Executive Summary

Submitted to:
NJ TRANSIT

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EXECUTIVE SUMMARY

INTRODUCTION

The New Jersey Transit Corporation (NJ TRANSIT), in cooperation with the Delaware Valley Regional Planning Commission (DVRPC), North Jersey Transportation Planning Authority (NJTPA) and the New Jersey Department of Transportation (NJDOT), conducted the Central New Jersey Route 1 Bus Rapid Transit Alternatives Analysis (Route 1 BRT AA) along the U.S. Route 1 corridor between the City of Trenton (Trenton) and the Township of South Brunswick, New Jersey. The Route 1 BRT AA began in early 2004, with the purpose of identifying transportation needs and potential transit improvements within the primary study area shown in Figure ES-1. The potential service market area for any proposed transit enhancements would encompass the entirety of Mercer, Somerset and Middlesex Counties as well as portions of Monmouth, and Burlington Counties in New Jersey and Bucks County in Pennsylvania.

This study builds upon previous planning efforts in the region that have sought to identify congestion relief along U.S. Route 1 as well as transit enhancements to the relatively low density development patterns present in the study corridor. The Route 1 BRT AA has been prepared consistent with the Federal Transit Administration’s (FTA) guidance for an AA, which includes identifying the transportation and related community needs of the study area, devising strategic transit enhancements that address those needs and selecting, through local consensus, the most effective solution that considers the goals of the study and the resources available for future project implementation.

Figure ES-1: Primary Study Area and Service Market Area
STUDY PURPOSE AND PROCESS

The purpose of the Route 1 BRT AA was to identify transit opportunities that would address the transportation needs of the study area – identified through an extensive public outreach campaign, build on existing resources, support economic development, and provide a reasonable probability for moving forward to the next phases of project development.

The study followed the step-by-step approach defined by the FTA for projects seeking federal funds. As shown in Figure ES-2, the first step was to establish the limits of the study area, which was followed by the documentation of existing conditions and identification of transportation needs. BRT alternatives were then developed that would meet the needs of the study area and work with its existing infrastructure and resources. The alternatives were reviewed with respect to several evaluation criteria, and with additional feedback from the public and other stakeholders, final recommendations were made for advancement of transit alternatives.

Throughout this process, input and guidance was continually sought from the public and regional stakeholders in outreach activities that included open house meetings, targeted outreach meetings, alternative consensus building work sessions and presentations to the Central Jersey Transportation Forum and the BRT Subcommittee. Feedback from the public outreach effort was the primary source for the development of transportation and community needs and goals and the subsequent BRT alternatives.

Figure ES-2: The Federal Alternatives Analysis Process
Although a general AA process is prescribed by the FTA, the specific process followed by the Route 1 BRT AA, illustrated in Figure ES-3, is more complex. This process included all of the components of the federal AA process, but broke the identification of alternatives into several sub-tasks.

**Figure ES-3: Central New Jersey Route 1 BRT AA Study Process**
Since the Route 1 BRT AA dealt with alternatives that were each complete transit networks, the process for developing those alternatives involved several simultaneous analyses. The final “network alternatives” were composed of a BRT service concept, a guideway alternative on which the BRT routes would travel and a Dinky option. Additionally, the BRT service concepts were composed of BRT routes, feeder buses and prospective park-and-ride locations.

The alternatives for the BRT service concepts, BRT guideway and the Dinky were developed simultaneously so that they would be compatible with each other, but evaluated as individual components before being combined into network alternatives. The final recommendations for those three components were then combined into several network alternatives that were reviewed for performance in several categories, including costs, benefits and environmental impacts.

**PREVIOUS STUDIES**

Several studies and plans within the region and the Route 1 BRT study area that have been completed in the recent past are summarized in Table ES-1. The results of these studies were used as a starting point for much of the analysis performed in the Route 1 BRT AA.

<table>
<thead>
<tr>
<th>Study</th>
<th>Status</th>
<th>Study Focus</th>
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</thead>
<tbody>
<tr>
<td>NJ Turnpike Authority: Route 92 EIS Study</td>
<td>DEIS Nearly Completed</td>
<td>A Draft Environmental Impact Statement (DEIS) is being finalized under the direction of US Army Corps of Engineers for Route 92, a proposed 6.7 mile 4-lane limited access east-west facility between U.S. Route 1 near Ridge Road in South Brunswick and the NJ Turnpike at Exit 8A interchange (at the South Brunswick/Monroe Twp. border).</td>
</tr>
<tr>
<td>NJDOT: Penn's Neck Area EIS Study</td>
<td>FHWA issued ROD on April 1, 2005</td>
<td>This study developed a preferred roadway improvement alternative to improve connections between Alexander and Fisher Roads and evaluated its impacts.</td>
</tr>
<tr>
<td>GMTMA: Route 1 Corridor Bus Rapid Transit Concept Study</td>
<td>Completed March 2003</td>
<td>This study advanced the BRT analysis performed by the CJTF. Evaluated environmental and physical constraints for constructing a BRT system in the U.S. Route 1 area.</td>
</tr>
<tr>
<td>Middlesex County: Comprehensive Traffic Safety Analysis and Study of Southern Middlesex County</td>
<td>Completed 2003</td>
<td>The study identified traffic volume and safety characteristics in the area adjacent to the Exit 8A interchange with the NJ Turnpike.</td>
</tr>
<tr>
<td>Middlesex County: Southern Middlesex Traffic and Safety Study</td>
<td>Completed 2002-2003</td>
<td>Focused on the traffic conditions in an area around the Exit 8A interchange of the NJ Turnpike.</td>
</tr>
<tr>
<td>CJTF (DVRPC): Executive Summary of the CJTF</td>
<td>Completed 2002</td>
<td>Established the goals and issues that the CJTF was organized to address, highlighted roundtable discussions with regional stakeholders and established the desire for light rail or bus rapid transit in the region. Initial modeling results lead to conclusion that “light rail was not economically feasible in the region”. The forum, after considering analysis done by NJ TRANSIT, recommended the examination of the feasibility of bus rapid transit (BRT), which was less capital intensive, requires a lower ridership threshold and has more routing flexibility than light rail.</td>
</tr>
<tr>
<td>NJDOT Route 1 Safety Impact Review</td>
<td>Completed 2003</td>
<td>Focused on the need to eliminate bottlenecks, improved safety, reduce crashes and address pedestrian needs in the U.S. Route 1 Corridor.</td>
</tr>
</tbody>
</table>
PUBLIC OUTREACH

