

I. Purpose and Need

A. Introduction and Background

The Delaware Turnpike Improvement Program study was initiated in the early 1990s to address deficiencies on the Delaware Turnpike portion of I-95 in northern New Castle County, Delaware. The Delaware Turnpike includes that portion of I-95 extending from the Maryland-Delaware line on the south to the I-95/I-295/I-495 Christiana Interchange on the north, a distance of approximately 11 miles (**Figure 1**). The original study included, in addition to build alternatives, the evaluation of commuter rail service, enhanced transit service and transit supportive infrastructure, intelligent transportation systems (ITS) and an aggressive program of travel demand management initiatives through the Transportation Management Association of Delaware (TMA Delaware). In 1995, then Secretary of Transportation Anne Canby initiated the implementation of a series of recommended non-capacity improvements and other activities intended to reduce the volume of traffic on I-95 in Delaware.

A detailed description of these improvements is found in *Purpose and Need, I-95/SR 1 Interchange/Turnpike Mainline Project*, July 10, 2003. While many of these initiatives have been successful, their ability to slow down the growth in traffic on the Turnpike has been unsuccessful. This project evaluates alternatives to improve the operation and flow of traffic on the Turnpike (I-95) from SR 1 to SR 141, including the I-95/SR 1 Interchange. The *Purpose and Need* document also provides the data and details that substantiate the discussions herein.

B. Project Area

The project area includes I-95 from south of and including the SR 1 Interchange to the SR 141 Interchange. **Figure 2** illustrates the Project Area. The Project Area expands beyond the existing right of way to include sufficient length and width to assure the evaluation of environmental issues on a broad scope

