TRANSPORTATION MANAGEMENT PLAN

SUBMITTAL AT FINAL DESIGN STAGE

I-95 / SR 1 INTERCHANGE IMPROVEMENTS

NEW CASTLE COUNTY, DELAWARE
SEPTEMBER, 2010

PREPARED FOR DELAWARE DEPARTMENT OF TRANSPORTATION

PREPARED BY RUMMEL, KLEPPER & KAHL, LLP

RK&K

RECOMMENDED – RK&K

APPROVED – DELDOT SAFETY PROGRAMS MANAGER

APPROVED – FEDERAL HIGHWAY ADMINISTRATION

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I. Project Description

A. Introduction

The I-95 / SR 1 interchange project will upgrade a severely-congested interchange in New Castle County. The project will improve the operational efficiency of the interchange by providing new high-speed (55 mph) ramps to accommodate the heavy traffic movements from northbound SR 1 to northbound I-95 and southbound I-95 to southbound SR 1, as well as additional ramp modifications to improve traffic flow through the interchange. The project also provides physically-separated roadways for through and local traffic along SR 1 south of the interchange to minimize weaving conflicts and improve safety. **Figure 1** shows the proposed ultimate conditions.

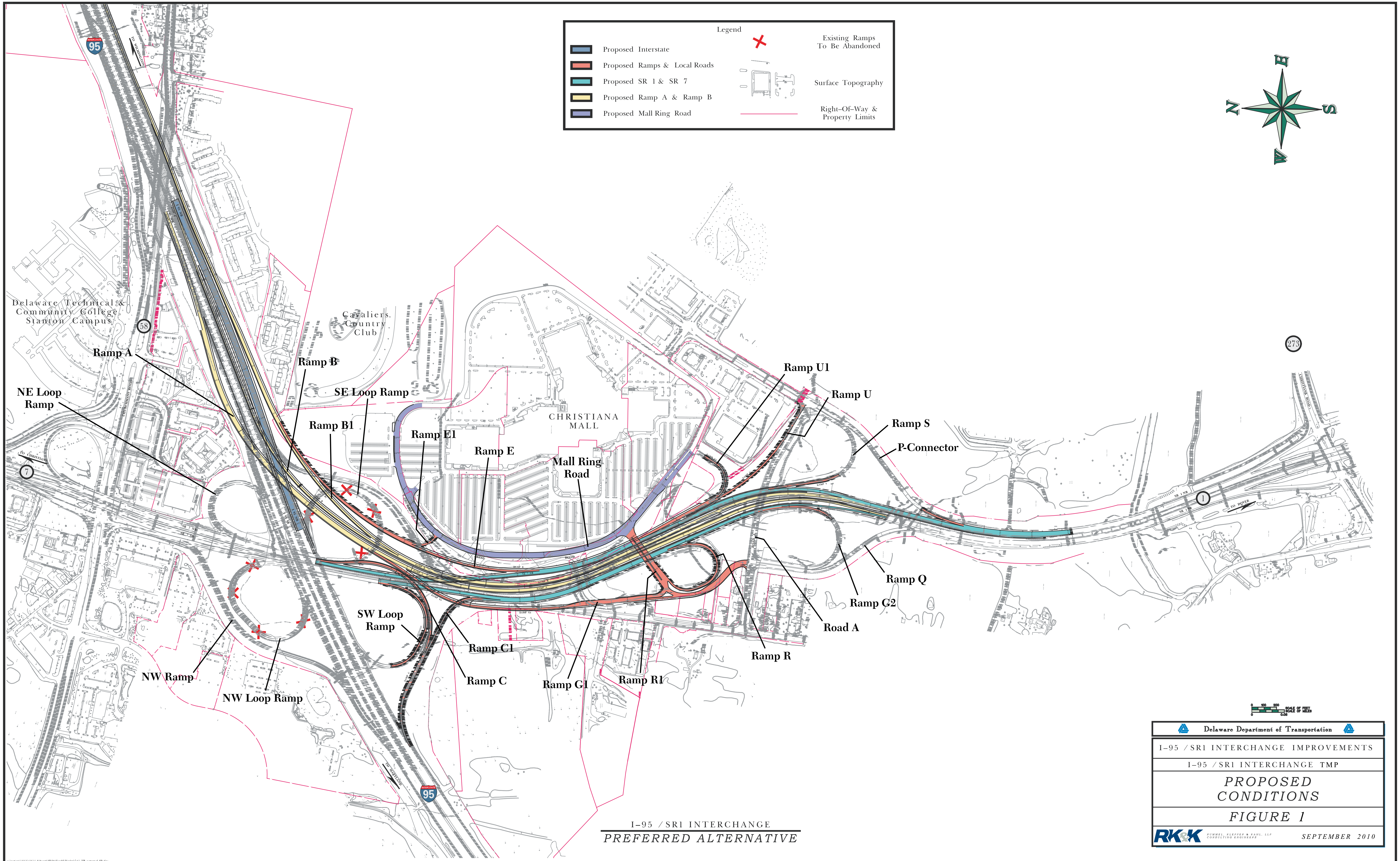
In response to FHWA's Rule on Work Zone Safety and Mobility (23 CFR 630, Subpart J), the Delaware Department of Transportation (DelDOT) has developed "Work Zone Safety and Mobility Procedures and Guidelines" to address safety and mobility impacts of work zones. These procedures require the development of a project-specific Transportation Management Plan (TMP) for all "significant projects". The I-95/SR 1 interchange project is considered a significant project and therefore requires a Type B TMP. This document includes all the required components of a Type B TMP, including a Temporary Traffic Control Plan (TTCP), Public Information (PI) and Transportation Operations (TO) components, and a Work Zone Impacts Assessment. It should be noted that a TMP is a "dynamic document" that should be updated throughout the project. It is anticipated that DelDOT's design consultant (RK&K) will be responsible for completing all revisions to the TMP document throughout the project, whether the changes are proposed by DelDOT or by the selected contractor. The current version reflects the status at the completion of the final design stage of the I-95/SR 1 interchange project.

B. Project Background

The I-95/SR 1 interchange is being modified as part of a series of capacity improvements recommended for the Delaware Turnpike to improve the operational efficiency of the corridor. The Delaware Turnpike includes approximately 11 miles of Interstate 95 in northern New Castle County, Delaware, extending from the Maryland-Delaware state line to the I-95/I-295/I-495 Christiana Interchange. In the early 1990's, the Delaware Turnpike Improvement Program study was initiated to address deficiencies on the Delaware Turnpike. 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 and improve the efficiency, operation, and management of the corridor.

While these initiatives have been successful in generating increased transit usage and heightened traveler awareness, they have been unsuccessful in their ability to slow down the growth of traffic on the Delaware Turnpike. In fact, design year 2010 traffic volume projections from the 1990 Delaware Interstate System Study were exceeded by the year 1998. Traffic volumes on portions of the Delaware Turnpike currently exceed the capacity of the existing facilities. Consequently, DelDOT moved forward with project development activities to evaluate capacity improvement alternatives along the I-95 corridor. Included in these capacity improvements are design modifications to the I-95/SR 1 interchange.

The interchange improvements were originally part of a larger project that included the widening of I-95 between SR 1 and I-495 from four to five lanes in each direction. Due to available funding and other policy issues, DelDOT decided to move forward with construction of the I-95 widening as a separate project and postpone the interchange improvements until the mainline widening



I-95 / SR1 INTERCHANGE

PREFERRED ALTERNATIVE

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

I-95 / SR1 INTERCHANGE TMP

PROPOSED CONDITIONS

FIGURE 1

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was completed. Construction on the I-95 mainline widening project was completed in 2008, and DelDOT is now ready to construct the interchange improvements.

C. Project Need

The need for the revised design of the I-95/SR 1 interchange is primarily a function of existing traffic volumes exceeding the capacity of the freeway and ramps as currently designed. In addition, the current design of the interchange is outdated and substandard, further contributing to decreased level of service and reduced safety. A safety analysis revealed that the weaving, merge, and diverge areas within the I-95/SR 1 interchange have experienced a significant number of rear-end crashes, likely caused by congestion in the area. Future traffic projections show that the volume of traffic using the interchange is expected to increase, while transit and management improvements already implemented have not slowed traffic growth. All of these factors combine to show the need for capacity improvements at the I-95/SR 1 interchange.

Refer to the Interstate Modification Report (IMR), developed to support DelDOT's request for an Interstate Access Point Approval (IAPA), dated December 2008, for an in depth discussion of the need for this project.

D. Project Schedule

The I-95 / SR 1 interchange project was initially expected to be constructed as a single project under one large construction contract. However, DelDOT has decided to perform some of the required roadway and bridge work as part of an advance breakout project, which will allow critical path items to be completed earlier in the project and will also reduce the scope of the main project. The breakout project will include constructing the new Christiana Mall Road Bridge over SR 1, and performing required bridge rehabilitation on the three bridges carrying I-95 over SR 1. Construction work on the breakout project is expected to begin in February 2011 and be completed by October 2011. For the main I-95 / SR 1 interchange project, construction is expected to begin in May 2011 and be completed by October 2014. Refer to Section III-B of this report for additional information regarding each proposed construction phase for the main project and the breakout project.

E. Related Projects

There are several projects that are in the planning stages, under construction, or recently completed that are either directly or indirectly related to the interchange improvements at the I-95 / SR 1 interchange. More projects will be added to this section, as needed, when new projects are identified.

Christiana Mall Ring Road Improvements

The proposed alignment and cross section of SR 1 for the interchange project impacted the Christiana Mall Ring Road. Therefore, General Growth Properties, Inc. contracted with Langan Engineering & Environmental Services to develop construction plans to realign the Christiana Mall Ring Road prior to construction of the I-95 / SR 1 interchange improvements. This work was completed in November, 2009.

I-95 Widening – SR 1 to I-495

The I-95 5th Lane Widening project involved constructing an additional (5th) lane on I-95, and was completed in 2008. The project limits were between SR 141 and SR 1 in the southbound direction, and from SR 1 to north of I-495 in the northbound direction. Currently, the new 5th lane ties into the existing ramps from northbound SR 1 to northbound I-95 and southbound I-95 to southbound SR 1 at the I-95 / SR 1 interchange. When the I-95 / SR 1 interchange improvements are completed, the 5th lane will tie into the newly-constructed directional ramps (Ramp A and Ramp B, as shown in Figure 1).

Christina Interstate Bridge Maintenance Project

The Christina Interstate Bridge Maintenance project involves bridge maintenance and repair work on a number of I-95 bridges located between Delaware Route 896 and I-495 in New Castle County, DE. The work will require temporary (night-time) lane closures on I-95 and ramp detours in some locations. Work on this project began in March, 2010 and is expected to be completed by September, 2010.

Newport Viaduct Bridge Rehabilitation Project

The Newport Viaduct Bridge Rehabilitation project involves bridge repair work on the Newport Viaduct, which carries SR 141 over the Christina River, AMTRACK and SR 4 in the town of Newport. Construction is expected to start in spring 2011 and last approximately two years.

SR 7 Widening – Newtown Road to SR 273

Final design is complete for the widening of SR 7 from two to four lanes between Newtown Road and SR 273. The SR 7 widening constructed between US 40 and Newtown Road will be extended to SR 273 under this contract. This project includes sidewalks and bike lanes, as well as significant improvements and a new traffic signal at the School Bell Road intersection. Right of way acquisition is underway. Advance utility construction is scheduled to begin in early 2010. Project construction is anticipated to start in the summer of 2010, depending on the progress of the advance utility work.

US 301

The US 301 project will provide a new four-lane US 301 tolled limited-access roadway in southern New Castle County. The roadway will extend northeast from the current US 301 at the Maryland-Delaware state line, bypass Middletown, and connect with SR 1 north of the Biddles Corner Toll Plaza, just south of the C&D Canal. FHWA signed the record of decision (ROD) on April 30, 2008, thereby allowing DelDOT to proceed with final design and construction of the project. This project is expected to increase traffic on SR 1 north of the C&D Canal, including through the I-95 / SR 1 interchange. The future traffic projections developed for the SR 1 interchange project include the impacts of the US 301 project.

SR 1 Widening

DelDOT anticipates a future need to widen SR 1 from two (2) lanes to three (3) lanes between Tybouts Corner (US 13) and I-95. This widening will be necessary due to projected traffic growth along the SR 1 corridor resulting from proposed development in New Castle County and the US 301 project. While the SR 1 widening project is only in the very preliminary stages at this point, the I-95 / SR 1 interchange is being designed to tie-in to both the current configuration of SR 1, as well as the potential widened SR 1 section.

I-95 Newark Toll Plaza Improvements

The Newark Toll Plaza is located approximately 6.6 miles south along I-95 from the SR 1 interchange. The toll plaza experiences high levels of congestion due to the current plaza configuration. As approximately 55 percent of travelers through the plaza use E-ZPass, congestion could be drastically reduced with the construction of highway speed E-ZPass lanes. Improvements include reconstructing and reconfiguring the toll plaza to incorporate two highway-speed E-ZPass lanes in the northbound and southbound directions. Construction on this project began in spring 2010 with an anticipated completion date of summer 2011. Close coordination between the two projects will be required, since the toll plaza project and the I-95 / SR 1 interchange construction schedules will overlap in the spring and summer of 2011.

II. Existing & Future Conditions

A. Existing Roadway Characteristics

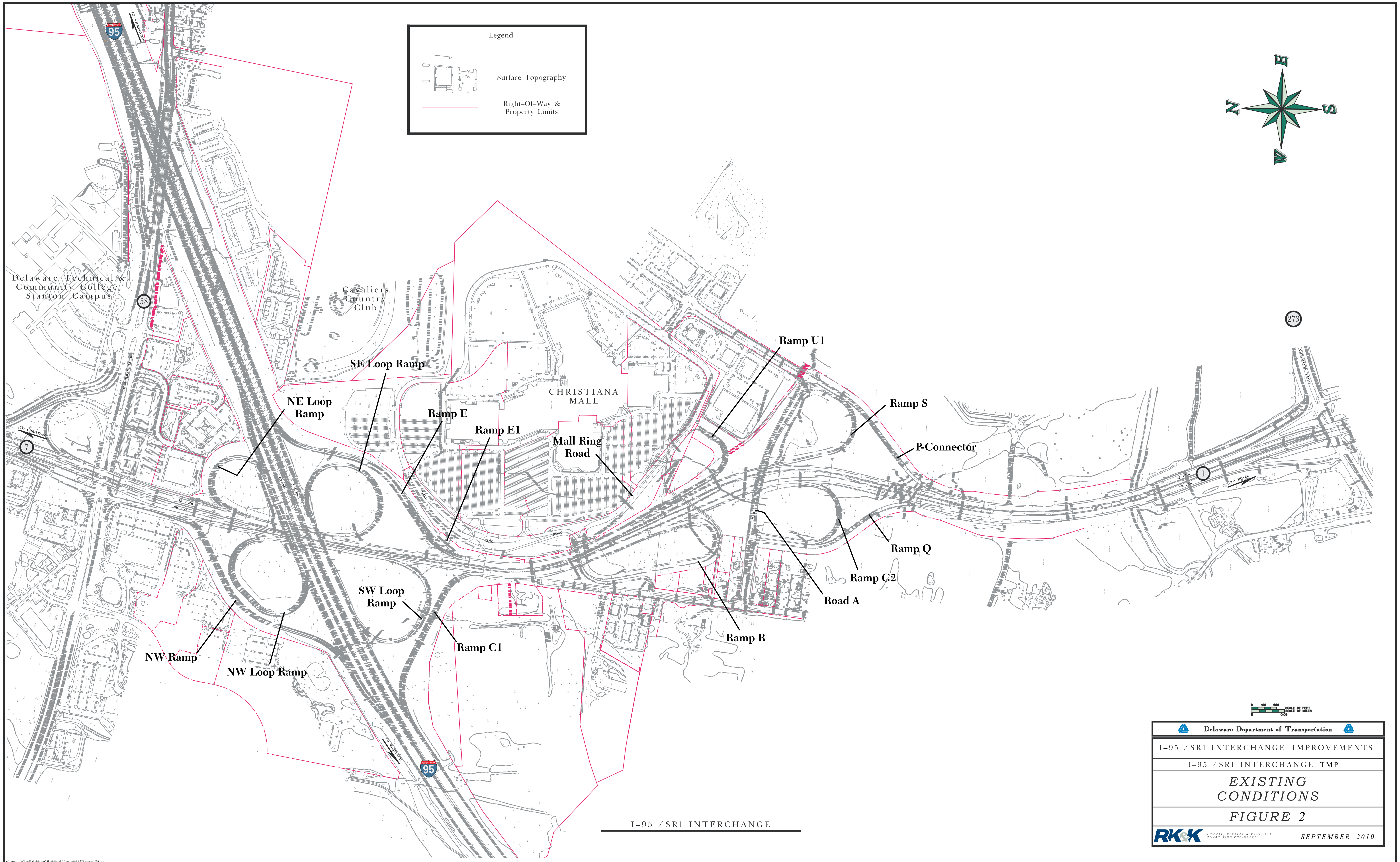
The I-95/SR 1 interchange is a full cloverleaf interchange that connects Interstate 95 to SR 1 and SR 7 in New Castle County, Delaware. I-95 runs from southwest to northeast through the interchange. The north-south cross street is designated as SR 7 to the north of the interchange and SR 1 to the south of the interchange. SR 7 is a principal arterial road, while SR 1 is a multi-lane freeway that connects I-95 to Dover and has become the major north-south spine road in Delaware. **Figure 2** shows a plan view of the existing interchange configuration.

In the northbound direction, I-95 carries four (4) through lanes. There is an auxiliary lane between the SR 273 interchange and the SR 1 interchange that drops at the ramp to southbound SR 1. A weave condition exists on the mainline between the loop ramps to and from SR 7. In the southeast quadrant of the interchange, a single-lane ramp connects northbound SR 1 to northbound I-95. This ramp also contains a slip ramp that provides a direct connection between the Christiana Mall Ring Road and northbound I-95. Five (5) through lanes currently continue north on I-95 beyond the interchange through Churchmans Marsh following the completion of the I-95 widening project in 2008.

In the southbound direction, I-95 carries five (5) through lanes approaching the SR 1 interchange. The fifth lane drops at the interchange, forming a collector-distributor (C-D) road through the I-95/SR 1 interchange to handle the movements between I-95 and SR 7/SR 1. Traffic heading south on SR 1 from southbound I-95 exits the mainline onto the C-D road, and a weave condition exists on the C-D road between the loop ramps to and from SR 1. Traffic from southbound SR 7 to southbound I-95 merges onto the C-D road before the C-D road rejoins the I-95 mainline. There is no ramp provided for the southbound I-95 to northbound SR 7 movement; this movement is carried by a ramp from southbound I-95 to Churchmans Road, approximately ½ mile upstream from the I-95/SR 1 interchange. Four (4) mainline lanes are provided on southbound I-95 south of the interchange.

A large number of ramp movements are provided in the area, due to the proximity of the 1.6 million square foot Christiana Mall (located just south of I-95 in the southeast quadrant of the interchange) and the SR 7/Churchmans Road interchange, located just north of I-95 in the intensively developed Churchmans Crossing area. Traveling northbound on SR 1 towards the interchange, motorists encounter a diverge ramp to the mall, two (2) merge ramps from the mall, the diverge to northbound I-95, and a weave under the I-95 overpass. Southbound motorists on SR 7 encounter a diverge to southbound I-95, a weave under the I-95 overpass, a merge from northbound I-95, a diverge to the Mall Access Road, a diverge to Road A, and a merge from Road A within approximately 1.5 miles.

As discussed in the Project Need section, the design of the interchange is outdated, substandard, and ill-suited to handle the current and future traffic patterns through the interchange. **Table 1** below describes the existing ramps and the ramp modifications proposed for the I-95 / SR 1 interchange project.



I–95 / SR1 INTERCHANGE

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I–95 / SR1 INTERCHANGE IMPROVEMENTS

I–95 / SR1 INTERCHANGE TMP

EXISTING CONDITIONS

FIGURE 2

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Table 1. SR 1 Interchange Ramps Summary

Movement	Name	Proposed Conditions
I-95 NB to SR 7 NB	Ramp C	Replace loop ramp with flyover Ramp C.
I-95 NB to SR 1 SB	Ramp C1	Minor re-alignment. Add Ramp C connection.
I-95 SB to SR 1 SB	NW Loop Ramp	Replace loop ramp with flyover Ramp A.
SR 7 SB to I-95 SB	NW Ramp	No change.
SR 7 SB to I-95 NB	SW Loop Ramp	Minor re-alignment.
SR 1 NB to I-95 SB	NE Loop Ramp	No change
SR 1 NB to I-95 NB	Ramp E	Ramp E relocated. Add Ramp B & Ramp B1.
Ring Road to I-95 NB	Ramp E1	Relocated.
SR 1 SB to Ring Road	Ramp R	Relocated tie-in to Ring Road. Add Ramp G1.
Ring Road to SR 1 NB	Ramp U1	Minor re-alignment.
Road A to SR 1 NB	Ramp S	Minor re-alignment. Add Ramp U.
Road A to SR 1 SB	Ramp Q	No change.
SR 1 NB to Road A	P-Connector	No change.
SR 1 SB to Road A	Ramp G2	Add Ramp G1.