An extensive public outreach and agency coordination process was designed to cover the large and diverse study area of the Route 1 BRT AA. The goal of this effort was to establish a sound purpose and needs statement that would serve as the foundation for all subsequent study tasks and to obtain feedback on the alternatives developed in response to those needs. In total, 70 meetings were conducted during the course of the study, as is listed in Table ES-2.

<table>
<thead>
<tr>
<th>Table ES-2: Public Outreach Meetings</th>
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<tr>
<td><strong>Type of Meeting</strong></td>
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<tr>
<td>Open Houses</td>
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<tr>
<td>Targeted Outreach</td>
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<tr>
<td>Alternative Consensus Building Work Sessions</td>
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<tr>
<td>Route 1 BRT Subcommittee</td>
</tr>
<tr>
<td>Central Jersey Transportation Forum</td>
</tr>
<tr>
<td>Total Meetings</td>
</tr>
</tbody>
</table>

Public outreach was performed in three rounds, which were specifically related to key milestones of the study process:

- **Round 1** – Introduction to the study and identification of study area needs
- **Round 2** – Development of initial BRT concepts
- **Round 3** – Review of BRT service alternatives, BRT alignments, locations of P&R facilities and Dinky options

Several different outreach strategies were employed throughout the duration of the study:

- **Open House Meetings** – Public meetings in an open house format that afforded the public the opportunity to have one-on-one contact with study team members to answer any questions and record their comments on different phases of the study.

- **Targeted Outreach** – Focused outreach to local municipalities, key institutions, employers and organizations, as well as state agencies and elected officials in an effort to round out public participation throughout the study area. The study team conducted approximately 37 targeted outreach meetings during the course of the study.

- **Alternative Consensus Building Work Sessions** – Work sessions were held with municipalities and major stakeholders located within the core study area to gain feedback on BRT alignment options, proposed development, BRT guideway locations, BRT service concepts and locations for P&R facilities.

- **Central Jersey Transportation Forum** – BRT project development updates were presented throughout the study to the forum at their regularly scheduled quarterly meetings. The forum also provided the study team with information on concurrent studies or projects that could affect the BRT study or should be coordinated with the study.

- **BRT Subcommittee** – The BRT Subcommittee comprised of members from the surrounding counties, mayors from core municipalities and major property owners and
businesses. The BRT Subcommittee provided guidance and technical advice to the study team on transportation related issues relating to the study.

This outreach process was supplemented by project newsletters and an interactive website with links to other project sponsors.

**STUDY AREA NEEDS**

The transportation and community needs of the study area were developed through the results of the public outreach process, technical analysis and agency coordination efforts. A Statement of Needs was developed and documented for the study to guide all subsequent phases of analysis:

- **Improve the Existing Transit System** with more frequent rail or bus service to Princeton Junction and Princeton including an enhanced schedule that better coordinates connections with Northeast Corridor trains. Increase transit and shuttle connections to the primary study area from the Princeton Junction Station to provide more transit options. Increase the availability and quality of transit information and improve the quality of bus stop facilities.

- **Develop a High Quality Transit System** that will increase the number of trips made by transit in the area. This system would need to be frequent, reliable and convenient with direct and more efficient links between the U.S. Route 1 corridor and outlying destinations to compete with the automobile.

- **Reduce Highway Congestion** by diverting the increasing travel demand in the area from single-occupant automobiles, especially during peak commuter periods. Investigate highway improvement projects to help alleviate traffic congestion along U.S. Route 1 improving the reliability of transit travel. Keep transit investments separated from roadway congestion to make them attractive alternatives to driving.

- **Coordinate Transit and Community Planning** by improving coordination between community and transit planning efforts, identifying opportunities for enhanced economic development through public/private partnerships and improving existing transit facilities to establish them as assets to the communities they serve. Focus additional development into compact, pedestrian-friendly and transit-oriented patterns providing connectivity between various activity centers.

- **Enhance Environmental Quality** with the use of existing rights-of-way to minimize future land impacts, attractive designs of transit stops and stations that enhance surrounding communities and investments in pedestrian and bicycle facilities along existing and planned transit investments.