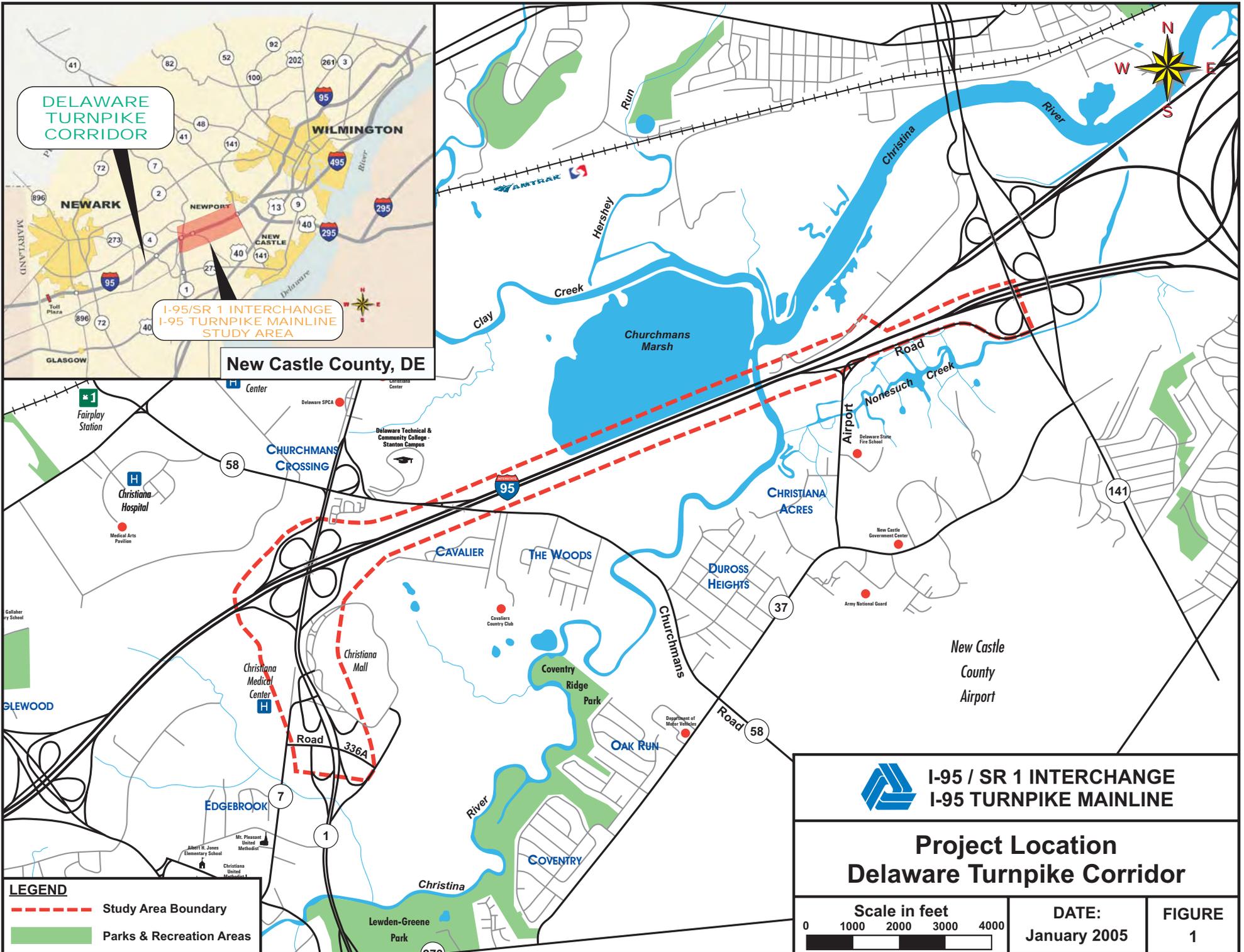
C. Project Purpose

The purpose of the I-95/SR 1 Interchange/Turnpike Mainline Project is to evaluate operational and capacity improvements to improve traffic operations and safety at the I-95/SR 1 Interchange and on the Turnpike Mainline from the I-95/SR 1 Interchange to and including the SR 141 Interchange.

D. Project Need

Traffic on portions of the Delaware Turnpike currently exceeds the capacity of the existing facilities. Two of those locations are the I-95/SR 1 Interchange and on the Turnpike Mainline between the SR 1 and SR 141 Interchanges. In addition, the weaving, merging and diverging areas of the SR 1 and SR 141 Interchanges have been identified as high accident locations.

Although non-capacity measures have achieved success, daily use of the Delaware Turnpike continues to grow. There are daily 2-mile backups on SR 1 northbound in the AM that extend from the Turnpike to south of SR 273. Similar backups occur on southbound I-95 in the PM that extend from SR 141 north toward Wilmington and from SR 1 north toward Churchmans Marsh (between Churchmans Road and Airport Road).



