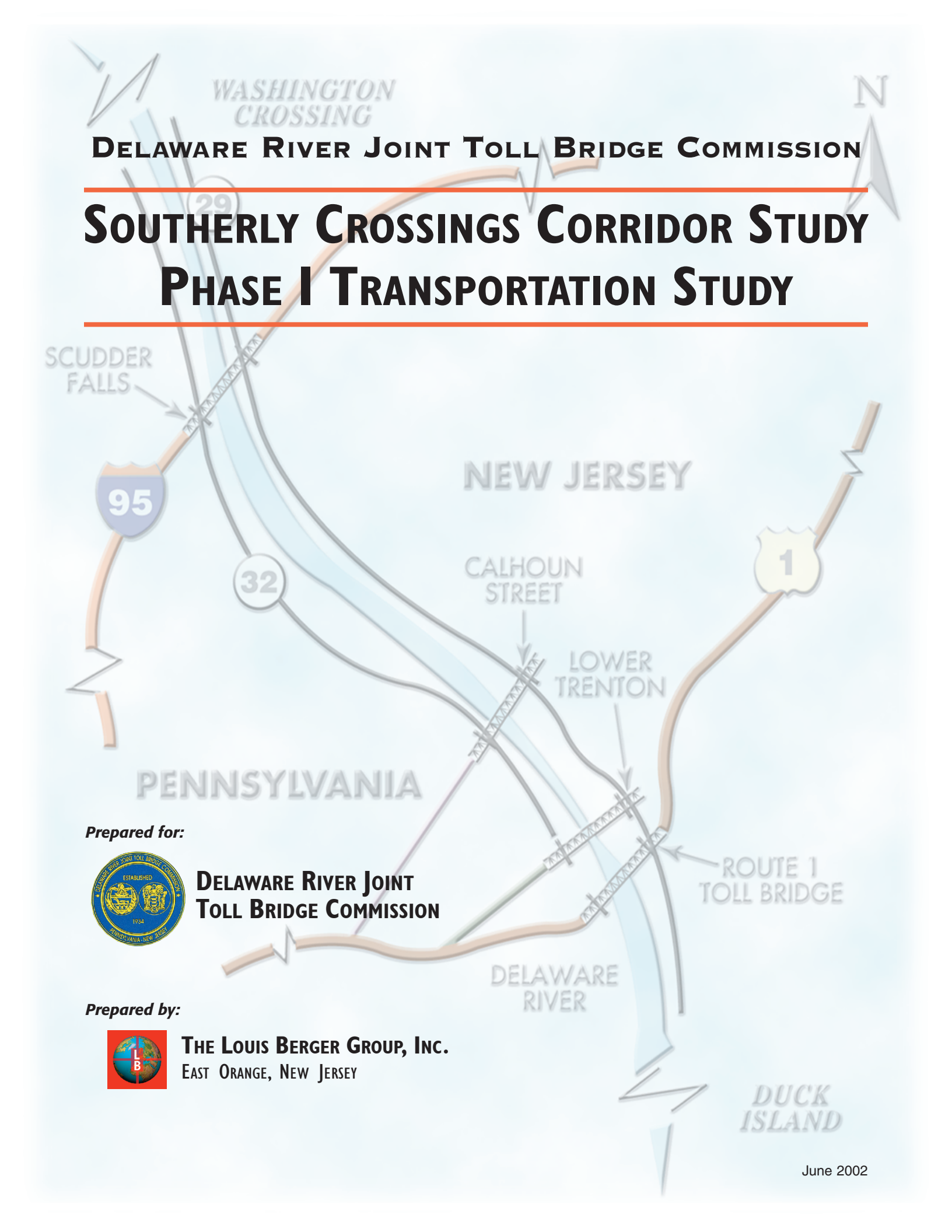

Delaware River Joint Toll Bridge Commission

Southerly Crossings Corridor Study
Phase I Transportation Study

Prepared for:

Delaware River Joint Toll Bridge Commission

Prepared by:

The Louis Berger Group, Inc.
East Orange, New Jersey

June 2002

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This Report presents the results of the Southerly Crossings Corridor Study (the "Study") prepared for the Delaware River Joint Toll Bridge Commission (the "Commission") by The Louis Berger Group, Inc. This Report summarizes the results of the analysis of various alternatives to alleviate congestion in the Southerly Crossings Corridor in the year 2025. Other consulting firms contributing to the Study include Winsor Associates, Ammann & Whitney, and SYSTRA Consulting. In addition, staff of the Delaware Valley Regional Planning Commission (DVRPC) provided technical support to the Study.

The Southerly Crossings Corridor (the "Corridor") encompasses areas in Pennsylvania and New Jersey along the Delaware River between Duck Island to the south and the Washington Crossing area to the north. The Commission owns and operates four roadway bridges in the Corridor – the U.S. Route 1 (Toll), Lower Trenton, Calhoun Street, and Scudder Falls (I-95) bridges – as well as the I-95 park-and-ride facility in Yardley.

Several studies prepared for the Commission over the past 30 years have identified the need to expand bridge capacity in the Corridor. The primary transportation problem in the Corridor has been and continues to be traffic congestion. The four bridges are operating at or near capacity conditions. Traffic volumes are expected to grow by 25 percent, and traffic congestion expected to worsen, as population and employment continue to grow in the region.

The Study used the DVRPC's Regional Travel Model as modified specifically for the Study to simulate travel patterns and traffic volumes in the area. The model enabled examination of the effects of bridge and other transportation system improvement options on traffic volumes and travel patterns. Analysis years for the study included 2001 (existing conditions), 2005 (short-term improvements), and 2025 (long-term improvements). Level-of-service (LOS) D was defined as the target standard for evaluating the traffic flow operational conditions of various options.

Preliminary options for addressing traffic congestion and related problems were identified from the previous studies, from meetings between Commission and consultant staffs, through coordination with a multi-agency Interagency Advisory Committee, and through a public open house held in August 2001. Options that appeared to meet the Study objectives, primarily the ability to alleviate congestion in the Corridor, were advanced for further evaluation.

A major step in the evaluation was the sensitivity analysis of traffic volumes on the bridges to capacity increases at other bridges in the Corridor and to the construction of a new bridge connecting Falls Township, PA with Hamilton Township, NJ (a Falls-Hamilton bridge was proposed in the 1970s and reevaluated in the 1980s). The sensitivity analysis provided insight as to driver behavior, e.g., trip diversions, from various infrastructure investment choices. In this way, the analysis permitted evaluation of solutions from a Corridor-wide rather than individual bridge facility perspective.

Results of the Study relative to level of service under various scenarios are summarized in Table ES-1. Major findings of the Study include the following:

- Without improvements, all bridges in the Corridor will experience LOS F (congested flow) peak hour, peak direction traffic conditions in 2025. The duration of the peak period traffic congestion can be expected to spread to well beyond the peak hour.

TABLE ES-1
LEVELS OF SERVICE (LOS) FOR VARIOUS STUDIED SCENARIOS[1]

Scenarios Description	Route 1		Lower Trenton		Calhoun Street		Scudder Falls		Falls-Hamilton	
	NB AM	Toll SB PM	EB AM	WB PM	EB AM	WB PM	NB AM	SB PM	NB AM	Toll SB PM
Baseline (2001)	F	E	E	E	F	F	F	F	N/A	N/A
No-Build (2005)	F	E	E	E	F	F	F	F	N/A	N/A
No-Build (2025)	F	F	E	F	F	F	F	F	N/A	N/A
No-Build Plus (2005)[2]	F	E	E	E	F	E	E	E	N/A	N/A
No-Build Plus (2025)	F	E	E	F	F	F	F	F	N/A	N/A
Alternative A (2025)[3]	D	D	D	D	C	D	D	D	D	F
Alternative B (2025)[4]	D	E	D	D	D	D	D	D	N/A	N/A

Notes
1) AM and PM peak hour analysis reflect the peak travel directions
2) No-Build Plus highway and transit improvements included in the DVRPC regional transportation plan plus NJ Transit service from a new station at the Morrisville, PA rail yard, express bus service linking the Oxford Valley Mall in Langhorne, PA with the Quakerbridge Mall in Lawrenceville, NJ, and implementation of electronic toll collection at the Route 1 Bridge (southbound direction).
3) Alternative Build Scenario A: A six-lane Scudder Falls Bridge (widened from four lanes), a four-lane Calhoun Street Bridge (widened from two lanes) and a new four-lane bridge to be constructed between Falls Township, PA and Hamilton Township, NJ.
4) Alternative Build Scenario B: Same as Alternative A except that the Route 1 Bridge is widened to six lanes from five lanes in lieu of constructing the Falls-Hamilton Bridge.

- The Study conducted detailed evaluation of three mass transportation investments in addition to those mass transportation projects contained in the DVRPC transportation improvements program and transportation plan. Two of these mass transportation investments, New Jersey Transit passenger rail service at Morrisville Yard and an express bus service linking the Oxford Valley Mall in Langhorne, PA with the Quakerbridge Mall in Lawrenceville, NJ (with several park-and-ride lots in between), are estimated to have a measurable effect on bridge traffic volumes and merit further consideration (part of the No-Build Plus analysis scenario). The third option, extending the Southern New Jersey Light Rail Transit from downtown Trenton to the SEPTA R3 West Trenton Station, was shown to have minimal effect on bridge traffic. Investments in mass transportation, while needed, will not reduce traffic volumes, congestion, and delays on the bridges to acceptable levels.

- While the Calhoun Street Bridge ranks third among the four bridges in terms of average daily traffic, the sensitivity analysis indicates that its future capacity has the greatest influence in varying traffic volumes on the other bridges. In contrast, the Lower Trenton Bridge volumes show little variation relative to bridge capacity investment options elsewhere in the Corridor.

- There is a need for the Calhoun Street Bridge to provide two lanes for peak period-peak direction travel (i.e., eastbound in the A.M. peak period and westbound in the P.M. peak period) to achieve acceptable traffic flow conditions regardless of what investment choices are made on the other bridges. There are several options to accomplish this necessity which will require further study. These options include bridge replacement, constructing a new adjacent span, implementing reversible lanes, or operating the Calhoun Street Bridge as a one-way pair with the Lower Trenton Bridge.

- There is a need to increase the capacity of the Scudder Falls Bridge from four to six lanes to achieve acceptable traffic flow conditions regardless of what investment choices are made on the other bridges. A similar widening of the I-95 approach segments in Pennsylvania (to Route 332) and New Jersey (to Bear Tavern Road or Scotch Road) will be needed to provide acceptable traffic flow in the corridor.

- Traffic flow on the northbound two-lane section of the U.S. Route 1 Bridge is severely impeded by the weave that occurs between the Pennsylvania Avenue interchange on the Morrisville side and the NJ Route 29 interchange on the Trenton side. This segment will continue to operate at unacceptable traffic flow conditions even with improvements at Calhoun Street and Scudder Falls unless either (1) a third northbound lane (an auxiliary lane) is added to the bridge and transitioned to an exit-only lane at the Route 29 interchange, or (2) a new four-lane bridge is constructed at Falls-Hamilton.

- The order-of-magnitude 2002 construction cost of increasing capacity at the Route 1 (five to six lanes), Calhoun Street (two to four lanes), and Scudder Falls (four to six lanes) bridges would range from $164 million to $178 million (Alternative B). The order-of-magnitude 2002 construction cost of constructing a Falls-Hamilton Bridge (four lanes) and increasing capacity at the Calhoun Street (two to four lanes) and Scudder Falls (four to six lanes) bridges would range from $291 million to $378 million (Alternative A). It should be noted that these estimates do not include non-construction costs, e.g., engineering, right-of-way, etc. In addition, the Falls Hamilton alternative does not meet the study target of LOS D or better because, with a toll, the southbound PM peak would be LOS F. Therefore, to meet the target, a wider bridge would be required at an additional expense beyond that estimated in this study.

- The highest cost item, constructing a Falls-Hamilton Bridge ($147 - $220 million), which is part of Alternative A, is not warranted based on the criteria of this study. The targeted level of service (LOS)

for traffic flow, LOS D, can be met on the Corridor's bridges in 2025 without constructing a Falls-Hamilton Bridge with one exception —the Route 1 Bridge in the southbound direction during the PM peak travel hour (during which time the bridge would operate at the upper end of LOS E, rather than the lower end of LOS D, because of the effect of toll collection on traffic flow). The difference in PM peak hour travel speeds between Alternatives A and B is 0.6 mph. Additional gains in traffic flow from future improvements in electronic toll collection technology will likely ameliorate this situation.

- Each of the recommended improvements has independent utility. Consequently, each improvement can be advanced through design/environmental studies to construction on separate schedules, and through separate contracts.

1.0 INTRODUCTION

1.0 INTRODUCTION AND STUDY METHODOLOGY

1.1 Background

The Delaware River Joint Toll Bridge Commission, the "Commission," was established in 1934 by legislation enacted by the Commonwealth of Pennsylvania and the State of New Jersey and operates under a compact that was approved by the United States Congress in August 1935. The compact empowers the Commission to acquire, construct, administer, operate and maintain such bridges as the Commission deems necessary to advance the interests of the two states. The Commission's jurisdiction extends approximately 140 miles from the Philadelphia-Bucks County line to the New York State line.

The Commission has designated the reach of the River between Duck Island (south of Trenton) and the Washington Crossing area as the Southerly Crossings Corridor, the "Corridor". Municipalities within the Corridor include Falls Township, Morrisville Borough, Lower Makefield Township, and Yardley Borough in Bucks County, Pennsylvania, and Hamilton Township, City of Trenton, and Ewing Township in Mercer County, New Jersey.

