consider RiverLINE instead of PATCO on NJ-3?

One of the conclusions of this study is that an extension of the RiverLINE be added as fourth option for more detailed study. We have named this option **NJ-3b**. While the proposed PATCO *heavy rail* system on the Conrail corridor (**NJ-3**) performs significantly better than the highway options being considered (**NJ-1** and **NJ-2**), it may nonetheless not be the most appropriate model for the Glassboro to Camden connection when considering the multiple transit performance goals of a public transit system.

A number of benefits in cost, service and minimization of impact would be realized by a *light-rail* versus *heavy-rail* system. The capital investment needed to create an off-grade heavy rail system is significantly greater than the investment

needed to upgrade the existing tracks to a RiverLINE system. Construction time of the Camden to Trenton RiverLINE took several years whereas the heavy-rail systems under consideration are expected to take more than a decade to complete. The impact to communities and the environment for an off-grade system will be substantial and must be fully evaluated. The raised and lowered tracks for a modified PATCO-type system will result in towns divided by mounds and canyons substantially changing the character of these communities.

*Figure 13. This study concludes that an extension of the RiverLINE on the existing Conrail corridor (**NJ-3b**) is the most appropriate and cost-effective mode for a future South Jersey commuter rail system.*

Most importantly, a high-speed, high-capacity *heavy rail* PATCO type system may not serve the future public transportation needs of the region. A commuter rail system designed to transport workers from suburban bedroom communities to places of employment in center city may be obsolete before it is completed. Changing employment trends such as tele-commuting via the internet and the suburbanization of places of employment make the future demand for center-city employment commuting unpredictable. A smaller-scale *light-rail* system such as the RiverLINE designed primarily as a means of linking local communities with local destinations may be more appropriately scaled and justifiable than a system designed for 1970's workforce commuting patterns. A RiverLINE extension more elegantly links South Jersey towns to important NJ destinations within Glassboro, Woodbury, Camden and Trenton, while still providing a reasonable means of center city Philly commuting via transfer to PATCO.

The on-grade crossing concerns that have worried many community residents in the past have evaporated on the RiverLINE. While *light-rail* would run somewhat slower than an off-grade line, the smaller stations would allow additional stops providing better access to more users. Once again the door to door travel time must be calculated rather than simply the inter-station train speed.

The most significant downside to extending the RiverLINE would be the need to transfer to the PATCO Lindenwold Speedline in order to reach Philadelphia. While a PATCO transfer is not ideal for Philadelphia-bound commuters, a number of important counter benefits make the rationale for RiverLINE extension worthy of serious consideration. Many of the potential users of a South Jersey commuter rail system would be en-route to non-Philadelphia destinations. According to the DRPA preliminary report 85% of commuters within the study area have a destination within the South Jersey study area. The report also states that nearly as many regional commuters are destined for Camden city as Philadelphia (DRPA p. 3-15). The RiverLINE route would provide direct access to some of the major Camden destinations including the Tweeter Center, the State Aquarium, and Rivershark stadium. The extension of the RiverLINE tracks through South Camden carries the potential to provide a powerful incentive for revitalization of this blighted area.

Table 6: Additional benefits of the **NJ-3b** RiverLINE *light-rail* option:

- Substantially lower cost than *heav- rail*
- Able to have more stations serving more residents and more destinations
- Less disruptive to the character of existing towns
- Significantly shorter construction time
- Supports redevelopment of Camden waterfront
- Builds on the success of the RiverLINE
- Will enhance the public investment already spent on the RiverLINE
- Creates an important North Jersey to South Jersey link.

While a transfer for Philly-bound riders would be needed, a RiverLINE extension would actually eliminate the need for a transfer for riders to reach North Jersey. The current transfer connection between the RiverLINE and PATCO has proven reasonably efficient. On balance, the

disadvantage of loosing a direct connection to Philadelphia may be more than offset by the advantages of the additional direct connections served by the RiverLINE.

Conclusion

This analysis demonstrates that the Conrail corridor (**NJ-3** & **NJ-3b**) has a significant geographic advantage over the RT 55 (**NJ-2**) and RT 42 (**NJ-1**) corridor options. The Conrail corridor is the superior route for connecting the greatest number of people with the greatest number of destinations. A Conrail corridor-based system would serve the largest employment centers of Gloucester County, foster economic revitalization while providing a substantial and viable option for non-auto travel to many intra-corridor destinations. Finally, the analysis demonstrates that a *light-rail* version of the Conrail option (**NJ-3b**) extending the RiverLINE to Glassboro will provide the greatest transportation benefit, cost substantially less than the other options and would offer the most appropriately scaled solution for serving a diversity of transportation needs for the Gloucester County region.