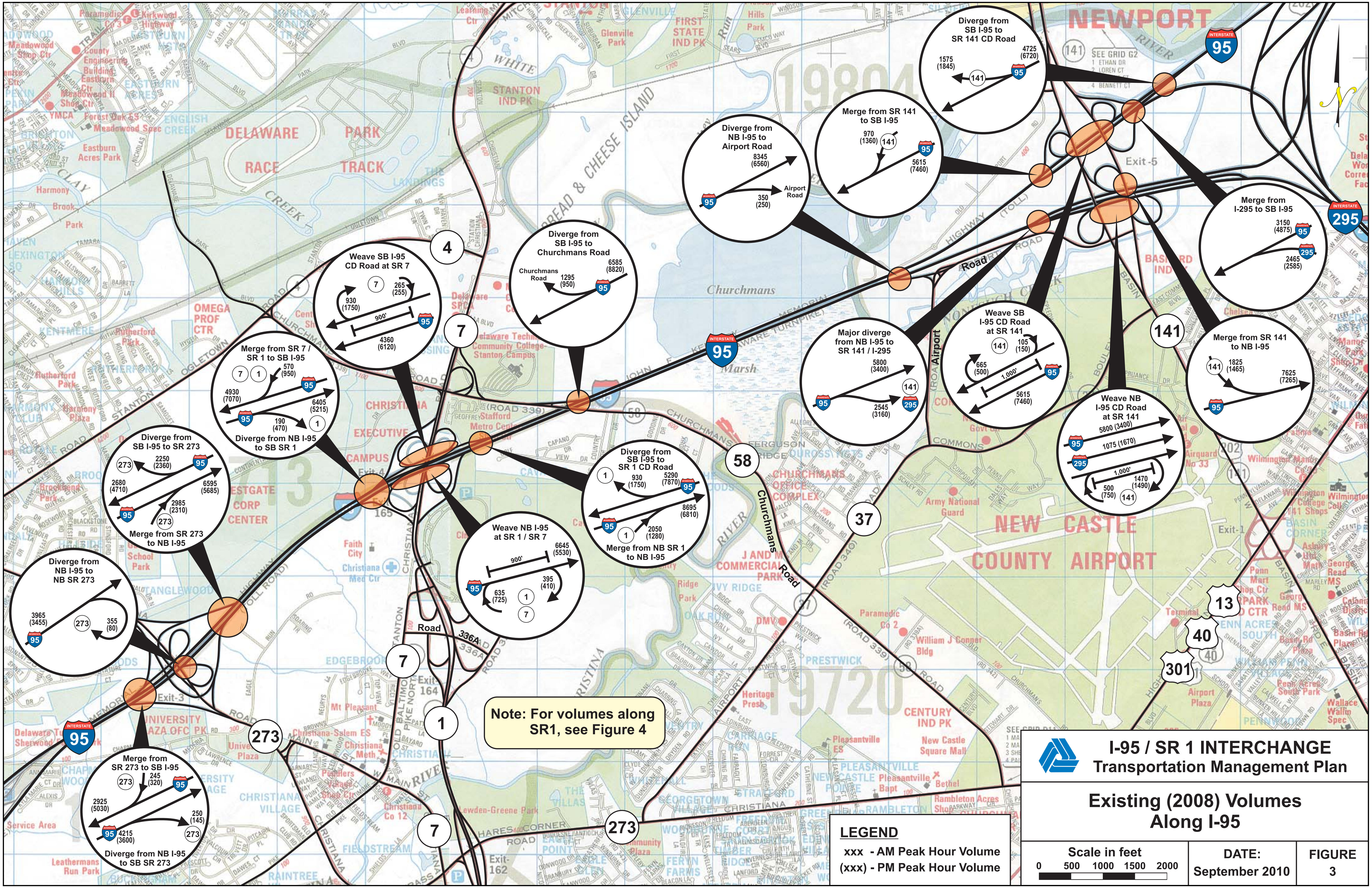
B. Existing Traffic

Year 2008 traffic volumes were obtained for the study area by conducting manual and automatic tube traffic counts at various mainline segments and ramps along I-95 and SR 1 in May, 2008 as part of the preparation of the IMR report for this project. The count locations are listed below:

- I-95, north of SR 1 (manual count, peak hours only)
- SR 7, north of I-95 (tube count, southbound only)
- I-95 / SR 1 interchange ramps (tube counts)
- SR 1 / Mall interchange ramps (tube counts)
- SR 1 / Road A interchange ramps (tube counts)
- SR 1 / SR 273 interchange ramps (tube counts)

Additionally, the 2008 count data was supplemented with historical count data collected along I-95 in June 2006 (tube counts) and along SR 1 northbound, south of SR 273, in June 2005 (tube counts). The count data was seasonally adjusted and balanced to develop a network of existing traffic volumes for use in analyzing existing conditions at the I-95 / SR 1 interchange and the adjacent interchanges along I-95. **Figure 3** shows the resulting year 2008 AM and PM peak hour volumes along the I-95 corridor, while **Figure 4** shows the resulting year 2008 AM and PM peak hour volumes along SR 1. It should be noted that ramp volumes at the adjacent I-95/SR 141 interchange were developed from historic data using appropriate growth factors, because the construction activity for the I-95 widening project prevented new counts from being collected.

The balanced AM and PM peak hour volumes and the existing lane configurations were used to perform Highway Capacity Software (HCS) analysis of existing conditions. The results indicate that four (4) movements within the I-95/SR 1 interchange currently operate at level of service (LOS) F. During the AM peak period, the merge from northbound SR 1 to northbound I-95 operates at LOS F, and the northbound freeway segment on I-95 north of the SR 1 interchange is over capacity. Field observations indicate that queues generally form along northbound I-95 and



Note: For volumes along SR1, see Figure 4

LEGEND

xxx - AM Peak Hour Volume

(xxx) - PM Peak Hour Volume

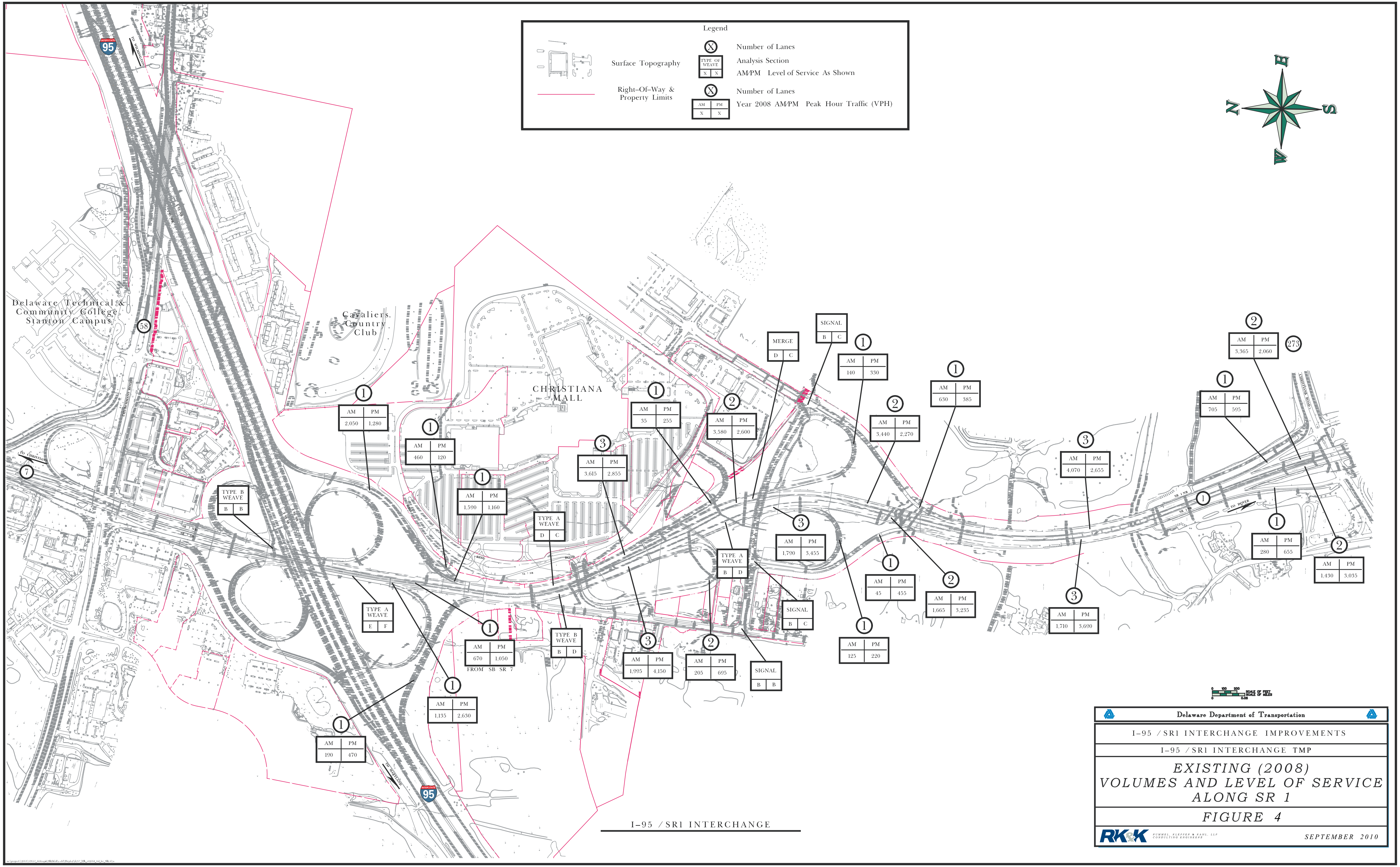
I-95 / SR 1 INTERCHANGE
Transportation Management Plan

Existing (2008) Volumes Along I-95

Scale in feet
0 500 1000 1500 2000

DATE:
September 2010

FIGURE
3



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I-95 / SR1 INTERCHANGE IMPROVEMENTS

I-95 / SR1 INTERCHANGE TMP

EXISTING (2008) VOLUMES AND LEVEL OF SERVICE ALONG SR 1

FIGURE 4

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northbound SR 1 during the AM peak period as a result of these failing conditions. During the PM peak period, two weaves within the interchange are currently failing. The weave on the southbound I-95 C-D road between the northeast and northwest quadrant loop ramps operates at LOS F, as does the weave along southbound SR 7 between the I-95 loop ramps. Field observations indicate that queues from these failing weaves generally spill back from the C-D road into the mainline lanes on southbound I-95 during the PM peak period. It should be noted that all of these failing movements will be eliminated or improved by the preferred alternative. **Figure 4** summarizes all existing levels of service along the SR 1 corridor, while **Figure 5** summarizes the existing volumes and levels of service along the I-95 corridor.

C. Construction Year Traffic

To estimate traffic conditions during construction, year 2013 traffic forecasts were developed. Construction year (2013) volumes were determined using a straight-line interpolation between the balanced year 2008 volumes and the 2030 design year forecast volumes developed as part of the IMR report. HCS analyses were performed for the implementation year for the No-Build condition to develop a baseline when performing traffic analyses for each construction phase. It should be noted that the 2013 No-Build condition includes the I-95 widening project that was completed at the end of 2008.

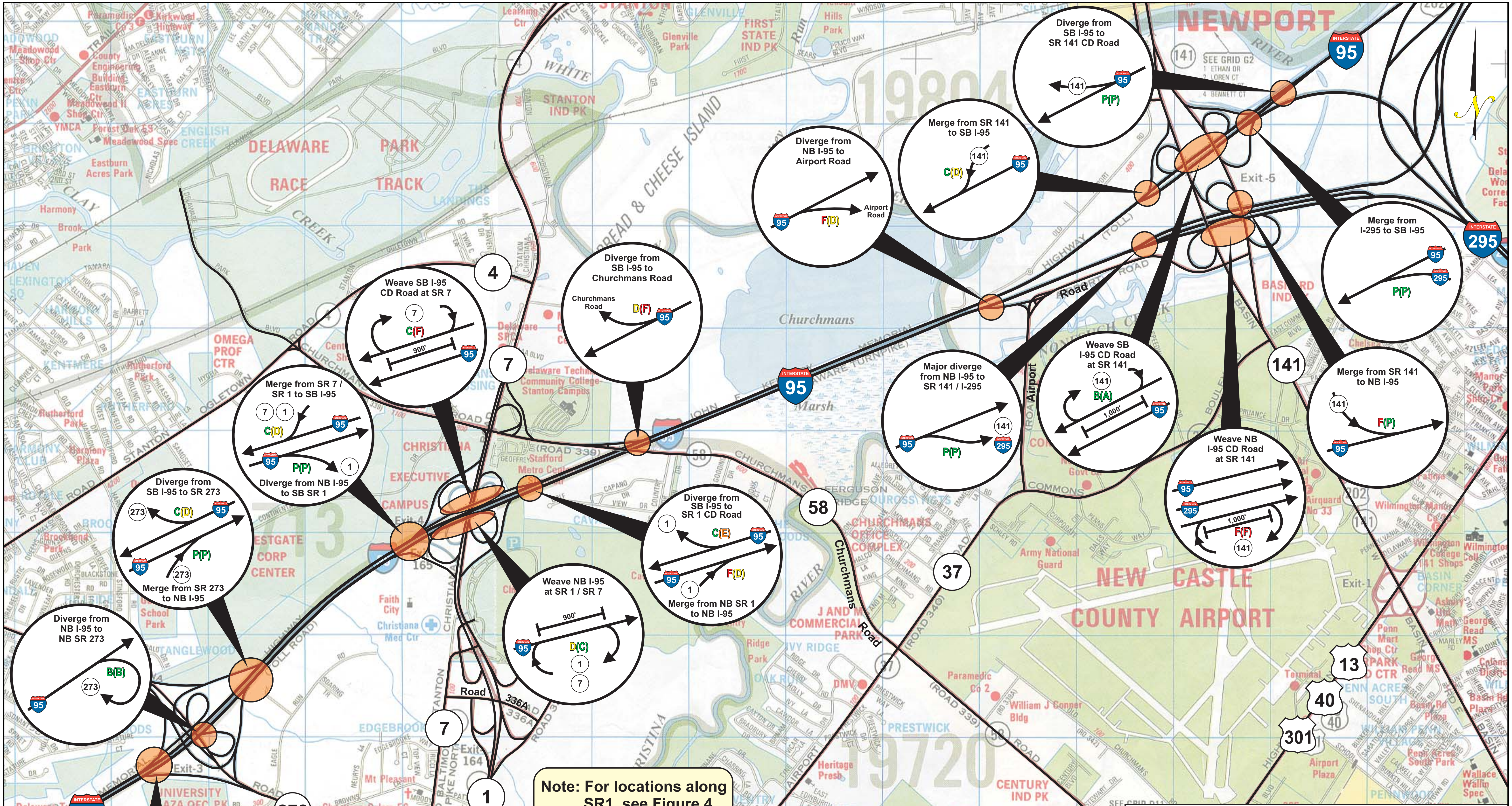
The results of the HCS analyses for the 2013 No-Build condition indicate that four (4) movements within the I-95 / SR 1 interchange are projected to fail (LOS F), despite the improvements from the I-95 widening project, which was intended to provide additional mainline capacity and not to improve this interchange. While the mainline segment of northbound I-95, north of SR 1, is expected to improve to LOS D during the AM peak hour, the merge from northbound SR 1 to northbound I-95 is still projected to operate at LOS F due to ramp volumes that exceed capacity. The two weaves within the interchange that currently operate at LOS F in the PM peak hour will also continue to fail under 2013 No-Build conditions. Additionally, the diverge from southbound I-95 to the SR 1 C-D road is projected to fail during the PM peak hour in the year 2013 because the projected traffic growth between 2008 and 2013 will cause the single-lane ramp to be over capacity. **Figure 6** and **Figure 7** summarize the 2013 No-Build volumes and levels of service, respectively, along the I-95 corridor. **Figure 8** summarizes the 2013 No-Build volumes and levels of service along SR 1.

D. Crash Data

The Delaware Turnpike corridor experienced substantial traffic growth throughout the 1990's, until the corridor reached saturated conditions in the early 2000's. A review of crash data during that time period indicates that there was a direct correlation between congestion levels and crash rates. Over the four-year period from 1998 to 2001, the average crash rate on the Delaware Turnpike increased steadily from 73 per 100 million vehicle miles (mvm) in 1998 to 90 per 100 mvm in 2001. Rear-end collisions were the most common crash type, accounting for 56 percent of all crashes. This crash pattern is typical of congested freeways, where stop-and-go traffic frequently occurs during the peak hours.

Recently, as traffic volumes have reached saturation and commuters have become accustomed to the typical daily congestion locations, crash rates have reduced slightly. Rear-end crashes still remain the primary crash type along I-95 and SR 1. This crash pattern is indicative of congested freeways and ramp segments where stop-and-go traffic frequently occurs during the peak periods. Given that rear-end crashes are the most common type of crash, particular attention should be paid to providing adequate merge distances throughout all phases of construction. Other common crash types included fixed-object crashes and sideswipe crashes.

A complete analysis of crash data covering the period between May 2005 and April 2008 can be found in the Interstate Modification Report (IMR). The safety analysis in the IMR discusses the



Note: For locations along SR1, see Figure 4

I-95 / SR 1 INTERCHANGE
Transportation Management Plan

Existing (2008) Level of Service Along I-95

LEGEND

A(B) - AM(PM) peak hour level of service (LOS)

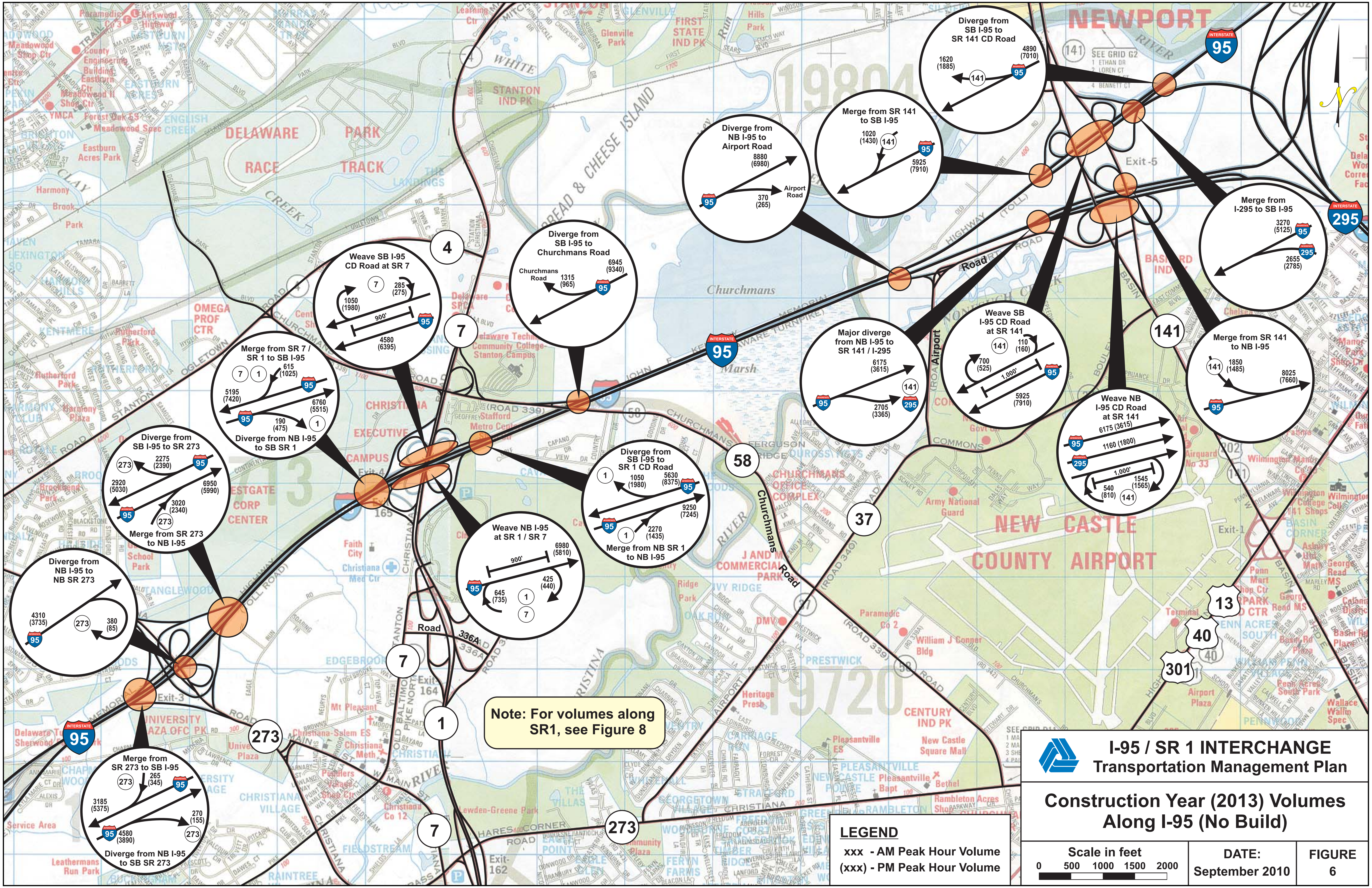
P - "Pass" condition at major merge or diverge

Scale in feet

0 500 1000 1500 2000

DATE: September 2010

FIGURE 5



Note: For volumes along SR1, see Figure 8

LEGEND
xxx - AM Peak Hour Volume
(xxx) - PM Peak Hour Volume

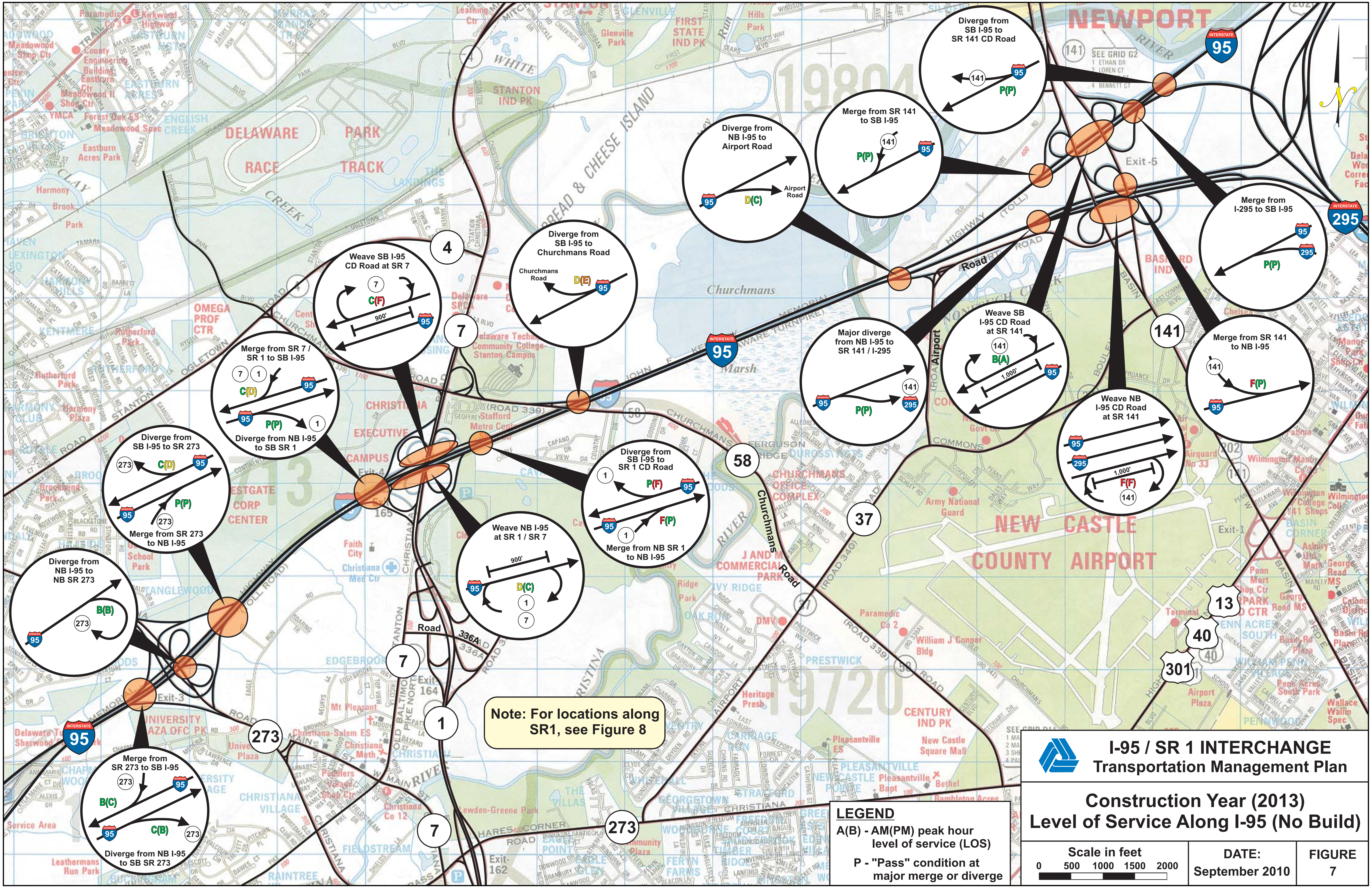
I-95 / SR 1 INTERCHANGE
Transportation Management Plan