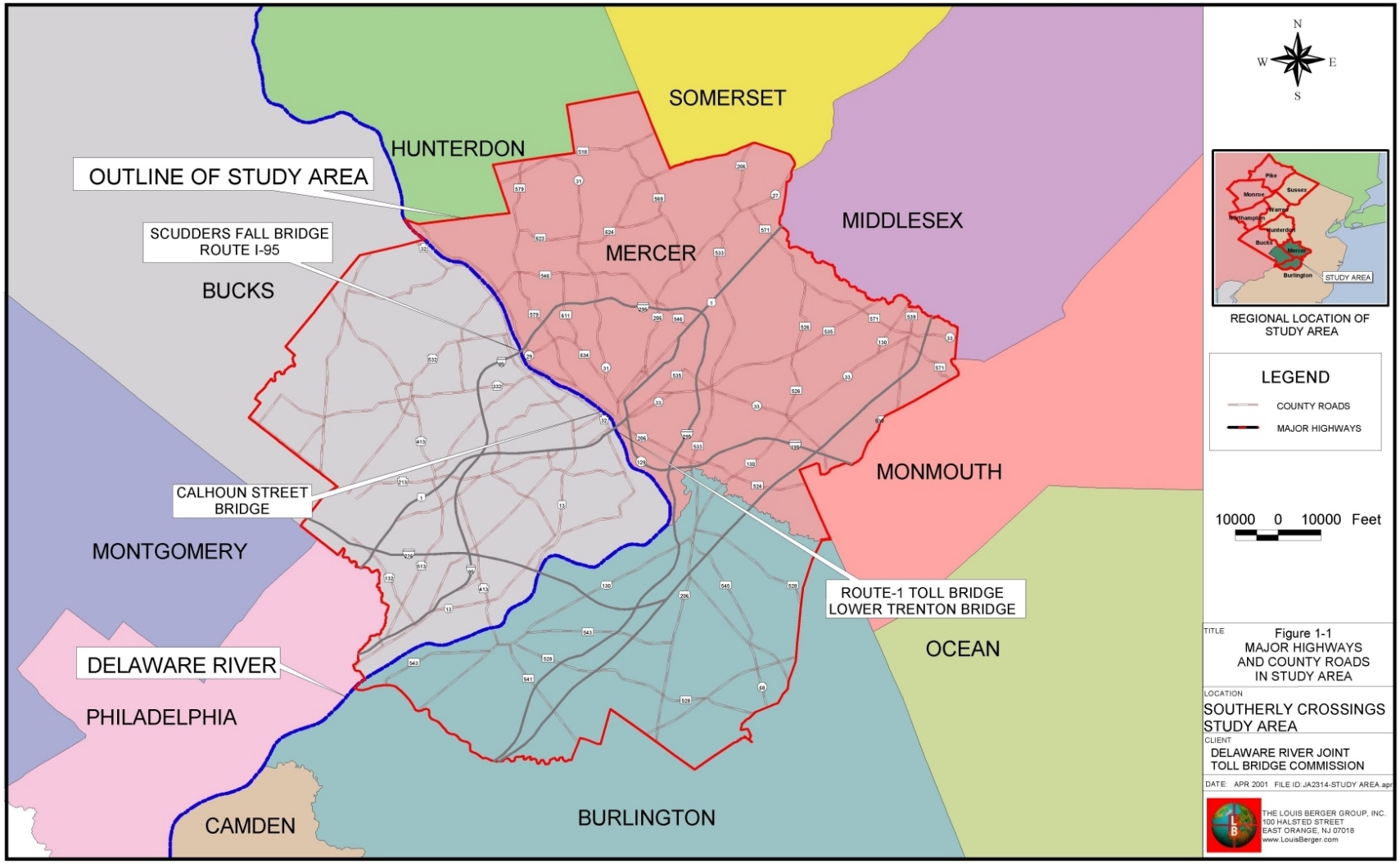
The Commission owns and operates four bridges connecting Pennsylvania and New Jersey in the Corridor. These are the Trenton-Morrisville (U.S. Route 1) Toll Bridge, the Lower Trenton ("Trenton Makes") Bridge, the Calhoun Street Bridge, and the Scudder Falls (Interstate Route 95) Bridge. The bridges range in age from approximately 40 to 120 years. In addition, the Commission operates and maintains the Yardley, PA park-and-ride lot adjacent to the I-95 - Taylorsville Road interchange near the Scudder Falls Bridge. The locations of the Corridor, these bridges, and the park-and-ride lot are depicted in Figure 1-1.

The Corridor's bridges provide vital links for the movement of people and goods between communities in the two states. The U.S. Route 1 and Scudder Falls bridges also carry a substantial amount of through traffic. Population and employment growth in the region have led to growing traffic congestion on all of these bridges.

Various studies have been conducted over the past 30 years to address the traffic congestion on the Corridor's bridges. Specific studies and their recommendations include the following:

- In 1972, the Commission prepared pre-feasibility engineering and traffic studies of a proposed Falls-Hamilton Toll Bridge between Falls Township, PA (Tyburn Road/U.S. Route 13/U.S. Route 1) and Hamilton Township, NJ (NJ Route 29, Interstate Routes 295 and 195) south of the Trenton-Morrisville Toll Bridge. These studies indicated that while a Falls-Hamilton Bridge was physically feasible, the cost could not be justified based on the traffic forecast. Because of growing traffic congestion on the Commission's nearby bridges, the concept was re-evaluated by the Commission in a 1988 Phase I traffic and revenue study. Similar to the 1972 study, the 1988 study concluded that traffic forecasts for a new bridge did not justify the cost of constructing the new bridge. Both studies examined a four-lane structure.

- In 1974, the Commission developed plans and applied for a permit from the U.S. Coast Guard to construct a new four-lane toll bridge across the River between Morrisville, PA and Trenton, NJ at Calhoun Street. The original plans were modified, although a four-lane section was retained, to address community concerns over the impact of the proposed project. The Coast Guard rejected the application in 1980. Several additional options were investigated by the Commission in a 1983


SOMERSET
HUNTERDON
OUTLINE OF STUDY AREA
SCUDDERS FALL BRIDGE
ROUTE I-95
BUCKS
MERCER
MIDDLESEX
CALHOUN STREET
BRIDGE
MONTGOMERY
MONMOUTH
ROUTE-1 TOLL BRIDGE
LOWER TRENTON BRIDGE
OCEAN
DELAWARE RIVER
PHILADELPHIA
CAMDEN
BURLINGTON
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W
E
S
STUDY AREA
REGIONAL LOCATION OF
STUDY AREA
LEGEND
COUNTY ROADS
MAJOR HIGHWAYS
10000 0 10000 Feet
TITLE
Figure 1-1
MAJOR HIGHWAYS
AND COUNTY ROADS
IN STUDY AREA
LOCATION
SOUTHERLY CROSSINGS
STUDY AREA
CLIENT
DELAWARE RIVER JOINT
TOLL BRIDGE COMMISSION
DATE: APR 2001 FILE ID:JA2314-STUDY AREA.apr
THE LOUIS BERGER GROUP, INC.
100 HALSTED STREET
EAST ORANGE, NJ 07018
www.LouisBerger.com

study. The four-lane toll bridge concept at Calhoun Street was again re-evaluated by the Commission in 1992 and 1993. Additional modifications to the 1970s design were studied by the Commission to further mitigate environmental and community impacts. After review, the Commission did not advance the project.

- A comprehensive study of traffic conditions on the four Corridor bridges was conducted by the Commission in 1989. This study concluded that peak hour traffic conditions were approaching capacity on the Route 1 Bridge and were at capacity on the Calhoun Street and Scudder Falls bridges. The study contained recommendations for improvements on all four bridges to alleviate existing and future traffic problems. Major future improvements recommended by the study to alleviate traffic congestion included widening the Route 1 Bridge from five to six lanes by adding a northbound lane; replacing the Calhoun Street Bridge at its present location or constructing a new bridge at a nearby location; and widening I-95 from four to six lanes from the Taylorsville Road interchange to the NJ 29 interchange including the Scudder Falls Bridge. None of these recommendations were implemented.

Population, employment, and travel demand continued to grow during the 1990s. As a result, and in the absence of major improvements, traffic congestion on the bridges and their approaches has also increased.

1.2 Objectives of the Southerly Crossings Corridor Study

The objectives of the Southerly Crossings Corridor Study have been to:

- Quantify the transportation needs in the Corridor.
- Define potential concepts and their limits for both short- (5-year time horizon) and long- (25-year time horizon) term improvement opportunities.
- Provide order of magnitude cost estimates.
- Initiate an on-going community involvement effort with key stakeholders culminating in a consensus on the needs and the range of solutions.

This Southerly Crossings Corridor Study Report has been prepared for the Commission to document the process and analysis developed, tested, and used to forecast travel on the bridges and other major highway and transit facilities in the Corridor. The analysis accounts for the limits of the Study Area, current and planned characteristics of transportation facilities in the Study Area, and current and projected demographic characteristics. The analysis was used to develop alternative transportation improvement concepts for further consideration.

1.3 Traffic Forecasting & Analysis Methodology

1.3.1 Overview

The transportation systems analysis methodology used for this Study generally follows the process used by the U.S. Department of Transportation for the analysis of transportation infrastructure improvements. The general steps associated with the process are as follows:

- Identify the analysis base year and document existing conditions.

- Identify and evaluate conditions for an interim analysis year (typically, a year when some or all proposed improvement(s) are anticipated to be completed; often referred to as ETC - estimated time of completion).

- Identify and evaluate conditions for a future planning horizon year (typically, ETC+20 years) under a No-Build scenario.

- Establish purpose and need for action.

- Identify and evaluate conditions for one or more improvement alternatives and compare these against the No-Build.

The analysis methodology follows a straightforward process of identifying and evaluating alternatives.

The base year used in the study is 2001. The interim year for evaluating short-term conditions and improvements in the Study is 2005 and the year 2025 was chosen as the future year for evaluating long-term conditions and improvements.

1.3.2 Travel Demand Forecasting

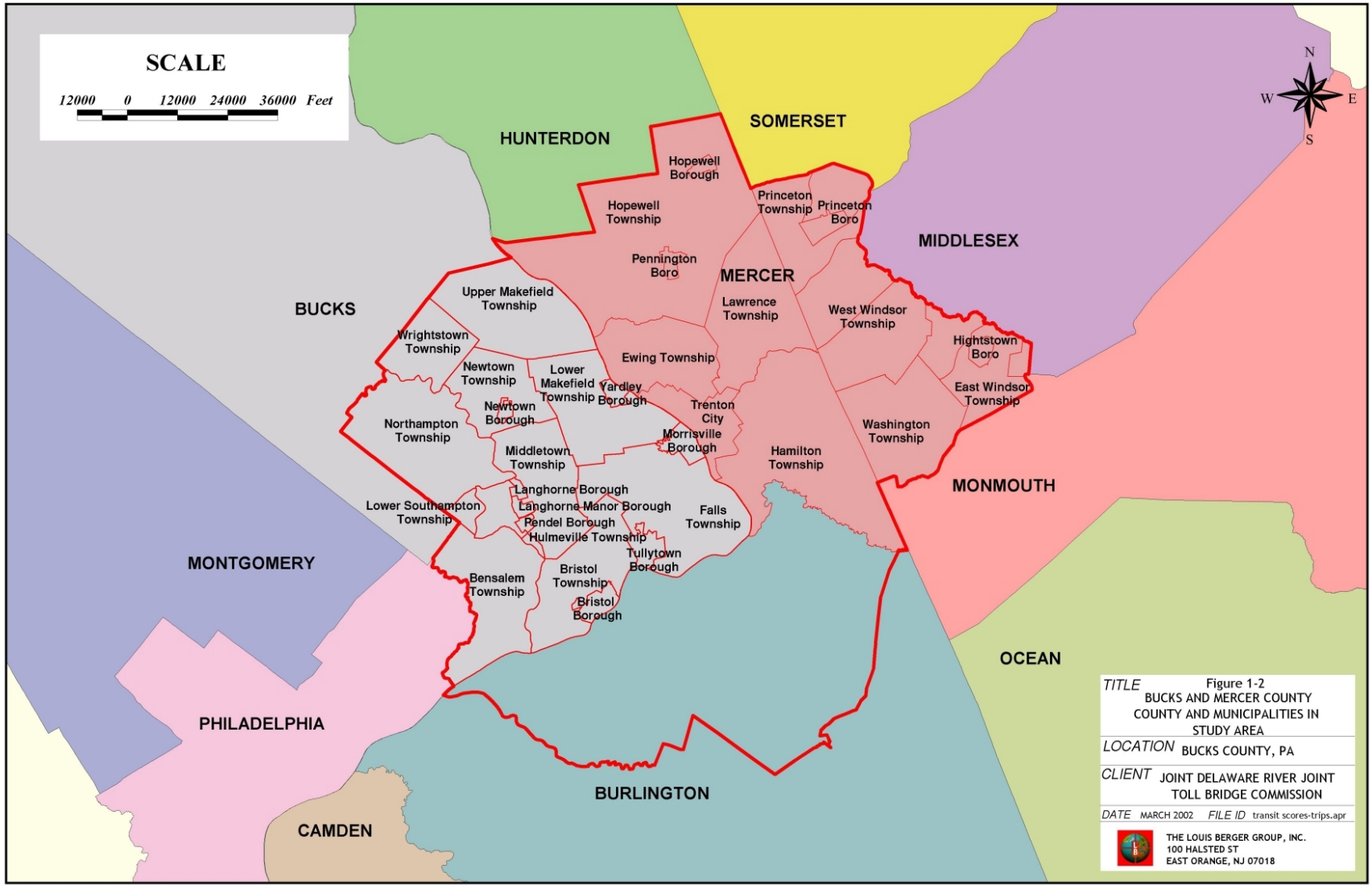
A travel demand-forecasting model was used in the Study to forecast future travel demand and to test alternative improvements. The Delaware Valley Regional Planning Commission's (DVRPC) Regional Transportation Model was used a basis for this modeling effort. TRANPLAN software modules are used to perform travel simulation in the DVRPC model.

The DVRPC model was refined for specific use in the Study analysis through the following steps:

- A Study Area for analysis was defined (Figure 1-2). The Study Area contains 25 municipalities; it covers all of Mercer and portions of Bucks and Burlington counties. This area was larger than the Corridor limits so as to capture a large proportion of trips that use the Corridor bridges.

- The DVRPC model traffic analysis zones (geographic analysis units) within the Study Area were split into smaller analysis units commensurate with the focus on the Study Area as opposed to the substantially larger DVRPC region. The finer geography was developed to enable the model to better predict trip diversions from one bridge to another from changes in bridge capacity or travel demand.

- Traffic counts were obtained through automated traffic recorders at selected locations during April, 2001. The information from these counts were fed into the model in order to improve the model's accuracy at predicting traffic volumes and travel patterns in the Corridor. The locations at which Study-specific traffic counts were obtained include the following:


SCALE
12000 0 12000 24000 36000 Feet
N
W
E
S
HUNTERDON
SOMERSET
MIDDLESEX
MERCER
BUCKS
MONMOUTH
MONTGOMERY
PHILADELPHIA
BURLINGTON
CAMDEN
OCEAN
Hopewell Borough
Hopewell Township
Princeton Township
Princeton Boro
Pennington Boro
Upper Makefield Township
Wrightstown Township
Lawrence Township
West Windsor Township
Hightstown Boro
East Windsor Township
Ewing Township
Newtown Township
Lower Makefield Township
Yardley Borough
Newtown Borough
Northampton Township
Trenton City
Morrisville Borough
Washington Township
Hamilton Township
Middletown Township
Langhorne Borough
Langhorne Manor Borough
Lower Southampton Township
Rendel Borough
Hulmeville Township
Falls Township
Tullytown Borough
Bensalem Township
Bristol Township
Bristol Borough
TITLE Figure 1-2
BUCKS AND MERCER COUNTY
COUNTY AND MUNICIPALITIES IN
STUDY AREA
LOCATION BUCKS COUNTY, PA
CLIENT JOINT DELAWARE RIVER JOINT
TOLL BRIDGE COMMISSION
DATE MARCH 2002 FILE ID transit scores-trips.apr
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100 HALSTED ST
EAST ORANGE, NJ 07018

Vicinity of Washington Crossing Bridge:

1. PA 32, River Rd, between PA 532, Gen. Washington Memorial Blvd and Gen. Moore Rd., Upper Makefield Twp., Bucks County
2. PA 532, Gen. Washington Blvd, between Taylorsville Rd and PA 32, River Rd, Upper Makefield Twp., Bucks County
3. Taylorsville Rd, between PA 532, Gen. Washington Blvd and PA 32, River Rd, Upper Makefield Twp., Bucks County
4. CR 546, Washington Crossing Rd, between NJ 29, River Rd and CR 579, Bear Tavern Rd, Hopewell Twp., Mercer County
5. CR 579, Bear Tavern Rd, between CR 546, Washington Crossing Rd and Lafayette Ave, Hopewell Twp., Mercer County
6. CR 546, Pennington Rd, between Jacobs Creek Rd and Scotch Rd, Hopewell Twp., Mercer County

Vicinity of Calhoun St. Bridge:

7. NJ 29, John Fitch Pkwy, south of the Calhoun St Bridge interchange, City of Trenton
8. Calhoun St, between NJ 29, John Fitch Pkwy interchange and E. State St, City of Trenton

Vicinity of Bridge St. / US 1 Bridges:

9. S. Pennsylvania Ave, between Bristol Pike and Bowling Green Ave, Morrisville Borough, Bucks County
10. NJ 29, John Fitch Pkwy, south of AMTRAK bridge, City of Trenton
11. NJ 29, John Fitch Pkwy, north of Bridge St Bridge overpass, City of Trenton
12. NJ 29, John Fitch Pkwy ramp to US 1 Bridge SB, City of Trenton
13. US 1, between Broad St SB on-ramp to US 1 and US 1 on-ramp from NJ 29, John Fitch Pkwy SB, City of Trenton
14. Warren St, between E. State St and Perry St, City of Trenton
15. CR 635, E. State St, between Clinton Ave and CR 620, Chambers St, City of Trenton
16. CR 606, Hamilton Ave, between Clinton Ave and CR 620, Chambers St, City of Trenton
17. US 206, Broad St, between NJ 129 and CR 620, Chambers St, City of Trenton

Other Study Area Count Locations:

18. NJ 29, between I-295 / I-195 interchange and NJ 29 / NJ 129 interchange, Hamilton Twp., Mercer County
19. NJ 31, Pennington Rd, between I-95 and CR 546, Pennington Rd, Hopewell Twp., Mercer County
20. CR 583, Princeton Pike, south of Fackler Rd, Lawrence Twp., Mercer County
21. CR 649, Sloan Rd, between AMTRAK overpass and I-295, Hamilton Twp., Mercer County

- Future population and employment estimates used in the model were updated, where appropriate, based on a survey conducted with local officials from each municipality within the Study Area. The primary purpose of the survey was to identify attributes of proposed development projects (location, size, etc.) in the Study Area and compare the survey information with that in DVRPC's model files. Among other information, municipalities were asked to identify approved future commercial developments of at least 50,000 square feet and approved future residential developments of at least 50 dwelling units. The model files were amended, as appropriate, to include new or updated information from the survey. The survey was conducted in January and February, 2001.