These efforts established the framework for the remainder of the study as alternatives were developed and evaluated against their ability to address these needs for this study.
BRT SERVICE CONCEPTS

BRT service concepts were first defined and evaluated as theoretical scenarios. The most appropriate of the theoretical scenarios in relation to the study corridor were modified into preliminary BRT service concepts that were tailored to the specifics of the U.S. Route 1 corridor. The preliminary BRT service concepts underwent three revisions (see Figure ES-4) to reflect comments received in working group sessions, targeted outreach meetings, discussions with the BRT Subcommittee and parallel developments on BRT guideway options and Dinky options. The revisions yielded a final set of four BRT service concepts, of which each included three components:

- BRT routes – different for each service concept
- Feeder network – identical in each service concept
- Park-and-ride locations – identical in each service concept

The three components in each of the Final BRT service concepts are:

**BRT Routes:**
The BRT routes in each of the four Final BRT service concepts were designed to be on exclusive guideway where possible to allow fast, direct travel from station to station that is unimpeded by traffic conditions on local roads. These routes would operate primarily in the central, or “core” portion of the primary study area, and would pick up inbound riders from park-and-ride lots or from feeder routes at transfer points. The BRT routes in each of the Final BRT service concepts are:

**BRT Service Concept 1** – This BRT service concept was designed to provide direct connections between key origins and destinations and express service between the P&R lots and the more distant employment centers (see Figure ES-5). The service is comprised of five mainline BRT routes:

- **BRT Route 1** – Local service between the southern P&R lot off of I-295 and the South Brunswick P&R lot, serving the east side of U.S. Route 1 via Princeton Junction.

- **BRT Route 2** – Local service between the BRT station (anticipated transfer center) located near the Quaker Bridge Mall and the South Brunswick P&R lot, serving the west side of U.S. Route 1 via Princeton.

- **BRT Routes 3 and 5** – These routes would be express interlined services, which means that BRT Route 3 would operate northbound and return southbound as BRT Route 5.
Northbound service (BRT Route 3) would operate between the BRT station (anticipated transfer center) located near the Quaker Bridge Mall and the South Brunswick P&R lot. The service would operate non-stop between the Quaker Bridge Mall and Sarnoff at which point the service would make local station stops serving both the east and west side of U.S. Route 1.

Southbound service (BRT Route 5) would operate between the South Brunswick P&R lot and the BRT station (anticipated transfer center) located near the Quaker Bridge Mall. The service would operate non-stop between the South Brunswick P&R lot and Sarnoff at which point the service would make local station stops serving the east side of U.S. Route 1.

- **BRT Route 4** – Local service between the southern P&R lot off of I-95 and Princeton serving the east side of U.S. Route 1. Upon reaching Princeton the service would follow the current NJ TRANSIT Route 605 alignment.

  During midday hours BRT Route 4 would travel in a loop between Quaker Bridge and Mercer Malls to the south and Carnegie Center and Market Fair to the north connecting the east and west sides of U.S. Route 1.

**BRT Service Concept 2** – Noting the complexity and high costs of BRT Service Concept 1, a second option, with a more streamlined approach to service was developed (see Figure ES-6). The service is comprised of four mainline BRT routes:

- **BRT Route 1** – Local service between the southern P&R lot off of I-295 and the South Brunswick P&R lot. This service would serve both the east and west side of U.S. Route 1, crossing U.S. Route 1 via College Road to serve the Forrestal Village and proposed Nursery Center.

- **BRT Route 2** – Local service between the BRT station (anticipated transfer center) located near the Quaker Bridge Mall and the Forrestal Village serving west side of U.S. Route 1 (Same as BRT Service Concept 1).

- **BRT Route 3** – Express service, operating during the peak-period only, between the southern P&R lot and the South Brunswick P&R lot, making local stops only at the stations between Carnegie Center South and FMC.

- **BRT Route 4** – Local service between the southern P&R lot off of I-95 and Princeton, serving the east side of U.S. Route 1. Upon reaching Princeton the service would follow the current NJ TRANSIT Route 605 alignment (Same as BRT Service Concept 1).

  During midday hours BRT Route 4 would travel in a loop serving all stations between Quaker Bridge and Mercer Malls to the south and Carnegie Center and Market Fair to the north connecting the east and west sides of U.S. Route 1 (Same as BRT Service Concept 1).
Figure ES-6: Final BRT Service Concept 2

[Diagram showing various BRT routes, transfer centers, and park-and-ride locations in Central New Jersey.]

- BRT Route 1
- BRT Route 2
- BRT Route 3 (express)
- BRT Route 4 (mid-day only)
- Feeder Route
- Dinky Track
- Northeast Corridor
- Exclusive BRT Guideway
- Core BRT Station
- Other Station
- Park-and-Ride

Not to scale
BRT Service Concept 3 – This BRT service concept was based off of BRT Service Concept 2 with the addition of extra BRT service along the Dinky right-of-way. The additional BRT service along the Dinky right-of-way would replace the existing Dinky Line (see Figure ES-7). The service is comprised of the following BRT routes:

- **BRT Route 1** – Local service between the southern P&R lot off of I-295 and the South Brunswick P&R lot. This service would serve both the east and west side of U.S. Route 1, crossing U.S. Route 1 via College Road to serve the Forrestal Village and proposed Nursery Center (Same as BRT Service Concept 2).

- **BRT Route 2** – Local service between the BRT station (anticipated transfer center) located near the Quaker Bridge Mall and the Forrestal Village, serving west side of U.S. Route 1 (Same as BRT Service Concept 1).

- **BRT Route 3** – Express service, operating during the peak-period only, between the southern P&R lot and the South Brunswick P&R lot, making local stops only at the stations between Carnegie Center South and FMC. (Same as BRT Service Concept 2)

- **BRT Route 4** – Local service between the southern P&R lot off of I-95 and Princeton, serving the east side of U.S. Route 1. Upon reaching Princeton the service would follow the current NJ TRANSIT Route 605 alignment (Same as BRT Service Concept 1).