Construction Year (2013) Volumes Along I-95 (No Build)

Scale in feet
0 500 1000 1500 2000

DATE:
September 2010

FIGURE
6



Note: For locations along SR1, see Figure 8

LEGEND

A(B) - AM(PM) peak hour level of service (LOS)

P - "Pass" condition at major merge or diverge

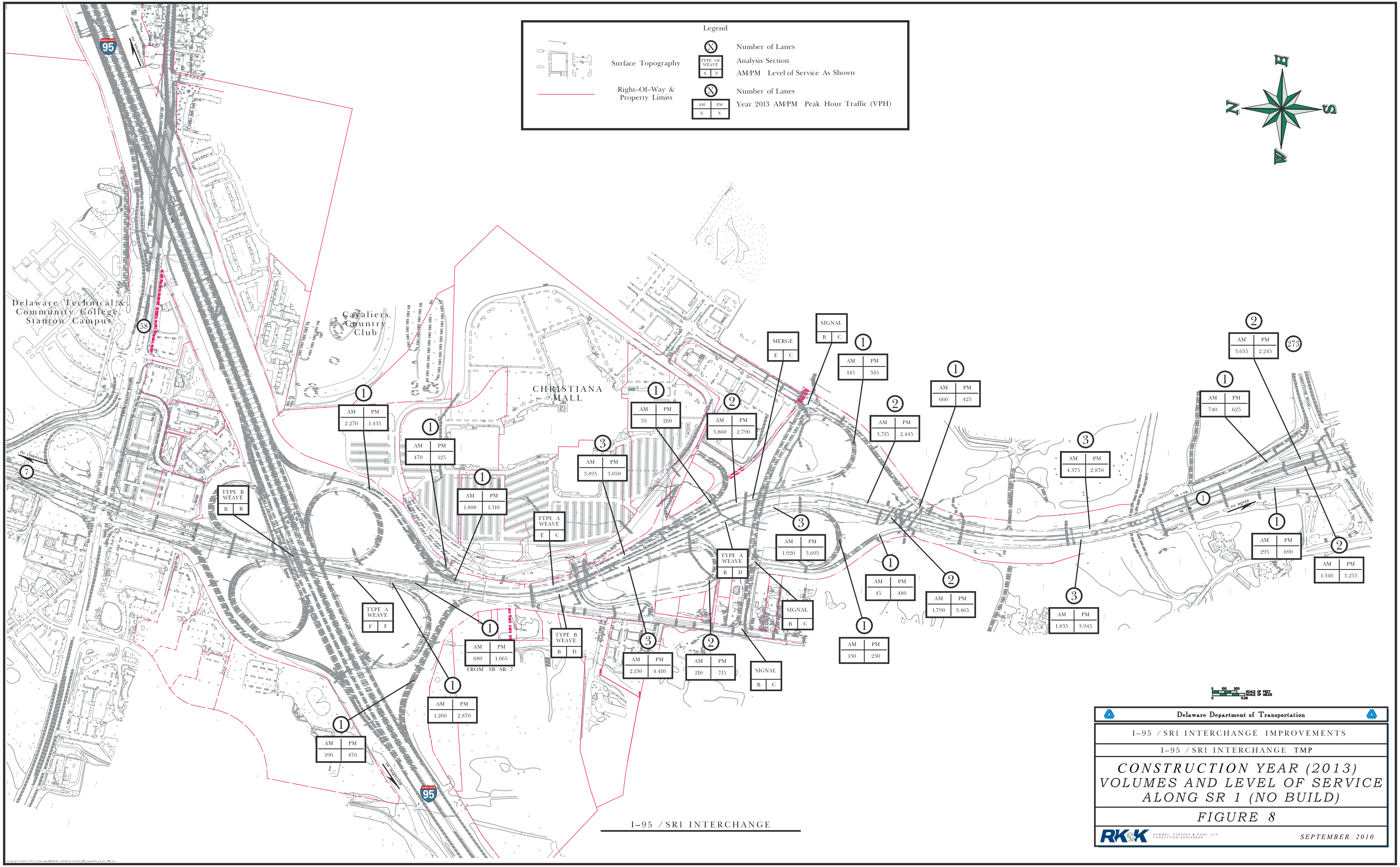
I-95 / SR 1 INTERCHANGE
Transportation Management Plan

Construction Year (2013)
Level of Service Along I-95 (No Build)

Scale in feet
0 500 1000 1500 2000

DATE:
September 2010

FIGURE
7



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I-95 / SR1 INTERCHANGE IMPROVEMENTS

I-95 / SR1 INTERCHANGE TMP

CONSTRUCTION YEAR (2013) VOLUMES AND LEVEL OF SERVICE ALONG SR 1 (NO BUILD)

FIGURE 8

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crash rates and trends along I-95, SR 1 and the interchange ramps within the study area for the aforementioned period, including a comparison to statewide averages.

It should be noted that additional crash data will be collected during construction as part of the TMP monitoring effort, and RK&K will be responsible for analyzing crash patterns during construction. Research conducted by RK&K for DelDOT during the I-95 5th lane widening project indicated that crash rates along I-95 increased by about 25 percent during construction of that project compared to pre-construction levels. Therefore, it will be important to closely monitor the crash patterns during construction of the SR 1 interchange project and identify any work zone safety issues early in the project.

E. Community Concerns

The I-95 / SR 1 interchange is located in a developed area near hospitals, schools, businesses, and residential communities, and it is also adjacent to the Christiana Mall. The construction of this project will affect access to these facilities. Refer to Chapter III of this report for specific details regarding ramp closures and required detour routes. Outreach efforts to the affected stakeholders will be important for this project, and these efforts are outlined later in this report in the Public Information Plan in Section IV-B.

III. Work Zone Impacts Assessment

A. General

A Work Zone Impacts Assessment is performed to determine the type, severity, and extent of the anticipated work zone impacts associated with various project alternatives. Both a qualitative assessment and a quantitative assessment are required for a Type B TMP. The purpose of the Work Zone Impacts Assessment is to identify the impacts of proposed lane closures or detours within the study area and to promote more efficient and effective construction staging.

This chapter of the I-95 / SR 1 TMP describes the proposed construction phasing, presents a qualitative and quantitative analysis of operations during construction, and provides an analysis of the detour routes that will be required to accommodate ramp closures and temporary roadway closures. This chapter also identifies potential diversion routes that may be utilized by the traveling public during construction, and addresses safety impacts related to the work zone.

B. Proposed Construction Phasing

The I-95 / SR 1 interchange project was initially expected to be constructed as a single project under one large construction contract. However, DelDOT has decided to perform some of the required roadway and bridge work as part of an advance breakout project, which will allow critical path items to be completed earlier in the project and will also reduce the scope of the main project. This section of the TMP describes the work to be completed as part of the breakout project and also describes the proposed construction phases for the main I-95 / SR 1 interchange project based on the latest design plans (PS&E submittal). If changes to the construction phases are proposed by the selected contractor, they must be reviewed by DelDOT's design consultant (RK&K) and approved by DelDOT before implementation.

Breakout Project

The breakout project will include bridge rehabilitation of the three existing bridges on I-95 over SR 1 and construction of the new Christiana Mall Road Bridge (Ramp R-1) over SR 1. Construction on the breakout project will begin approximately three (3) months before the main project and will take approximately eight (8) months. Construction activities on the projects will therefore overlap for approximately five (5) months, and close coordination between the two projects will be critical.

The bridge rehabilitation activities performed as part of the breakout project will include: 1) replacing the approach slabs on each of the three bridges on I-95 over SR 1; 2) heat straightening of a damaged beam; and 3) painting underneath the bridge.

Construction work on the new Christiana Mall Road Bridge will include construction of the segment of Ramp G-1 between Ramp R-1 and Road A, in addition to constructing the bridge itself. Traffic accessing the Christiana Mall from southbound SR 1 will be shifted from the existing Mall Bridge to the ultimate configuration on Ramp R-1, and a new signal will be activated on the Mall Ring Road at the Ramp R-1 connection. The old Mall Bridge will be demolished, and the existing traffic signal at Road A and Ramp G-2 from southbound SR 1 will also be modified to accommodate the new fourth leg from Ramp G-1.

Main Project

The main I-95 / SR 1 interchange project is expected to be completed in seven (7) phases, as described below. Plan sheets showing the proposed phases of the main project are included with this report in **Appendix A**.

Main Project - Construction Phase 1

During Phase 1 of construction of the main project, which will begin three months after the advance breakout project construction commences, work will begin on the segments of Ramp A and Ramp B-1 near I-95 outside of the existing pavement. Temporary ramps will be constructed to modify the connections from southbound I-95 to southbound SR 1 (temporary Ramp A) and from northbound SR 1 to northbound I-95 (temporary Ramp E). These temporary connections will allow all existing traffic movements within the interchange to be maintained when the existing ramps are closed during later phases.

Along SR 1, permanent roadway work will begin on the SR 1 northbound lanes in Phase 1. The construction activity for temporary Ramp E from northbound SR 1 to northbound I-95 will require the closure of Ramp E-1, which provides direct access from the Christiana Mall to northbound I-95. This ramp will remain closed throughout construction. Mall traffic destined for northbound I-95 will be re-routed to Ramp U-1 and Ramp S. Additionally, temporary roadway and ramp work required to relocate SR 7 northbound will be developed during this phase.

Main Project - Construction Phase 2

During Phase 2 of construction, traffic from southbound I-95 to southbound SR 1 and from northbound SR 1 to northbound I-95 will shift to the temporary ramps constructed during Phase 1. Northbound I-95 will be widened to enable traffic to be shifted to the right to accommodate future construction activity in the median. A temporary ramp (temporary Ramp C) will be constructed for the northbound I-95 to southbound SR 1 movement.

Along SR 1, northbound traffic will be shifted onto the temporary SR 7 northbound, and northbound SR 1 lane widths will be reduced as the roadway approaches the I-95 overpass to allow traffic on the loop ramp from northbound I-95 to enter northbound SR 7 in its own lane. Temporary pavement will be constructed adjacent to Ramp G-1 for use in Phase 3. Permanent roadway work will also be performed on a segment of Ramp A and SR 7 northbound while temporary roadway work will be constructed to connect existing SR 7 northbound to the permanent SR 7 northbound segment.

Main Project - Construction Phase 3

During Phase 3 of construction, traffic on northbound I-95 will be shifted to the right and construction activity will take place in the median to begin work on the tie-in from Ramp B. Traffic from northbound I-95 to southbound SR 1 will be shifted to the temporary ramp while the existing ramp is modified.

Along SR 1, northbound SR 1 will be shifted to the east to construct pavement widening in the vicinity of the Eagle Run crossing. The bridge widening over Eagle Run will also be constructed. The temporary Phase 1 northbound SR 7 roadway will remain operational to facilitate the movement from SR 1 northbound to I-95 northbound via temporary Ramp E. Temporary Ramp E2 will be constructed for use in Phase 4 to connect SR 7 northbound to I-95 northbound. With the construction activity on northbound SR 7 near the I-95 overpass complete, northbound SR 1 will be shifted back onto the existing pavement with a transition onto the new SR 7 northbound pavement approaching I-95.

Main Project - Construction Phase 4

During Phase 4 of construction, the new Ramp C flyover will be constructed over SR 1, which will replace the existing loop ramp from northbound I-95 to northbound SR 7. The Ramp G-1 bridge over SR 1 will also be constructed during Phase 4. Additional segments of Ramp A and Ramp B will be constructed to allow the bridges over I-95 to be constructed during Phase 5.

Along SR 1, temporary Ramp S will be constructed to provide a designated acceleration lane onto northbound SR 1. Northbound SR 7 will be shifted to the west to construct the new SR 7 northbound pavement segment and temporary Ramp S modifications.

Main Project - Construction Phase 5

Phase 5 is a major construction phase in which the Ramp A and Ramp B bridges over I-95 will be constructed. Steel will be erected during night-time road closures on I-95 (see Section III-D for more information regarding acceptable lane closure periods and proposed detour routes). The construction activity during Phase 5 will also require the closure of the loop ramp from northbound I-95 to northbound SR 7. Traffic will be detoured until the ultimate connection to flyover Ramp C is completed (refer to Section III-D for a description of the proposed detour).

Along SR 1, the ultimate northbound alignment will be completed and Ramp U-1 will be re-aligned to tie-in to the ultimate SR 1 alignment. This will require the closure of Ramp U and U-1, with traffic detoured to Ramp S. Also during Phase 5, Ramp G-1 will be completed and the new Ramp U from Road A to northbound SR 1 will be constructed. Temporary ramp construction will also begin of temporary Ramp E-5 to connect permanent northbound SR 7 to northbound I-95.

Main Project - Construction Phase 6

During Phase 6 of construction, traffic on northbound SR 1 will be shifted to its ultimate SR 7 alignment while work is performed in the median to complete the connections of Ramp A and Ramp B to SR 1. Ramp U-1 is re-opened, the new Ramp U will become operational, and a new Ramp E-1 connection will be constructed at its ultimate alignment.

Main Project - Construction Phase 7

Phase 7 is the final phase of construction. During this phase, the existing loop ramp and temporary Ramp A from southbound I-95 to southbound SR 1 will be taken out of operation, and traffic will shift to the ultimate Ramp A. Ramp B and Ramp B-1 will also become operational, and I-95 will be resurfaced.

Along SR 1, southbound SR 1 will also be resurfaced along with miscellaneous shoulder reconstruction, and Ramp R-1 traffic will be temporarily detoured to Road A. Road A will also be resurfaced and re-striped to accommodate minor lane changes designed to improve operations.

C. Operational Analysis of Proposed Construction Phases

A Type B TMP requires a qualitative and quantitative analysis of work zone impacts. As discussed in Chapter II of this report, the I-95 / SR 1 interchange currently experiences severe congestion during the peak hours, with several segments operating at a failing level of service. The existing traffic demand already exceeds the existing capacity of the interchange.

Research has shown that the mere presence of construction activity, cones, barrels, and safety barriers reduces the capacity of roadways in a work zone. Narrow lanes and reduced shoulder widths required to safely accommodate construction vehicles and workers in the work zone will further reduce capacity in the travel lanes, thereby worsening the traffic operations through the interchange. Unfortunately, these conditions cannot be avoided while completing this project. Therefore, minimizing the construction duration will be a key component in reducing the operational impacts of the work zone.

While narrow lanes and reduced shoulder widths are expected to slightly worsen traffic operations through the work zone, lane closures and roadway closures would have a much more detrimental effect on work zone operations. Therefore, the proposed construction staging maintains all existing traffic movements through the interchange without lane reductions as often as possible during the construction period. During the infrequent occasions where lanes will need to be reduced, roadways closed, or a significant operational change is proposed, a quantitative analysis was conducted. The following sections summarize the analyses of several different potential MOT alternatives, some of which were retained, and some of which were dropped from further consideration based on their operational impacts.

Proposed Stop Control at Ramp Terminals – *Dropped from Further Consideration*

The construction phasing plans developed during the preliminary design stage of the project proposed stop control at two ramps as they tie-in to northbound SR 1/SR 7 during certain phases of construction. During construction Phase 2, stop-control was proposed on the loop ramp from northbound I-95 to northbound SR 7 (SE Loop Ramp) because construction activities along northbound 7 at the ramp junction reduced the available roadway width from three lanes to two lanes. During construction Phases 3 through 6, stop-control was proposed on Ramp S from Road A to northbound SR 1 because there would not be enough pavement available to provide an acceleration lane. It should be noted that Phase 5 is critical for Ramp S operations, because Ramp S must also carry traffic from the closed Ramp U-1 during Phase 5.

To test the operational impacts of the proposed stop-controlled ramps, analyses were conducted using the Highway Capacity Software (HCS) unsignalized intersections module. The results indicate that both of the stop conditions would operate at LOS F with excessive delays for vehicles on the ramps. To determine the extent of the queues expected, a simulation network using Synchro software was developed for the northbound SR 1 corridor. Although Synchro is typically not used to analyze expressway operations, this tool was chosen because it could easily model both a merge condition and a stop condition at the ramp terminals. A base network was created using the year 2013 traffic forecasts, and the model was calibrated to match existing queue lengths along mainline SR 1. Then, separate models were created showing the proposed ramp operations under stop control during Phase 2 (SE Loop Ramp) and Phase 5 (Ramp S).

SE Loop Ramp:

The results of the Synchro analyses for Phase 2 indicated that the queue on the Southeast Loop Ramp would be expected be over 1,750 feet during the AM peak hour, which would extend onto mainline I-95. Since this would clearly be detrimental to northbound I-95 operations, alternative SE Loop Ramp treatments were considered during Phase 2. One option considered was to reduce northbound SR 1 to one lane as it approaches the SE Loop Ramp tie-in during Phase 2. This would allow the SE Loop Ramp to enter northbound SR 7 in its own lane (as it does under existing conditions), and would prevent queuing onto mainline I-95. However, this option would also reduce capacity on northbound SR 1. Therefore, this option was also modeled in Synchro to test the operational impacts to northbound SR 1. The results showed minimal queuing on northbound SR 1 at the merge point from two lanes to one lane during the peak hours. The majority of traffic on northbound SR 1 uses the I-95 northbound exit, and the congestion at this diverge point meters the traffic that continues on northbound SR 1. Although the analysis showed that this option would result in minimal congestion along SR 1, a second option was also considered due to the reduced capacity on SR 1 under this option.

The second option considered was to shift the roadway to allow all lanes to be maintained during Phase 2. Once it was determined that this option could work geometrically, this option was preferred. The construction plans have been modified to re-align SR 7 and the SE Loop Ramp during Phase 2 to provide sufficient space to maintain the existing number of lanes.

Ramp S:

The results of the Synchro analyses for Phase 5 indicated that almost no vehicles would be able to exit Ramp S onto northbound SR 1 during the AM peak hour if Ramp S were stop-controlled, because the heavy volumes on northbound SR 1 at the ramp junction do not provide sufficient gaps. Projected queues on Ramp S were over 3,000 feet. Based on these findings, stop-control is no longer proposed for Ramp S. The construction plans have been modified to shift northbound SR 1 lanes to the west during construction to provide sufficient space to maintain an acceleration lane from Ramp S. It was particularly important to maintain free-flow operations from Ramp S onto northbound SR 1 because Ramp S is part of several proposed detour routes.

Ramp R-1 Reduced to One Lane – ***Alternative Retained***

During construction of the new Christiana Mall Bridge, Ramp R-1 from southbound SR 1 to the Mall will have to be reduced from two lanes to one lane to accommodate the new bridge abutment. To test the operational impact of this change, the weaving segment along southbound SR 1 between the ramp from northbound I-95 and Ramp R-1 was analyzed using Highway Capacity Software (HCS), considering a single-lane takeoff at Ramp R-1. This segment is an example of a "Type B" weave, with traffic on southbound SR 1 required to move one lane to access Ramp R-1, while traffic entering southbound SR 1 from northbound I-95 is not required to make a lane change to remain on southbound SR 1 beyond Ramp R-1.

The results of the HCS analyses indicate that this weave is projected to operate acceptably (LOS D or better) during the construction year (2013) AM and PM peak periods. Additionally, the projected peak hour volume on Ramp R-1 during construction (715 veh/hr) is less than the capacity of a single-lane ramp (1,800 veh/hr, per the Highway Capacity Manual). Based on these findings, the Ramp R-1 lane reduction has been retained in the construction phasing plans. However, this ramp reduction will not be permitted during the peak holiday shopping season between November 1 and January 15.

Shortened Weave Along I-95 Northbound – ***Alternative Retained***

There is currently a weave condition along northbound I-95 between SR 1 and I-495. Traffic entering northbound I-95 from northbound SR 1 must weave across multiple lanes on northbound I-95 through Churchman's Marsh to get into the left lanes in order to continue through to Wilmington. The ultimate I-95 / SR 1 interchange improvements will provide a significant improvement to this existing weave condition by providing a new Ramp B connection on the left (median) side of northbound I-95 for traffic destined to Wilmington. Vehicles using the left entrance will be properly positioned in their destination lane, significantly reducing the weaving activity required along northbound I-95, once the project is completed.

However, during construction, the existing weave along northbound I-95 will remain until the new Ramp B connection is completed and operational in Phase 7. Additionally, the available weaving distance along northbound I-95 will be reduced by approximately 3,000 feet when the temporary Ramp B tie-in is moved north of Churchman's Bridge starting in construction Phase 2. It should be noted that the available weaving distance will continue to be much longer than the maximum weaving distance of 2,500 feet considered by the Highway Capacity Manual (HCM). A weaving distance of over three (3) miles will be available between SR 1 and I-495 during construction, including approximately 10,000 feet between SR 1 and I-295 (the location of the first lane drop).

To test the impact of this shortened weave, operational analyses were conducted using a CORSIM simulation model. As noted above, the maximum weaving distance considered by the HCM is only 2,500 feet. Therefore, analyses using the methodologies in the HCM were not performed because the HCM analyses would yield identical results for both scenarios. The results of the CORSIM analyses indicate that shortening the weave is projected to have a minimal impact on the operations in the weaving segment. Based on the CORSIM results, the shortened weaving segment is projected to increase the density within the weaving segment through Churchman's Marsh by only two (2) percent. The safety impacts of this shortened weaving segment were also considered. However, since there is no good tool available to estimate the potential impact this would have on future crash rates, a quantitative analysis could not be performed. The project team does not anticipate that this change will result in major safety impacts, since the available weaving distance will remain much longer than a typical weaving segment, as defined by the HCM.

In addition to the quantitative analyses discussed above, analyses were also performed to determine the anticipated operational impacts related to the required detour routes. These analyses are presented in the following section.