- The model included all highway and transit projects included in the 2001 Transportation Improvement Program (TIP) and the 2025 Transportation Plan.

DVRPC staff modified the model to reflect the information gathered specifically for the Study. The Study model was calibrated by the DVRPC to actual existing traffic volumes on bridges within and nearby the Corridor.

1.4 Alternatives Development and Screening

Consideration of alternatives for analysis began with concepts developed from the Commission's prior studies. Input to the process of developing alternatives also came from a series of meetings with the Study's Interagency Advisory Committee (IAC), as well as from the public through an Open House. The IAC comprises representatives from the following agencies:

DVRPC

Pennsylvania Department of Transportation	New Jersey Department of Transportation
Pennsylvania Turnpike Commission	New Jersey Turnpike Authority
SEPTA	New Jersey Transit
Pennsylvania Department of Environmental Protection	NJ Department of Environmental Protection
PA Department of Conservation & Natural Resources	New Jersey Office of Statewide Planning
Bucks County	Mercer County

The Open House for the Study was held on August 8, 2001 at The College of New Jersey.

A range of specific and general solutions to corridor traffic congestion were identified for consideration as preliminary alternatives. Included were highway and transit capital improvement alternatives, transportation systems management alternatives, and travel demand management alternatives.

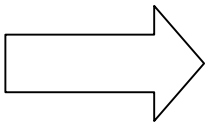
A screening of preliminary alternatives was conducted to develop a manageable list of alternatives to assess with the travel-forecasting model. The screening framework is presented in Table 1-1 below. Preliminary alternatives were examined first for whether or not they related to the primary purpose of the Study, i.e., relieve cross-River traffic congestion in the Corridor.

TABLE 1-1 SOUTHERLY CROSSINGS STUDY: SCREENING FRAMEWORK

The Commission's Role:

- Assure safe and efficient crossings
- Maintain and improve asset base
- Plan and construct new infrastructure
- Facilitate commerce between states
- Foster economic development
- Protect the environment

Confirm Goals and Objectives



Goals and Objectives for Southerly Crossings:

- Improve mobility in the corridor
  - Reduce highway travel and congestion
  - Increase public transit use
- Work cooperatively with other transportation agencies
  - Share technology
  - Coordinate services
- Protect the environment
  - Improve air quality
- Maintain or improve safety
  - Achieve and maintain good repair
  - Utilize modern technology

Preliminary alternatives, which advanced beyond the first pass, were then evaluated using select link analysis and the transit score method (these tools also helped identify certain preliminary alternatives). Both methods answer the basic question of whether demand for a preliminary infrastructure or service improvement alternative exists at a level that would justify further consideration.

Select link analysis consists of examining the travel model trip table to focus on specific trip origin-destination patterns among selected traffic analysis zones. In this way, the potential viability of preliminary alternatives aimed at linking certain communities, e.g., through new or expanded bus or transit routes or roadway improvements, could be evaluated.

The transit score method was developed by NJ Transit in its report entitled *The 2020 Transit Report: Possibilities for the Future* (October 2000). This report produced a "transit potential map" covering the New Jersey's 1,950 census tracts, which ranked each tract based on potential for transit ridership. The transit score is the composite average of four factors that influence the potential for transit ridership.

The transit score for each minor civil division (MCD) is based on forecasts for each of four factors. The forecast year 2025 was used for Bucks County, consistent with the DVRPC model. (NJ TRANSIT used 2020 data for New Jersey; the difference is inconsequential.) The four factors that make up the transit score are:

1. Household Density
2. Population Density
3. Employment Density
4. Zero and One-Car Household Density

The NJ TRANSIT scoring equation is as follows:

Transit Score = (Population/acre)/ average household size) + Households/acre + (Number of Zero car households/acre)/0.5 + (Number of One car Households/acre)/average household size + (Employment/acre)/2.5.

There are five NJ TRANSIT "transit potential" classifications as follows:

- LOW- 0 to 0.5 Transit Score
- MARGINAL- 0.5 to 1.0 Transit Score
- MEDIUM- 1.0 to 3.0 Transit Score
- MEDIUM-HIGH- 3.0 to 9.0 Transit Score
- HIGH- > 9.0 Transit Score.

To apply the transit score approach to the Study Area required that the method be applied to the portion of Bucks County in the Study Area (to add to Mercer County and the portion of Burlington County in the Study Area). Calculating the composite of these factors and ranking Study Area MCD's for transit potential, provided an additional means to evaluate the potential viability of preliminary transit alternatives.

The screening resulted in a reasonably broad range of alternative transportation modal solutions for further analysis in the Study. Meanwhile, a number of preliminary alternatives that were identified but eliminated from further consideration in this Study through the alternatives screening process could have merit in other contexts or policy frameworks.

1.5 Alternatives Analysis-Measures of Effectiveness

1.5.1 Level of Service

Traffic volumes were developed from the model to determine the directional design hourly volumes (DDHV) for each of the four bridges. The steps to arrive at the bridges' DDHV were as follows:

- Bridge counts from October 2001 were averaged over three weekdays during the morning and evening peak periods.
- The AM and PM peak hours were divided by 24-hour counts to determine the percentage volume that occurs during each peak period (k-factor).
- The peak hour directional split was determined by dividing peak hour volumes by the directional volumes.
- The k-factor and directional splits were applied to the daily traffic volumes from the model projections for DDHV capacity and level of service analyses.

For the purpose of this Study, the target level-of-service (LOS) for 2025 conditions on the Corridor bridges is LOS D, as defined by the *Highway Capacity Manual* (2000). Roadway capacity is the maximum hourly rate that vehicles can traverse a given point or roadway section. LOS, a quality measure based on traffic volume/roadway capacity, is used to describe traffic flow conditions on a grading scale from LOS A (best) to LOS F (worst). Generally, LOS D is the level at which speeds begin to decline slightly with increasing traffic volumes. In the LOS D range, density begins to increase somewhat more quickly with increasing flow. Freedom to maneuver is more noticeably limited. Drivers experience reduced physical and psychological comfort levels. Minor incidents can be expected to create queuing because the traffic stream has little space to absorb disruptions.

The four bridges in the Corridor represent a range of roadway hierarchies from interstate highway to local roadways.

The Route 1 Toll Bridge presents a *weaving section* per HCM 2000. A ramp-to-ramp length of less than 2,500 feet between the Pennsylvania Avenue on-ramp in Morrisville and the Route 29 off-ramp in Trenton, and existing lane configurations, fall under the criteria of a Type "A" weave. The turbulance in traffic flow created by the mixing of entering/exiting traffic with through traffic over the relatively short distance between the interchanges governs the level of service on the bridge. The northbound non-toll direction is posted for 40 MPH and was analyzed at the same speed. The southbound toll direction was analyzed at 35 MPH, which is the lowest speed for a weaving analysis.

Lower Trenton Bridge has the characteristics of two-lane highway and to a lesser extent an urban arterial. For this Study, the Lower Trenton Bridge was analyzed as two-lane highway, as this capacity analysis better describes the existing roadway characteristics.

Calhoun Street Bridge traffic movements are directly influenced by the immediate traffic signal and intersection configurations and operations on the Pennsylvania side at Delmorr Avenue. Calhoun Street Bridge is best characterized as an urban street with narrow travel lanes and frequent signalized intersections.

The Scudder Falls Bridge (I-95) was analyzed as a multi-lane highway. This classification reflects the current operating speeds, traffic volumes and geometrics of the bridge.

Because the unique circumstances of each bridge dictate a different approach of the HCM analysis to determine LOS, other measures of effectiveness, e.g., delay, density and volume/capacity ratio, could not be used universally to describe and compare traffic flow conditions of the bridges.

1.5.2 Construction Cost Estimates

The New Jersey Department of Transportation provides estimating and design guidelines with respect to bridge rehabilitation and new bridge construction. The construction cost estimates used in this study followed the NJDOT bridge take-off methodology, in the case of improving the existing bridges, or was based on previous work performed for the commission, specifically, the 1988 Falls-Hamilton Bridge Study. The cost estimates reflect construction costs in 2002 dollars, i.e., right-of-way, design, and other costs are not included.

2.0 EXISTING CONDITIONS

2.0 EXISTING CONDITIONS

2.1 Travel Patterns and Trends in the Corridor Per Other Studies

Journey-to-work data for the Delaware Valley region from the 1990 Census is summarized at the county level and compared with similar data from the 1970 and 1980 censuses. Changes in the distribution of resident workers, commuting patterns, means of transportation, travel times and employment are analyzed. For the purposes of this memorandum, only travel patterns for Bucks, Burlington and Mercer Counties will be presented since these counties lie within the Southerly Crossings Study Area.

Mercer County

Mercer County contains the state capital, Trenton, which is a major employment center, and has a northward orientation towards New York. High technology employers in the vicinity of Princeton also attract many workers from Mercer and surrounding counties. The majority of resident workers (76.6%) were employed in Mercer County. The most common work destinations within the DVRPC region are in Bucks and Burlington Counties, each attracting about 3,000, or 2%, of the resident workers. In 1990, only 1,200 residents, or less than one percent, commuted to Philadelphia.

Bucks County

Bucks County has traditionally served as a bedroom community for Philadelphia. However, an increasing number of residents are commuting to jobs in New Jersey. For example, the number of work trips to Middlesex County increased by 205 percent and to Somerset County by 382 percent between 1980 and 1990. These two counties attracted nearly one-fourth of Bucks County residents, who work outside of the region. Meanwhile, Mercer County was the destination for 9 percent of workers and commuters to New York City accounted for 14 percent.

Burlington County

Burlington County sends its workers in a variety of directions: south to Camden County, west to Philadelphia, north to Trenton and southeast to Atlantic City. In 1990, about 57% (116,000) of resident workers were employed within the County, 14% (28,000) commuted to Camden County, 8% (17,000) to Philadelphia, 8% traveled to Mercer County and 2% to Bucks County.

For this study, thirty-three reports on recent and on-going transit studies relevant to the Southerly Crossings Corridor study area were reviewed. Following are synopses of those projects that may have an impact on the Southerly Crossings Corridor Study.

Public transportation within the study area is provided primarily by New Jersey Transit (NJT) and Southeastern Pennsylvania Transportation Authority (SEPTA). The available transit modes in the study area include commuter rail and bus service. The study area is comprised of three counties, Burlington and Mercer Counties in New Jersey and Bucks County in Pennsylvania.

In Burlington County, buses are the primary mode of public transportation. NJT provides commuter bus service to destinations such as Philadelphia, Trenton and the City of Burlington. In addition, Academy Bus Lines, a private bus carrier, offers service to New York City.

In Mercer County, NJT operates commuter rail service via the Northeast Corridor Line (NEC) between Trenton and New York City. Intercity rail service is available along the NEC by Amtrak through its Northeast Direct and Metroliner services. Local bus service is provided by NJT and connects a number of important destinations within the county such as Trenton and Princeton. Suburban Transit, a private bus carrier, provides commuter bus service to destinations in New York City.

In Bucks County, SEPTA is the primary public transportation provider. Regional rail, suburban bus and local bus service is available. Regional rail service connects to Philadelphia and West Trenton. Suburban bus service is typically provided to major commercial destinations, rail stations and Philadelphia. There are three private bus carriers in Bucks County, which provide commuter services to Philadelphia and New York City.

Journey-to-Work Trends in Eight Suburban Townships 1970-1990 Delaware Valley Regional Planning Commission (March 1994)

This report develops profiles and describes the commutation patterns of workers who either live or work in eight suburban townships contained within the region: Mount Laurel (Burlington County), Voorhees (Camden), Washington (Gloucester), and East Windsor (Mercer) in New Jersey, Lower Makefield (Bucks County), West Whiteland (Chester), Concord (Delaware) and Upper Merion (Montgomery) in Pennsylvania. For the purposes of this task, only travel patterns for East Windsor and Lower Makefield will be presented since these townships lie within the Southerly Crossings Study Area.

East Windsor

East Windsor Township is located in northeastern Mercer County. After peaking in the 1970s, population growth is slowing. Employment in the township has slowed, too. The New Jersey Turnpike, US 130 and NJ 33 provide the primary travel infrastructure in the Township. The only transit service in the township is provided by Suburban Transit Corporation, which operates buses that run locally between Princeton and Hightstown and then express to/from New York, but this is complemented by NJ TRANSIT rail service at Princeton Junction.

East Windsor itself is the largest source of jobs (15%) for township residents, and New York City is the second largest destination for township residents, attracting almost 10% of the workers. The boroughs of Princeton and Hightstown are important destinations, each attracting 6% of resident workers. The only jurisdiction contributing a significant amount of work trips to East Windsor Township is Hamilton Township, which contributes as much as 10% of the workforce.

Lower Makefield

Lower Makefield is located along the eastern edge of Bucks County, PA. It experienced strong residential growth in the 1980s due to its proximity to both Philadelphia and New York. Frequent fast rail service to New York is provided from rail stations in Mercer County that are accessible via I-95 or US 1. These highways also provide direct routing to Philadelphia, Princeton and Trenton. PA 32 and PA 332 serve the township as well. SEPTA's R3 service provides direct service to Philadelphia. The township's resident workers travel to a wide variety of destinations. There is no single destination that attracts as much as 10%

of these workers. The largest share, just less than 10%, travels to Trenton, followed closely by Philadelphia with 8%. Yardley Borough, Ewing and Lawrence Townships in New Jersey each attract 6% of the total and New York City attracts 5% of the total. Employment in Lower Makefield Township is relatively small. Major contributors to employment in Lower Makefield are Bristol (17%), Falls (12%) and Middletown (9%) Townships.

Trenton Area Reverse Commute Options
Delaware Valley Regional Planning Commission (March 1997)

The DVRPC undertook this study at the request of the City of Trenton to explore reverse commute initiatives as a way to support the transition from welfare-to-work and to increase transit ridership by improving service to expanding markets. The primary objectives of this study were to analyze commuting patterns from Trenton, assess transportation and labor market conditions from the perspectives of employers and job placement professionals, and develop strategies to strengthen connections between Trenton and expanding suburban employment centers.