  During midday hours BRT Route 4 would travel in a loop serving all stations between Quaker Bridge and Mercer Malls to the south and Carnegie Center and Market Fair to the north connecting the east and west sides of U.S. Route 1 (Same as BRT Service Concept 1).

- **BRT Route 5** – Service that emulates the Dinky, traveling non-stop between Princeton and Princeton Junction, extending through downtown Princeton to the Princeton Shopping Center.

- **BRT Route 6** – Service between West Windsor and the Princeton Shopping Center via the Dinky right-of-way, making core station stops between Princeton Junction and Princeton.

- **BRT Route 7** – Service between the Twin Rivers P&R lot and Montgomery Township via the Dinky right-of-way, making core station stops between Princeton Junction and Princeton.

- **BRT Route 8(M)** – Service between East Brunswick and Princeton. The service would operate non-stop between East Brunswick and the South Brunswick P&R lot at which point the service would make local station stops serving both the east and west side of U.S. Route 1, crossing U.S. Route 1 via College Road to serve the Forrestal Village and proposed Nursery Center.
Figure ES-7: Final BRT Service Concept 3
**BRT Service Concept 4** – This BRT service concept was based off of BRT Service Concept 2 with the addition of extra BRT service along the Dinky right-of-way. The additional BRT service along the Dinky right-of-way would be in addition to the existing Dinky Line (see Figure ES-8). The service is comprised of the following BRT routes:

- **BRT Route 1** – Local service between the southern P&R lot off of I-295 and the South Brunswick P&R lot. This service would serve both the east and west side of U.S. Route 1, crossing U.S. Route 1 via College Road to serve the Forrestal Village and proposed Nursery Center (Same as BRT Service Concept 2).

- **BRT Route 2** – Local service between the BRT station (anticipated transfer center) located near the Quaker Bridge Mall and the Forrestal Village, serving west side of U.S. Route 1 (Same as BRT Service Concept 1).

- **BRT Route 3** – Express service, operating during the peak-period only, between the southern P&R lot and the South Brunswick P&R lot, making local stops only at the stations between Carnegie Center South and FMC (Same as BRT Service Concept 2).

- **BRT Route 4** – Local service between the southern P&R lot off of I-95 and Princeton, serving the east side of U.S. Route 1. Upon reaching Princeton the service would follow the current NJ TRANSIT Route 605 alignment (Same as BRT Service Concept 1).

  During midday hours BRT Route 4 would travel in a loop serving all stations between Quaker Bridge and Mercer Malls to the south and Carnegie Center and Market Fair to the north connecting the east and west sides of U.S. Route 1 (Same as BRT Service Concept 1).

- **BRT Route 6** – Service between West Windsor and the Princeton Shopping Center via the Dinky right-of-way, making core station stops between Princeton Junction and Princeton (Same as BRT Service Concept 3).

- **BRT Route 7** – Service between the Twin Rivers P&R lot and Montgomery Township via the Dinky right-of-way, making core station stops between Princeton Junction and Princeton (Same as BRT Service Concept 3).

- **BRT Route 8(M)** – Service between East Brunswick and Princeton. The service would operate non-stop between East Brunswick and the South Brunswick P&R lot at which point the service would make local station stops serving both the east and west side of U.S. Route 1, crossing U.S. Route 1 via College Road to serve the Forrestal Village and proposed Nursery Center (Same as BRT Service Concept 3).
Figure ES-8: Final BRT Service Concept 4
Feeder Bus Network:
The feeder bus network was established to support core BRT Service Concepts 1, 2, 3 and 4 previously presented. The feeder bus network is a combination of modified existing NJ TRANSIT bus routes and new bus routes as illustrated in Figure ES-9. The feeder bus network is comprised of the following routes:

Route A – Peak only service between the southern P&R lot off of I-295 and the South Brunswick P&R lot, serving the west side of U.S. Route 1 via Princeton Junction.

Route B – Off-peak only service between the southern P&R lot off of I-95 and the Quaker Bridge Mall.

Route C – Service between the Hamilton Market Place and Nassau Park via the Quaker Bridge/Mercer Malls. Formerly NJ TRANSIT bus Route 603.

Route D – Service between the Ewing and the southern P&R lots off of I-295/I-95 via the Trenton Rail Station and College of NJ. Formerly NJ TRANSIT bus Route 601.

Route E – Service between the downtown Trenton and Princeton Junction via Quaker Bridge Mall, Wyeth, Carnegie Center and the Office Park. Formerly NJ TRANSIT bus Route 600.


Route G – Service between the Princeton North Shopping Center and Princeton Junction via West Windsor.

Route H – Service between the Plainsboro and Princeton Junction via U.S. Route 1.

Route I – Service between the P&R lot at NJ Turnpike, Exit 8A and Princeton Junction via the proposed Princeton Nursery, Forrestal Village, FMC, Sarnoff and the Office Park.

Route J – Service between the proposed South Brunswick Rail Station P&R lot and Princeton via the South Brunswick P&R lot.


Route L – Service between East Brunswick and Princeton Junction via the South Brunswick P&R lot, proposed Princeton Nursery, Forrestal Village, FMC, Sarnoff and the Office Park.