D. Required Detours

The I-95 / SR 1 interchange is one of the busiest interchanges in the state of Delaware, serving over 200,000 vehicles per day, including commuters, seasonal travelers, and truck traffic. As discussed in the previous section, every effort has been made by the project team to maintain all existing traffic movements at all times during construction. However, it was not feasible to safely construct certain components of the project while maintaining all travel lanes through the interchange. Therefore, seven detour routes will be required during construction, including three ramp detours that will be required during certain project phases and four mainline detours that will be in place during night-time closures only. During the project development process, operational analysis of various detour alternatives was conducted to determine the detour routes that would result in the minimum disruption to travel flow in the study area. The resulting recommended detour routes are described below. The detour plan sheets are included with this report in **Appendix B**.

Detour #1 – SR 1 Northbound

Northbound SR 1 will have to be shut down temporarily for construction work on Ramp A, Ramp B, Ramp C, Ramp G-1, Ramp R-1, and the demolition of the existing Mall bridge. This work can be accomplished during night-time closures. A table of acceptable lane closure periods to be included in the contract documents is presented later in this report in Section III-E.

For the proposed northbound SR 1 detour, all traffic will exit at SR 273 and follow SR 273 westbound to I-95 and back onto SR 1/7. The detour plans also include provisions for local traffic that needs to access the Christiana Mall area during the closure periods. This closure may also impact ambulance access to the hospital. Early coordination should be undertaken between DelDOT, emergency services, and the hospital. Refer to Section IV-B of this report for additional information regarding outreach efforts to emergency services.

Detour #2 – SR 1 Southbound

Southbound SR 1 will have to be shut down temporarily for construction work on Ramp C, Ramp G-1, Ramp R-1, and the demolition of the existing Mall bridge. This work can be accomplished during night-time closures. A table of acceptable lane closure periods to be included in the contract documents is presented later in this report in Section III-E.

For the proposed southbound SR 1 detour, all traffic will exit at I-95 southbound and follow I-95 southbound to SR 273 eastbound and back to SR 1. The detour plans also include provisions for local traffic that needs to access the Christiana Mall area during the closure periods.

Detours #3 & #4 – I-95 Northbound & I-95 Southbound

The most-significant operational impact of the project will be the temporary shutdown of mainline I-95 to erect structural steel for the Ramp A and Ramp B bridges over I-95 during Phase 5 of construction. Mainline I-95 may also need to be temporarily closed to complete the bridge rehabilitation work performed as part of the breakout project. These shutdowns will require detours for northbound and southbound I-95 traffic. DelDOT has experience closing this segment of I-95 during previous projects, including the construction of the Churchmans Road Bridge over I-95 and the I-95 widening project. Based on this experience, it is critical that all work requiring I-95 closures be completed at night when traffic is lightest, well outside of the peak travel periods. The project team has determined that this work can be accomplished in approximately 6-hour increments during these night-time closures. Detailed information related to the proposed bridge construction staging is provided with this report in **Appendix C**. A table of acceptable lane closure periods to be included in the contract documents is presented later in this report in Section III-E, and the project team recommends penalties if the roadway is not re-opened on-time.

During the required northbound I-95 closures, all traffic will exit at the SR 1 southbound ramp and will then exit SR 1 southbound at the loop ramp to Road A. The detoured traffic will continue along Road A, with traffic returning to SR 1 northbound via Ramp S and then returning to I-95 northbound via a temporary ramp that connects to the ultimate Ramp B-1. Point control (police officers) will be required at the intersections along Road A to facilitate the right turn movements onto and off Road A when the detour is in place. Additionally, the proposed detour plan will reduce northbound SR 1 to one lane approaching Road A during the closure period to allow the detoured I-95 traffic to enter SR 1 northbound freely in the right lane. It is anticipated that this detour will be required for northbound I-95 traffic a total of approximately 15 nights during construction.

During the required southbound I-95 closures, all traffic will exit at Churchmans Road, continue west, and turn left at the signalized intersection with the SR 7 southbound ramps. Traffic destined for southbound SR 1 will continue straight, while traffic destined for I-95 southbound will take the exit back to I-95 south. It is anticipated that detours will be required for southbound I-95 traffic a total of approximately ten (10) nights during construction.

Detour #5 – Ramp C

Ramp C is a loop ramp that carries the movement from northbound I-95 to northbound SR 7. The proposed interchange improvements replace this loop ramp with a new flyover ramp over SR 1. During construction Phase 5, this movement will have to be temporarily detoured while construction work is completed for the tie-in of the new flyover ramp. Northbound I-95 traffic will be detoured to the SR 1 southbound ramp and will exit SR 1 southbound at the loop ramp to Road A. The detoured traffic will continue along Road A, with traffic returning to SR 1 northbound via Ramp S and following SR 1 until it becomes SR 7 at the end of the detour route. It is anticipated that this detour will be required over the course of two or three weekends while the tie-ins are completed.

As with Detour #1, this closure may also impact ambulance access to the hospital. Early coordination should be undertaken between DelDOT, emergency services, and the hospital. Refer to Section IV-B of this report for additional information regarding outreach efforts to emergency services.

Detour #6 – Ramp R-1

Ramp R-1 carries traffic from SR 1 southbound to the Christiana Mall. During construction Phase 7, this movement will have to be temporarily detoured while construction work is completed on this ramp. Mall traffic will be detoured south to the loop ramp at Road A and will be able to access the Mall via Road A. This detour will not be permitted during the peak holiday shopping season between November 1 and January 15.

Detour #7 – Ramp E / Ramp E-1

Detour 7 accommodates the required temporary closures of Ramp E and Ramp E-1. Ramp E provides the major movement from northbound SR 1 to northbound I-95. This movement will have to be temporarily closed during night-time hours on approximately two weekends to complete required phase shifts. The detour route will take northbound SR 1 traffic through three loop ramps within the I-95 / SR 1 interchange to access northbound I-95. Ramp E-1 is a minor ramp that provides access from the Christiana Mall directly to I-95 northbound. This ramp will be closed throughout the project between Phase 1 and Phase 6. The detour route will re-direct mall traffic to other exit locations at Ramp U-1 and Ramp S.

E. Acceptable Lane Closure Schedule

Operational analyses were performed to determine the night-time hours that lanes could be closed on I-95 and SR 1 without generating significant queues and delays. Analyses were performed using 24-hour traffic projections developed along I-95 and SR 1 for weekdays and weekends during both summer and non-summer periods. A spreadsheet tool was used to determine the projected queues and delays associated with potential closure periods based on a comparison of capacity and demand for each hour. Based on these analyses, the project team developed **Tables 2 through 5**, which show the times that the contractor will be permitted to close lanes on I-95 and SR 1 during construction. "Summer" time periods are defined as May 15 through September 15. These tables will be included in the contract documents.

Table 2. Allowable Lane Closures on I-95 During Summer Time Periods

Summer Time Period		3 Lanes Open; 1 Lane Closed	2 Lanes Open; 2 Lanes Closed	1 Lane Open; 3 Lanes Closed (Detour)
Monday PM through Friday AM	**Begin Setup**	9:00 PM	10:00 PM	12:00 mid
	End	5:00 AM	5:00 AM	5:00 AM
Friday PM through Saturday AM	**Begin Setup**	10:00 PM	12:00 mid	Not allowed
	End	8:00 AM	6:00 AM	
Saturday PM through Sunday AM	**Begin Setup**	8:00 PM	10:00 PM	
	End	8:00 AM	7:00 AM	
Sunday PM through Monday AM	**Begin Setup**	9:00 PM	11:00 PM	
	End	5:00 AM	5:00 AM	

Table 3. Allowable Lane Closures on I-95 During Non-Summer Time Periods

Non-Summer Time Period		3 Lanes Open; 1 Lane Closed	2 Lanes Open; 2 Lanes Closed	1 Lane Open; 3 Lanes Closed (Detour)
Monday PM through Friday AM	**Begin Setup**	7:00 PM	9:00 PM	11:00 PM
	End	5:00 AM	5:00 AM	5:00 AM
Friday PM through Saturday AM	**Begin Setup**	9:00 PM	10:00 PM	12:00 mid
	End	9:00 AM	7:00 AM	6:00 AM
Saturday PM through Sunday AM	**Begin Setup**	7:00 PM	10:00 PM	12:00 mid
	End	10:00 AM	9:00 AM	7:00 AM
Sunday PM through Monday AM	**Begin Setup**	8:00 PM	10:00 PM	12:00 mid
	End	5:00 AM	5:00 AM	5:00 AM

Table 4. Allowable Lane Closures on SR 1 During Summer Time Periods

Summer Time Period		Northbound 1 Lane Open; 1 Lane Closed (Detour)	Southbound 1 Lane Open; 1 Lane Closed (Detour)
Monday PM through Friday AM	**Begin Setup**	10:00 PM	11:00 PM
	End	5:00 AM	6:00 AM
Friday PM through Saturday AM	**Begin Setup**	Not allowed	Not allowed
	End		
Saturday PM through Sunday AM	**Begin Setup**		
	End		
Sunday PM through Monday AM	**Begin Setup**		
	End		

Table 5. Allowable Lane Closures on SR 1 During Non-Summer Time Periods

Non-Summer Time Period		Northbound 1 Lane Open; 1 Lane Closed (Detour)	Southbound 1 Lane Open; 1 Lane Closed (Detour)
Monday PM through Friday AM	**Begin Setup**	9:00 PM	10:00 PM
	End	5:00 AM	6:00 AM
Friday PM through Saturday AM	**Begin Setup**	11:00 PM	12:00 mid
	End	8:00 AM	7:00 AM
Saturday PM through Sunday AM	**Begin Setup**	11:00 PM	10:00 PM
	End	9:00 AM	9:00 AM
Sunday PM through Monday AM	**Begin Setup**	11:00 PM	10:00 PM
	End	5:00 AM	6:00 AM

In addition to the restrictions outlined in the Tables 1 through 4, the contractor will not be permitted to close lanes during the following holiday periods and special events:

- New Year's Day – December 31 through January 3
- Easter Weekend – Friday through Sunday
- Memorial Day Weekend – Thursday through Tuesday
- NASCAR Race Weekends – Thursday through Day After Race Event
- Fourth of July Holiday – July 3 through July 5
- Labor Day Weekend – Thursday through Tuesday
- Thanksgiving Holiday – Wednesday through Monday
- Christmas – December 24 through December 27

The project team is also developing a table of potential lane closure penalties that could be assessed to the contractor if lanes are not re-opened on-time, based on the calculated road user costs associated with the late opening of lanes. These values could be included in the contract documents to provide incentive for the timely completion of night work, thereby minimizing the overall operational work zone impacts of the project.

F. Potential Diversion Routes

Although most traffic movements will be maintained throughout construction, some motorists may voluntarily choose to divert around the work zone to avoid the work zone impacts. Early in the TMP development process, the project team identified the following corridors that would likely serve additional traffic during construction of the I-95 / SR 1 interchange project due to diversions:

- SR 2
- SR 4
- SR 141
- SR 273
- US 40
- US 13

The purpose of this exercise was to identify potential improvement projects along these corridors that could be implemented prior to the reconstruction of the I-95 / SR 1 interchange. However, after discussions with DelDOT Traffic staff, it was determined that all signals along the expected diversion routes are either currently "on-system" (remotely accessible by DelDOT via the Transportation Management Center (TMC) and responsive to changing traffic volumes), or scheduled to be placed on-system by other projects. Therefore, impact management strategies related to upgrading signals along potential diversion routes will not be required for the I-95 / SR 1 interchange project.

IV. Work Zone Impact Management Strategies

In accordance with DelDOT guidelines for a Type "B" TMP, a Temporary Traffic Control Plan (TTCP), a Public Outreach Plan (PO), and a Transportation Operations Plan (TO) have been developed for the I-95 / SR 1 interchange project to outline the work zone impact management strategies to be implemented during construction. These plans are discussed below.

A. Temporary Traffic Control Plan

A Temporary Traffic Control Plan (TTCP) is under development and will be included as part of the Contract Documents for this project. The TTCP is being prepared in accordance with the Delaware Manual on Uniform Traffic Control Devices (DE-MUTCD) and DelDOT's Road Design

Guide. Any changes to the TTCP proposed by the contractor must be reviewed and approved by DelDOT and updated in the TMP document by DelDOT's design consultant (RK&K).

The DelDOT publication "Work Zone Safety and Mobility Procedures and Guidelines" provides a list of various control strategies, traffic control devices, and innovative construction strategies that can be included in a TTCP to facilitate traffic flow through and around work zones and to promote safety. The following elements have been included in the Temporary Traffic Control Plan for the I-95 / SR 1 interchange project:

- Construction Phasing
- Full Roadway Closures
- Lane Shifts
- Channelizing Devices
- Reduced Lane Widths to Maintain Number of Lanes
- Ramp Closures/Relocations
- Night Work
- Business Access Improvements
- Off-Site Detours
- Temporary Signs
- Changeable Message Signs
- Temporary Pavement Markings
- Lighting Devices
- Project Coordination
- Contracting Strategies

It should be noted that innovative construction techniques, such as accelerated bridge construction using self-propelled modular transporters (SPMTs), were also considered, but were not deemed to be cost-effective.

B. Public Outreach Plan

It is necessary that public outreach strategies be used to inform the public in advance of the beginning of the project to ensure that the project proceeds smoothly and the public is aware of construction activities and impacts to the traveling public. The following public outreach strategies will be used to inform the public of activities associated with this project:

- Coordination with affected stakeholders – DelDOT Public Relations staff will coordinate with impacted business and organizations whose access will be impacted by construction activity. The affected stakeholders include the Christiana Mall and Christiana Hospital. DelDOT will continue its ongoing coordination with the Mall to discuss temporary access restrictions and upcoming traffic pattern changes for Mall staff and customers. DelDOT will also notify the Hospital in advance of construction phases requiring ramp closures and detours. This advance notice is necessary to give the Hospital staff time to plan alternate emergency routes. DelDOT will prepare a presentation for emergency services staff as part of a Transportation Management Team meeting during the final design phase of the project.
- Changeable Message Signs (CMS) – Fixed and portable changeable message signs will be placed strategically within and around the project limits to convey information to travelers. These signs will provide real time information to drivers concerning specific work operations, traffic patterns, travel times, and upcoming changes. These messages will be especially important for long-distance travelers who are not able to receive project information via the local media.
- Announcements in local media market – It will be the responsibility of DelDOT to provide news releases to local media, including the *Wilmington News Journal*, WDEL radio and

other traffic reporting stations to keep the traveling public informed of the start of the project as well as individual MOT switches, which result in full roadway closures.

- Project website – DelDOT will regularly update the project website with information regarding current traffic patterns and travel conditions within the work zone.
- Project information brochure – RK&K will develop a project information brochure for DelDOT that can be distributed at local businesses and major traffic generators, including the Christiana Mall and Christiana Hospital. The brochure will inform the public of the project and provide information regarding the project website and public meetings.
- Dissemination of traveler information through the local Transportation Management Association (TMA).
- DelDOT Travelers Advisory Radio Station (WTMC-1380AM) - It will be the responsibility of the Transportation Management Center staff to prepare and broadcast the necessary radio messages associated with ramp closures, night-time roadway closures, and other construction impacts for this project.
- DelDOT Real-Time Travelers Advisory Website - It will be the responsibility of the Transportation Management Center staff to update the travelers' advisory information on the DelDOT website based on current conditions for this project.

C. Transportation Operations Plan

Transportation operations (TO) strategies are used to mitigate work zone impacts through the use of improved management of the transportation system. The following TO strategies have been incorporated into the I-95 / SR 1 interchange project at the final design stage:

Limit Allowable Lane Closure Periods

As discussed in Section III-D of this report, lane closures and roadway closures along SR 1 and I-95 will be restricted to off-peak night-time hours when the operational impact would be minimal. A table of acceptable lane closure hours was presented earlier in this report in Section III-D. Penalties will be assessed to the contractor if lanes are not re-opened on-time.

Innovative Contract Delivery Methods

One of the most effective ways to reduce the safety and mobility impacts of the work zone is to minimize the construction duration. This can be achieved by utilizing innovative contract delivery methods that promote aggressive and creative construction schedules to complete the job faster. Reducing the duration of the construction work has several benefits including:

- Limiting the exposure of the workers to safety hazards
- Minimizing the inconvenience that motorists experience while the work zone is present
- Realizing the safety and operational benefits of the finished product sooner.

One example of an innovative contract delivery method is A+B bidding. In A+B bidding, a contractor bids both the project cost for work items (part A) and the total number of days to complete the project (part B). The winning bid is determined by combining the part A cost with the road user costs associated with part B. This strategy was used effectively for the I-95 5th lane widening project, with that project being completed in 1.5 years instead of the projected three (3) years. This contracting strategy could potentially be used for the I-95 / SR 1 interchange project.

Speed Limit Reduction

A temporary work zone speed limit will be used on SR 1 during construction to improve safety and help protect the workers. The speed limit along SR 1 will be reduced from 50 mph to 40 mph during construction, which accounts for physical constraints along SR 1, such as narrow lanes and reduced shoulder widths.

It should be noted that a reduced speed limit was also originally proposed along I-95. However, field data collected by DelDOT during the 5th lane widening project indicated minimal compliance with the reduced speed limit along mainline I-95 during construction. For the few vehicles that actually reduced to 45 mph, a safety concern was created due to the large speed differential between vehicles driving at the reduced speed limit and vehicles driving at 75 mph. Therefore, the project team proposes to keep the 55 mph speed limit on I-95 and to work with the State Police for better enforcement of this speed limit during construction.

ITS for Traffic Monitoring

DelDOT's TMC will monitor traffic operations within the work zone via traffic cameras. There are currently two permanent traffic cameras located within the project limits; one along the Christiana Mall Ring Road, and another along northbound I-95 at the I-95 / SR 1 interchange. Additionally, DelDOT plans to install approximately six (6) additional traffic detectors to constantly monitor traffic operations. The detectors will be located along northbound and southbound SR 1, and at each end of the project limits along northbound and southbound I-95. These detectors can alert the TMC to changing travel patterns and warn of potential incidents. When a disturbance is identified by the detectors and/or cameras, traveler information can be provided to motorists from the TMC via changeable message signs (CMS), and adjustments can be made to the work zone to eliminate the problem. DelDOT anticipates the need for approximately seven (7) CMS boards, placed in strategic locations within and around the work zone for use during the project to notify travelers of upcoming traffic pattern changes and to warn motorists of incidents and/or congestion ahead. Additional information related to the use of the PCMS boards as part of the contingency plan is included in Section VI of the report. Costs related to these traffic monitoring devices are outlined in Chapter VII of this report.

Incident Management

DelDOT's TMC will coordinate and manage traffic and incident management activities in and around the work zone. Prior to beginning construction, the Contractor should provide the DelDOT TMC with a current list of contact information for key field and office personnel, including 24-hour emergency phone numbers and an updated construction schedule. If an incident takes place within the work zone, it will be important to safely and efficiently remove the vehicles that break down, particularly in locations where shoulders have been removed or temporarily eliminated to accommodate construction vehicles. Lane blockages can quickly lead to deteriorating traffic conditions, length delays, and angry motorists. Rapid response to these incidents is critical. As discussed in the Traffic Monitoring section, traffic cameras, traffic detectors, and CMS boards will be utilized on the project for incident management.

Signal Timing / Coordination Improvements

As discussed in Section III-F of this report, all of the signalized intersections along the critical corridors within the study area for the I-95 / SR 1 interchange project are currently on-system, and can communicate with the TMC. However, DelDOT anticipates the need to upgrade the fiber communications connections along the SR 273 corridor to improve signal coordination during the project, particularly when detours are required along SR 273.

Media Coordination

DelDOT's Public Relations section and the TMC will work with the local media to publicize information regarding traffic delays and incidents. An important part of this strategy is to work with the media contacts in advance of the project to establish procedures to be followed in the event of a major delay or incident.

Additional Transportation Operations Strategies To Be Considered

The TO strategies outlined in this section have been incorporated into the I-95 / SR 1 interchange project at the final design stage. It is recommended that the following additional TO strategies are considered by DelDOT and the project team before and during construction:

- Examine potential upgrades to local transit services to promote non-auto travel during construction activity.
- Work with local businesses to promote carpooling, telecommuting, and other demand management strategies during construction.
- Consider implementing incentive/disincentive clauses into the contract for certain critical construction phases to minimize construction duration.

V. TMP Monitoring Plan

It is important for DelDOT to monitor safety and mobility throughout the duration of construction of the I-95 / SR 1 interchange project. There are two primary components of the TMP monitoring plan for this project. The first component is related to monitoring traffic flow within and around the work zone during construction, and responding to incidents quickly and efficiently. This component of the monitoring plan is primarily the responsibility of the TMC, but DelDOT has also requested that RK&K assist with data collection during certain peak periods and major phase switches. RK&K will be responsible for documenting traffic operations during these periodic reviews and will assist DelDOT with their post-evaluation effort. RK&K will attend Transportation Management Team meetings to discuss the monitoring plan prior to advertisement of the project and during the project, and will also meet with the DelDOT Safety Section and TMC staff prior to construction and before major traffic switches. The TMC and/or the Contractor should also periodically monitor queue lengths and delays at various locations within the work zone to determine whether projected impacts match the observed conditions in the field. This effort can be accomplished remotely from the TMC using information obtained from traffic detectors and cameras, or through data collected during field visits.

The second component of the TMP monitoring plan is related to ensuring that the MOT elements and TMP recommendations are being properly implemented in the field on a day-to-day basis throughout the construction period, and insuring that proposed construction set-ups are working as anticipated. Routine work zone reviews should be performed by DelDOT inspectors and the District Safety Officer using the Department's standard traffic control inspection report form to ensure that signs, barriers, barrels, and cones are properly placed according to the design plans and that traffic control devices are maintained in accordance with specifications. Reviews should be performed during both the day and night, due to differences in lighting, sign reflectivity, and other factors. If a crash occurs within the work zone, the DelDOT Safety Section shall respond immediately to prepare a report of the incident and ensure that the Temporary Traffic Control Plan elements are properly in-place at the time of the incident.

The TMP can be revised as necessary in response to identified issues or deficiencies determined during the monitoring stage of the project. Some of the anticipated monitoring and incident management strategies recommended for the I-95 / SR 1 interchange project were discussed in detail in Chapter IV of this report.

VI. Contingency Plan

A contingency plan is an important component of the TMP that outlines the activities that should be undertaken to minimize traffic impacts when unexpected events occur in the work zone, such as crashes, inclement weather, and unusually high traffic demand.