An analysis of employment data suggested that large numbers of Trenton residents commute to jobs outside of the city. This trend is problematic because a significant number of Trenton residents do not own or have access to a car.

To gauge employer priorities, DVRPC surveyed over 400 employers in Mercer, Bucks, Middlesex, Somerset and Burlington counties. The survey showed that new reverse commute initiatives are not employers' highest priority. DVRPC's interviews with job trainers and placement professionals yielded different results. This group offered the opinion that the lack of reverse commute options for Trenton residents creates a significant transportation barrier and limits employment opportunities to Trenton residents who lack access to an automobile.

In light of the opinions expressed by placement professionals and mandated welfare to work requirements, it was concluded that well-designed reverse commute initiatives could help Trenton's low-income population enter the workforce in significant numbers. The study recommended nine approaches that could be used as the basis for reverse commute strategy:

- Create a Roundtable for Transportation and Job Placement Professionals
- Improve Interjurisdictional Coordination
- Expand Use of TransitCheks
- Promote Employer-Operated Van Service
- Expand Employee-Operated Van Service
- Create a TMA-Operated Start-Up Van Service
- Modify Ridesharing and Guaranteed Ride Home Programs
- Facilitate the Process for NJ TRANSIT Route Modifications
- Use Welfare Restructuring as an Opportunity

The following table displays relevant 1990 Census Journey to Work Travel Patterns originating in Trenton and terminating in Pennsylvania only.

TABLE 2-1 RELEVANT 1990 CENSUS JOURNEY TO WORK TRAVEL PATTERNS

Place of Employment	Number of Workers	Share of Workers	Drove Alone	Carpool/ Vanpool	Transit (1)	Bike	Walk	Other (2)
Morrisville	248	0.7%	165	75	0	0	0	8
Total Bucks Cty	1,082	3.0%	614	380	56	0	9	23
Total Chester Cty	37	0.1%	14	23	0	0	0	0
Total Delaware Cty	29	0.1%	29	0	0	0	0	0
Total Montgomery Cty	85	0.2%	68	17	0	0	0	0
Total Philadelphia Cty	197	0.5%	124	22	47	0	4	0
Rest of PA	108	0.3%	74	27	0	0	0	7

(1) "Transit includes sum of bus/trolley + subway/elevated +railroad
(2) "Other Means" include ferryboat, taxicab & motorcycle

This report identified 12 regional employment centers for the study area. Two of these regional employment centers are located in Bucks County, PA. They are identified as Route 1 Business and New Falls Road. These two locations, respectively, represent the 2nd and 10th largest geographic concentrations of existing and expected new jobs of the 12 regional employment centers.

Assessment of the Market Demand for New Jersey Ferry Services
New Jersey Department of Transportation (January 2000)

The purpose of this project was to identify the most promising passenger and freight ferry services in critical corridor areas and to formulate cost effective strategies for encouraging the development of those services by the public and private sector.

The project scope consisted of a sequence of steps to establish a basis for future statewide policy on water transportation: 1) a database was prepared comparing existing New Jersey ferry services with examples of ferry systems of other US and international systems, 2) a market demand assessment of feasible New Jersey passenger and freight ferry systems, 3) an operations and cost assessment of the most promising routes was conducted, 4) policy issues and alternative directions for a statewide ferry policy framework were outlined with short and long term alternative ferry assistance options.

No ferry services were recommended within the Study Area.

Fiscal Year 2001 Capital Budget and Fiscal Years 2001-2012 Capital Program and Comprehensive Plan
Southeastern Pennsylvania Transportation Authority (June 2000)

The SEPTA Fiscal Year 2001 Capital Budget and Fiscal Years 2001-2012 Capital Program and Comprehensive Plan outline the investments for this time period for SEPTA. These investments are used to bring its system to a state-of-good repair, to maintain normal replacement of assets and infrastructure and to expand the system to serve new markets. In addition, a list of Major Transit Planning Studies currently underway in the region and a description of the activities of the Job Access and Reverse

Commute program are included in this document. Following a review of the Capital Program, a number of inputs were identified as relevant to the study. These inputs are listed below:

Under the FY 2001-2004 Capital Program, as part of the Infrastructure Safety Renewal Program, SEPTA's transit and railroad infrastructure will be restored to a state of good repair. As part of this initiative, station buildings and associated facilities will undergo rehabilitation. Within the Study Area (specifically Bucks County), affected stations include the R3 Yardley station and the R3 Woodburne station. The R3 Yardley station will undergo rehabilitation and the R3 Woodburne station will be reconstructed. Also under this program, the R3 West Trenton Line, Bridge 23.22 will be replaced.

The Rail Stations and Parking Improvement Program provides for the rehabilitation of rail stations including parking, signage, lighting, station facilities and parking expansion. FY 2001 funding is being considered for the following locations:

- R2 Warminster: Warminster Station - Parking Expansion
- R7 Trenton Line: Croydon and Levittown Stations - Parking and Station Improvements

The Station Accessibility Program provides improved access at railroad and rail transit stations. The following Bucks County stations participate in this program:

- R2 Westminster Station
- R3 Neshaminy Falls Station
- R5 Doylestown Station
- R7 Trenton Station (Mercer County)

Under the Small Bus Acquisition Program, SEPTA has purchased 25- and 30-foot buses to provide circulator service for use on selected fixed routes where economical. In Bucks County, the following bus routes operate these types of services:

- Routes 128 and 129
- Route 203 - Circulator connects the R3 Woodburne Station with Oxford Valley Mall (Began in January 2001)

Fiscal Year 2001 Annual Service Plan
Southeastern Pennsylvania Transportation Authority (May 2000)

This document describes the service proposals suggested by the general public, government agencies, elected officials and SEPTA staff and presents the technical and financial analyses that determine whether the proposal merits implementation. The Annual Service Plan Process begins with proposals. Proposals undergo a planning and evaluation process. Proposals that warrant further consideration are included on a project list. The proposal list is presented and discussed with affected groups and agencies. The financial impacts of the proposed changes are determined. Public hearings are held on the recommended projects. If the SEPTA board approves the proposals, they are implemented if funding is available. At the end of one year, a post-implementation review is held. At this point, project modifications are made as warranted.

In the FY 2001 Annual Service Plan nine projects were evaluated and eight recommended. Included in these eight projects was the Bucks County Transit Improvement Project (BCTIP). The BCTIP is a collaborative effort between SEPTA, Bucks County planning and transportation agencies and other organizations. Included in the project are route alignments, service improvements and new routes. The proposals address changing ridership needs and accommodate Bucks County's current demographic patterns and business and residential growth. The implemented plan includes a restructuring of Bus Routes 14, 20, 127, 128, 129, and 130. Proposals for expanded evening and weekend service, as well as several new routes, are included under this project pending funding availability and project demand.

Report on the 1999 Survey of Major Employers
Delaware Valley Regional Planning Commission (June 2000)

The report summarizes the results of a survey of business executives performed in the fall of 1999 to gauge their opinions on the most crucial transportation-related projects over the next 25 years. According to the survey respondents, the most significant of the three groups of issues presented was commuting behavior. One of the major conclusions of the report was that transit service should be made more accessible to suburban commuters.

Intermodal Management System New Jersey Report
Delaware Valley Regional Planning Commission (November 1998)

The Intermodal Management System (IMS) is a systematic process for evaluating improvements, which will expedite the transfer of goods and people between modes of travel. A total of 52 intermodal passenger and freight facilities (including 29 passenger stations, 16 freight terminals and 7 airports) in the New Jersey portion of the region were assessed. Performance measures were used to evaluate how effectively the set of passenger and freight facilities operate in terms of key service and physical attributes. Performance measures for the passenger system included accessibility, mobility/connectivity, station amenities, parking and ADA compliance. The findings of the performance evaluation for the passenger system are summarized below:

- **Accessibility** - Trailblazer signage along the connector highways serving passenger rail stations was found to be satisfactory. For the PATCO system, station identification signs were found to be lacking. The trailblazer-signing network for the NJ park-and-ride network was unsatisfactory.
- **Mobility/Connectivity** - The lack of integrated regionwide transit fares (between PATCO, SEPTA and NJ TRANSIT) is a significant deficiency and discourages regular and reverse transit ridership. However, at the time of the study, these agencies were involved in a cooperative effort to coordinate fare collection technology and policy issues. It was recommended that customer-friendly means of accessing stations such as interconnecting bus service be promoted to help counter parking constraints at rail stations.
- **Station Amenities** - Station amenity levels were found to be lowest at bus stations. It was recommended that an enhanced standard of amenities be provided.
- **Parking** - Land for parking expansions, adjacent to rail stations, is very limited. Greater reliance on interconnecting bus service to stations will be necessary in light of the limited land.
- **ADA** - The operators are complying with their contracts to be accessible to their mobility disadvantaged clients.

The following intermodal passenger facilities identified in this report are located within the boundary of the Southerly Crossings study area:

Mercer County

Rail Stations
- Trenton (NJT/AMTRAK/Local bus service)
- Hamilton (NJT/AMTRAK)
- Princeton Junction (NJT/AMTRAK)
- Princeton (NJT/AMTRAK)
- West Trenton (SEPTA/NJT/Local bus service)

Bus Transfer Stations
- Quaker bridge Mall (NJT/ Local bus service)

Burlington County

Bus Transfer Stations
- Burlington Station (NJT/ Local bus service)
- Moorestown Mall (NJT/ Local bus service)
- Mount Holly (NJT/ Local bus service)

Park-and-Ride
- Mt. Laurel (Greyhound)
- NJ Turnpike-Interchange 5 (Academy)
- Willingboro (NJT/Academy)

Access-to-Jobs: Addressing Barriers to Bi-State Commuting
Delaware Valley Regional Planning Commission (July 1998)

In response to federal and state welfare reform, the DVRPC undertook this study to explore new ways to help public assistance recipients to travel from the region's core cities (Philadelphia, Camden and Trenton) to job opportunities throughout the region. This report estimates the existing and potential markets for bi-state commutes, identifies barriers that limit bi-state commutes and develops recommendations for overcoming these barriers.

Some of the obstacles that are specific to work trips that cross state lines include:
- Information Gaps and Psychological Barriers
- Complex and Costly Transfers Between Transit Systems
- Single-State Transit Vouchers and Fare Instruments
- Administrative Barriers

Existing transit service across the Delaware River is as follows:

NJ TRANSIT Bus Routes
- NJT #409 Philadelphia-Willingboro-Trenton

SEPTA Bus Route

- Route 127 Trenton to Neshaminy Mall and Penndel via Trenton Road

SEPTA Rail Service

- R3 West Trenton to Elwyn
- R7 Trenton to Chestnut Hill East

PATCO Hi-Speed Line

- PATCO connects Central Philadelphia to nine stations in Camden County with service terminating at Lindenwold.

Intermodal Management System Phase II Report
Delaware Valley Regional Planning Commission (November 1997)

The Intermodal Management System (IMS) is a systematic process to identify intermodal facilities, evaluate the effectiveness of their operations, and identify strategies to rectify deficiencies. This report used the same methodology and measures that were presented in the *Intermodal Management System New Jersey Report* (November 1998). This report concluded that the following improvements could be made to passenger facilities in Pennsylvania:

- Increasing accessibility through the addition of trailblazer and pedestrian signs.
- Provide additional parking spaces.
- Improve ADA accessibility.

The following intermodal passenger facilities identified in this report are located within the boundary of the Southerly Crossings study area:

Bucks County

Rail Stations

- Warminster (R2)
- Langhorne (R3)
- Cornwells Heights (R7)
- Croydon (R7)
- Doylestown (R5)
- Yardley (R3)
- Neshaminy Falls (R3)
- Woodburne (R3)
- Trevose (R3)

Bus Transfer Stations

- Neshaminy Mall (bus only)
- Oxford Valley Mall (bus only)

Park-and-Ride

- Yardley Park-and-Ride Lot at I-95 (auto only)

Pennsylvania Congestion Management System Report (Phase 2 Report)
Delaware Valley Regional Planning Commission (July 1997)

According to federal management systems regulations, a Congestion Management System (CMS) is "a systematic process that provides information on transportation system performance and alternative strategies to alleviate congestion and enhance the mobility of persons and goods". A fully operational CMS is required in urban areas that are nonattainment for ozone or carbon monoxide.

To facilitate CMS planning, DVRPC established a CMS network comprising major highways and the passenger rail network. Twenty-eight CMS corridors were established in the Pennsylvania portion of the DVRPC region. One of these corridors, No. 8 – Trenton to Center City (Philadelphia), is relevant to the Southerly Crossings Corridor. This corridor was divided into two subcorridors: I-95 and U.S. Route 1.

Improvement strategies for the I-95 subcorridor were described as follows:

> Mode shift, incident management and ITS (Intelligent Transportation Strategies) are the primary focus in this subcorridor. Specific applications include park-and-ride lots, intersection improvements, traffic surveillance, elimination of bottlenecks and ramp metering. Many of the I-95 interchanges need to be upgraded with longer acceleration/deceleration lanes, elimination of lane drops, and improvements to the ramp junctions with the local arterials. ITS techniques include advanced mode choice and traveler information systems. The extension of rail service to the Far Northeast is a long-range transit option. SOV (single occupant vehicle) capacity improvements for I-95 and PA 413 should be considered, as should the construction of the I-95 and Pennsylvania Turnpike interchange.

SOV roadway widening was scored as "practical" in this subcorridor. Park-and-ride was scored as "very practical" in this subcorridor.

Improvement strategies for the U.S. Route 1 subcorridor are described as follows:

> Transit service and operations improvements, traffic operations improvements and mode shift strategies are applicable in this subcorridor. Transit strategies include new transit service, expansion of existing service and better coordination. The extension of rail service to Northeast Philadelphia is a long-range option that is currently under investigation in the Northeast Philadelphia Metro MIS (Major Investment Study) study. Mode shift strategies, such as transit marketing and park-and-ride lots, are also applicable. Driveway controls are another pertinent strategy. SOV capacity improvements for Byberry Road and PA 413 should be considered.

New Jersey Congestion Management System Report
Delaware Valley Regional Planning Commission (December 1997)

DVRPC established 16 CMS corridors in New Jersey. Subcorridors within two of the designated corridors are germane to the Southerly Crossings: the Trenton subcorridor (part of Corridor No. 2 – Princeton to Trenton) and the I-95 subcorridor (part of Corridor No. 12 – West Trenton to Bordentown).

Specific improvement strategies for the Trenton subcorridor were described as follows:

> Because Trenton is a major employment center, commuting and commute-alternative strategies are also very appropriate in this subcorridor. There is a large employment base of State workers; therefore, alternative work hours and carpooling and ridematching services are recommended. Traffic operations improvements, specifically intersection and roadway widening and traffic surveillance systems, are applicable. Due to the dense development patterns, new transit service, as well as enhancements to the existing service, are warranted. Pedestrian and bicycle improvements strategies are also appropriate, due to the compact nature of development.

Traffic congestion in the I-95 subcorridor was described in the report as follows:

> I-95 backs up from the Scudder's Falls Bridge due to a reduction from six to four lanes. There are also heavy truck volumes and inadequate interchanges on this segment of I-95. Trucks bound for New York use NJ 31 to avoid tolls on the New Jersey Turnpike and cause long delays on the two-lane segment. Because I-95/295 is a beltway, there is a combination of long-term through trips and short-term localized trips. Several roads around the Princeton/US 1 Corridor are also congested due to business parks and retail development. This entire subcorridor is a high-growth area.