Route M – Service between East Brunswick and the South Brunswick P&R lot. This route was incorporated into BRT Route 8 for all of the Final BRT service concepts.
Figure ES-9: Feeder Bus Network
**Park-and-Ride Facility Locations:**
Potential locations for park-and-ride facilities were established to capture commuters as early in their trips as possible (see Figure ES-10 and Figure ES-11). The BRT system would include P&R facilities at these locations:

- I-95 in Pennsylvania (Buck’s County): At the I-95/Route 332 interchange
- I-95 in New Jersey: In the median of I-95 between Route 31 and Federal City Road
- I-295 in New Jersey: Alongside of I-295, between Cypress Street and Kuser Road
- U.S. Route 1 in Trenton: In the vicinity of Spruce Street and Princeton Pike
- U.S Route 1 in South Brunswick: At the U.S. Route 1/Route 522 intersection
- NJ Turnpike at Exit 8A

**Figure ES-10: Southern Park-and-Ride Locations**
Figure ES-11: Northern Park-and-Ride Location

U.S. Route 1
South Brunswick
Park-and-Ride Lot
BRT GUIDEWAY OPTIONS

U.S. Route 1 is heavily congested with automobile traffic during the peak hours. In order to establish an alternative to the automobile the BRT must operate as a fast and reliable service, therefore, an alignment was created that would directly connect to the major activity centers and only allow access to BRT and supporting feeder route buses, separating the buses from the automobile congestion on U.S. Route 1.

Based on the location of the activity centers and the design of the BRT service concepts, two primary BRT guideways were developed, one on the east side and one on the west side of U.S. Route 1. East-west connections were added at key locations between the east and west sides.

Several guideway alignment options were developed and evaluated based on impacts on travel times, environmental concerns, coordination with planned development and access to activity centers. The evaluation led to the selection of the preferred alignment that is shown in Figure ES-12 through Figure ES-14.

The proposed BRT alignment would be coordinated with the NJDOT Penns Neck Area EIS improvements along U.S. Route 1 and at the Princeton Junction Station, where the Vaughn Drive extension would connect Alexander Road and County Route 571. The BRT guideway was also planned in coordination with the West Windsor Princeton Junction Station Area Vision Plan (June 2005), which proposed an approach for long term change around the station.
Figure ES-12: Final BRT Guideway (Map 1 of 3)
Figure ES-13: Final BRT Guideway (Map 2 of 3)

If the Penn's Neck area is not rebuilt, the BRT would operate in mixed traffic on the existing roads in this area.
DINKY OPTIONS

A range of rail technology options were considered during this study. Early in the study effort light rail was considered and eliminated due to the inefficiencies and operating difficulty in applying a unique technology to such a short rail line. Five options were selected for consideration for the future form of the Dinky that varied in the mode of the dinky (rail or BRT), the guideway design (BRT guideway, single track, double track), the number of vehicles used to operate the service, and the maximum possible frequency of the service. Through a qualitative evaluation, the five preliminary Dinky options were reduced to three final options. The three final Dinky options were later combined with the final BRT service concepts and the BRT guideway to form complete network alternatives. The five original Dinky options, including a No-Build option, were defined as follows:

No-Build Option
The current operation consists of one train, on a 2.78 mile single track, traveling between the Princeton and Princeton Junction stations. The current operation has a five-minute running time between stations with a five-minute layover period at each station for maintenance checks. This results in a minimum twenty-minute interval between trains (headway).

Dinky Option 1 - Replacement of the Dinky Line with BRT
This option would replace the existing single track Dinky with a paved bi-directional cartway for a BRT system. The BRT operation for this option would consist of a ten-minute headway between the Princeton and Princeton Junction stations.

Dinky Option 2 - Dinky Line Including a BRT System
This option consists of a paved bi-directional cartway for a BRT system adjacent to the existing Dinky Line. The Dinky would retain its existing schedule with twenty-minute headways. A cartway next to the Dinky Line would allow for BRT buses to make through movements to serve between Lawrence and South Brunswick.

Dinky Option 3 - Double Track Dinky with Single Track into Stations
This option consists of a single track into each station starting approximately 1000 feet prior to each station and double track throughout the rest of the Dinky corridor. This would allow for more than one train to operate in the corridor at the same time, increasing service between Princeton Junction and Princeton to a headway of approximately ten-minutes.

Dinky Option 4 - Double Track Dinky Line with New Platforms
This option consists of double track for the entire length of the Dinky corridor. This would allow two trains to operate independently of each other between Princeton and Princeton Junction resulting in a combined ten-minute headway.

Dinky Option 5 - Single Track Dinky Line with Double Track into Each Station
This option consists of double track into each station starting approximately 1000 feet prior to each station and single track throughout the rest of the Dinky corridor. This would allow for a three-train operation traveling between Princeton and Princeton Junction resulting in a thirteen-minute headway.

Summary of Dinky Options
Dinky Options 1, 2 and 4 warrant further review for the Dinky corridor. Dinky Option 1 allowed the BRT the flexibility to extend beyond the Dinky corridor, allowing passengers a one seat ride.
to destinations within the entire BRT network. Dinky Option 2 allowed the same flexibility as Dinky Option 1, but without the removal of the existing, functional Dinky service. Dinky Option 4 allowed two Dinky trains to operate independently of each other, allowing a higher percentage of Dinky trains the ability to meet Northeast Corridor trains at Princeton Junction.

**NETWORK ALTERNATIVES**

The network alternatives are a combination of several different components developed in the BRT service concepts including the NJ TRANSIT bus and feeder bus network, the location of P&R facilities, the BRT guideway and the Dinky options (see Table ES-3). A No-Build Alternative was also developed as a basis for comparison. Table ES-4 summarizes attributes for each of the network alternatives.