For a complex work zone like the one required for I-95 / SR 1 interchange project, it is difficult to project exactly where incidents may occur and at what locations traveler information will be the most useful. Therefore, one component of the contingency plan for the I-95 / SR 1 interchange project will be to determine a centralized staging area for equipment, including cones, barrels, detour signs, and arrows, that can be deployed quickly in response to an emergency in the work zone. Possible locations include the park and ride lot at the Christiana Mall or the DelDOT North District Office adjacent to I-95. DelDOT also anticipates having approximately seven (7) CMS boards strategically placed in the field at pre-determined locations that can be activated remotely from the TMC office in Smyrna to display sign messages to alert travelers to an incident or other travel hazard. It is anticipated that CMS boards will initially be placed at the following locations:

- Along northbound I-95, east of the I-95 / SR 896 interchange
- Along northbound I-95, east of the I-95 / SR 273 interchange
- Along northbound SR 1, north of the SR 1 / US 40 interchange
- Along northbound SR 1, north of the SR 1 / SR 273 interchange
- Along southbound SR 7, north of I-95
- Along southbound I-95, west of the I-95 / SR 141 interchange
- Near the Christiana Mall ramps within the I-95 / SR 1 interchange

Since the CMS boards are portable, they can also be moved around, as necessary. Specific sign messages will be developed on a case-by-case basis by the TMC.

If at any point during construction work zone conditions are deemed unsafe by the North District DelDOT Safety Officer, changes may be requested to the traffic control set-ups. The Safety Officer will communicate all safety issues with the lead construction inspector or a designee, and all issues will be corrected within the time period specified by the Safety Officer. The Safety Officer has the authority to shut the project down in cases where there is immediate danger to the construction workers or the traveling public. **Table 6** below summarizes the emergency contacts for the project in the event that an incident occurs within the work zone. This table will be updated with additional contact information as it becomes available throughout the project.

Table 6. Project Personnel Contact Information

Name	Title / Agency	Phone Number
Adam Weiser	DelDOT Safety Programs Manager	302-222-5905
Wayne Hamilton	North District Safety Officer	302-222-5997
Gerald Nagyiski, Jr.	Chief Safety Officer	302-222-5977
	Project Supervisor	
	Project Resident	
	Area Engineer	
	Project Engineer	
	Construction Engineer	

Note: Information to be completed once construction contract is awarded.

VII. TMP Implementation Costs

Most of the costs associated with the implementation of the recommendations from the TMP for the I-95 / SR 1 interchange project are standard costs related to the Temporary Traffic Control Plan, which have been included in the construction cost estimates. However, there are a few additional items required to implement some of the recommended transportation operations strategies that will need additional DelDOT funding. These items include real-time traffic monitoring station (RTMS) detectors, which can be purchased using funds from the I-95 / SR 1 interchange project budget through an existing DelTrac state contract (the DelTrac state contract will simply be the mechanism used to acquire, but not pay for, the devices). There will also be a cost associated with the fiber upgrades required along SR 273. This work can be performed by DelDOT Traffic on-call forces. The CMS boards that will be used for the project were previously purchased for the I-95 Toll Plaza project. **Table 7** below summarizes the TMP implementation costs for the I-95 / SR 1 project, with a total cost of $501,000.

Table 7. TMP Implementation Costs

Item	Quantity	Unit Cost	Total Cost
CMS Boards	7	$19,950	$0*
RTMS Detectors	6	$16,500	$99,000
Upgrade Fiber	N/A	N/A	$402,000
Total			$501,000

** Note: The I-95 / SR 1 interchange project will use CMS boards previously purchased for the I-95 Toll Plaza project.*

APPENDIX A

CONSTRUCTION PHASING PLANS

PHASE 1

Legend

←	Proposed Traffic Flow During Construction
🟦	Permanent Roadway Under Construction
🟨	Permanent Roadway Previously Built
🟩	Temporary Roadway Under Construction
🟩	Temporary Roadway Previously Built
▨	Temporary Roadway Under Construction - With Traffic
▨	Temporary Roadway Previously Built - With Traffic
🟦	Permanent Storm Water Management Facilities
△	Waters of the US, Including Wetlands
—EXIST. R/W—	Existing Right of Way & Property Lines
—R/W—	Proposed Right of Way & Property Lines
■—■	Proposed Drainage
RSF SCD IP	Proposed Erosion and Sediment Control Devices
	Proposed MOT Devices and Striping
▨	Proposed Milling and Overlay / Wedge and Level

NOTE:

1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT.
2. USE CASE 14 MODIFIED AS REQUIRED TO INSTALL TEMPORARY RAMP TRANSITION ONTO ADJACENT PAVEMENT.

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 1

RK&K RUMMEL, KLEPPER & KAHL, LLP
CONSULTING ENGINEERS

APRIL 2010

Construct Ramp As First Order of Work

Legend

←	Proposed Traffic Flow During Construction	🟦	Permanent Storm Water Management Facilities
🟦	Permanent Roadway Under Construction	△	Waters of the US, Including Wetlands
🟨	Permanent Roadway Previously Built	—EXIST. R/W—	Existing Right of Way & Property Lines
🟩	Temporary Roadway Under Construction	—R/W—	Proposed Right of Way & Property Lines
🟩	Temporary Roadway Previously Built	■—■	Proposed Drainage
▨	Temporary Roadway Under Construction - With Traffic	RSF SCD IP	Proposed Erosion and Sediment Control Devices
▨	Temporary Roadway Previously Built - With Traffic		Proposed MOT Devices and Striping
		▨	Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 1

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 1

RK&K RUMMEL, KLEPPER & KAHL, LLP
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Legend

←	Proposed Traffic Flow During Construction
🟦	Permanent Roadway Under Construction
🟨	Permanent Roadway Previously Built
🟩	Temporary Roadway Under Construction
🟩	Temporary Roadway Previously Built
▨	Temporary Roadway Under Construction - With Traffic
▨	Temporary Roadway Previously Built - With Traffic
▭	Permanent Storm Water Management Facilities
△	Waters of the US, Including Wetlands
—EXIST. R/W—	Existing Right of Way & Property Lines
—R/W—	Proposed Right of Way & Property Lines
■—■	Proposed Drainage
RSF SCD IP	Proposed Erosion and Sediment Control Devices
	Proposed MOT Devices and Striping
▨	Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 2

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 2

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Legend

- ← Proposed Traffic Flow During Construction
- 🟦 Permanent Roadway Under Construction
- 🟨 Permanent Roadway Previously Built
- 🟩 Temporary Roadway Under Construction
- 🟩 Temporary Roadway Previously Built
- ▨ Temporary Roadway Under Construction - With Traffic
- ▨ Temporary Roadway Previously Built - With Traffic
- ▭ Permanent Storm Water Management Facilities
- △ Waters of the US, Including Wetlands
- —EXIST. R/W— Existing Right of Way & Property Lines
- —R/W— Proposed Right of Way & Property Lines
- ■—■ Proposed Drainage
- Proposed Erosion and Sediment Control Devices
- Proposed MOT Devices and Striping
- ▨ Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 2

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 2

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PHASE 3

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 3

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Legend

- ← Proposed Traffic Flow During Construction
- 🟦 Permanent Roadway Under Construction
- 🟨 Permanent Roadway Previously Built
- 🟩 Temporary Roadway Under Construction
- 🟩 Temporary Roadway Previously Built
- ▨ Temporary Roadway Under Construction - With Traffic
- ▨ Temporary Roadway Previously Built - With Traffic
- ▭ Permanent Storm Water Management Facilities
- △ Waters of the US, Including Wetlands
- —EXIST. R/W— Existing Right of Way & Property Lines
- —R/W— Proposed Right of Way & Property Lines
- ■—■ Proposed Drainage
- Proposed Erosion and Sediment Control Devices
- Proposed MOT Devices and Striping
- ▨ Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 3

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 3

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PHASE 4

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I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 4

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Legend

- ← Proposed Traffic Flow During Construction
- 🟦 Permanent Roadway Under Construction
- 🟨 Permanent Roadway Previously Built
- 🟩 Temporary Roadway Under Construction
- 🟩 Temporary Roadway Previously Built
- ▨ Temporary Roadway Under Construction - With Traffic
- ▨ Temporary Roadway Previously Built - With Traffic
- 🟦 Permanent Storm Water Management Facilities
- △ Waters of the US, Including Wetlands
- EXIST. R/W Existing Right of Way & Property Lines
- R/W Proposed Right of Way & Property Lines
- Proposed Drainage
- Proposed Erosion and Sediment Control Devices
- Proposed MOT Devices and Striping
- ▨ Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 4

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 4

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NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 5

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 5

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Legend

- ← Proposed Traffic Flow During Construction
- 🟦 Permanent Roadway Under Construction
- ▨ Permanent Roadway Previously Built
- 🟩 Temporary Roadway Under Construction
- ▨ Temporary Roadway Previously Built
- ▨ Temporary Roadway Under Construction - With Traffic
- ▨ Temporary Roadway Previously Built - With Traffic
- ■ Permanent Storm Water Management Facilities
- △ Waters of the US, Including Wetlands
- —EXIST. R/W— Existing Right of Way & Property Lines
- —R/W— Proposed Right of Way & Property Lines
- ■—■ Proposed Drainage
- Proposed Erosion and Sediment Control Devices
- Proposed MOT Devices and Striping
- ▨ Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 5

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 5

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Legend

← Proposed Traffic Flow During Construction
🟦 Permanent Roadway Under Construction
🟨 Permanent Roadway Previously Built
🟩 Temporary Roadway Under Construction
🟩 Temporary Roadway Previously Built
▨ Temporary Roadway Under Construction - With Traffic
▨ Temporary Roadway Previously Built - With Traffic
🟦 Permanent Storm Water Management Facilities
△ Waters of the US, Including Wetlands
—EXIST. R/W— Existing Right of Way & Property Lines
—R/W— Proposed Right of Way & Property Lines
■—■ Proposed Drainage
Proposed Erosion and Sediment Control Devices
Proposed MOT Devices and Striping
▨ Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT.

PHASE 6

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 6

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APRIL 2010

Legend

←	Proposed Traffic Flow During Construction	▭	Permanent Storm Water Management Facilities
🟦	Permanent Roadway Under Construction	△	Waters of the US, Including Wetlands
🟨	Permanent Roadway Previously Built	—EXIST. R/W—	Existing Right of Way & Property Lines
🟩	Temporary Roadway Under Construction	—R/W—	Proposed Right of Way & Property Lines
▭	Temporary Roadway Previously Built	■—■	Proposed Drainage
▨	Temporary Roadway Under Construction - With Traffic	RSF SCE IP	Proposed Erosion and Sediment Control Devices
▨	Temporary Roadway Previously Built - With Traffic		Proposed MOT Devices and Striping
		▨	Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

PHASE 6

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 6

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PHASE 7

Legend

←	Proposed Traffic Flow During Construction
🟦	Permanent Roadway Under Construction
🟨	Permanent Roadway Previously Built
🟩	Temporary Roadway Under Construction
🟩	Temporary Roadway Previously Built
▨	Temporary Roadway Under Construction - With Traffic
▨	Temporary Roadway Previously Built - With Traffic
🟦	Permanent Storm Water Management Facilities
△	Waters of the US, Including Wetlands
—	Existing Right of Way & Property Lines
—	Proposed Right of Way & Property Lines
—	Proposed Drainage
—	Proposed Erosion and Sediment Control Devices
—	Proposed MOT Devices and Striping
▨	Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 7

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Legend

←	Proposed Traffic Flow During Construction	▇	Permanent Storm Water Management Facilities
▇	Permanent Roadway Under Construction	△	Waters of the US, Including Wetlands
▇	Permanent Roadway Previously Built	—EXIST. R/W—	Existing Right of Way & Property Lines
▇	Temporary Roadway Under Construction	—R/W—	Proposed Right of Way & Property Lines
▇	Temporary Roadway Previously Built	■—■	Proposed Drainage
▨	Temporary Roadway Under Construction - With Traffic		Proposed Erosion and Sediment Control Devices
▨	Temporary Roadway Previously Built - With Traffic		Proposed MOT Devices and Striping
		▨	Proposed Milling and Overlay / Wedge and Level

NOTE:
1. REFER TO DE MUTCD MANUAL FOR SIGN PLACEMENT

0 50 100 SCALE OF FEET
0 .025 SCALE OF MILES

PHASE 7

Delaware Department of Transportation

I-95 / SR1 INTERCHANGE IMPROVEMENTS

CONSTRUCTION PHASING
Phase 7

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APRIL 2010

APPENDIX B

DETOUR PLANS

CHANGEABLE MESSAGE BOARDS

PRIOR TO DETOUR

CMS–1 (10 DAYS PRIOR TO BEGINNING OF DETOUR)

SR 1 NB
CLOSING
AT MALL

STARTING
XX/XX/XX
XXPM–XAM

DURING DETOUR

CMS–1

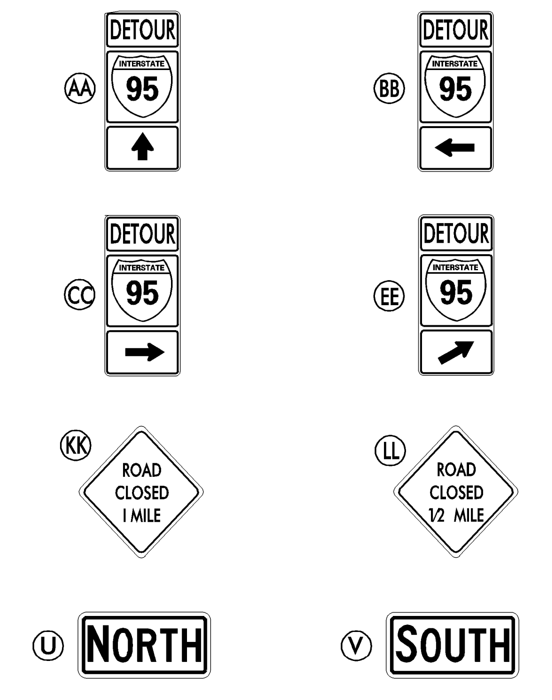
SR 1 NB
CLOSED
AT MALL

FOLLOW
SR 273
DETOUR

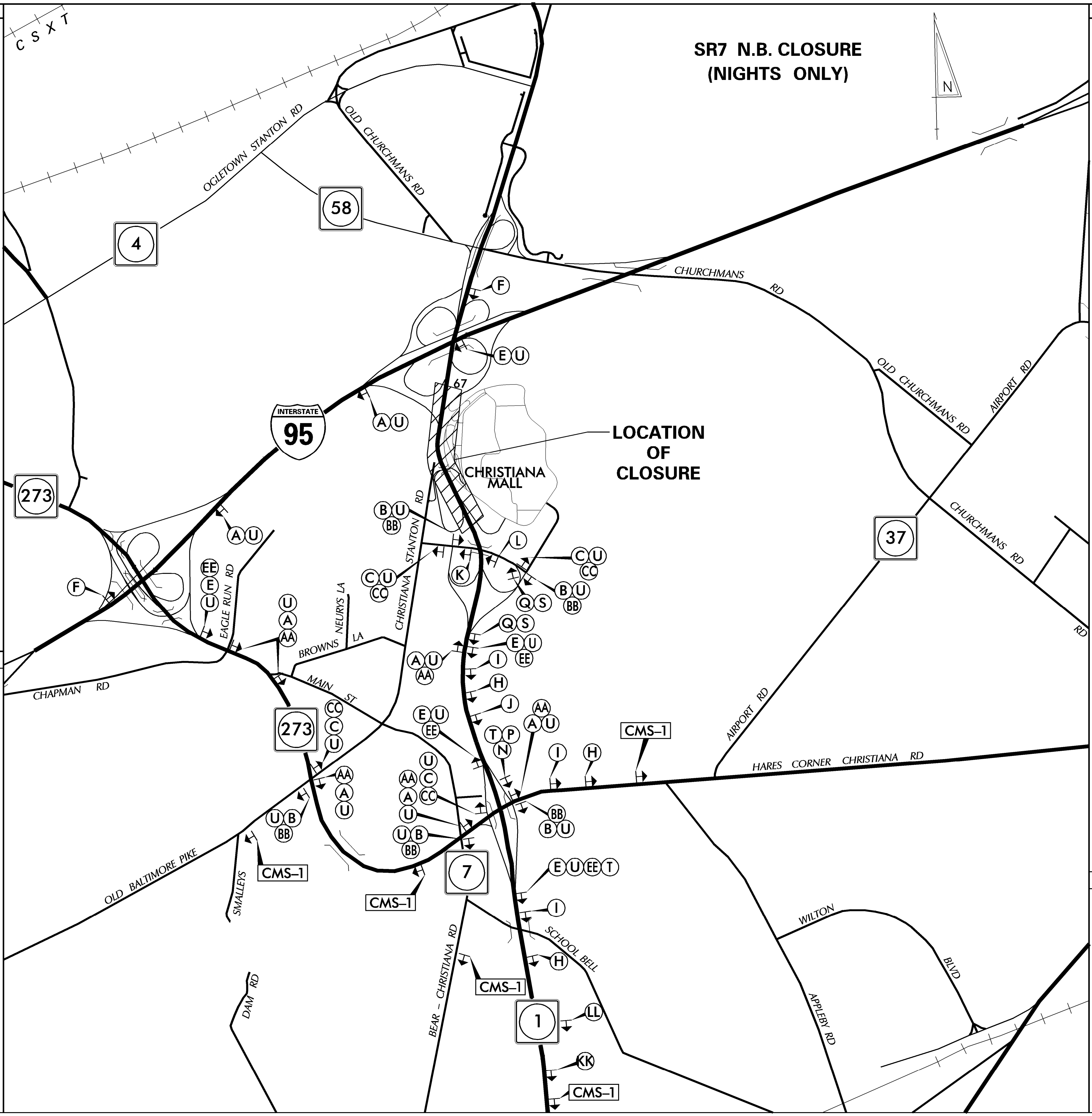
ADDITIONAL NOTES:

1. SIGNS PLACED ON ROADWAYS WITH MORE THAN ONE LANE IN ONE DIRECTION SHALL BE POSTED ON BOTH THE LEFT AND RIGHT SHOULDERS.
2. USE CASE 7 OF THE DE MUTCD TO CLOSE LANES PRIOR TO ROAD CLOSURES.
3. MAINTAIN A SINGLE LANE ON NORTHBOUND SR 1 BETWEEN SR 273 AND MALL ROAD.
4. ALL SIGNS SHOWN ON THIS SHEET, EXCLUDING CHANGEABLE MESSAGE BOARDS, SHALL BE FURNISHED AND INSTALLED UNDER CONTRACT T201009004. THE WARNING SIGNS SHALL BE LEFT IN PLACE AND BECOME THE PROPERTY OF THE T200809003 CONTRACTOR UPON COMPLETION OF THE T201009004 CONTRACT. MAINTENANCE OF THESE SIGNS SHALL BE INCLUDED IN 763500 MAINTENANCE OF TRAFFIC.
5. ALL BARRICADES SHOWN ON THIS SHEET SHALL BE FURNISHED AND INSTALLED UNDER CONTRACT T201009004. THE BARRICADES SHALL BE LEFT IN PLACE AND BECOME THE PROPERTY OF THE T200809003 CONTRACTOR UPON COMPLETION OF THE T201009004 CONTRACT, MAINTENANCE OF THESE BARRICADES SHALL BE INCLUDED IN 763500 MAINTENANCE OF TRAFFIC.

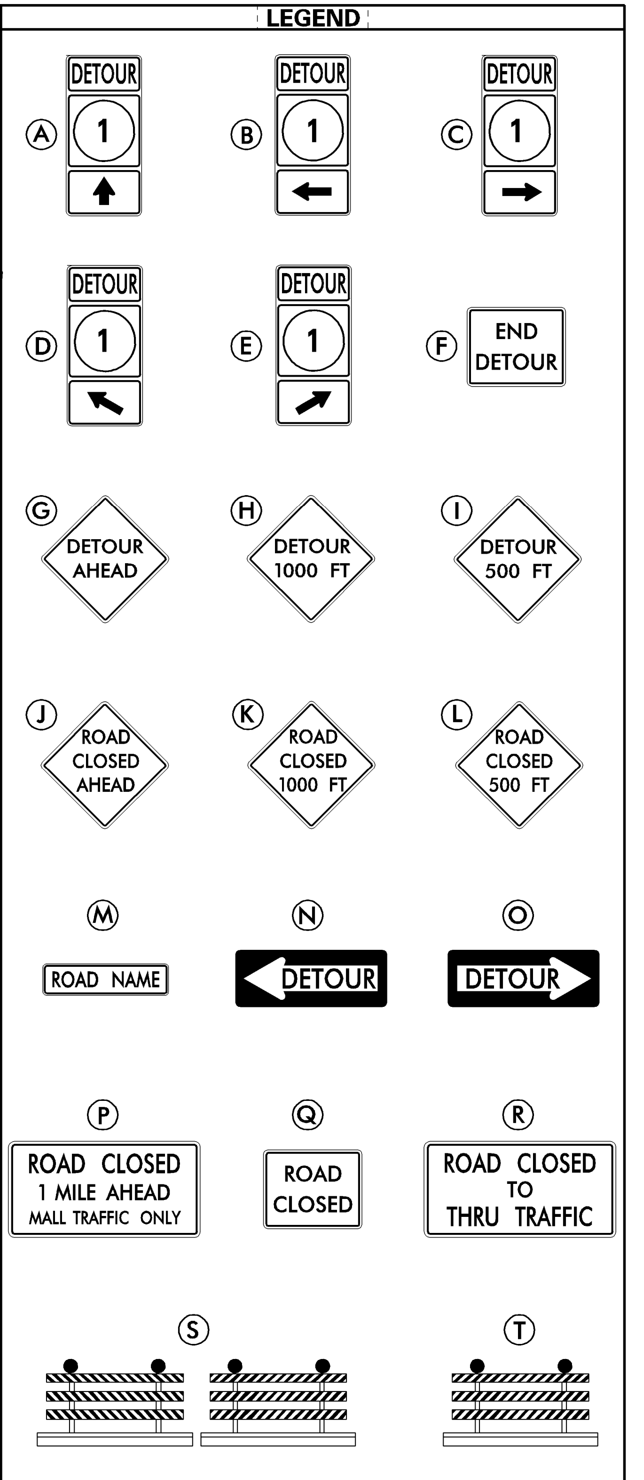
SPECIAL SIGNS



SR7 N.B. CLOSURE (NIGHTS ONLY)



LEGEND



GENERAL NOTES

1. ALL DETOUR SIGNING INCLUDING, TRAILBLAZERS, ARE TO BE SUPPLIED AND MAINTAINED BY THE GENERAL CONTRACTOR IN COMPLIANCE TO THE DE MANUALOF UNIFORM TRAFFIC CONTROL DEVICES.
2. THE CONTRACTOR SHALL COMPLY WITH GUIDELINES IN "THE DELAWARE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (DE- MUTCD PART 6) FOR LIGHTS, BARRICADES AND SIGNS.(AS PER LATEST REVISION)
3. FIELD CONDITIONS MAY DICTATE CHANGES AT SOME TIME DURING THE LIFE OF THE CONTRACT. IN THE EVENT OF OMISSIONS OR CORRECTIONS, THE SIGNING PROVISIONS OF THE DELAWARE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES WILL PREVAIL.
4. SIGNS J THROUGH L AND P THROUGH R ,THE WORD (ROAD) SHOULD BE CHANGED TO RAMP, R/R OR BRIDGE WHERE APPLICABLE.
5. WARNING SIGNS SHOULD BE MOUNTED ON BREAKAWAY POSTS AND HAVE RETROREFLECTIVE FLUORESCENT SHEETING.
6. "S" BARRICADES SHALL COMPLETELY RUN THE FULL WIDTH OF ROADWAY.
7. BARRICADES SHALL BE A MINIMUM OF 6 FEET WIDE UNLESS DIRECTED BY THE ENGINEER.