Specific improvement strategies were described as follows:

> Incident management strategies and ramp metering are recommended along I-95. Park-and-ride lots situated at I-95 interchanges will also be useful. Because this subcorridor is a high-growth area with large undeveloped parcels, it is recommended that land use policies be adopted and that development be steered toward activity centers. As the area is more fully developed, enhanced transit service and commute-related strategies will become more applicable.

SOV roadway widening and park-and-ride were both scored as "very practical' in this subcorridor.

2.2 Existing Traffic Volumes and Levels of Service

The four bridges in the corridor have an aggregate service life of 279 years. A total of 13 travel lanes are provided by a combination of girder and through-truss bridges. The four bridges, from south to north, are as follows:

- US Route 1 Toll Bridge
- Lower Trenton Bridge, Toll Supported
- Calhoun Street Bridge, Toll Supported
- Route I-95, Toll Supported

For the purposes of this planning study, the target Level of Service for the projected years 2005 and 2025 is Level of Service "D" for bridge and highway improvements. The Level of Service "D" criteria are per the most recent edition of the Highway Capacity Manual (2000). The four bridges in the study area have been classified to best fit the classifications provided in the Highway Capacity Manual (see prior discussion in Section 1.5.1 of the Report). The bridges can be classified as follows:

- US Route 1 Toll Bridge, weaving section between the Pennsylvania Avenue on-ramp and Route 29 off-ramp controls northbound traffic flow; the toll plaza processing rate controls southbound traffic flow.
- Lower Trenton Bridge two-way, two lane highway
- Calhoun Street, urban street (The Delmorr Avenue/West Trenton Avenue intersection controls traffic flow.)
- Route I-95/Scudder Falls Bridge, multilane highway

Capacity is the maximum hourly rate that vehicles or persons can traverse a given point or roadway section. Level of Service (LOS) is a quality measure describing traffic conditions on a grading scale from LOS A (best) and LOS F (worst).

Generally, LOS D is the level at which speeds begin to decline slightly with increasing flows. In this range, density begins to increase somewhat more quickly with increasing flow. Freedom to maneuver within the traffic stream is more noticeably limited. Drivers experience reduced physical and psychological comfort levels. Minor incidents can be expected to create queuing, because the traffic stream has little space to absorb disruptions.

LEVEL OF SERVICE "D" FOR LIMITED ACCESS HIGHWAY
FROM HCM 1997

2.2.1 Route 1 Toll Bridge

The Route 1 Toll Bridge provides three westbound and two eastbound lanes of travel in each direction and no shoulders are provided for breakdowns. The Route 1 Toll Bridge has been in service since 1952 and constructed as a steel girder bridge. There is no provision for pedestrians on the bridge.

The existing toll plaza is configured for Route 1 southbound (westbound) collection only. Six bays are provided for southbound toll collection. The typical passenger vehicle toll is assessed at $0.50 with a tiered rate structure for heavier vehicles. Currently, there are no vehicle weight restrictions on the Route 1 Bridge. The posted speed limit for the northbound (eastbound) direction is currently 40 miles per hour.

From a traffic analysis and planning perspective, the US Route 1 Bridge has been analyzed as a highway weaving section. The highway weaving section analysis considers the through traffic movements and lane changing movements associated with the interchanges at Pennsylvania Avenue in Pennsylvania and with Route 29 in New Jersey. Particular to Route 1, a separate weaving analysis was conducted due to the asymmetrical 3/2 lane designations and lower operating speed (35 mph vs. 45 mph northbound) due to southbound toll collection.

Existing Conditions Summary:

- Roadway Characteristic: Highway weaving section
  - Bridge Tolls provided for entering Pennsylvania
- Five lane cross section: 2 lanes non-toll northbound, 3 lanes toll southbound
- 48,900 annual average daily traffic volume (ADT)
- Directional Design Hourly Volumes
  - Northbound (non-toll) through traffic: 3960 per design hour
  - Southbound (toll) through traffic: 2914 per design hour
  - Weaving Analyses yields:
  - Failing level of service (LOS F) for Route 1 northbound (non-toll) in the AM peak hour
  - Level of Service “E” for Route 1 southbound (toll) in the PM peak hour

Please see the following Table 2-2 that indicates the operational and capacity characteristics of the Route 1 Bridge Toll Bridge.

TABLE 2-2 ROUTE 1 BRIDGE EXISTING OPERATING CONDITIONS

	Non-toll NB (AM)	Toll SB (PM)
Lanes	2	3
DDHV-through	3946	3001
LOS (A-F)	F	E

2.2.2 Lower Trenton Bridge (Bridge Street & Trenton Makes)

The Lower Trenton Bridge, also known as the Bridge Street Bridge/Trenton Makes, provides a Trenton-Morrisville connection by providing one travel lane in each direction with a planked pedestrian walkway on the northerly side of the Bridge. The Lower Trenton Bridge has been in service for the Commission since 1928. The bridge is a Warren truss. The distance between the Calhoun Street Bridge and the Lower Trenton Bridge is approximately 0.9 miles as measured along Route 29. Current Bridge limits include: a 5 ton vehicle weight limit, speed posted at 25 miles per hour and posted vehicle clearance of 10 feet.

Existing Conditions Summary:

- Roadway Characteristic: Arterial Roadway, local road connections in Morrisville and Trenton City, two lane cross-section, provides recreational pedestrian link
- 5 ton weight limit
- 16,113 ADT
- Directional Design Hourly Volume 1,364 vehicles
- Operating at LOS E during the critical peak hour which was determined to be the PM peak

Please see Table 2-3 for a tabular summary of the capacity and Level of Service results.

TABLE 2-3 LOWER TRENTON BRIDGE EXISTING OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	901	1363
Measure 1 LOS (A-F)	E	E

2.2.3 Calhoun Street Bridge

The Calhoun Street Bridge is approximately five miles south of the Scudder Falls Bridge; it has been in service since 1884. The bridge type is a Phoenix Pratt truss. The Calhoun Street Bridge provides one lane in each travel direction with a pedestrian walk along the northerly side. Current Bridge restrictions include: a 3-ton weight limit, clearance of 8 feet, with vehicles limited to cars only, as well as a 15 mile per hour speed restriction. The immediate New Jersey intersection with Route 29 is a full interchange. The immediate Pennsylvania signalized intersection with North Delmorr Avenue has a left turn restriction for westbound bridge traffic onto North Delmorr Avenue southbound.

The Bridge provides a recreational pedestrian link from Trenton to Morrisville. Pedestrians were noted to cross the Bridge and walk south along the built-up river embankment on the westerly Delaware River bank to Williamson Park.

Existing Conditions Summary:

- Roadway Characteristic: Arterial Roadway-Urban Street, Local road connections in Morrisville and Trenton City, provides recreational pedestrian link on walkway
- Bridge is 100+ years old, 3 ton weight limit (panel van and lighter)
- Current Deficits: No shoulders limiting weight restriction. 2-lane Cross Section,
- 21,900 ADT
- Directional Design Hourly Volume 1,330 vehicles
- Experiences fairly steady traffic flow through the day with high vehicle density
- Operates at LOS F during the critical peak hour, which was determined to be the AM peak.

The following Table 2-4 reports the results of the capacity analysis for the baseline DDHV.

TABLE 2-4 CALHOUN STREET BRIDGE EXISTING OPERATING CONDITIONS

	EB to NJ AM Peak Hour	**WB to PA PM Peak Hour**
Lanes	1	1
DDHV-through	1329	1086
LOS (A-F)	F	F

2.2.4 Route I-95/Scudder Falls Bridge

The Scudder Falls Bridge presently is designated as part of Interstate Route 95. The Bridge is constructed as a steel plate girder. The main bridge section provides two lanes of travel for each direction separated by a concrete median. Other cross-section features include narrow emergency sidewalks, no breakdown lanes and no shoulders. The bridge has been in service since 1961 with no changes in overall lane capacity.

The bridge length is approximately 1,740 feet, with interchanges on the New Jersey and the Pennsylvania sides. The immediate New Jersey Interchange Number 1 provides full northbound and southbound access to Route 29. The Pennsylvania Interchange 31B and 31A provides northbound and southbound access from/to Taylorsville Road. The Commission maintains a park and ride facility immediately north of Interchange 31A.

Existing Conditions Summary:

- Roadway Characteristic: Limited Access, Interstate Highway
- Operating over capacity, chronic peak hour congestion, designated truck route,
- Current Deficits: No shoulders
- 4-lane Cross Section, ADT 54,600
- Mass Transit Facilities: Park and Ride on PA side North of Bridge
- Operating at LOS F for Multilane Highway during the critical peak hour, which was determined to be the AM peak hour.

The following Table 2-5 represents the current operating characteristics of the Scudder Falls/Route 95 Bridge.

TABLE 2-5 SCUDDER FALLS BRIDGE EXISTING OPERATING CONDITIONS

	NB AM Peak Hour	SB PM Peak Hour
Lanes	2	2
DDHV-through	4112	3892
LOS (A-F)	F	F

2.3 Summary of Existing Conditions and Needs

In summary, the four bridges under discussion provide a total of 13 lanes for vehicle traffic and two lanes for pedestrian traffic. Nine bridge lanes are provided for vehicles over 5 tons (e.g., city-busses and single unit trucks) divided between the Route 1 Bridge and the Scudder Falls Bridge. Approximately 141,500 vehicles per day cross the Delaware River over the Southerly Crossings Corridor's four bridges. Three of the four bridges operate at LOS F (unstable flow) while the fourth, Lower Trenton, operates at LOS E.

3.0 FUTURE NO-BUILD CONDITIONS

3.0 FUTURE NO-BUILD CONDITIONS

3.1 Future No-Build Highway and Passenger Rail Network

As the metropolitan planning organization (MPO) for the region, DVRPC is responsible for developing the short-term Transportation Improvement Program (TIP) and the long-term Transportation Plan of future transportation system improvements. Characteristics of each project included in the TIP and Plan, e.g., termini, nature of improvement, estimated time of completion, etc., are coded by DVRPC into the Regional Transportation Model so that the travel effects of these projects are simulated by the model.

Major highway and transit projects in the DVRPC 2001 TIP and 2025 Transportation Plan and regional model and, therefore, part of this Study's modeled No-Build transportation network include the following:

- I-95@ I-276 - construct interchange and widen Pennsylvania Turnpike to six lanes from Interchange 28 to New Jersey.
- NJ 29, Ferry Street to Lamberton Road - construct.
- I-95 @ NJ 31 - construct ramp.
- West Trenton Avenue, U.S. 1 to Delaware River - widen to four lanes.
- Cross County Metro, Glenloch to Morrisville – construct.
- Southern New Jersey Light Rail Transit – construct.
- NJ Transit Rail, West Trenton to Newark – restore service.

3.2 Future Population and Employment

As the MPO for the region, DVRPC, is also responsible for developing population and employment projections for use in transportation systems' analysis. Tables 3-1 and 3-2 show Study Area population and employment by municipality for 1997 (model baseline), 2005, and 2025. The 2025 demographic data used in the Study model was adjusted to account for information from the Study-specific development survey of municipalities.

TABLE 3-1 EXISTING AND ESTIMATED FUTURE POPULATION

	1997	2005	2025
Pennsylvania Portion of Study Area	344,278	361,910	396,230
New Jersey Portion of Study Area	454,346	472,050	564,029
Total Study Area	**798,624**	**833,960**	**960,259**

TABLE 3-2 EXISTING AND ESTIMATED FUTURE EMPLOYMENT

	1997	2005	2025
Pennsylvania Portion of Study Area	151,473	161,200	195,761
New Jersey Portion of Study Area	275,777	290,150	366,088
Total Study Area	**427,250**	**451,350**	**561,849**

3.3 Future No-Build Traffic Volumes and Levels of Service

3.3.1 2005 Future No-Build Traffic Volumes and Levels of Service

Traffic volumes on the four Southerly Crossings Bridges will continue to increase from the 2001 baseline conditions. Although levels of service will remain unchanged as compared to existing conditions, speeds will decline and densities will increase. The transportation model projections for 2005 are linear (first order) regression points from the 2001 transportation model to the 2025 transportation model.

Route 1 Bridge

The Route 1 Bridge operating characteristics will worsen as traffic in both directions will operate slightly slower with increases in density and traffic volumes. Table 3-3 shows the results of the projected year No-Build 2005 conditions.

TABLE 3-3 ROUTE 1 BRIDGE 2005 NO-BUILD OPERATING CONDITIONS

	Non-toll NB (AM Peak Hour)	Toll SB (PM Peak Hour)
Lanes	2	3
DDHV-through	4289	3263
LOS (A-F)	F	E

Lower Trenton Bridge

The Lower Trenton Bridge is projected to experience minor changes with respect to volume as compared to bridge capacity. Consequently, the service level will remain essentially unchanged.

TABLE 3-4 LOWER TRENTON BRIDGE 2005 NO-BUILD OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	1004	1488
LOS (A-F)	E	E

Calhoun Street Bridge

The Calhoun Street Bridge continues to operate over capacity with control delays exceeding 4 minutes. Operationally, the Calhoun Street Bridge has the worst capacity and level of service conditions of the four corridor bridges.

TABLE 3-5 CALHOUN STREET BRIDGE 2005 NO-BUILD OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	1349	1102
LOS (A-F)	F	F

Scudder Falls/Route 95 Bridge

Scudder Falls/Route 95 has been projected to experience modest traffic volume increases that will be subject to multi-lane operating speeds of less than 45 miles per hour.

TABLE 3-6 SCUDDER FALLS BRIDGE 2005 NO-BUILD OPERATING CONDITIONS

	NB	SB
Lanes	2	2
DDHV-through	4505	4264
LOS (A-F)	F	F

3.3.2 2025 Future No-Build Traffic Volumes and Levels of Service

Route 1 Bridge

Traffic volume projections indicate that the northbound and southbound traffic flow volumes would both operate under failing levels of service (LOS F) during the AM and PM peak hours, respectively. Table 3-7 indicates the year 2025 conditions.

TABLE 3-7 ROUTE 1 BRIDGE 2025 NO-BUILD OPERATING CONDITIONS

	Non-toll NB AM Peak Hour	Toll SB PM Peak Hour
Lanes	2	3
DDHV-through	4987	3793
LOS (A-F)	F	F

Lower Trenton Bridge

The analyses of projected traffic volumes indicate that Lower Trenton Bridge would degrade to operate under failing levels of service (LOS F).

TABLE 3-8 LOWER TRENTON BRIDGE 2025 NO-BUILD OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	1176	1742
Measure 1 LOS (A-F)	E	F

Calhoun Street Bridge

The Calhoun Street Bridge failing levels of service continue operating at the worst end of the capacity spectrum.

TABLE 3-9 CALHOUN STREET BRIDGE 2025 NO-BUILD OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	1389	1136
LOS (A-F)	F	F

Scudder Falls/Route 95 Bridge

Traffic volumes on a design hourly volume basis are projected to increase. The additional traffic volumes will cause the peak period to spread beyond the current two-hour period during the morning commute.

TABLE 3-10 SCUDDER FALLS BRIDGE 2025 NO-BUILD OPERATING CONDITIONS

	NB AM Peak Hour	SB PM Peak Hour
Lanes	2	2
DDHV-through	5302	5018
LOS (A-F)	F	F

3.4 Summary of Future No-Build Conditions and Needs

As compared to existing conditions, peak-hour, peak-direction traffic volume on each of the bridges is estimated to grow on the order of 25-30 percent by 2025, with the exception of the Calhoun Street Bridge, for which volumes are estimated to grow approximately five percent. Each Southerly Crossings Corridor bridge will reach peak-hour, peak-direction level of service F conditions by 2025.