Each network alternative was reviewed based on three key attributes:

**Ridership**

Ridership for the network alternatives was forecasted using a combination of the DVRPC travel demand model, the North Jersey Regional Transportation Model (NJRTM) and the NJ Transit Demand Forecasting Model (NJTDFM).

Model runs for each alternative were based on input of the proposed network alternative, including the physical alignment, location of stops, locations of P&R lots, distance and travel time (including dwell time) between stops, frequency of each route and service pattern (local, express) of each route. The NJTDFM was run first to determine trips with an origin or destination north of New Brunswick. Output from that model was transferred to the DVRPC model prior to transit assignment so that a combined report of transit ridership could be generated.

**Operating and Maintenance Costs**

Operating and maintenance (O&M) costs for the BRT and other bus services were based on an O&M cost model created to represent O&M costs and service levels of the existing NJ TRANSIT system. O&M costs for rail service in the Dinky options were developed using a model provided by NJ TRANSIT.

**Capital Costs**

Capital cost estimates for this study were based on an application of unit costs for items in the Federal Transit Administration’s cost categories to the quantity in which they occur in the proposed system. The categories include guideway, track work, maintenance facility/shops/yard, systems, stations, vehicles, right-of-way, contingency and soft costs.

The NJDOT’s *Construction Cost Estimation Preparation Manual for Preliminary Design* (CCEPMPD) was used to determine unit costs for BRT guideway sections.

Costs for right-of-way were based on average values for commercial property, as supplied by the townships of Lawrence, Princeton, West Windsor, Plainsboro and South Brunswick. A weighted average was used to account for variations in property value by township and the percentage of the guideway that would be in each township.
<table>
<thead>
<tr>
<th>Network Alternative</th>
<th>Final BRT Service Concept</th>
<th>Final Dinky Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Build Alternative</td>
<td>None</td>
<td>No-Build remains “as-is”</td>
</tr>
</tbody>
</table>
| Network Alternative 1  
BRT Service Concept 1  
with Dinky Alongside | Final BRT Service Concept 1  
Five BRT routes | Final Dinky Option 2a  
shift Dinky to allow for BRT Guideway |
| Network Alternative 2a  
BRT Service Concept 2  
with Dinky Alongside | Final BRT Service Concept 2  
Four BRT Routes | Final Dinky Option 2a  
shift Dinky to allow for BRT Guideway |
| Network Alternative 2b  
BRT Service Concept 2  
with upgraded Dinky Alongside | Final BRT Service Concept 2  
Four BRT Routes | Final Dinky Option 2b  
shift Dinky and double-track to increase service frequency (incl. at stations) |
| Network Alternative 3a  
BRT Service Concept 3  
Operate Dinky until BRT opens | Final BRT Service Concept 3  
Four BRT Routes plus  
Four BRT Routes replacing the Dinky (Alternative 3c also includes two additional Bucks County park-and-ride lots) | Final Dinky Option 2a  
shift Dinky to allow for BRT Guideway and stop Dinky operation after BRT opens |
| Network Alternative 3b  
BRT Service Concept 3  
Remove Dinky for Construction of BRT | Final BRT Service Concept 3  
Four BRT Routes plus  
Four BRT Routes replacing the Dinky (Alternative 3c also includes two additional Bucks County park-and-ride lots) | Final Dinky Option 1  
remove Dinky to replace with BRT |
| Network Alternative 3c  
BRT Service Concept 3 plus two additional  
Buck’s County park-and-rides,  
Remove Dinky for Construction of BRT | Final BRT Service Concept 3  
Four BRT Routes plus  
Four BRT Routes replacing the Dinky (Alternative 3c also includes two additional Bucks County park-and-ride lots) | Final Dinky Option 1  
remove Dinky to replace with BRT |
| Network Alternative 4a  
BRT Service Concept 3  
with Dinky Alongside | Final BRT Service Concept 4  
Four BRT Routes plus  
Three BRT Routes supplementing the Dinky (Alternative 4c also includes two additional Bucks County park-and-ride lots) | Final Dinky Option 2a  
shift Dinky to allow for BRT Guideway |
| Network Alternative 4b  
BRT Service Concept 3  
with upgraded Dinky Alongside | Final BRT Service Concept 4  
Four BRT Routes plus  
Three BRT Routes supplementing the Dinky (Alternative 4c also includes two additional Bucks County park-and-ride lots) | Final Dinky Option 2b  
shift Dinky and double-track to improve service frequency (incl. at stations) |
| Network Alternative 4c  
BRT Service Concept 3 (modified)  
with Dinky Alongside, plus two additional  
Buck’s County park-and-rides | Final BRT Service Concept 4  
Four BRT Routes plus  
Three BRT Routes supplementing the Dinky (Alternative 4c also includes two additional Bucks County park-and-ride lots) | Final Dinky Option 2a  
shift Dinky to allow for BRT Guideway |
| Network Alternative 5  
Dinky Upgrade (No BRT) | None | Final Dinky Option 4  
double-track to improve service frequency (incl. at stations) |

1 The same feeder bus network and P&R facilities are used in all of the Final BRT Service Concepts.  
2 The original Dinky Option 2 was split into Dinky Option 2a and Dinky Option 2b. Dinky Option 2a is the original Dinky Option 2 with the BRT alongside of the existing Dinky. Dinky Option 2b is a combination of Dinky Option 2 and Dinky Option 4 with the BRT alongside a double track Dinky.
Table ES-4: Network Alternatives – Summary of Attributes