RECOMMENDED ____________________ DATE: __________

RECOMMENDED ____________________ DATE: __________

RECOMMENDED ____________________ DATE: __________

APPROVED CHIEF SAFETY OFFICER ____________________ DATE: __________

APPROVED TRAFFIC ENGINEER ____________________ DATE: __________

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE
0 1000 2000 3000
FEET

SR1 / I–95 INTERCHANGE

CONTRACT	BRIDGE NO.	X	
T200809003	DESIGNED BY:	JCR	
COUNTY			
NEW CASTLE	CHECKED BY:	MCS/JAB	

DETOUR PLAN 1
SR7 N.B. CLOSURE
RAMPS A, B, R1, C1 & G1

SHEET NO.
674
TOTAL SHTS.
803

9/7/2010 10:41:55 AM
M:\projects\2003\03059_deltrnpk\SR1Mall\Cadd\2809003\Plans\dp01_sr1.dgn

CHANGEABLE MESSAGE BOARDS

CMS–1

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

SR 1 SB CLOSING AT I–95	STARTING XX/XX/XX XXPM–XAM

CMS–1

DURING DETOUR

SR 1 SB CLOSED AT I–95	FOLLOW DETOUR

CMS–2

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

RAMP TO SR 1 SB CLOSING	STARTING XX/XX/XX XXPM–XAM

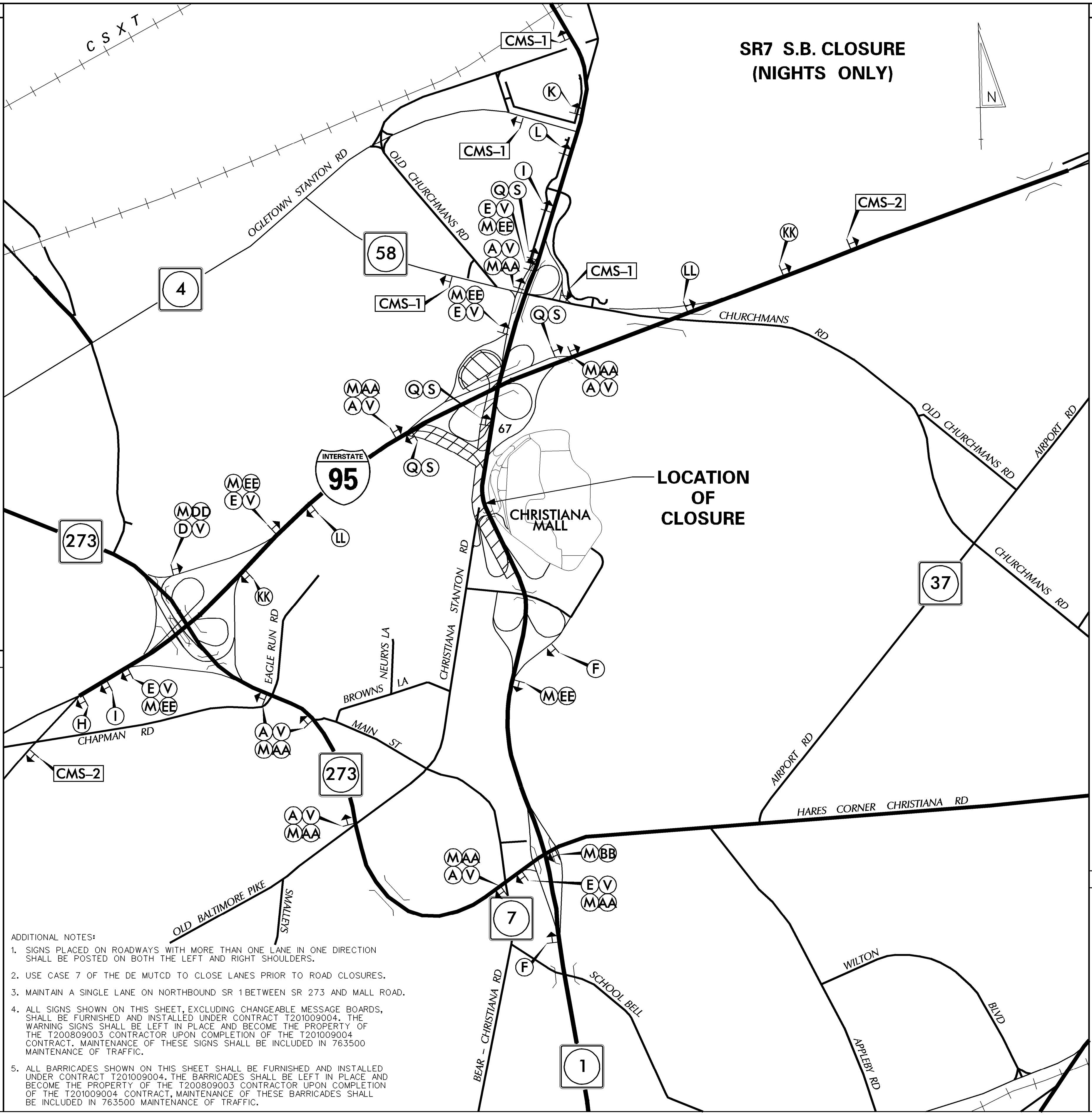
CMS–2

DURING DETOUR

RAMP TO SR 1 SB CLOSED	USE SR 273 EXIT 3

SPECIAL SIGNS

(KK) RAMP CLOSED 1 MILE	(LL) RAMP CLOSED 1/2 MILE
(V) SOUTH	(AA) DETOUR ↑
(BB) DETOUR ←	(CC) DETOUR →
(DD) DETOUR ↖	(EE) DETOUR ↗



ADDITIONAL NOTES:

1. SIGNS PLACED ON ROADWAYS WITH MORE THAN ONE LANE IN ONE DIRECTION SHALL BE POSTED ON BOTH THE LEFT AND RIGHT SHOULDERS.
2. USE CASE 7 OF THE DE MUTCD TO CLOSE LANES PRIOR TO ROAD CLOSURES.
3. MAINTAIN A SINGLE LANE ON NORTHBOUND SR 1 BETWEEN SR 273 AND MALL ROAD.
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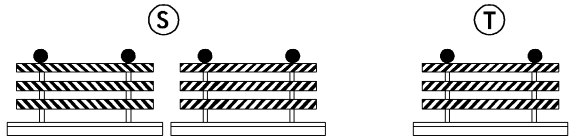
LEGEND

(A) DETOUR 1 ↑	(B) DETOUR 1 ←	(C) DETOUR 1 →
(D) DETOUR 1 ↖	(E) DETOUR 1 ↗	(F) END DETOUR
(G) DETOUR AHEAD	(H) DETOUR 1000 FT	(I) DETOUR 500 FT
(J) ROAD CLOSED AHEAD	(K) ROAD CLOSED 1000 FT	(L) ROAD CLOSED 500 FT
(M) MALL ROAD	(N) ◀ DETOUR	(O) DETOUR ▶
(P) ROAD CLOSED XX MILES AHEAD LOCAL TRAFFIC ONLY	(Q) ROAD CLOSED	(R) ROAD CLOSED TO THRU TRAFFIC



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RECOMMENDED ______________ DATE:________

RECOMMENDED ______________ DATE:________

RECOMMENDED ______________ DATE:________

APPROVED CHIEF SAFETY OFFICER ______________ DATE:________

APPROVED TRAFFIC ENGINEER ______________ DATE:________

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE 0 1000 2000 3000 FEET

SR1 / I–95 INTERCHANGE

CONTRACT	BRIDGE NO.	X		SHEET NO.
T200809003	DESIGNED BY: JCR		**DETOUR PLAN 2** **SR7 S.B. CLOSURE** **RAMPS A, B, R1, C1 & G1**	675
COUNTY				TOTAL SHTS.
NEW CASTLE	CHECKED BY: MCS/JAB			803

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CHANGEABLE MESSAGE BOARDS

CMS-1

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

I-95 NB
NIGHTIME
CLOSURES

STARTING
XX/XX

CMS-1

DURING DETOUR

I-95 ND
CLOSED
AT SR1

FOLLOW
DETOUR

CMS-2

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

RAMP TO
I-95 NB
CLOSURES

NIGHTS
STARTING
XX/XX

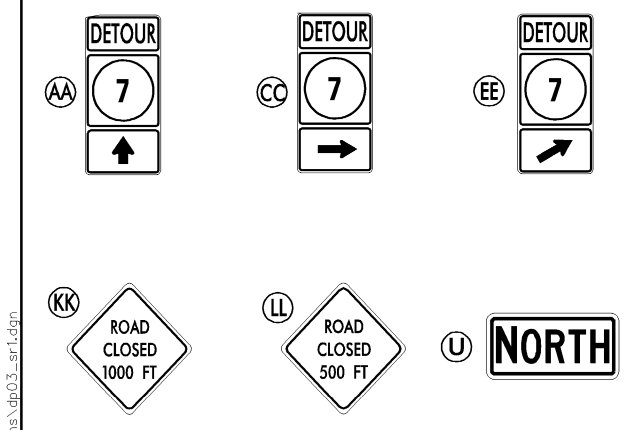
CMS-2

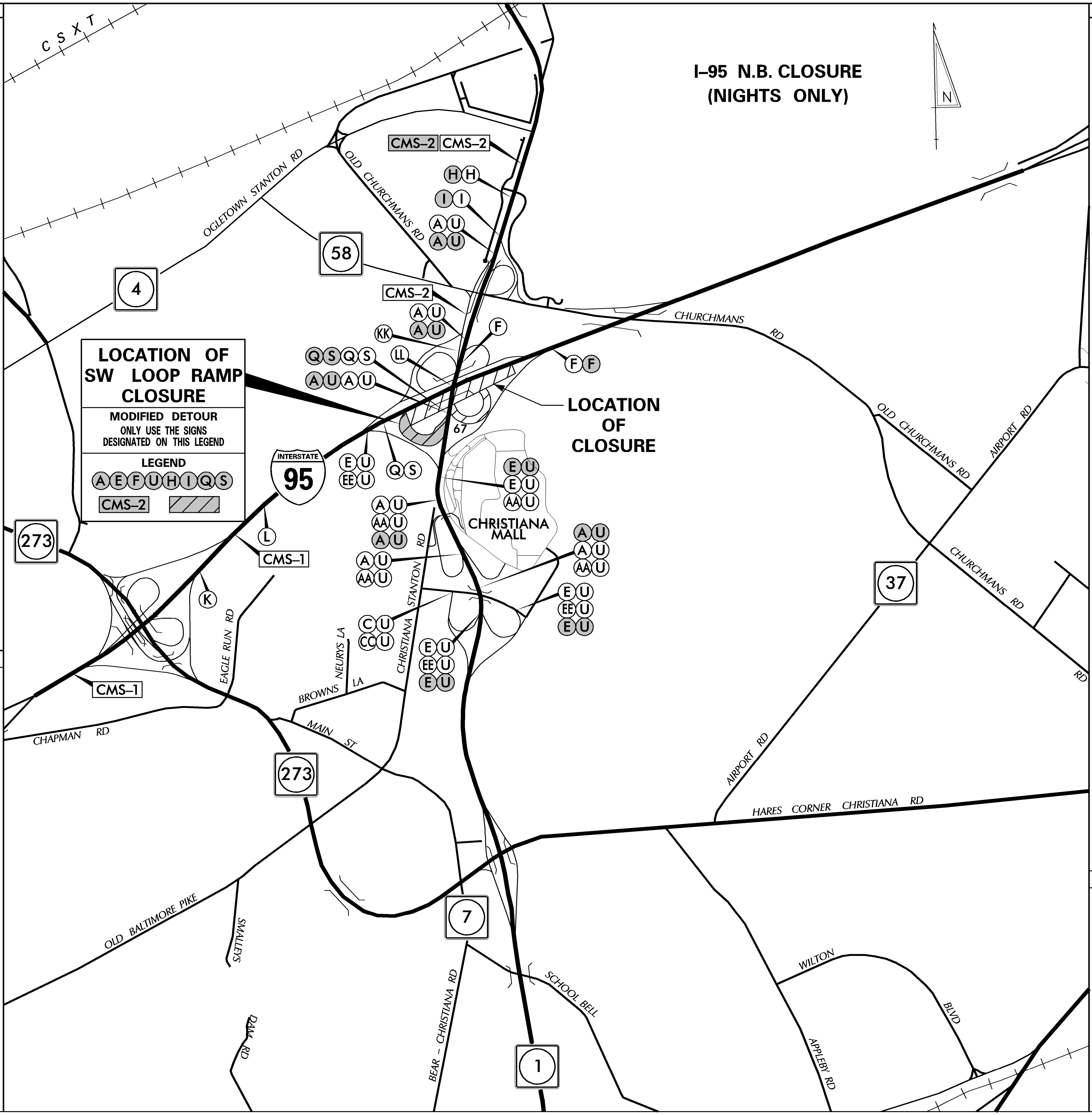
DURING DETOUR

RAMP TO
I-95 NB
CLOSED

FOLLOW
DETOUR

SPECIAL SIGNS





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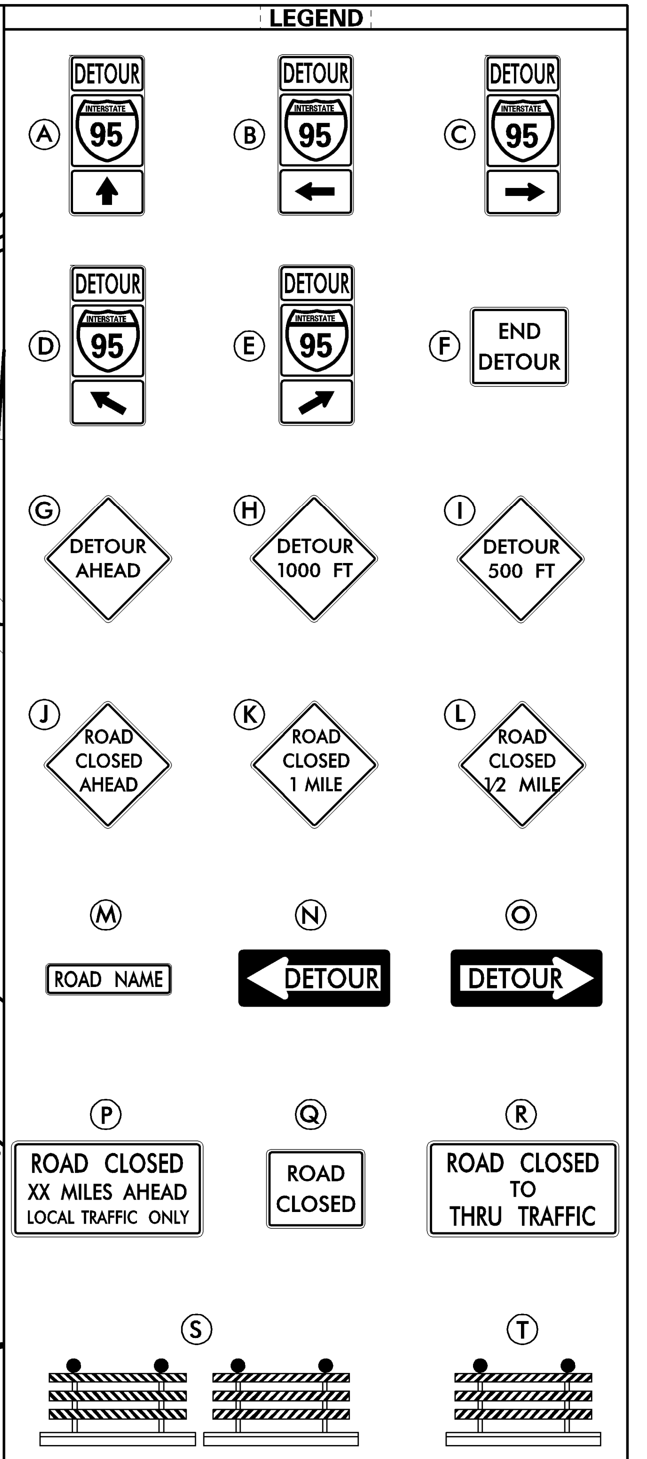

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RECOMMENDED ____________________ DATE:________

RECOMMENDED ____________________ DATE:________

APPROVED CHIEF
SAFETY OFFICER ____________________ DATE:________

APPROVED
TRAFFIC ENGINEER ____________________ DATE:________

**DELAWARE
DEPARTMENT OF TRANSPORTATION**

ADDENDUM / REVISIONS

SCALE
0 1000 2000 3000
FEET

SR1 / I-95 INTERCHANGE

CONTRACT
T200809003
COUNTY
NEW CASTLE

BRIDGE NO. X
DESIGNED BY: JCR
CHECKED BY: MCS/JAB

DETOUR PLAN 3
I-95 N.B. CLOSURE
RAMPS A, B

SHEET NO.
676
TOTAL SHTS.
803

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CHANGEABLE MESSAGE BOARDS

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

CMS–1

I–95 SB NIGHTIME CLOSURES	STARTING XX/XX

DURING DETOUR

CMS–1

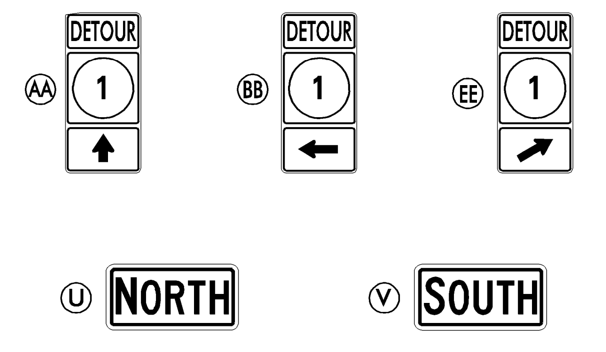
I–95 SB CLOSED AT SR1	FOLLOW DETOUR

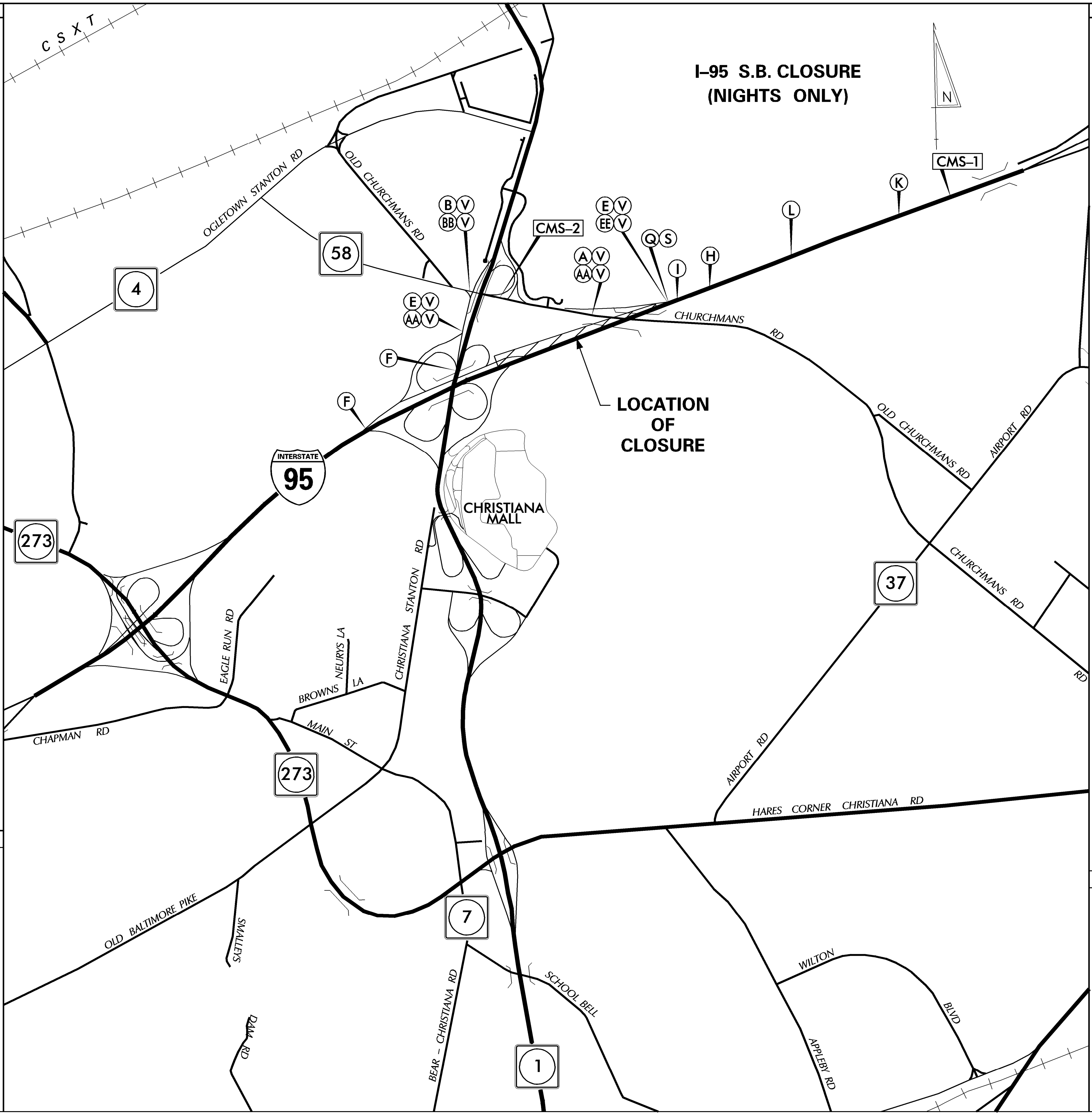
DURING DETOUR

CMS–2

TO I–95 SB SR1 SB	NEXT LEFT

SPECIAL SIGNS





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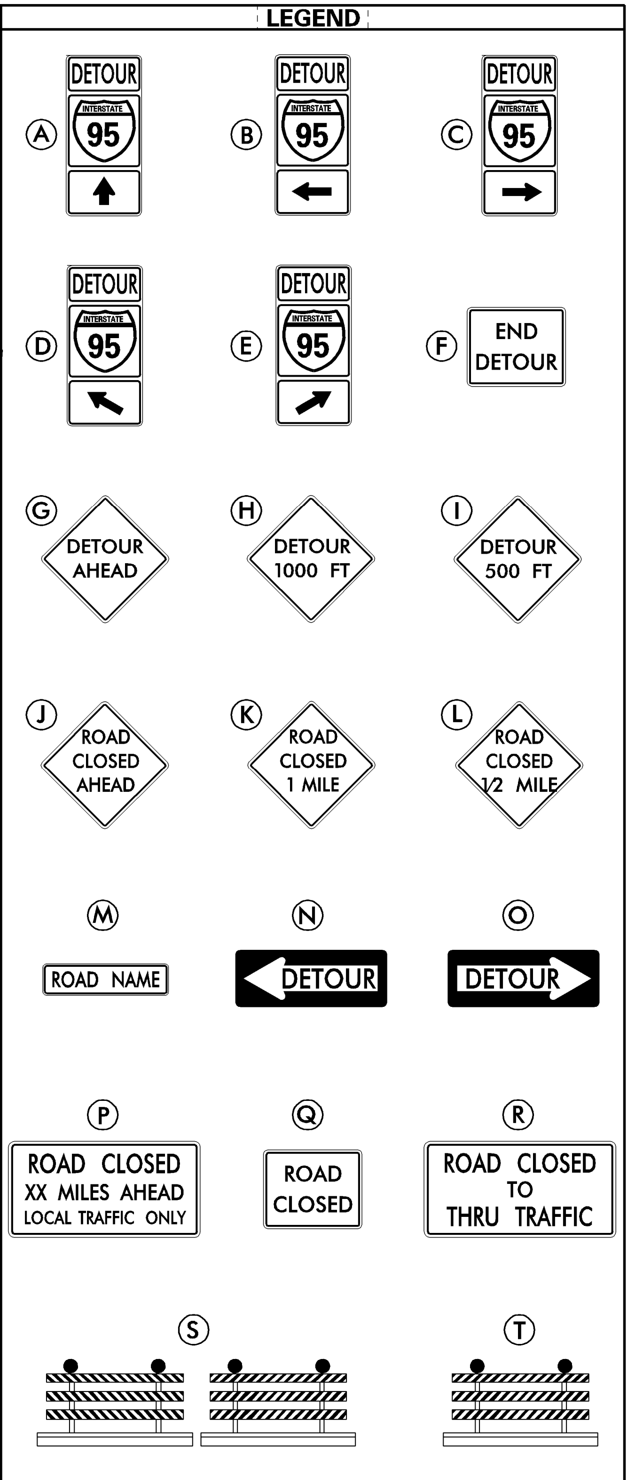