4.0 FUTURE NO-BUILD PLUS TRANSPORATION SYSTEMS MANAGEMENT (TSM) CONDITIONS

4.0 FUTURE NO-BUILD PLUS TRANSPORTATION SYSTEMS MANAGEMENT (TSM) CONDITIONS

4.1 Identification of TSM Improvements

During the course of the Study, several TSM-type improvements were identified and evaluated. These included highway and rail operational improvements, as well as improved bus and rail transit service.

As a first step in identifying potential TSM options, a select link analysis was conducted using the regional travel model. The select link analysis reveals trip origin-destination travel patterns between communities in the Study Area. Of interest to this Study were trip origins and destinations between communities on either side of the river, e.g., between trips originating in Bristol Township, PA that are destined to Princeton Township, NJ. A high demand for such trips revealed a potential for transit service linking such trip origin-destination paired communities. The select link analysis also revealed the bridge utilization preferences. For example, the Calhoun Street bridge is heavily used for local trips, primarily trips between portions of Middletown and Lower Makefield Townships and Trenton. Moreover, there is a general preference for I-95 over Route 1 for trips between lower Bucks County and the areas containing employment centers along and near Route 1 in New Jersey.

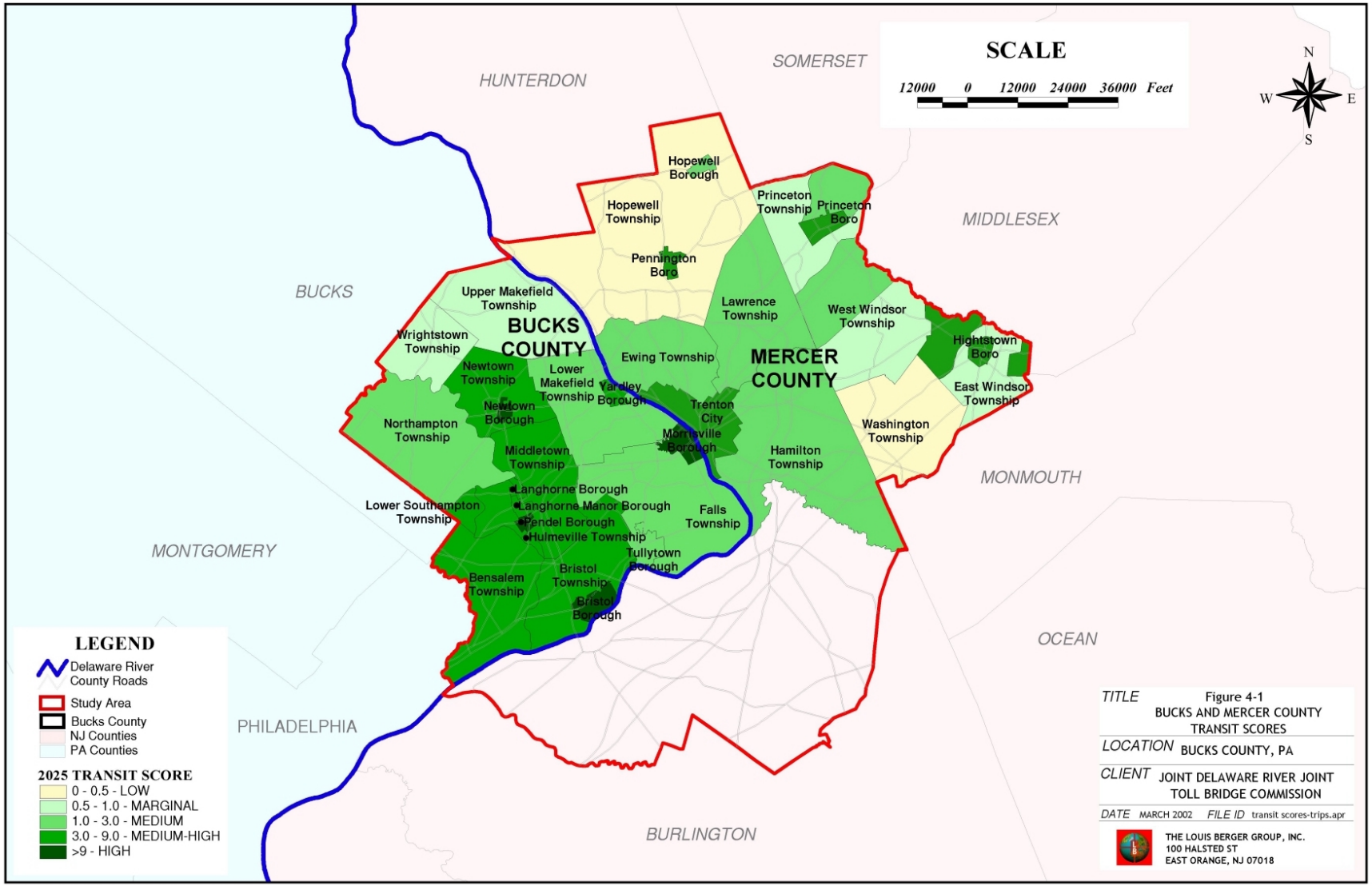
Potential types of transit service applicable to the travel demand patterns revealed by the select link analysis were then examined using the transit score method. The results of applying the transit score method to the Study Area are shown in Tables 4-1 through 4-3 (communities scoring medium or higher for transit potential). This level was chosen for this Study as the minimum level of transit-potential based investment that could affect regional travel on the Corridor's bridges. The following Figure 4-1 illustrates the transit scoring methodology.

Promising TSM improvements were evaluated further through the Study's travel demand model to assess their potential effectiveness. As a result of the evaluation, the following TSM improvements were identified as being the most effective for reducing congestion on the Corridor's bridges:

- Installation of electronic toll collection on the Route 1 Toll Bridge.
- Initiation of express bus service between Oxford Valley Mall (Langhorne, PA) and Quakerbridge Mall (Lawrence, NJ). The proposed route, deemed the "OQ Express," would also make stops at the existing Yardley park-and-ride lot, as well as proposed park-and-rides at the PA 332, NJ 29, NJ 31, U.S. 206 interchanges with I-95. Park-and-ride on the I-95 corridor scored "very practical" in DVRPC's CMS studies.
- Initiation of NJ Transit passenger rail service in Morrisville (at the NJT Morrisville Yard).

The OQ express bus ridership estimates a service span of 16 hours per day. The route would operate on a 10-minute headway between 5:00 AM and 11:00 PM. Service would be provided seven days per week.

Auto diversion was estimated to be 940 vehicles for 2005 and 1,400 vehicles for the 2025.


SCALE
12000 0 12000 24000 36000 Feet
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MONTGOMERY
OCEAN
PHILADELPHIA
BURLINGTON
BUCKS COUNTY
MERCER COUNTY
Hopewell Borough
Hopewell Township
Pennington Boro
Princeton Township
Princeton Boro
Upper Makefield Township
Wrightstown Township
Newtown Township
Newtown Borough
Northampton Township
Lower Makefield Township
Yardley Borough
Ewing Township
Lawrence Township
West Windsor Township
Hightstown Boro
East Windsor Township
Washington Township
Trenton City
Morrisville Borough
Hamilton Township
Middletown Township
Langhorne Borough
Langhorne Manor Borough
Pendel Borough
Hulmeville Township
Lower Southampton Township
Falls Township
Tullytown Borough
Bristol Township
Bristol Borough
Bensalem Township
LEGEND
Delaware River
County Roads
Study Area
Bucks County
NJ Counties
PA Counties
2025 TRANSIT SCORE
0 - 0.5 - LOW
0.5 - 1.0 - MARGINAL
1.0 - 3.0 - MEDIUM
3.0 - 9.0 - MEDIUM-HIGH
>9 - HIGH
TITLE Figure 4-1
BUCKS AND MERCER COUNTY
TRANSIT SCORES
LOCATION BUCKS COUNTY, PA
CLIENT JOINT DELAWARE RIVER JOINT
TOLL BRIDGE COMMISSION
DATE MARCH 2002 FILE ID transit scores-trips.apr
THE LOUIS BERGER GROUP, INC.
100 HALSTED ST
EAST ORANGE, NJ 07018

TABLE 4-1 HIGH TRANSIT POTENTIAL COMMUNITIES AND POTENTIALLY SUITABLE INVESTMENTS

APPLICABLE STUDY AREA COMMUNITIES

Bucks County
Newtown Borough
Pendel Borough
Bristol Borough
Morrisville

Mercer County
Trenton
Pennington
Princeton Borough
Hightstown
West Windsor (portion)
East Windsor (portion)

TRANSIT SCORE CATEGORY (Score)	FIXED GUIDEWAY	BUS & OTHER TRANSIT	INTERMODAL & ACCESS TO TRANSIT
HIGH (9+)	1. **Rapid Transit**-Only if direct connection to Philadelphia or Manhattan or 150,000+ jobs in center 2. **Commuter Rail** as a Destination or Terminal- Only if a Regional Center with 60,000+ jobs in municipality 3. **High Capital Cost Electric LRT**- 33% of line can be in tunnel or elevated. Must have 30,000+ jobs in center or municipality, 60,000 jobs preferred. 4. **Medium/Low Capital Cost Electric LRT**- Must have 30,000+ jobs in center or municipality to be terminal for line. 5. **Bus Priority Treatment**-On major arterials with 40+ buses /peak hr. direction 6. **Bus Only Ramps/Lanes**- On limited access roads/connectors to Centers with 60,000+ jobs	1. **Express Bus Service** to areas as a Destination or Terminal if 60,000+ jobs in center or municipality. 2. **High Intensity Local Bus Service**. All day service span (16-24 hours) with average 20-minute frequency over the span of a day. 3. **Ferry Services** to High Score areas with 60,000+ jobs. Fixed Guideway or Local Transit connecting service. 4. "**Wheels" type Express Mini-Bus** service from High Score areas to suburban employment centers with 30,000+ jobs. **5. Vanpools and vanpool subsidies** which do not compete with existing transit.	1. Major **Multi-Modal** Terminals 2. Limited Park-Ride Facilities in Structured Parking 3. Bus/Rail Transfer Centers and Feeder Bus services

TABLE 4-2 MEDIUM-HIGH TRANSIT POTENTIAL COMMUNITIES AND POTENTIALLY SUITABLE INVESTMENTS

APPLICABLE STUDY AREA COMMUNITIES

Bucks County
Newtown Township
Middletown Township
Lower Southampton Township
Bensalem Township
Bristol Township
Hulmeville Township
Langhorne Manor
Langhorne

Mercer County
Ewing
Hamilton (portion)
Lawrence
West Windsor (portion)
Princeton Township (portion)

TRANSIT SCORE CATEGORY	FIXED GUIDEWAY	BUS & OTHER TRANSIT SERVICE	INTERMODAL & ACCESS TO TRANSIT
MEDIUM-HIGH (3 to 9)	1. **Medium/Low Capital Cost Electric LRT**- At least 50% of the line must be on pre-existing rail/utility/median etc. ROW. Must connect to High Transit Score area with 30,000+ jobs in center/municipality. 2. **Commuter Rail/Diesel LRT**- Must connect to High Transit Score area Terminus with 30,000-60,000 jobs. 3. **Bus Priority Treatment**- Queue Jumps/Bus Pullouts with 6+ Buses/ Peak Hour on Arterials and at New Development. NJDOT design standards. Bus lanes and peak direction bus only use of shoulders as in High Transit Score areas.	1. **Express Bus service** with primarily walk access to High Transit Score Areas 2. **Medium Intensity Local Bus Service**- Majority of day span (12-18 Hours), with average 30-minute frequency. 3. **"Wheels" Type mini-bus service** to suburban employment centers from line-haul transit and local area.	1. **Shuttle Bus to Rail/LRT /Express Bus** if minimum of 500 peak period boarding riders 2. Structured Parking for Fixed Guideway Transit if 1000+ peak period boarding riders at stop. 3. **Surface Park-Ride** for All Other Fixed Guideway /Express Bus/ Ferry Service 4. Local Bus Transfer Points

TABLE 4-3 MEDIUM TRANSIT POTENTIAL COMMUNITIES AND POTENTIALLY SUITABLE INVESTMENTS

APPLICABLE STUDY AREA COMMUNITIES

Bucks County
Northampton
Lower Makefield
Falls
Tullytown

Mercer County
Hopewell

TRANSIT SCORE CATEGORY	FIXED GUIDEWAY	BUS & OTHER TRANSIT SERVICE	INTERMODAL & ACCESS TO TRANSIT
MEDIUM (1 to 3)	1. **Commuter Rail/Diesel LRT** to High Transit Score areas with 60,000+ jobs in center or municipality. 2. **Medium/Low Cost LRT**- Only if area is surrounded by Medium-High Score areas. 3. **Bus Priority**- Same as Medium-High except limited to Primary Arterials such as State Highways with LOS "D" or worse in Peak Hour. 4. **Recreational Transit**- Rail/Express Bus/Ferry to seasonal tourist areas as a destination. Must have minimum 30% of housing units in seasonal units and 1500 seasonal units in a municipality. 5. **Ferry with Park-Ride** access to High Transit Score Areas with 60,000+ jobs	1. **Minimum Intensity Local Bus Service-** Span of 8-12 Hours/Day, with average frequency of 30-60 minutes over day. 2. **Local Circulator Bus Service** in Rural Centers in State Plan. (PA 3, 4, & 5) Span of 8-12 Hours/Day with average frequency of 30-60 minutes 3. "**Wheels**" type mini-bus service to Suburban Employment Centers from line-haul transit service. Preferred minimum of 10,000 jobs in employment center. 4. "**Wheels**" **type Express** "**Reverse**" Mini-Bus service from High Score areas to Suburban Employment Centers with 30,000+ jobs.	1. Shuttle Bus Walk Access to Rail/LRT /Express Bus if minimum of 500 boarding riders at stop and Gross Housing Density of 2+ units per acre. 2. Remote Parking and Shuttle Bus to Rail/LRT/Express Bus if housing density not met. 3. Surface Park-Ride Only for Express Bus/ Commuter Rail/ Ferry except in constrained areas with 1000+ peak period riders

Following is the ridership estimate for the Morrisville Yard train station in Bucks County, as well as the estimated impact on the highway system. Ridership estimates were developed with the assistance of NJ Transit and results are specific to the Southerly Crossings Corridor Study.

1. Parking fee recommended $2.00 per day

2. Only trains that stopped at Trenton in the Post-Secaucus train plan were assumed to stop at Morrisville. This does not include every peak period train, but almost every off-peak train and headway of about every 20-25 minutes in the peak periods.

3. Highway access and walk to the station platform via both sides of the train yard.

4. Fares assumed at an extra 2 fare zones, or about $8 more per month for this station. Based on NJT fare zones.

It was estimated that the Morrisville Yard Station would serve 1,610 riders per day (3,220 trips). Of the riders, 80% would arrive in the AM Peak Period (arrive Newark/New York 6-9 AM). This means that riders destined for the Morrisville station will be arriving between 5-8 AM. Accordingly, peak period demand would be about 1300 riders.

Of the riders, 150 riders would be new to the system in the AM Peak Period (3 hours, roughly 5-8 AM at Trenton), and would be diverted from auto at the station to their final destination. A total of 150 inbound-to- Trenton auto vehicle trips would be reduced during the three hour AM Peak Period, mostly from the Route 1 bridge. The daily inbound diversion of new riders would be 200 vehicle trips from bridges.

There would be shifting of 1,400 Year 2020 Trenton station riders inbound (to Trenton) per day to the Morrisville train station. This represent a reduction of 1,250 vehicle trips going eastbound (inbound) to Trenton per day, with 1,000 of these 1,250 vehicle trips reduced during the AM Peak Period (3 hours)

The vehicle trip reductions amount to 1,450 trips inbound to Trenton and 1,450 outbound from Trenton daily. During the AM Peak Period (3 hours) of the rail line, which is 5-8 AM eastbound on the bridges, the reduction in vehicle trips to Trenton eastbound is 1,150 vehicle trips. The PM Peak Period is a four-hour period leaving Trenton between 5 and 9 PM.