DELAWARE TURNPIKE CORRIDOR

**I-95/SR 1 INTERCHANGE
I-95 TURNPIKE MAINLINE
STUDY AREA**

New Castle County, DE

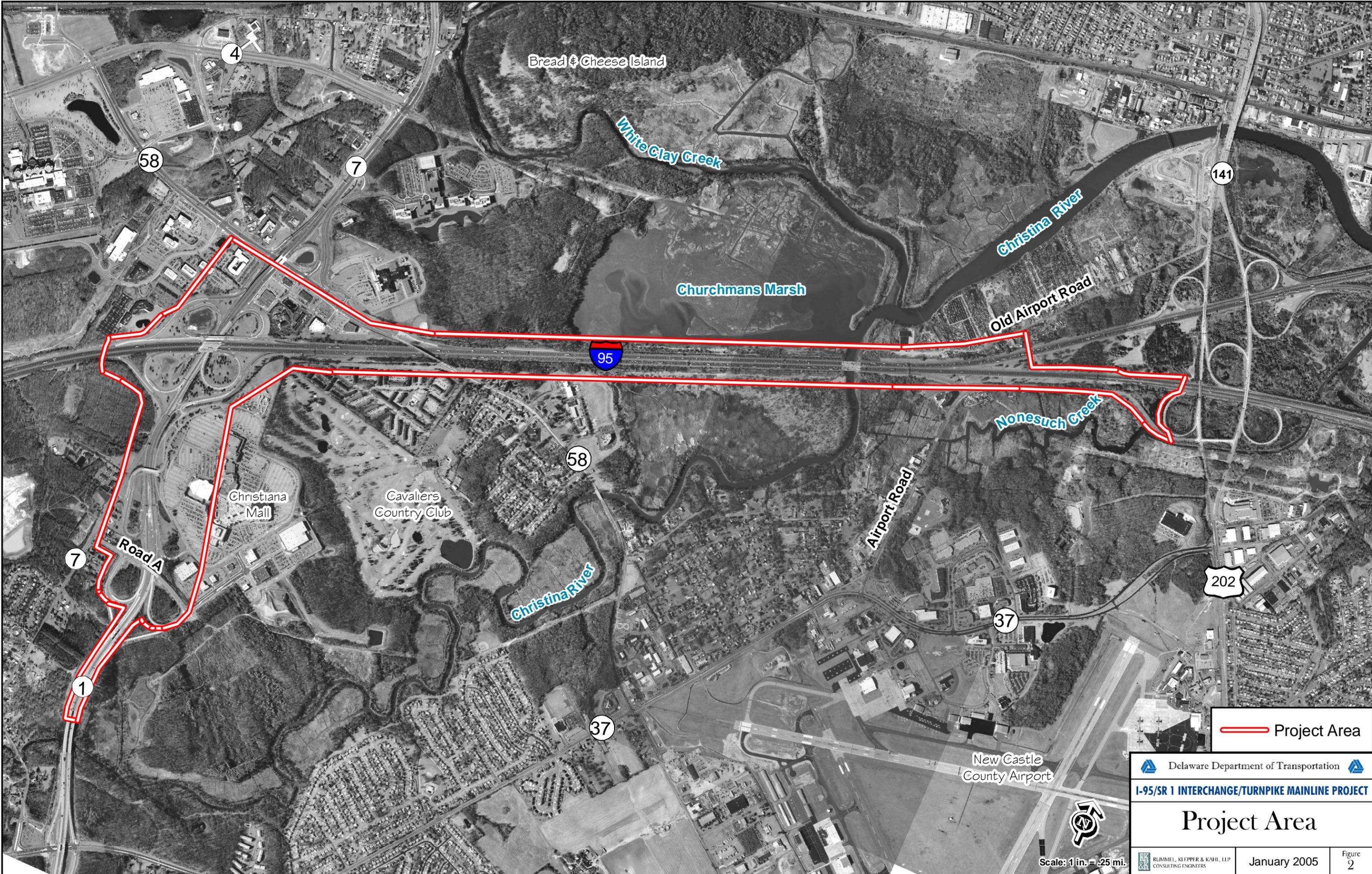
LEGEND

- - - Study Area Boundary
- Parks & Recreation Areas

**I-95 / SR 1 INTERCHANGE
I-95 TURNPIKE MAINLINE**

**Project Location
Delaware Turnpike Corridor**

<p>Scale in feet</p> <p>0 1000 2000 3000 4000</p>	<p>DATE:</p> <p>January 2005</p>	<p>FIGURE</p> <p>1</p>
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1. Traffic

a. Historical Traffic Growth

From 1980 to 2000, traffic on the Delaware Turnpike has increased 178 percent in the project area. During the 1980s, overall traffic growth was about 50 percent, or an average annual growth rate of about 4.8 percent. During the 1990s, the growth rose to over 60 percent, or an average annual growth rate of about 6.2 percent. This traffic growth occurred despite the implementation of several non-capacity improvement measures between 1995 and 2000 aimed specifically at reducing the traffic growth rate (including rail and bus transit and ITS alternatives).