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No-Build Alternative</td>
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<td>No-Build</td>
<td>20,400</td>
<td>$0.0 m</td>
<td>$0.0 m</td>
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<tr>
<td>Network Alternative 1</td>
<td>BRT Service Concept 1</td>
<td>Dinky Option 2a</td>
<td>41,000</td>
<td>$20.8 m</td>
<td>$604.3 m</td>
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<tr>
<td>BRT Service Concept 1 with Dinky Alongside</td>
<td>Five BRT routes</td>
<td>shift Dinky to allow for BRT Guideway</td>
<td></td>
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<td></td>
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<tr>
<td>Network Alternative 2a</td>
<td>BRT Service Concept 2</td>
<td>Dinky Option 2a</td>
<td>40,800</td>
<td>$20.0 m</td>
<td>$600.8 m</td>
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<td>BRT Service Concept 2 with Dinky Alongside</td>
<td>Four BRT Routes</td>
<td>shift Dinky to allow for BRT Guideway</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Network Alternative 2b</td>
<td>Dinky Option 2b</td>
<td>shift Dinky to allow for BRT Guideway</td>
<td>41,100</td>
<td>$23.0 m</td>
<td>$650.0 m</td>
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<tr>
<td>BRT Service Concept 2 with upgraded Dinky Alongside</td>
<td>Four BRT Routes</td>
<td>shift Dinky and double-track (incl. at stations)</td>
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<td></td>
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<tr>
<td>Network Alternative 3a</td>
<td>BRT Service Concept 3</td>
<td>Dinky Option 1</td>
<td>44,100</td>
<td>$22.3 m</td>
<td>$637.8 m</td>
</tr>
<tr>
<td>BRT Service Concept 3 Operate Dinky until BRT opens</td>
<td>Four BRT Routes plus</td>
<td>remove Dinky to replace with BRT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Alternative 3c also includes two additional Bucks County park-and-ride lots)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Alternative 3b</td>
<td>Dinky Option 1</td>
<td>remove Dinky to replace with BRT</td>
<td>44,100</td>
<td>$22.3 m</td>
<td>$618.6 m</td>
</tr>
<tr>
<td>BRT Service Concept 3 Remove Dinky for Construction of BRT</td>
<td>Four BRT Routes plus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Alternative 3c also includes two additional Bucks County park-and-ride lots)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Alternative 3c</td>
<td>Dinky Option 1</td>
<td>remove Dinky to replace with BRT</td>
<td>45,200</td>
<td>$22.4 m</td>
<td>$635.6 m</td>
</tr>
<tr>
<td>BRT Service Concept 3 plus two additional Buck’s County park-and-ride lots, Remove Dinky for Construction of BRT</td>
<td>Four BRT Routes plus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Alternative 3c also includes two additional Bucks County park-and-ride lots)</td>
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<td></td>
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<td></td>
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<tr>
<td>Network Alternative 4a</td>
<td>BRT Service Concept 4</td>
<td>Dinky Option 2a</td>
<td>42,600</td>
<td>$24.1 m</td>
<td>$637.5 m</td>
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<tr>
<td>BRT Service Concept 4 with Dinky Alongside</td>
<td>Four BRT Routes plus</td>
<td>shift Dinky to allow for BRT Guideway</td>
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<td></td>
<td></td>
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<tr>
<td>Network Alternative 4b</td>
<td>Dinky Option 2b</td>
<td>shift Dinky and double-track (incl. at stations)</td>
<td>42,900</td>
<td>$27.1 m</td>
<td>$686.8 m</td>
</tr>
<tr>
<td>BRT Service Concept 4 with upgraded Dinky Alongside</td>
<td>Three BRT Routes plus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Alternative 4c also includes two additional Bucks County park-and-ride lots)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Alternative 4c</td>
<td>Dinky Option 2a</td>
<td>shift Dinky to allow for BRT Guideway</td>
<td>43,500</td>
<td>$25.5 m</td>
<td>$668.3 m</td>
</tr>
<tr>
<td>BRT Service Concept 3 (modified) with Dinky Alongside, plus two additional Buck’s County park-and-ride lots</td>
<td>Four BRT Routes plus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Alternative 4c also includes two additional Bucks County park-and-ride lots)</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Network Alternative 5</td>
<td>None</td>
<td>Dinky Upgrade</td>
<td>20,700</td>
<td>$3.0 m</td>
<td>$47.9 m</td>
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<tr>
<td>Dinky Upgrade (No BRT)</td>
<td>Upgrade to Double Track (incl. at stations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 The same feeder bus network and P&R facilities are used in all of the Final BRT Service Concepts.
2 The original Dinky Option 2 was split into Dinky Option 2a and Dinky Option 2b. Dinky Option 2a is the original Dinky Option 2 with the BRT alongside of the existing Dinky. Dinky Option 2b is a combination of Dinky Option 2 and Dinky Option 4 with the BRT alongside a double track Dinky.

STV Incorporated

Final Report

February, 2006
ALTERNATIVES ANALYSIS STUDY RESULTS

The following is a listing of the key study results:

- Ten network alternatives representing potential service options for a regional BRT system were analyzed.

- Analysis of these network alternatives was based upon estimates of ridership, capital cost and net annual operating and maintenance cost. This resulted in narrowing the list to two network combinations, Alternatives 3c and 4c.