In summary, the Morrisville Yard station in Bucks County would (in 2020) have an inbound ridership (eastbound to Trenton) of 1,610 people per day. Of these, about 250 are new rail riders. During the AM Peak Period (three hours, 5-8 AM) eastbound ridership would be 1,270 riders at Morrisville station, of which 1,150 would be eastbound vehicle trips diverted from the four crossings of the Delaware River near Trenton. Most (about 80% to 90%) would be reductions at the Route 1 Freeway Bridge.

The Morrisville station would require 1,200 to 1,300 parking spaces, depending on the amount of turnover of parking and bus/pedestrian access provided.

The station would have no significant impact on or diversions from Hamilton or Princeton Junction stations. It is estimated that about 500 cars from Pennsylvania use these stations, and less then 100 cars or people would divert from these stations to Morrisville.

These initiatives were considered as common elements of any future scenarios rather than being alternatives. As such, the effects of these “No-Build Plus” initiatives on traffic volumes and travel patterns were

simulated by the Study Area model for the No-Build and Build scenarios. Further, the No-Build Plus initiatives are considered as short-term alternatives, i.e., it is assumed that all will be in operation by 2005. It is assumed that demand for the Morrisville Station and OQ Express Bus Service would grow at a rate similar to vehicular trvel demand, or about 25 percent.

An extension of the Southern New Jersey Light Rail Transit System (Camden-Trenton) was also explored as a potential mass-transit project which could divert a portion of cross-river trips from automobiles. The extension examined in this Study would extend from the Northeast Corridor Trenton Rail Station to the SEPTA R3 West Trenton Station, a distance of approximately 5.5 miles, with several intermediate stops. With such service, commuters in the R3 catchment areacould use an R3/Light Rail link to travel to jobs in Downtown Trenton. Similarly, commuters in the R7 catchment area could use an R7 (or AMTRAK)/Light Rail link to travel to jobs in West Trenton. It was estimated that such service could divert from 500 to 700 automobile trips per day from the corridor bridges. This level of diversion was considered too low to warrant the inclusion of the Light Rail extension in the No-Build Plus scenario. However, the extension may be warranted in other policy/planning contexts.

4.2 Future No-Build Plus Traffic Volumes and Levels of Service

4.2.1 2005 No-Build Plus

Route 1 Bridge

The two components of the No-Build Plus condition that improve Route 1 Bridge traffic operations are the Morrisville Yard train station and Route 1 EZ-Pass. As noted in the following Table 4-1, the northbound traffic volumes would be reduced from the trip diversions to the Station. The effect of the No-Build Plus (northbound AM peak) is slightly faster operating speeds at a lesser per lane density. From an overall capacity perspective, however, Route 1 northbound will continue to operate at failing levels of service.

TABLE 4-4 ROUTE 1 BRIDGE 2005 NO-BUILD PLUS OPERATING CONDITIONS

	Non-toll NB AM Peak Hour	**Toll SB PM Peak Hour**
Lanes	2	3
DDHV-through	3489	2463
LOS (A-F)	F	E

Lower Trenton Bridge

On a comparison basis, the volume to capacity ratio remains the same with minor changes to the total travel time.

TABLE 4-5 LOWER TRENTON BRIDGE 2005 NO-BUILD PLUS OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	884	1368
LOS (A-F)	E	E

Calhoun Street Bridge

The effect of the No-Build plus condition is negligible on the operating conditions at the Calhoun Street Bridge. Operationally, Calhoun Street would have a volume to capacity ratio at 1.4

TABLE 4-6 CALHOUN STREET BRIDGE 2005 NO-BUILD PLUS OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV-through	1368	1230
LOS (A - F)	F	E

Scudder Falls/Route 95 Bridge

In the near term, Scudders Falls/Route 95 experiences better levels of service, LOS E vs. LOS F in the No-Build, due to the auto diversions associated with the OQ express bus line.

TABLE 4-7 SCUDDER FALLS BRIDGE 2005 NO-BUILD PLUS OPERATING CONDITIONS

	NB AM Peak Hour	SB PM Peak Hour
Lanes	2	2
DDHV-through	3755	3514
LOS (A-F)	E	E

4.2.2 2025 No-Build Plus

The operational improvements realized by the No-build Plus are anticipated to be diminished by the traffic growth that will occur in the Corridor between 2005 and 2025. All bridges would experience peak-hour, peak direction level of service F conditions, except for the Route 1 southbound PM condition which would be LOS E and the Lower Trenton eastbound AM condition which would be LOS E.

4.3 Summary of Future No-Build Plus Conditions and Needs

The three components of the No-build Plus: Route 1 EZ-Pass, Morrisville Yard train station and the Route 95 OQ express service provide some degree of operational relief on the bridges, particularly the Route 1 and Scudder Falls bridges, in the near term year 2005. However, traffic volume growth between 2005 and 2025 will absorb most of the near term operational gains. The need for increased bridge lane capacity in the Southerly Crossings Corridor will remain.

5.0 SENSITIVITY EVALUATION OF POTENTIAL BRIDGE IMPROVEMENT CONCEPTS

5.0 SENSITIVITY EVALUATION OF POTENTIAL BRIDGE IMPROVEMENT CONCEPTS

In total, the travel effects of 14 different bridge improvement scenarios were modeled to help focus the evaluation of needed lane capacity improvements in the Southerly Crossings Corridor. The following scenarios were modeled (refer to the corresponding tables in Appendix A that indicate the results of the model runs):

1. Route 95 increased to a 6 lane cross-section
2. Route 95 increased to an 8 lane cross-section
3. Calhoun Street closed
4. Calhoun Street closed with an additional lane at Lower Trenton
5. Route 95 twin bridge with 4 additional lanes
6. New Falls-Hamilton Bridge
7. Route 95 with 3 lanes to New Jersey and 2 lanes to Pennsylvania
8. Calhoun Street with 4 lanes
9. Calhoun Street with 4 lanes and Route 95 with 6 lanes
10. Route 1 Bridge with 8 lanes Route 95 with 6 lanes
11. New Falls Hamilton Bridge with Calhoun Street at 4 lanes
12. Route 1 Bridge with 6 lanes and Route 95 with 6 lanes
13. Route 1 Bridge with 6 lanes, Route 95 with 6 lanes and Calhoun Street with 4 lanes
14. New Falls Hamilton Bridge, Calhoun Street at 4 lanes and Route 95 with 6 lanes

Essentially, the model runs tested the sensitivity of travel on each of the Corridor's bridges to various capacity improvements. The following section describes how operations on each bridge would vary under the modeled improvement scenarios during the critical peak hour, peak direction movements.

Route 1 Bridge

The following table shows operating conditions on the Route 1 Bridge with bridge improvements elsewhere in the Corridor. As shown, targeted LOS D cannot be achieved on the bridge through improvement elsewhere.

TABLE 5-1 ROUTE 1 BRIDGE 2025 OPERATING CONDITIONS UNDER VARIOUS SCENARIOS

Scenarios (In addition to No-Build Plus)	NB Non-toll AM Peak	SB Toll PM Peak
	LOS	LOS
Four-lane Calhoun Street Bridge	F	E
Four-lane Falls-Hamilton Bridge	F	E
Six-lane Scudder Falls Bridge	F	E
Four-lane Calhoun plus Falls-Hamilton Bridge	F	E
Four-lane Calhoun plus six-lane Scudder Falls Bridge	F	E

Lower Trenton Bridge

The following table shows operating conditions on the Lower Trenton Bridge with bridge improvements elsewhere in the Corridor. As shown, targeted LOS D can be met or exceeded with improvements elsewhere in the corridor.

TABLE 5-2 LOWER TRENTON-BRIDGE 2025 OPERATING CONDITIONS UNDER VARIOUS SCENARIOS

Scenarios (In addition to No-Build Plus)	Westbound PM Peak
	LOS
Four-lane Calhoun Street Bridge	E
Four-lane Falls-Hamilton Bridge	D
Six-lane Scudder Falls Bridge	F
Four-lane Calhoun plus Falls-Hamilton Bridge	C
Four-lane Calhoun plus six-lane Scudder Falls Bridge	E
Four-lane Calhoun plus six-lane Scudder Falls Bridge plus six-lane Route 1	D

Calhoun Street Bridge

As shown in Table 5-3, improvements at other bridges have little effect on the failing levels of service at the Calhoun Street Bridge.

TABLE 5-3 CALHOUN STREET BRIDGE 2025 OPERATING CONDITIONS UNDER VARIOUS SCENARIOS

Scenarios (In addition to No-Build Plus)	Eastbound AM Peak
	LOS
Four-lane Falls Hamilton Bridge	F
Six-lane Scudder Falls Bridge	F
Six-lane Route 1 Bridge	F

Scudders Falls/Route 95 Bridge

Model runs and subsequent capacity analyses indicate that operating conditions on the Scudder Falls Bridge would not be significantly affected by other bridges' improvements. Similar to Calhoun Street Bridge, the Scudder Falls Bridge requires additional lane capacity to accommodate the projected year 2025 traffic volumes (Table 5-4).

TABLE 5-4 SCUDDER FALLS BRIDGE 2025 OPERATING CONDITIONS UNDER VARIOUS SCENARIOS

Scenarios (In addition to No-Build Plus)	Northbound AM Peak
	LOS
Four-lane Calhoun Street Bridge	F
Four-lane Falls-Hamilton Bridge	F
Calhoun Street plus Falls-Hamilton Bridge	F

6.0 FUTURE 2025 BUILD SCENARIOS WITH ACCEPTABLE LEVELS OF SERVICE

6.0 FUTURE 2025 BUILD SCENARIOS WITH ACCEPTABLE LEVELS OF SERVICE

6.1 Build Scenarios

6.1.1 Alternative A

Alternative A corresponds to the model run presented on Table A-13. It includes the following improvements:

- Scudder Falls six lanes (three in each direction as compared with existing two in each direction).
- Calhoun Street four lanes (two in each direction as compared with existing one in each direction).
- Falls-Hamilton four lanes (two in each direction; new).

Route 1 Bridge

Under Alternative A, Route 1 would meet the targeted Level of Service "D".

TABLE 6-1 ROUTE 1 BRIDGE
ALTERNATIVE A 2025 OPERATING CONDITIONS

	NB AM Peak Hour	SB PM Peak Hour
Route 1 Lanes	2	3
DDHV	2,230	2,883
LOS (A-F)	D	D

Lower Trenton Bridge

Under Alternative A, the Lower Trenton Bridge would meet the targeted LOS D.

TABLE 6-2 LOWER TRENTON BRIDGE
ALTERNATIVE A 2025 OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV	711	1,053
LOS (A-F)	D	D

Calhoun Street Bridge

Calhoun Street Bridge shows a reduction in delays as level of service improves to LOS C under Alternative A.

TABLE 6-3 CALHOUN STREET BRIDGE
ALTERNATIVE A 2025 OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	2	2
DDHV	1,053	1,335
LOS (A-F)	C	D

Scudder Falls/Route 95 Bridge

Capacity analyses indicates that the targeted LOS D can be reached under Alternative A.

TABLE 6-4 SCHUDDER FALLS BRIDGE
ALTERNATIVE A 2025 OPERATING CONDITIONS

	NB to NJ AM Peak Hour	SB to PA PM Peak Hour
Lanes	3	3
DDHV	5,121	4,847
LOS (A-F)	D	D

Falls Hamilton Bridge

Under Alternative A, a Falls-Hamilton Bridge would operate at LOS D in the AM peak-hour, peak-direction-northbound into New Jersey. With current electronic toll collection technology the southbound (into Pennsylvania) traffic conditions would be LOS F.

TABLE 6-5 FALLS-HAMILTON BRIDGE
ALTERNATIVE A 2025 OPERATING CONDITIONS

	NB to NJ Non-toll AM Peak Hour	SB to PA Toll PM Peak Hour
Lanes	2	2
DDHV	3,402	3,142
LOS (A-F)	D	F

6.1.2 Alternative B

Alternative B Corresponds To Model Runs On Table A-14. It Includes The Following Improvements:

- Scudder Falls six lanes (three in each direction as compared with two in each direction under existing conditions).
- Calhoun Street four lanes (two in each direction as compared with one in each direction under existing conditions).
- Route 1 six lanes (three in each direction; lane added in northbound direction).

Route 1 Bridge

Under Alternative B, the Route 1 northbound traffic operation meets the targeted level of service "D". However, Route 1 southbound under the Alternative B operates at LOS E in the PM peak hour (although density is only slightly over LOS D conditions).

TABLE 6-6 ROUTE 1 BRIDGE
ALTERNATIVE B 2025 OPERATING CONDITIONS

	NB Non-toll AM Peak Hour	SB to PA Toll PM Peak Hour
Route 1 Lanes	3	3
DDHV	3,825	2,909
LOS (A-F)	D	E

Lower Trenton Bridge

The Lower Trenton Bridge would operate at LOS D under Alternative B peak-hour, peak direction operating conditions.

TABLE 6-7 LOWER TRENTON BRIDGE
ALTERNATIVE B 2025 OPERATING CONDITIONS

	EB to NJ AM Peak Hour	WB to PA PM Peak Hour
Lanes	1	1
DDHV	902	1,336
LOS (A-F)	D	D

Calhoun Street Bridge

Under Alternative B, the Calhoun Street Bridge would operate at acceptable LOS D in the critical (AM) peak hour, peak direction operating conditions.

TABLE 6-8 CALHOUN STREET BRIDGE
ALTERNATIVE B 2025 OPERATING CONDITIONS

	AM Peak Hour EB to NJ	PM Peak Hour WB to PA
Lanes	2	2
DDHV	2,348	1,919
LOS (A-F)	D	D

Scudder Falls Bridge

Under Alternative B, the Scudder Falls Bridge would operate at acceptable LOS D in the critical (AM) peak hour, peak direction operation conditions.

TABLE 6-9 SCUDDER FALLS BRIDGE
ALTERNATIVE B 2025 OPERATING CONDITIONS

	NB to NJ	AM Peak Hour SB to PA
Lanes	3	3
DDHV	5,423	5,132
LOS (A-F)	D	A

7.0 COST ESTIMATES

7.0 COST ESTIMATES

Following are summaries of construction costs in 2002 dollars for the No-Build Plus, Alternative A, and Alternative B scenarios.

No-Build Plus	**Cost Millions (2002 $)**
Route 1 EZ-Pass	$1
Morrisville Yard Train Station	$40
OQ Express along Route 95 with park and rides	$10
No-Build Plus Total Cost	**$51**

Alternative A	**Cost Millions (2002 $)**
Route 95 Components	
Provide New 3-lane bridge	$60
Rebuild Ramps at Route 29 and Taylorsville Road	$50
Extend Route 95 6-lane section to Route 332 in Pennsylvania	$7
Sub-Total	$117
Calhoun Street Bridge 4-Lane Cross-Section	
Option 1: New four-lane bridge	$41
Option 2: Twin with existing bridge	$27
New Falls-Hamilton Bridge 4-lane cross-section	
Option 1: Low Level Bridge movable	$147
Option 2: High Level Fixed	$220
Alternative A Total Cost	
High	**$378**
Low	**$291**

Alternative B	**Cost Millions (2002 $)**
Route 95 Components	
Provide New 3-lane bridge	$60
Rebuild Ramps at Route 29 and Taylorsville Road	$50
Extend Route 95 6-lane section to Route 332 in Pennsylvania	$7
Sub-Total	$117
Calhoun Street Bridge 4-Lane Cross-Section	
Option 1: New four-lane bridge	$41
Option 2: Twin with existing bridge	$27
Route 1 lane addition	$20
Alternative B Total Cost	
High	**$178**
Low	**$164**

8.0 CONCLUSION

8.0 CONCLUSION

Based on detailed traffic analysis performed for the Southerly Crossings Corridor Study, the following specific transportation needs are identified:

- There is currently unacceptable traffic congestion on the bridges and their approaches.
- Traffic volumes will continue to grow with population and employment growth.
- The degree of congestion and the daily duration of congested traffic flow conditions will worsen.
- Additional lane capacity is needed on the Corridor's bridges.