b. Current Traffic Conditions

Year 2000 traffic volumes were obtained for the Delaware Turnpike by using toll plaza counts, permanent count stations located along the turnpike, and additional manual tube counts on several access ramps. Based on capacity analysis using these volumes, the turnpike mainline operates at LOS F between the SR 1 and SR 141 interchanges. Average vehicle speeds through the corridor are below typical interstate highway speeds, particularly during the peak periods, and travelers experience excessive delays and lengthy travel times. The interchange areas are particularly congested, with many of the merge, diverge, and weave movements also currently operating at LOS F during peak periods. Highway levels of service are depicted on **Table 1**. Additionally, the interchange areas experience high accident rates, discussed further in the Safety section below. Traffic attempting to access the turnpike from SR 1 is also subject to congestion, delays, and backups.

c. Existing Design Deficiencies

The congestion at the I-95/SR 1 Interchange is due to a combination of factors including outdated design, higher traffic volumes, and changes in traffic patterns. The interchange was originally designed and constructed when SR 7 was a low volume local roadway. Subsequent to initial interchange construction, SR 7, south of I-95, was converted to SR 1, an expressway that extends from I-95 to Dover and is the major north-south spine road in Delaware.

Examples of the outdated design can be found in the geometry of the interchange ramps. The existing loop ramps have minimum radii of 229 feet; the geometry of the directional ramps is only slightly better with minimum radii of 450 feet. Assuming a maximum super elevation rate of 8%, this provides for design speeds of less than 30 miles per hour (mph) on the loops and just over 35 mph on the directional ramps. As a result, traffic using these ramps must slow from 55 mph (or greater) down to 35 mph (or less) and then accelerate back to 55 mph. The required change in speed for vehicles using these ramps is further hampered by the substandard lengths of deceleration and acceleration lanes available on both I-95 and SR 1. These factors contribute to the increase in congestion and a decreased level of service.

The current interchange functions as a connection between two freeway type facilities (I-95 and SR 1), but the existing design does not allow for desired directional-type movements between the two. In addition, the interchange does not accommodate the daily commuter traffic and seasonal traffic using SR 1 to access Delaware's Atlantic beaches. Most traffic movements at this interchange currently operate at a failing level of service (LOS F) or are anticipated to fail by 2005.

Table 1. Highway Levels of Service (LOS)

LOS	Description	Example
A	Primarily free flow speeds. Vehicles are able to maneuver freely and the effects of minor incidents are easily absorbed with little or no breakdown in traffic flow.	
B	Also primarily free flow speeds. The ability to maneuver freely is only slightly restricted and the effects of minor incidents are easily absorbed with little or no breakdown in traffic flow (although slightly worse than LOS A).	
C	Speeds at or near free flow speeds. The ability to maneuver freely is noticeably restricted. Lane changes require more care and vigilance on the part of the driver. The effects of minor incidents are still absorbed with little breakdown in traffic flow, but local deterioration in service may be substantial. Queues may be expected behind any significant blockage.	
D	Speeds are somewhat reduced from free flow and the ability to maneuver freely is noticeably reduced. The driver experiences reduced comfort levels. Even minor incidents are likely to create queuing because the traffic stream cannot absorb disruptions.	
E	Operation is at capacity with no useable gaps in the traffic stream. Speeds are still above 49 mph, however, even the most minor disruption in traffic may cause a serious breakdown in flow that propagates upstream like a wave. Maneuverability is very limited. Vehicles are closely spaced.	
F	Describes breakdown in traffic flow. This condition generally exists within queues that form behind breakdown points. These breakdowns occur when the volume of arriving vehicles exceeds the capacity of the roadway, due to incidents or at points of recurring congestion.	

Source: 2000 Highway Capacity Manual

d. Projected 2025 Design Year Traffic Conditions

The initial Turnpike Corridor Study, completed in the early 1990s, projected design year 2010 average daily traffic (ADT) volumes of 189,000 in the project area. This volume was exceeded by 1998. Current traffic forecasts for this project are based on WILMAPCO's regional transportation demand model and are projected for the 2025 design year. Current projections indicate an increase in ADT from 219,950 in 2000 to 276,560 in 2025 (0.7 percent increase per year).