- The BRT service and guideway elements of Alternatives 3c and 4c are very similar. The essential difference between them is the option for retaining or possibly improving the Princeton Branch “Dinky” rail service along with a new BRT system (Alternative 4c), versus the replacement of the Princeton Branch “Dinky” rail service by BRT service (Alternative 3c). In Alternative 3c the Princeton Branch alignment becomes one of many links of a large regional BRT system.

- A BRT system would add 17,000 to 19,000 average weekday trips to the transit system in the Route 1 corridor while reducing person trips by auto by 11,000 to 12,000. Within the “cordon boundary” of the Route 1 corridor, BRT ridership would be 14,755 per average weekday (see Table ES-5 and Figure ES-15).

- The BRT would increase the percent of work trips using transit from a range of 2 to 4% to a range of 5 to 9% in the core of the study area (West Windsor, Plainsboro, Princeton Township and Princeton Borough).

- BRT ridership would be achieved if commercial and residential development are designed or improved to include and be oriented to the BRT alignment and stations

- Ridership forecasts indicate that area jobs along the core of the BRT will increase by 40% for a total of 100,000 jobs

- BRT project would cost in the $600 to $700 million range to implement if advanced at one time. However, the system can be implemented in segments as growth and development occur. In addition, as private or public infrastructure are planned and constructed, BRT system segments can be integrated into projects.

- The BRT project is contained in the DVRPC fiscally constrained long-range plan and is included as a “project under study” in the NJTPA Access and Mobility Plan for the Year 2030.
## Table ES-5: Ridership Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Description of Service</th>
<th>Regional BRT Routes Ridership</th>
<th>Core Route 1 BRT Ridership</th>
<th>Average Weekday Regional Bus Ridership</th>
<th>Reduction in Person Trips by Auto</th>
<th>Reduction in Vehicle Miles of Travel by Auto</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Existing Service</td>
<td>NA</td>
<td>NA</td>
<td>14,000</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>2025</td>
<td>No Build Alternative</td>
<td>NA</td>
<td>NA</td>
<td>26,600</td>
<td>No Reduction as traffic is projected to grow by 55%*</td>
<td>No Reduction as VMT is projected to grow by 118%*</td>
</tr>
<tr>
<td></td>
<td>Added frequency to existing routes to accommodate growth in ridership</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2025</td>
<td>BRT Alternative 4c</td>
<td>30,100</td>
<td>14,755</td>
<td>43,500</td>
<td>11,100</td>
<td>368,000</td>
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<tr>
<td></td>
<td>Dinky Retained</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

* Estimated for 2020
Figure ES-15: BRT Alternative 4C – Daily 2025 Core Area Bus Trips

Total Bus Trips into Core Area – 9,811
Total Bus Trips Within Core Area – 4,944
TOTAL CORE AREA BUS TRIPS – 14,755

Legend
- Primary study area
- Service market area
- Activity center
- Commuter rail station
- Commuter rail line
- 500-level county road
- Interstate/US/State highway
- Municipal boundary
- County boundary
- NJTPA/DVRPC boundary

Source: ESRI, Inc., NJTPA and DVRPC.
Next Steps that could be taken by NJ TRANSIT if funds were available

The following provides guidance on the next steps that could be taken to advance segments of the proposed Route 1 BRT system in phases:

A. NJDOT Route 1 Regional Growth Strategy Study:
   - Utilize BRT system concept in NJDOT regional growth strategy study
   - BRT can be part of the mobility improvement plan that supports regional growth and provides a transit alternative to roadway congestion
   - NJDOT study team, with NJ TRANSIT support, should work closely with each municipality to devise a growth and transportation strategy that recognizes and incorporates the BRT system into local plans
   - Work with municipalities to formally adopt BRT system in their transportation and land use plans; including in municipal master plans

B. Identify and work to implement discrete BRT system elements, including:
   1. Consider opportunities for improving service on existing NJ TRANSIT bus routes in the Route 1 corridor to accommodate area growth.
   2. Develop a marketing and education plan that would establish a “brand” and identification for the BRT system that would be applied as services and facilities are developed.
   3. Identify guideway segments and related BRT services that would incrementally implement the BRT system from initial segments to full build-out. Examples can include establishing a pre-BRT service to supplement the Dinky (“Dinky Bus”) between Princeton and Princeton Junction; consider coordination with potential County Route 571 bus service; and enhance bus service in residential areas such as Plainsboro.
   4. Identify opportunities to establish park-ride facilities in coordination with existing and future bus services including BRT.
      - Establish a P&R facility in East Windsor with bus service between Princeton and East Windsor along County Route 571. In addition, coordinate with roadway improvements currently being planned along the County Route 571 corridor to include bus treatments.
      - Establish P&R facilities along I-95 with bus service between Bucks County and the Route 1 corridor.
      - Establish a P&R facility in South Brunswick with bus service between South Brunswick and core Route 1 corridor destinations.
5. Continue coordination with NJDOT on the following projects with the intent of facilitating BRT:
   - Penn’s Neck Area EIS Improvements
   - Millstone River Bridge Replacement Project

6. Continue coordination with DRJTBC on the Scudder Falls Bridge Replacement Project to establish BRT treatments.

7. Coordinate with Route 1 corridor development such as expansion of Quaker Bridge Mall and Forrestal Center to establish BRT stations and guideway.

8. Coordinate with both the Princeton Medical Center and the Capital Health System relocation proposals.

9. Encourage and assist municipalities with preserving right-of-way for the future implementation.

10. Pursue environmental analysis as appropriate for new facilities, segments or scenarios associated with the BRT system.