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RECOMMENDED ______________ DATE:________

APPROVED CHIEF SAFETY OFFICER ______________ DATE:________

APPROVED TRAFFIC ENGINEER ______________ DATE:________

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE 0 1000 2000 3000 FEET

SR1 / I–95 INTERCHANGE

CONTRACT	T200809003	BRIDGE NO.	X
COUNTY	NEW CASTLE	DESIGNED BY:	JCR
		CHECKED BY:	MCS/JAB

DETOUR PLAN 4
I–95 S.B. CLOSURE
RAMPS A, B

SHEET NO.	677
TOTAL SHTS.	803

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CHANGEABLE MESSAGE BOARDS

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

CMS–1

SR7 NB
RAMP
CLOSING

STARTING
XX/XX

DURING DETOUR

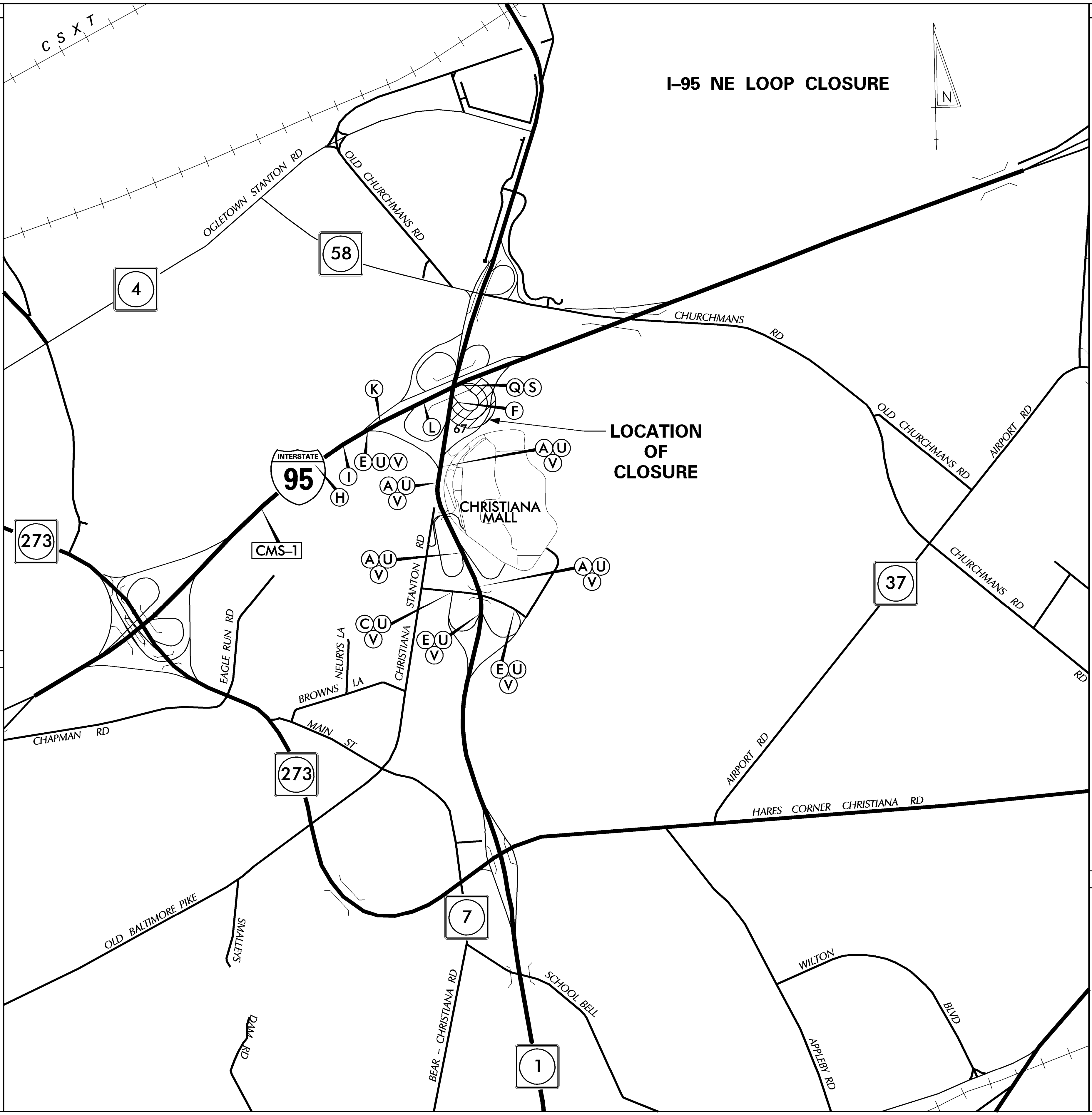
CMS–1

SR7 NB
RAMP
CLOSED

FOLLOW
DETOUR

SPECIAL SIGNS

I–95 NE LOOP CLOSURE



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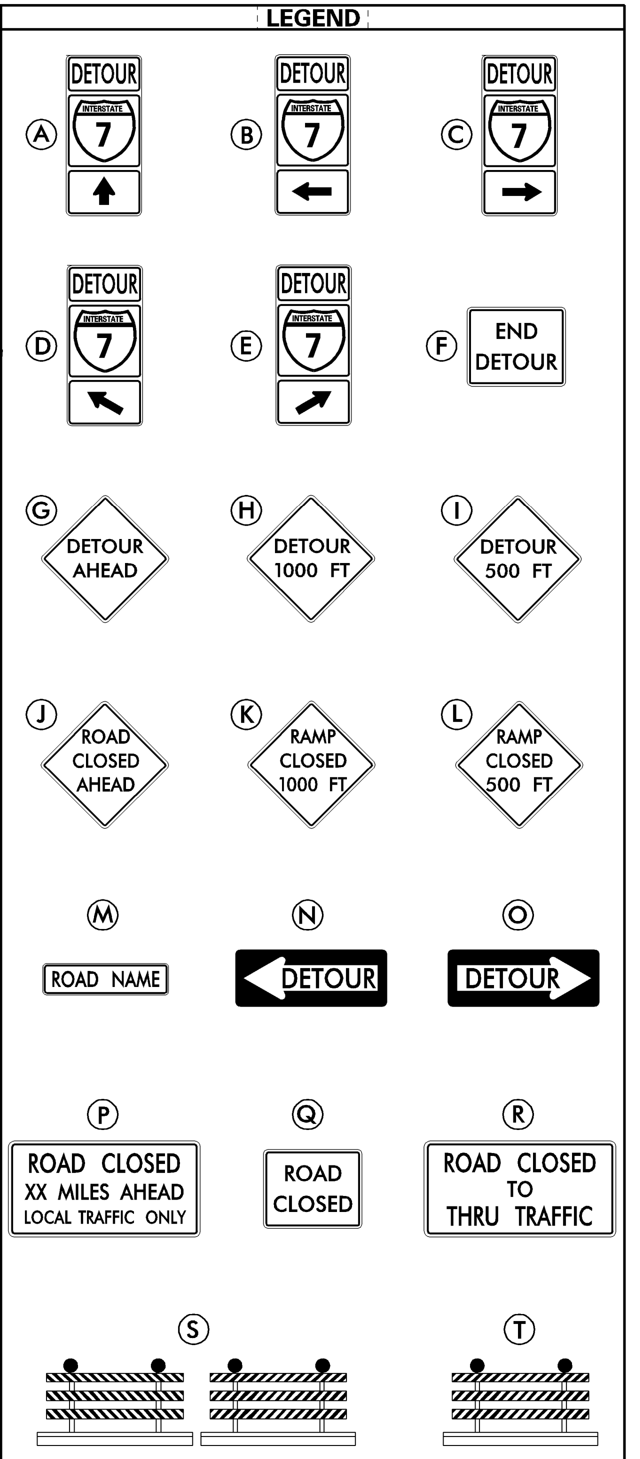

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RECOMMENDED ____________________ DATE:__________

APPROVED CHIEF
SAFETY OFFICER ____________________ DATE:__________

APPROVED
TRAFFIC ENGINEER ____________________ DATE:__________

**DELAWARE
DEPARTMENT OF TRANSPORTATION**

ADDENDUM / REVISIONS

SCALE
0 1000 2000 3000
FEET

SR1 / I–95 INTERCHANGE

CONTRACT	T200809003
COUNTY	NEW CASTLE
BRIDGE NO.	X
DESIGNED BY:	JCR
CHECKED BY:	MCS/JAB

**DETOUR PLAN 5
I–95 NE LOOP CLOSURE**

SHEET NO.	678
TOTAL SHTS.	803

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CHANGEABLE MESSAGE BOARDS

PRIOR TO DETOUR

CMS–1 (10 DAYS PRIOR TO BEGINNING OF DETOUR)

MALL RD RAMP CLOSING	STARTING XX/XX

DURING DETOUR

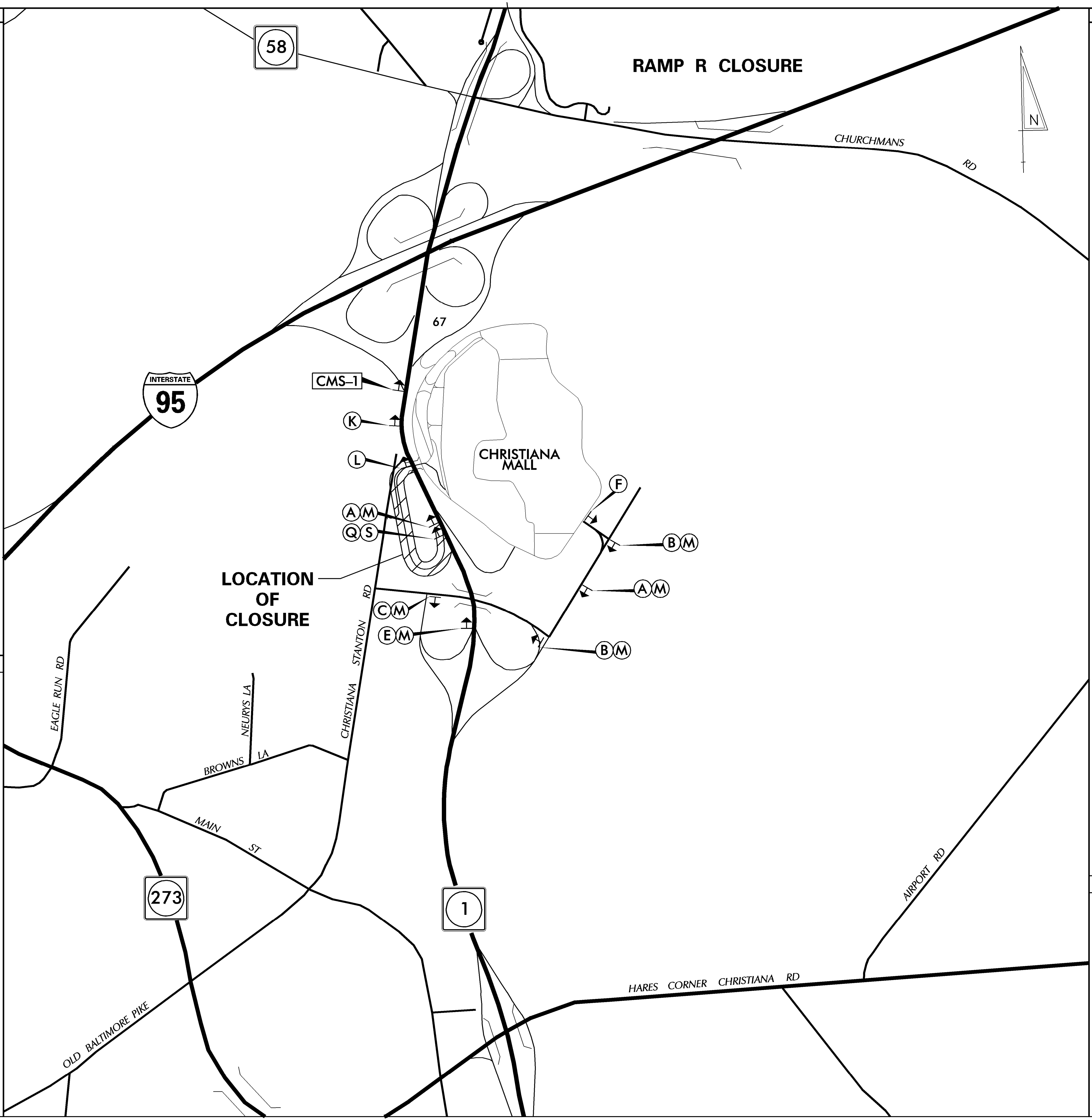
CMS–1

MALL RD RAMP CLOSED	FOLLOW DETOUR

SPECIAL SIGNS

ADDITIONAL NOTES:

1. SIGNS PLACED ON ROADWAYS WITH MORE THAN ONE LANE IN ONE DIRECTION SHALL BE POSTED ON BOTH THE LEFT AND RIGHT SHOULDERS.
2. USE CASE 7 OF THE DE MUTCD TO CLOSE LANES PRIOR TO ROAD CLOSURES.
3. MAINTAIN A SINGLE LANE ON NORTHBOUND SR 1 BETWEEN SR 273 AND MALL ROAD.
4. ALL SIGNS SHOWN ON THIS SHEET, EXCLUDING CHANGEABLE MESSAGE BOARDS, SHALL BE FURNISHED AND INSTALLED UNDER CONTRACT T201009004. THE WARNING SIGNS SHALL BE LEFT IN PLACE AND BECOME THE PROPERTY OF THE T200809003 CONTRACTOR UPON COMPLETION OF THE T201009004 CONTRACT. MAINTENANCE OF THESE SIGNS SHALL BE INCLUDED IN 763500 MAINTENANCE OF TRAFFIC.
5. ALL BARRICADES SHOWN ON THIS SHEET SHALL BE FURNISHED AND INSTALLED UNDER CONTRACT T201009004. THE BARRICADES SHALL BE LEFT IN PLACE AND BECOME THE PROPERTY OF THE T200809003 CONTRACTOR UPON COMPLETION OF THE T201009004 CONTRACT, MAINTENANCE OF THESE BARRICADES SHALL BE INCLUDED IN 763500 MAINTENANCE OF TRAFFIC.



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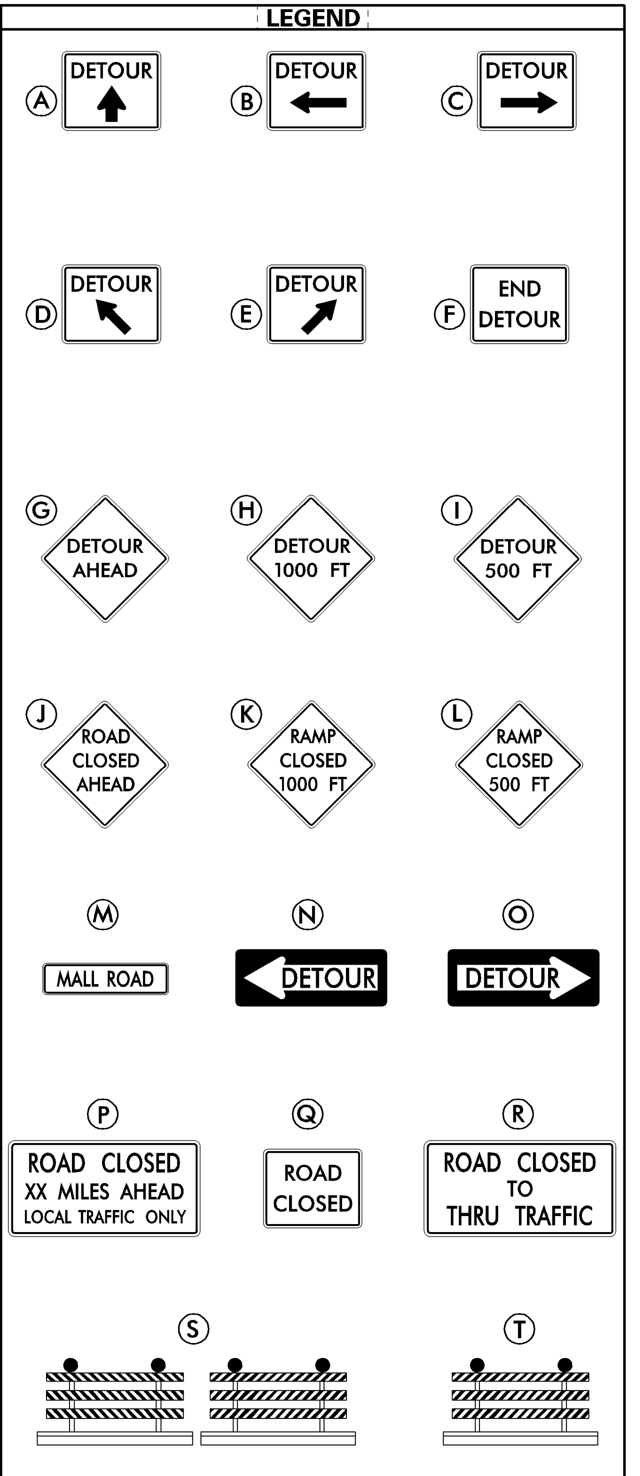

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APPROVED TRAFFIC ENGINEER ______________________ DATE:__________

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE
0 1000 2000 3000
FEET

SR1 / I–95 INTERCHANGE

CONTRACT: T200809003
COUNTY: NEW CASTLE
BRIDGE NO.: **X**
DESIGNED BY: JCR
CHECKED BY: MCS/JAB

DETOUR PLAN 6
RAMP R CLOSURE

SHEET NO.: 679
TOTAL SHTS.: 803

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CHANGEABLE MESSAGE BOARDS

PRIOR TO DETOUR
(10 DAYS PRIOR TO BEGINNING OF DETOUR)