As volumes increase, traffic conditions will continue to deteriorate, with greater delays, longer travel times, and extended periods of congestion along the I-95 and SR 1 corridors. For the purpose of this study, the need to improve traffic operations at the I-95/SR 1 Interchange and on the Turnpike Mainline from SR 1 to SR 141 is based on volumes of traffic that exist today; future traffic projections simply reinforce that need.

2. Safety

An analysis of traffic accidents on the Delaware Turnpike was performed for the years 1998 through 2001. During this four-year period, 1,712 reported accidents occurred on the turnpike. Rear-end collisions were the most common accident type, accounting for 56 percent of all accidents. This accident pattern is typical of congested freeways, where stop-and-go traffic frequently occurs during the peak hours. During the four-year period, accidents on the Delaware Turnpike resulted in 750 injuries and 18 deaths. The number of accidents on the turnpike per million vehicle miles (mvm) has increased steadily over the four-year period from an average accident rate of 73 per 100 mvm in 1998 to 90 per 100 mvm in 2001.

The four-year accident data was analyzed by mile point to determine the high accident locations along the Delaware Turnpike. The data indicates that the highest accident rate within the project area in the northbound direction is in the vicinity of the SR 1 Interchange. The number of accidents along the mainline between the SR 1 and SR 141 interchanges is relatively low, while the rate increases again in the vicinity of the SR 141 Interchange and the I-95/I-495/I-295 interchange. In the southbound direction, a greater number of accidents occur at the SR 141 Interchange, as traffic from I-295, I-495 and SR 141 merges with southbound Turnpike traffic. Accident rates are relatively low along the mainline between SR 141 and SR 1, and increase just prior to the Churchmans Road exit, SR 1 Interchange and within the SR 1 Interchange.

The safety study led to the conclusion that segments of the turnpike near the SR 1, SR 141 and the I-95/I-495/I-295 interchanges produce greater safety risks than other segments (except for the Newark Toll Plaza). Since these accidents are primarily caused by congestion and lane changes due to merges, diverges and weaves, operational and/or capacity improvements at appropriate locations on the Turnpike would be expected to provide an improvement in the safety of the roadway.

3. Population Growth and Economic Development

a. Population Growth

Transportation trends in the Newark/Wilmington metropolitan area during the past 20 to 25 years are very similar to trends experienced around the country. Trip origins and destinations are becoming more scattered, and downtown Wilmington has lost its characteristic as the single, highly concentrated activity center in the region. Suburb-to-suburb commuting patterns are overtaking once dominant radial commuting patterns.

In the Newark/Wilmington metropolitan area, land use policies have encouraged the redistribution of New Castle County's population to lower density areas. As these policy changes occurred, household demographic patterns showed an increase in the number of households and a continued rise in the number of dual-career, dual-income families, which placed an increasing number of vehicles onto the roadway network. The combination of these factors has contributed to higher traffic volumes and a greater number of trips made per vehicle. The dispersion of vehicle trips has increased, causing increased trip lengths.

Population increased in New Castle County by 56,685 persons (a 12.8 percent increase) between 1990 and 2000. The number of jobs in New Castle County increased by 27,755 (11.4

percent). The number of dwelling unit building permits issued in New Castle County in 2000 was 85 percent higher than the number building permits issued in 1990.