While the argument has been put forward that "any commuter rail system is better than no commuter rail" as a rationale for the politically easier RT 55 or RT 42 corridors, a system located in a poor location will not serve the transportation needs of the region and result in poor ridership. Considering the fiscal challenges facing New Jersey and the country, a costly commuter rail system that consumes substantial public funds while poorly addressing the actual transportation needs of the region may not be better than no commuter rail. Considering that construction costs of any route will be in the billions, a poorly located and poorly utilized systems may be a wasted public expenditure. From a geographic perspective, the Conrail corridor (**NJ-3** & **NJ-3b**) serves the greatest transportation needs, will be the most utilized, and will accomplish the greatest number of goals for reducing traffic, increasing public transportation usage and promoting smart growth revitalization of Gloucester County's established communities.

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APPENDIX A

B=Bank, C=Church, F=Fire Co, G=Grocery, M=Municipal Bldg, D=Physician, P=Police, PO=Post Office, R=Restaurant, S=School, L=Library, Pk=Park

***NJ-1** Accessibility data*	*Residential Accessibility*		*Destination Accessibility*												
STATION	**population 1/2 mi**	**population 1 mile**	**B**	**C**	**F**	**G**	**M**	**Dr**	**P**	**PO**	**R**	**S**	**L**	**Pk**	**total dest**
Morgan Boulevard	1982	8586		2	1										3
Nicholson Road P & R	1298	2440		1	1							1			3
Leaf Ave P & R	943	3175							1	1					2
RT 55 RT 42 P & R	0	0													0
Black Horse Pike P & R	881	4321				1									0
Crestmont Ave P & R	1262	4020						2							2
Hickstown Road P & R	236	2330		1				1							2
Berlin Crosskeys RD P & R	404	2676				1		4			1				6
Williamstown RD P & R	228	2828	2					5			3				10
Total	**7,235**	**30,377**													**28**

***NJ-2** Accessibility data*	*Residential Accessibility*		*Destination Accessibility*												
STATION	**population 1/2 mi**	**population 1 mile**	**B**	**C**	**F**	**G**	**M**	**Dr**	**P**	**PO**	**R**	**S**	**L**	**Pk**	**total dest**
Morgan Boulevard	1982	8586		2	1										3
Nicholson Road P & R	1298	2440		1	1							1			3
Leaf Ave P & R	943	3175							1	1					2
RT 55 RT 42 P & R	0	0													0
Deptford Mall	0	256									9				9
Gloucester County Col P & R	3	193										1			1
Wood-Glassb Rd P & R	171	635						1							1
RT 322 P & R	24	309									4				4
total	**4,421**	**15,594**													**23**

***NJ-3** Accessibility data*	*Residential Accessibility*		*Destination Accessibility*												
STATION	**population 1/2 mi**	**population 1 mile**	**B**	**C**	**F**	**G**	**M**	**Dr**	**P**	**PO**	**R**	**S**	**L**	**Pk**	**total dest**
Morgan Boulevard	1982	8586		2	1										3
Gloucester City	4995	8481		5	1					1		2			9
Crown Point Road	1833	3397	1	6		3		6	1	1	8	1		1	28
295 Park & Ride	722	2388		1	1										2
Cooper Street	1811	4093	3	4	1		1	25	1		13	3	1		52
Elm Ave	966	4149		3	1	1	1	3	1	1	1	1			13
Mantua Avenue	276	400													0
Wood-Glassb Rd P & R	171	635						1							1
Pitman	3585	9708	2	6	2		1	14	1	1	6	1	1		35
Rowan University	2069	5226		1		1					2	1			5
Ellis Street P & R	1149	4431	1	3		2	1	1	1		5	1			15
total	**19,559**	**51,494**													**163**

***NJ-3b** Accessibility data*	*Residential Accessibility*		*Destination Accessibility*												
STATION	**population 1/2 mi**	**population 1 mile**	**B**	**C**	**F**	**G**	**M**	**Dr**	**P**	**PO**	**R**	**S**	**L**	**Pk**	**total dest**
Morgan Boulevard	1982	8586		2	1										3
Gloucester City	4995	8481		5	1					1		2			9
Brooklawn	1493	4698		2			1		1			1			5
Crown Point Road	1833	3397	1	6		3		6	1	1	8	1		1	28
295 Park & Ride	722	2388		1	1										2
Deptford Ave	2184	4822	4	3	1	1		2			3				14
Red Bank Ave	1201	2609		3	1	1		133			6	1		2	147
Cooper Street	1811	4093	3	4	1		1	25	1		13	3	1		52
Woodbury-Junction	1263	3260		6				16			2				24
Elm Ave	966	4149		3	1	1	1	3	1	1	1	1			13
Wenonah	1502	3524	1	5	1	1	1	13	1	1	2	1			27
Mantua Avenue	276	400													0
Sewell	1051	3129			1			4		1					6
Wood-Glassb Rd P & R	171	635						1							1
Pitman	3585	9708	2	6	2		1	14	1	1	6	1	1		35
Rowan University	2069	5226		1		1					2	1			5
Ellis Street P & R	1149	4431	1	3		2	1	1	1		5	1			15
total	**28,253**	**73,537**													**386**