It is further concluded that certain transit improvements (beyond those already identified in DVRPC's regional transportation plan) can reduce auto trips across the bridges and reduce congestion to a degree. However, transit initiatives do not supplant the need for additional bridge lane capacity in the Corridor. Implementation of such initiatives, i.e., New Jersey Transit Service at Morrisville and Bucks-Princeton Express Bus Service serving park-and-ride lots along I-95 should be encouraged, particularly as these initiatives are consistent with relevant congestion management strategies.

Two alternatives were identified that generally achieve the target goal of attaining LOS values of D or better at each of the four existing bridge crossings. The distinction between the two alternatives is that Alternative A includes construction of a new Falls-Hamilton bridge along with capacity improvements at the Calhoun Street and Scudder Falls bridges. In contrast, Alternative B includes widening of the Route 1 Toll Bridge to six lanes through addition of a third northbound lane in the non-toll direction along with the Calhoun Street and Scudder Falls bridges' capacity improvements. The estimated construction costs for the two options are $291-$378 million for the Falls Hamilton alternative (Alternative A) and $164-$178 million for the Route 1 lane addition alternative (Alternative B). These costs indicate a capital cost premium of $127-$200 million for the Falls-Hamilton crossing alternative (Alternative A). It should be noted that the Falls Hamilton alternative does not meet the Study target of LOS D or better because, with a toll, the southbound PM peak hour would be LOS F. Therefore, to meet the target, a wider bridge would be required at an additional expense beyond that estimated in this Study.

The cost-effectiveness of the additional expense of $127-$200 million associated with the Falls-Hamilton crossing alternative is questionable. The primary benefit is a marginal improvement in the Route 1 southbound level of service (LOS) from the upper end of LOS E in the case of lane addition alternative (Alternative B) to the lower end of LOS D for the Falls-Hamilton alternative (Alternative A). The corresponding increase in travel speed over the length of the bridge in the southbound direction amounts to only 0.6 mph if the Falls-Hamilton option is implemented. Other factors that should be considered in assessing the cost to benefit ratio include additional future operation and maintenance costs associated with the new crossing, anticipated environmental issues (e.g., landfill cleanups), and general regulatory/permitting hurdles typical of any new facility.

In addition, a new Falls-Hamilton Bridge would likely be inconsistent with DVRPC's congestion management systems (CMS) plans for the two states, as it would add single-occupant vehicle (SOV) lane capacity. The Route 1 Bridge widening constitutes an auxiliary lane, not additional SOV capacity. An improvement at the Calhoun Street Bridge would remove a bottleneck (consistent with the CMS plans),

while an I-95 Scudder Falls Bridge widening is scored as a congestion management strategy in the DVRPC CMS plans.

For these reasons, Alternative B, i.e., the addition of the auxiliary lane in the northbound direction to the Route 1 toll bridge in lieu of a new Falls-Hamilton crossing, is the better solution in terms of the more cost-effective means for meeting the objectives for the Southerly Crossings Corridor. Alternative B is also more acceptable from a regional transportation planning perspective, as it is consistent with adopted congestion management strategies.

9.0 IMPLEMENTATION

9.0 IMPLEMENTATION

The need to improve each bridge is independently justified, i.e., each improvement in Alternative B would address a specific transportation need of each bridge. Each bridge improvement would have independent utility in that advancing the recommended improvement at any one of the bridges neither lessens nor "forces" the need to proceed with improvements at the other bridges. As such, the improvements can be developed as three separate projects on separate schedules and under separate design/environmental and construction contracts, should the Commission desire to proceed in this fashion.

The design/environmental studies should address the following items at each bridge, among other items:

- Scudder Falls Bridge - There is a need to extend the limits of improvements beyond the bridge limits. On the Pennsylvania side, between the Route 332 and Taylorsville Road Interchanges, peak period traffic volumes on I-95 are approaching the roadway's capacity and are estimated to exceed the roadway's capacity by about 20 percent by 2025. Meanwhile, on the New Jersey side, there will be the need to reconstruct the Route 29 interchange and ramps, as well as a transition section to the existing six-lane cross-section of the I-95 mainline. Coordination will be necessary with PennDOT and NJDOT over the work on I-95 under their respective jurisdictions, as well as with FHWA and DVRPC.

- Route 1 Bridge – There is no need to extend the auxiliary lane beyond the Pennsylvania Avenue northbound on-ramp or the Route 29 northbound off-ramp. Coordination with NJDOT will be necessary with respect to any of its future plans for Route 29 (e.g., reconfiguration to an urban boulevard).

- Calhoun Street Bridge – There are several options that should be explored in more detail for providing the two-lane peak period-peak direction capacity. Among these options are: bridge replacement, adding a parallel span, operating with reversible lanes or operating as a one-way pair with the Lower Trenton Bridge. Coordination will be needed with PennDOT on the Trenton Avenue widening (included in the DVRPC regional transportation plan), as well as on needed intersection improvements at Route 32 (Delmorr Avenue). Coordination will be needed with NJDOT over any future Route 29 improvements. Finally, coordination will be necessary with both states with respect to providing adequate bicycle-pedestrian amenities on the bridge.

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10.0 LIST OF REFERENCES

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APPENDIX A
RESULTS OF MODEL RUNS UNDER VARIOUS SCENARIOS

TABLE 1

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 4 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	1-95 4 Lanes ADT	Difference in traffic volume No-Build Plus vs. I-95 4 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	74,900	4,500	6%
2	Calhoun Street Bridge	Both	22,900	23,700	800	3%
3	Bridge Street	Both	20,600	19,500	(1,100)	-5%
4	US 1 Bridge	Both	61,800	58,400	(3,400)	-6%
	TOTAL		**175,700**	**176,500**	**800**	**0%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 2

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 4 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	1-95 4 Lanes ADT	Difference in traffic volume No-Build Plus vs. I-95 4 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	74,900	4,500	6%
2	Calhoun Street Bridge	Both	22,900	23,700	800	3%
3	Bridge Street	Both	20,600	19,500	(1,100)	-5%
4	US 1 Bridge	Both	61,800	58,400	(3,400)	-6%
	TOTAL		**175,700**	**176,500**	**800**	**0%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 3

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Without Calhoun Street Bridge

S/NO.	River Crossing	Direction	No-Build Plus ADT	Without Calhoun ADT	Difference in traffic volume No-Build vs. Without Calhoun	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	81,200	10,800	15%
2	Calhoun Street Bridge	Both	22,900		(22,900)	-100%
3	Bridge Street	Both	20,600	24,200	3,600	17%
4	US 1 Bridge	Both	61,800	72,500	10,700	17%
	TOTAL		**175,700**	**177,900**	**2,200**	**1%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 4

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Without Calhoun Street & Bridge Street with 2 Lanes into NJ & 1 Lane into PA

S/NO.	River Crossing	Direction	No-Build Plus ADT	Without Calhoun & Bridge Street with 2 Lanes into NJ & 1 Lane into PA ADT	Difference in traffic volume No-Build vs. Without Calhoun & Bridge Street with 2 Lanes into NJ & 1 Lane into PA	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	81,200	10,800	15%
2	Calhoun Street Bridge	Both	22,900		(22,900)	-100%
3	Bridge Street	Both	20,600	20,900	300	1%
4	US 1 Bridge	Both	61,800	62,700	900	1%
	TOTAL		**175,700**	**164,800**	**(10,900)**	**-6%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 5

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) Twinning

S/NO.	River Crossing	Direction	No-Build Plus ADT	Bridge (I-95) Twinning ADT	Difference in traffic volume No-Build vs. (I-95) Twinning	Difference in traffic volume in percentage
1	Bridge (I-95)*	Both	70,400	74,900	4,500	6%
2	Calhoun Street Bridge	Both	22,900	23,700	800	3%
3	Bridge Street	Both	20,600	19,500	(1,100)	-5%
4	US 1 Bridge	Both	61,800	58,400	(3,400)	-6%
	TOTAL		**175,700**	**176,500**	**800**	**0%**

Note:
1) Negative volumes are shown in parentheses
2) * ADT total (ADT on existing bridge = 42,200 and new bridge = 41,000); ADT is adjusted for calibration factor

Source: The Louis Berger Group, Inc.

TABLE 6

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. With Falls Hamilton Bridge

S/NO.	River Crossing	Direction	No-Build Plus ADT	With Falls Hamilton Bridge ADT	Difference in traffic volume No-Build vs. With Falls Hamilton Bridge	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	67,000	(3,400)	-5%
2	Calhoun Street Bridge	Both	22,900	21,700	(1,200)	-5%
3	Bridge Street	Both	20,600	12,300	(8,300)	-40%
4	US 1 Bridge	Both	61,800	36,900	(24,900)	-40%
	Falls Hamilton Bridge*	Both		47,120	47,120	
	TOTAL		**175,700**	**185,020**	**9,320**	**5%**

Note:
1) Negative volumes are shown in parentheses
2) * Bridge has same characteristics as of US 1 Bridge

Source: The Louis Berger Group, Inc.

TABLE 7

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) With 3 Lanes into NJ & 2 Lanes into PA

S/NO.	River Crossing	Direction	No-Build Plus ADT	Bridge (I-95) With 3 Lanes into NJ & 2 Lanes into PA ADT	Difference in traffic volume No-Build vs. I-95 With 3 Lanes into NJ & 2 Lanes into PA	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	75,000	4,600	7%
2	Calhoun Street Bridge	Both	22,900	21,100	(1,800)	-8%
3	Bridge Street	Both	20,600	18,500	(2,100)	-10%
4	US 1 Bridge	Both	61,800	55,600	(6,200)	-10%
	TOTAL		**175,700**	**170,200**	**(5,500)**	**-3%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 8

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Calhoun Bridge 2 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	Calhoun Bridge 2 Lanes ADT	Difference in traffic volume No-Build vs. Calhoun 2 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	70,000	(400)	-1%
2	Calhoun Street Bridge	Both	22,900	37,700	14,800	-65%
3	Bridge Street	Both	20,600	16,700	(3,900)	-19%
4	US 1 Bridge	Both	61,800	50,200	(11,600)	-19%
	TOTAL		**175,700**	**174,600**	**(1,100)**	**-1%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 9

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) With 3 Lanes (Each Direction) & Calhoun Bridge 2 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	I-95 3 Lanes & Calhoun 2 Lanes ADT	Difference in traffic volume No-Build vs. I-95 3 Lanes & Calhoun 2 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	69,800	(600)	-1%
2	Calhoun Street Bridge	Both	22,900	37,700	14,800	65%
3	Bridge Street	Both	20,600	16,700	(3,900)	-19%
4	US 1 Bridge	Both	61,800	50,200	(11,600)	-19%
	TOTAL		**175,700**	**174,400**	**(1,300)**	**-1%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 10

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 3 (Each Direction) & US 1 Bridge 4 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	Bridge I-95 3 Lanes & US 1 Bridge 4 Lanes ADT	Difference in traffic volume No-Build vs. I-95 3 Lanes & US 1 Bridge 4 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	73,500	3,100	4%
2	Calhoun Street Bridge	Both	22,900	23,800	900	4%
3	Bridge Street	Both	20,600	20,800	200	1%
4	US 1 Bridge	Both	61,800	62,500	700	1%
	TOTAL		**175,700**	**180,600**	**4,900**	**3%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 11

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 2 Lanes (Each Direction), Calhoun Street Bridge 2 Lanes (Each Direction) & Falls Hamilton Bridge

S/NO.	River Crossing	Direction	No-Build Plus ADT	I-95 2 Lanes, Calhoun 2 Lanes & Falls Hamilton Bridge ADT	Difference in traffic volume No-Build vs. I-95 2 Lanes, Calhoun 2 Lanes & Falls Hamilton Bridge	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	68,000	(2,400)	-3%
2	Calhoun Street Bridge	Both	22,900	22,000	(900)	-4%
3	Bridge Street	Both	20,600	5,700	(14,900)	-72%
4	US 1 Bridge	Both	61,800	44,000	(17,800)	-29%
5	Falls Hamilton Bridge*	Both		44,700	44,700	
	TOTAL		**175,700**	**184,400**	**8,700**	**5%**

Note:
1) Negative volumes are shown in parentheses
2) *Bridge has same characteristics as US 1 Bridge

Source: The Louis Berger Group, Inc.

TABLE 12

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 3 Lanes (Each Direction) & US 1 Bridge 3 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	I-95 3 Lanes & US 1 Bridge 3 Lanes ADT	Difference in traffic volume No-Build vs. I-95 3 Lanes & US 1 Bridge 3 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	72,400	2,000	3%
2	Calhoun Street Bridge	Both	22,900	23,100	200	1%
3	Bridge Street	Both	20,600	20,800	200	1%
4	US 1 Bridge	Both	61,800	62,500	700	1%
	TOTAL		**175,700**	**178,800**	**3,100**	**2%**

Note:
1) Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 13

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 3 Lanes (Each Direction), Calhoun Street Bridge 2 Lanes (Each Direction) & US 1 Bridge 3 Lanes (Each Direction)

S/NO.	River Crossing	Direction	No-Build Plus ADT	I-95 3 Lanes, Calhoun 2 Lanes & US 1 Bridge 3 Lanes (ADT)	Difference in traffic volume No-Build vs. I-95 3 Lanes, Calhoun 2 Lanes & US 1 Bridge 3 Lanes	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	72,000	1,600	2%
2	Calhoun Street Bridge	Both	22,900	38,700	15,800	69%
3	Bridge Street	Both	20,600	15,800	(4,800)	-23%
4	US 1 Bridge	Both	61,800	47,400	(14,400)	-23%
	TOTAL		**175,700**	**173,900**	**(1,800)**	**-1%**

Note:
Negative volumes are shown in parentheses

Source: The Louis Berger Group, Inc.

TABLE 14

Southerly Crossings Corridor Study Area
Traffic Volumes at River Crossings – 2025 Average Daily Traffic (ADT)
No-Build Plus vs. Bridge (I-95) 3 Lanes, Calhoun Street Bridge 4 Lanes and Falls Hamilton Bridge

S/NO.	River Crossing	Direction	No-Build Plus ADT	I-95 3 Lanes, Calhoun 4 Lanes & Falls Hamilton Bridge (ADT)	Difference in traffic volume No-Build vs. I-95 3 Lanes, Calhoun 4 Lanes & Falls Hamilton Bridge	Difference in traffic volume in percentage
1	Bridge (I-95)	Both	70,400	68,000	(2,400)	-3%
2	Calhoun Street Bridge	Both	22,900	22,000	(900)	-4%
3	Bridge Street	Both	20,600	12,450	(8,150)	-40%
4	US 1 Bridge	Both	61,800	37,350	(24,450)	-40%
5	Falls Hamilton Bridge*	Both		44,750	44,750	-23%
	TOTAL		**175,700**	**184,550**	**8,850**	**-5%**

Note:
1) Negative volumes are shown in parentheses
2) *Bridge has same characteristics as US 1 Bridge

Source: The Louis Berger Group, Inc.