b. Regional Economic Development

New Castle County accounts for 65 percent of the total employment and 80 percent of the total wages earned in the State of Delaware (2002 New Castle County Comprehensive Development Plan Update). Twelve percent of that workforce commutes from outside of the county. For the county, the distribution of jobs in any one sector is near the national average, with the exceptions of the financial sector (15 percent; national average is seven percent) and government (ten percent to a national average of six percent). Employment growth averaged 2.7 percent per year from 1995 to 2000 in the Wilmington Metropolitan Statistical Area (MSA), which includes New Castle County and Cecil County, Maryland and the I-95 commuting corridor. Employment is anticipated to grow more moderately in the next 20 years, from about 1.1 percent per year in the next 5 years to about 0.3 percent in 2020. According to the 2002 New Castle County Comprehensive Development Plan Update, Preliminary Draft (Plan), an estimated increase in employment from about 272,000 jobs in 2000 to about 350,000 jobs in 2020 will account for approximately 5,400 commuters entering and leaving New Castle County each day.

The I-95/SR 1 Interchange is located in an area zoned for mostly employment uses. Employers include commercial, medical, and business categories. Employment characteristics in the project area are determined through a combination of statistical information and field analysis. The statistical area used to determine current and projected employment is based on Transportation Analysis Zones (TAZs) in the project area. TAZs are statistical areas delineated by state and/or local transportation officials for tabulating traffic-related data, especially journey-to-work and place-of-work statistics. The TAZs identified in the project area (shown on Figure 12 in Chapter III) include those listed in **Table 2**. Within this geographical area, there are currently (2000) 11,003 jobs. This number is anticipated to increase to 16,045 by the year 2030 (an increase of almost 50 percent or about 0.8 percent per year).

Table 2. Employment Growth Projections in the Project Area

TAZ	2000	2005	2010	2015	2020	2025	2030	% Change, 2000 to 2030	# Change, 2000 to 2030
149	1,980	2,261	2,604	2,969	3,376	3,810	4,251	115	2,271
150	186	191	199	205	212	218	212	14	27
151	4,693	4,862	5,087	5,287	5,479	5,636	5,731	22	1,038
224	117	159	220	302	413	561	752	545	636
226	1	1	1	1	1	1	1	No change	0
227	0	0	0	0	0	0	976	976	976
228	3,474	3,499	3,558	3,591	3,619	3,623	3,474	No change	0
Total	11,003	11,546	12,266	12,974	13,741	14,506	16,045	46	5,043

Source: Wilmington Area Planning Council (WILMAPCO), www.wilmapco.org/data/pop.htm

As shown in **Table 2**, the greatest percent increases projected in the number of jobs in the project area are in the TAZs 227 and 224, south of I-95 and east and west of SR 1. The greatest increase in the number (2,271) of jobs in the project area is projected west of Churchman's Marsh (TAZ 149).

4. Connection of SR 1 to the Turnpike

When originally designed, the interchange between I-95 and then SR 7 involved an interstate

highway crossing over and connecting with a two lane, rural road. Now SR 1, a multi-lane expressway, extends south from I-95 to Dover, a distance of 42 miles. SR 1 is the major north-south spine road in Delaware and carries much of the commuter traffic from the very active development area between the Delaware Turnpike and the C & D Canal. Since SR 1 opened to traffic, the northbound SR 1 movement to northbound I-95 has experienced lengthy backups during the AM peak hour, as has the reciprocal movement from southbound I-95 to southbound SR 1 during the PM peak hour. SR 1, just south of the turnpike, carries approximately 62,850 vehicles per day (vpd), and is projected to carry about 92,000 vpd in 2025 at the same location.

5. Other Transportation Projects

A number of on-going and recently completed projects have focused on transportation improvements and enhancements that have been developed within or around the study area to reduce traffic on the turnpike and improve operational efficiency. These projects include enhancement of commuter rail service, enhanced transit service and transit supportive infrastructure, DelTRAC (ITS) improvements, and transportation demand management (TDM) efforts.

E. Conclusion

The need for the project is demonstrated in detailing the congestion and safety issues relevant to this portion of the Delaware Turnpike. By improving the traffic operations within the I-95/SR 1 Interchange and on the Turnpike Mainline from the SR 1 Interchange to the SR 141 Interchange, traffic flow and safety will improve.