CMS-1

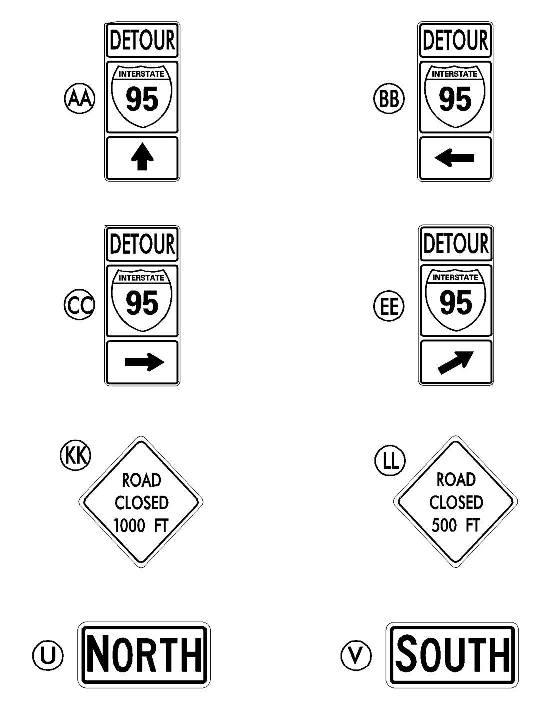
NB I-95 RAMP CLOSING	STARTING XX/XX

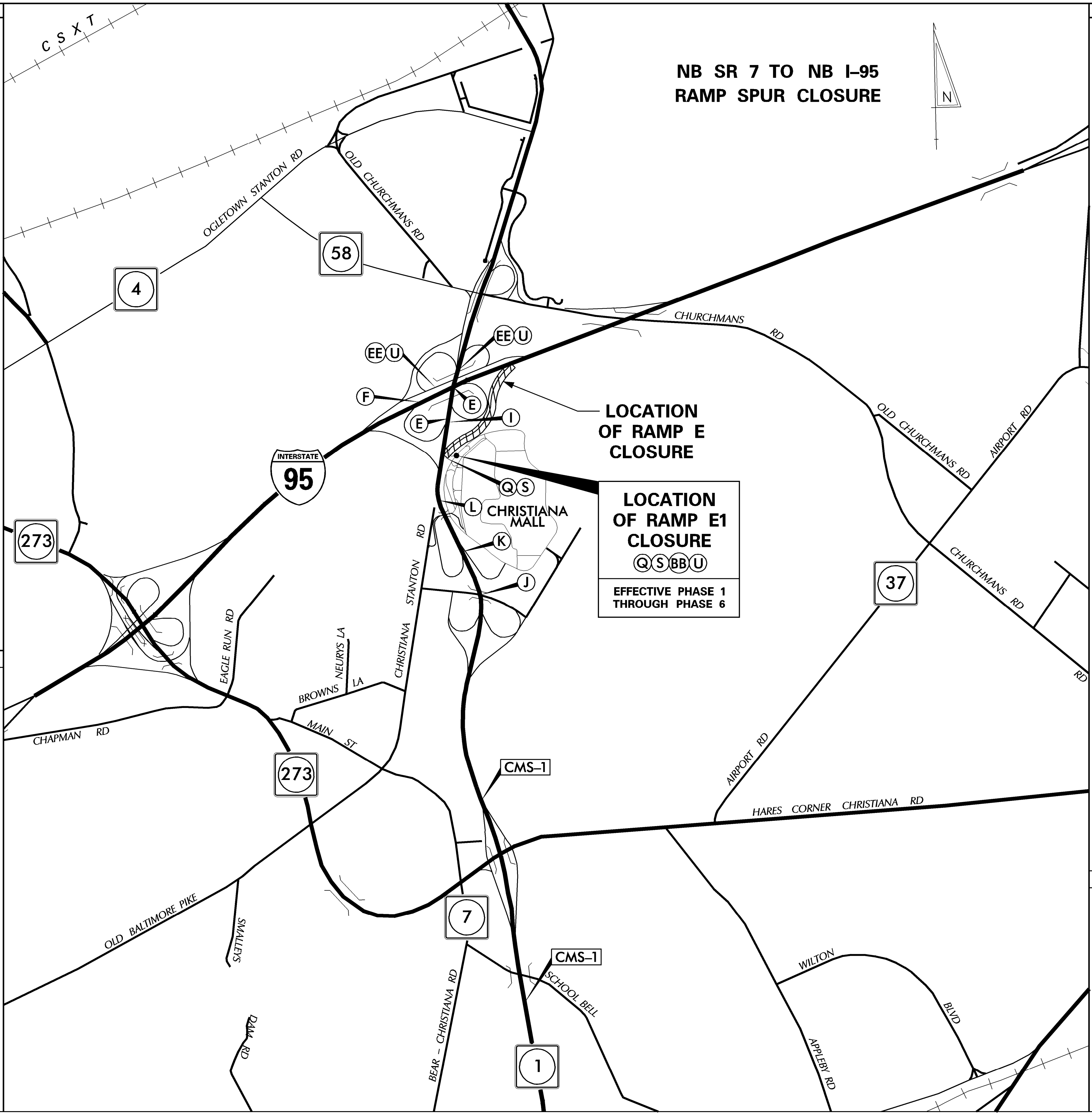
DURING DETOUR

CMS-1

NB I-95 RAMP CLOSED	FOLLOW DETOUR

SPECIAL SIGNS





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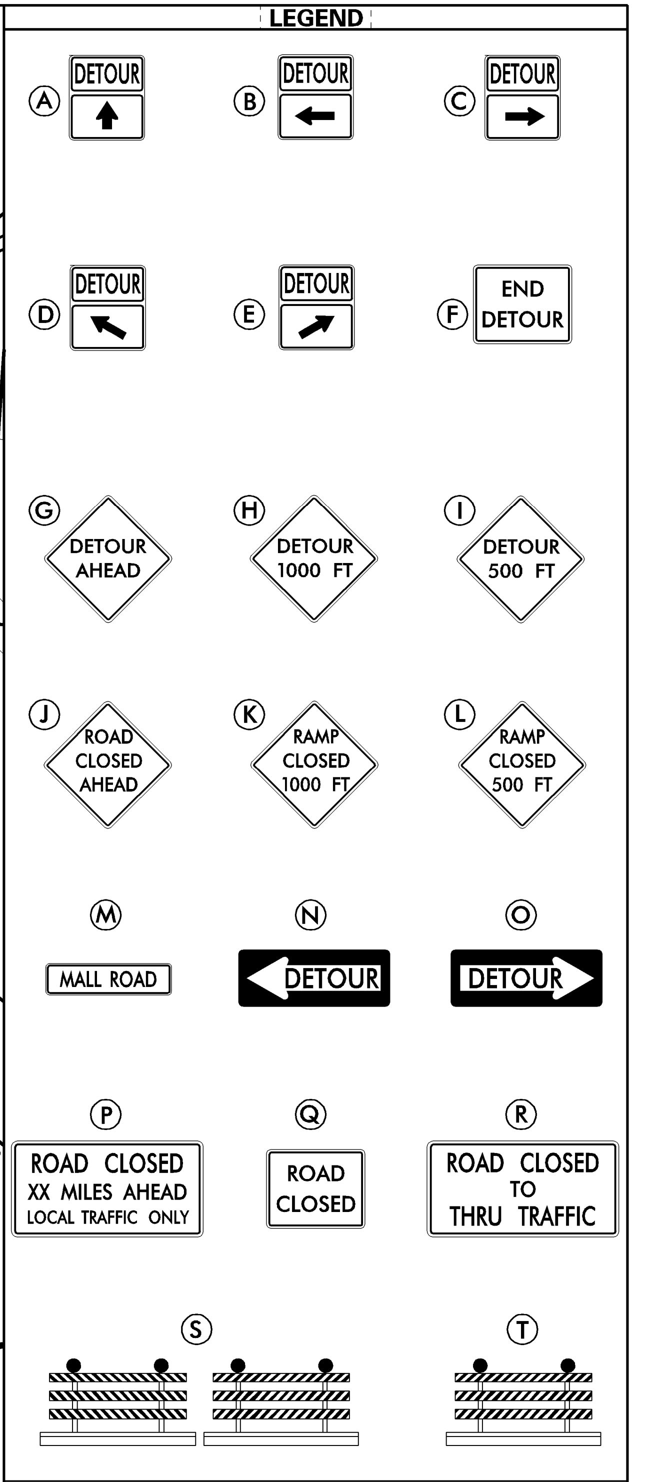

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RECOMMENDED ______________ DATE: ________

APPROVED CHIEF SAFETY OFFICER ______________ DATE: ________

APPROVED TRAFFIC ENGINEER ______________ DATE: ________

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DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE
0 1000 2000 3000
FEET

SR1 / I-95 INTERCHANGE

CONTRACT	T200809003	COUNTY	NEW CASTLE

BRIDGE NO.

DESIGNED BY: EDJ

CHECKED BY: RLS

DETOUR PLAN 7
RAMP SPUR CLOSURE

SHEET NO. 679A

TOTAL SHTS. 803

APPENDIX C

BRIDGE CONSTRUCTION STAGING

I-95 SR 1 Mall Interchange

Ramps A & B Over I-95
Erection Plan Time Estimate

20-Oct-09
Revised October 21, 2009 (rls)
Revised October 28, 2009 (dwd)
Comments November 7, 2009 (rfk)

Prepared By: RKK/rls/dwd
Based on and Erection Plans and Narrative

SUMMARY OF DETOURS AND LANE CLOSURES

CONSTRUCTION STAGE	Detours			Lane Closures							
				Shoulder Closed		1 Lane Cosed		2 Lanes Closed		3 Lanes Closed	
				4 Lanes Open		3 Lanes Open		2 Lanes Open		1 Lanes Open	
	NB	SB	Ramp	NB	SB	NB	SB	NB	SB	NB	SB
Stage 1			2		2						
Stage 2		3	3								
Stage 3		2						2			
Stage 4		2						2			
Stage 5	2						1				
Stage 6	1						1				
Stage 7											
Stage 8A				1				1			
Stage 8B				1				1			
Stage 9	2						2				
Stage 10	2										
Total:	7	7	5	2	2	0	4	6	0	0	0

STAGE 1

Activity	Duration	Time
NIGHT 1		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G1-3	0:20:00	1:20:00 AM
Tie to Abut and Temp Shoring Tower	0:15:00	1:35:00 AM
Erect G1-4	0:20:00	1:55:00 AM
Connect cross frames	0:15:00	2:10:00 AM
Erect G1-2	0:20:00	2:30:00 AM
Connect cross frames	0:15:00	2:45:00 AM
Demobilize Crane	0:30:00	3:15:00 AM
MOT Break-Down	1:00:00	4:15:00 AM
End Time		**4:15:00 AM**
Total Elapsed Time:	5:15:00	
NIGHT 2		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G1-5	0:20:00	1:20:00 AM
Connect cross frames	0:15:00	1:35:00 AM
Erect G1-1	0:20:00	1:55:00 AM
Connect cross frames	0:15:00	2:10:00 AM
Erect G1-6	0:20:00	2:30:00 AM
Connect cross frames	0:15:00	2:45:00 AM
Demobilize Crane	0:30:00	3:15:00 AM
MOT Break-Down	1:00:00	4:15:00 AM
End Time		**4:15:00 AM**
Total Elapsed Time:	5:15:00	

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Comments made by DWD

Reduced erection time to 20 minutes per girder

Comments made by RFK

How are cross frames set in place? Are they erected piece by piece or is the entire cross frame constructed and lifted in place by a crane?

STAGE 2 - Ramp A

Activity	Duration	Time
<u>Night 1</u>		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G2-3	0:20:00	1:20:00 AM
Tie to Temp Shoring Tower and Field Splice	0:45:00	2:05:00 AM
Erect G2-4	0:20:00	2:25:00 AM
Field Splice/Connect cross frames	0:45:00	3:10:00 AM
De-mobilize Crane	0:30:00	3:40:00 AM
MOT Break-Down	1:00:00	4:40:00 AM
End Time		**4:40:00 AM**
Total Elapsed Time	5:40:00	

Activity	Duration	Time
<u>Night 2</u>		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G2-2	0:20:00	1:20:00 AM
Field Splice/Connect cross frames	0:45:00	2:05:00 AM
Erect G2-5	0:20:00	2:25:00 AM
Field Splice/Connect cross frames	0:45:00	3:10:00 AM
De-mobilize Crane	0:30:00	3:40:00 AM
MOT Break-Down	1:00:00	4:40:00 AM
End Time		**4:40:00 AM**
Total Elapsed Time	5:40:00	

Activity	Duration	Time
<u>Night 3</u>		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G2-1	0:20:00	1:20:00 AM
Field Splice/Connect cross frames	0:45:00	2:05:00 AM
Erect G2-6	0:20:00	2:25:00 AM
Field Splice/Connect cross frames	0:45:00	3:10:00 AM
De-mobilize Crane	0:30:00	3:40:00 AM
MOT Break-Down	1:00:00	4:40:00 AM
End Time		**4:40:00 AM**
Total Elapsed Time	4:20:00	

STAGE 2 - Ramp B

Activity	Duration	Time
Night 1		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G6-2	0:20:00	1:20:00 AM
Tie to Abut and connect field splice	0:45:00	2:05:00 AM
Erect G6-3	0:20:00	2:25:00 AM
Connect cross frames and connect field splice	0:45:00	3:10:00 AM
De-mobilize Crane	0:30:00	3:40:00 AM
MOT Break-Down	1:00:00	4:40:00 AM
End Time		**4:40:00 AM**
Total Elapsed Time	5:40:00	

Activity	Duration	Time
Night 2		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Erect G6-1	0:20:00	1:20:00 AM
Field Splice/Connect cross frames	0:45:00	2:05:00 AM
Erect G6-4	0:20:00	2:25:00 AM
Field Splice/Connect cross frames	0:45:00	3:10:00 AM
De-mobilize Crane	0:30:00	3:40:00 AM
MOT Break-Down	1:00:00	4:40:00 AM
End Time		**4:40:00 AM**
Total Elapsed Time	5:40:00	

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Comments made by DWD

Reduced erection time to 20 minutes per girder

Comments made by RFK
I revised G6-3 to G6-1 for Night 2

STAGE 3 - Ramp A

Activity	Duration	Time
Night 1		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Cranes 1 & 2 Pick and Hold G3-3 and G4-3	0:10:00	12:10:00 AM
Connect Field Splice 3 on Ground	0:45:00	12:55:00 AM
Erect G3/4-3	0:20:00	1:15:00 AM
Field Splice 2	0:45:00	2:00:00 AM
Cranes 1 & 2 Pick and Hold G3-4 and G4-4	0:10:00	2:10:00 AM
Connect Field Splice 3 on Ground	0:45:00	2:55:00 AM
Erect G3/4-4	0:20:00	3:15:00 AM
Field Splice 2 / Connect cross frames	0:45:00	4:00:00 AM
De-mobilize Crane	0:00:00	4:00:00 AM
MOT Break-Down	1:00:00	5:00:00 AM
End Time		**5:00:00 AM**
Total Elapsed Time	6:00:00	
Night 2		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Cranes 1 & 2 Pick and Hold G3-2 and G4-2	0:10:00	12:10:00 AM
Connect Field Splice 3 on Ground	0:45:00	12:55:00 AM
Erect G3/4-2	0:20:00	1:15:00 AM
Field Splice 2 / Connect cross frames	0:45:00	2:00:00 AM
Cranes 1 & 2 Pick and Hold G3-5 and G4-5	0:10:00	2:10:00 AM
Connect Field Splice 3 on Ground	0:45:00	2:55:00 AM
Erect G3/4-5	0:20:00	3:15:00 AM
Field Splice 2 / Connect cross frames	0:45:00	4:00:00 AM
De-mobilize Crane	0:00:00	4:00:00 AM
MOT Break-Down	1:00:00	5:00:00 AM
End Time		**5:00:00 AM**
Total Elapsed Time	6:00:00	

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS:

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.

5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

1. No time was included for crane mobilization or de-mobilization as cranes all located behind the barriers.
2. Erection narrative calls for Girders G3 and G4 to be spliced (3) on the ground.
   Is there space to do this with the proposed crane locations?

Comments made by DWD

Reduced erection time to 20 minutes per girder
Reduced pick and hold time to 10 minutes for splicing on the ground
Increased splice time to 45 minutes

Comments made by RFK

1. I had the same concern regarding splicing the girders on the ground and lifting them in place. This may work fine for the first girder, G3-3 and G4-3, but the staging area will need to be outside of the footprint of the framing plan for it to be feasible for the remaining girders.
2. Is there a crane holding the first girder, G3, while the second girder is being erected? We need something for stability.

STAGE 4 - Ramp A

Activity	Duration	Time
Night 1		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Cranes 1 & 2 Pick and Hold G3-1 and G4-1	0:10:00	1:10:00 AM
Connect Field Splice 3 on Ground	0:45:00	1:55:00 AM
Erect G3/4-1	0:20:00	2:15:00 AM
Field Splice 2 / Connect cross frames	0:45:00	3:00:00 AM
De-mobilize Crane	0:30:00	3:30:00 AM
MOT Break-Down	1:00:00	4:30:00 AM
End Time		**4:30:00 AM**
Total Elapsed Time	5:30:00	

Activity	Duration	Time
Night 2		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	1:00:00	1:00:00 AM
Cranes 1 & 2 Pick and Hold G3-6 and G4-6	0:10:00	1:10:00 AM
Connect Field Splice 3 on Ground	0:45:00	1:55:00 AM
Erect G3/4-2	0:20:00	2:15:00 AM
Field Splice 2 / Connect cross frames	0:45:00	3:00:00 AM
De-mobilize Crane	0:30:00	3:30:00 AM
MOT Break-Down	1:00:00	4:30:00 AM
End Time		**4:30:00 AM**
Total Elapsed Time	5:30:00	

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS:

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

2. Erection narrative calls for Girders G3 and G4 to be spliced (3) on the ground.
   Is there space to do this with the proposed crane locations?

Comments made by DWD
Reduced erection time to 20 minutes per girder
Reduced pick and hold time to 10 minutes for splicing on the ground
Increased splice time to 45 minutes

Comments made by RFK
Same issue as Stage 3 regarding splicing on the ground. Maybe we should show the staging area on the plan.

STAGE 5 - Ramp A

Activity	Duration	Time
Night 1		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Cranes 1 & 2 Pick and Hold G5-2 and G6-2	0:10:00	12:10:00 AM
Connect Field Splice 5 on Ground	0:45:00	12:55:00 AM
Erect G5/6-2	0:20:00	1:15:00 AM
Field Splice 4 / Connect cross frames	0:45:00	2:00:00 AM
Cranes 1 & 2 Pick and Hold G5-3 and G6-3	0:10:00	2:10:00 AM
Connect Field Splice 5 on Ground	0:45:00	2:55:00 AM
Erect G5/6-3	0:20:00	3:15:00 AM
Field Splice 4 / Connect cross frames	0:45:00	4:00:00 AM
De-mobilize Crane	0:00:00	4:00:00 AM
MOT Break-Down	1:00:00	5:00:00 AM
End Time		**5:00:00 AM**
Total Elapsed Time	6:00:00	
Night 2		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Cranes 1 & 2 Pick and Hold G5-4 and G6-4	0:10:00	12:10:00 AM
Connect Field Splice 5 on Ground	0:45:00	12:55:00 AM
Erect G5/6-4	0:20:00	1:15:00 AM
Field Splice 4 / Connect cross frames	0:45:00	2:00:00 AM
Cranes 1 & 2 Pick and Hold G5-5 and G5-5	0:10:00	2:10:00 AM
Connect Field Splice 5 on Ground	0:45:00	2:55:00 AM
Erect G5/6-5	0:20:00	3:15:00 AM
Field Splice 4 / Connect cross frames	0:45:00	4:00:00 AM
De-mobilize Crane	0:00:00	4:00:00 AM
MOT Break-Down	1:00:00	5:00:00 AM
End Time		**5:00:00 AM**
Total Elapsed Time	6:00:00	

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS:

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.

6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

1. No time was included for crane mobilization or de-mobilization as cranes all located behind the barriers.
2. Erection narrative calls for Girders G5 and G6 to be spliced (5) on the ground.
   Is there space to do this with the proposed crane locations?
   If not there will need to be some additional time for the mid-air field splice.

Comments made by DWD

Reduced erection time to 20 minutes per girder
Reduced pick and hold time to 10 minutes for splicing on the ground
Increased splice time to 45 minutes

Comments made by RFK

1. Same issue with splicing the girders on the ground and lifting them in place.
Can we show the staging area on the plan?
2. Normally, the center girders are erected first.
3. Is there a crane holding the first girder, G2, while the second girder is
being erected? We need something for stability.

STAGE 6 - Ramp A

Activity	Duration	Time
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Cranes 1 & 2 Pick and Hold G5-1 and G6-1	0:10:00	12:10:00 AM
Connect Field Splice 5 on Ground	0:45:00	12:55:00 AM
Erect G5/6-1	0:20:00	1:15:00 AM
Field Splice 4 / Connect cross frames	0:45:00	2:00:00 AM
Cranes 1 & 2 Pick and Hold G5-6 and G6-6	0:10:00	2:10:00 AM
Connect Field Splice 5 on Ground	0:45:00	2:55:00 AM
Erect G5/6-6	0:20:00	3:15:00 AM
Field Splice 4 / Connect cross frames	0:45:00	4:00:00 AM
De-mobilize Crane	0:00:00	4:00:00 AM
MOT Break-Down	1:00:00	5:00:00 AM
End Time		**5:00:00 AM**
Total Elapsed Time	6:00:00	

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS:

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

2. Erection narrative calls for Girders G5 and G6 to be spliced (5) on the ground.
   Is there space to do this with the proposed crane locations?
   If not there will need to be some additional time for the mid-air field splice.

Comments made by DWD

Reduced erection time to 20 minutes per girder
Reduced pick and hold time to 10 minutes for splicing on the ground
Increased splice time to 45 minutes

Comments made by RFK

Same issue with interference for girders spliced on the ground.

STAGE 7 - Ramps A & B

Note:
All work in Stage 7 is behind the barriers and does not require detours or lane closures.
The NB shoulder may need to be closed during this phase.

STAGE 8-A Ramp B (Over Pier 1)

Activity	Duration	Time	
Start Time		**9:00:00 PM**	**(2-lane closure)**
MOT Set-up	1:00:00	10:00:00 PM	
Mobilize Crane	0:00:00	10:00:00 PM	
Erect G2-1	0:20:00	10:20:00 PM	
Field Splice 1	0:45:00	11:05:00 PM	
Erect G2-2	0:20:00	11:25:00 PM	
Field Splice/Connect cross frames	0:45:00	12:10:00 AM	
Erect G2-3	0:20:00	12:30:00 AM	
Field Splice/Connect cross frames	0:45:00	1:15:00 AM	
Erect G2-4	0:20:00	1:35:00 AM	
Field Splice/Connect cross frames	0:45:00	2:20:00 AM	
De-mobilize Crane	0:00:00	2:20:00 AM	
MOT Break-Down	1:00:00	3:20:00 AM	
End Time		**3:20:00 AM**	
Total Elapsed Time	6:20:00		

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

1. No time was included for crane mobilization or de-mobilization as cranes all located behind the barriers.
2. Per the narrative these activities will take place simultaneously, resulting in the need for NB I-95 to be closed and traffic to be detoured. (must close any lane that is being worked over as well as adjacent lane) If we construct separately, we would only need 2 lane closure for the work pier 1, resulting in an additional 2 hour window, and while working over pier 3 we could shift traffic onto the shoulder and only close 1 lane, resulting in an additional 4 hour window.

Comments made by DWD

Reduced erection time to 20 minutes per girder

Comments made by RFK

1. Is the first girder held by a crane while the second girder is being set?
2. Do we normally erect the center girders first?

STAGE 8-B Ramp B (Over Pier 3)

Activity	Duration	Time	
Start Time		**9:00:00 PM**	**(2 lane closure)**
MOT Set-up	1:00:00	10:00:00 PM	
Mobilize Crane	0:00:00	10:00:00 PM	
Erect G5-1	0:20:00	10:20:00 PM	
Field Splice 6	0:45:00	11:05:00 PM	
Erect G5-2	0:20:00	11:25:00 PM	
Field Splice/Connect cross frames	0:45:00	12:10:00 AM	
Erect G5-3	0:20:00	12:30:00 AM	
Field Splice/Connect cross frames	0:45:00	1:15:00 AM	
Erect G5-4	0:20:00	1:35:00 AM	
Field Splice/Connect cross frames	0:45:00	2:20:00 AM	
De-mobilize Crane	0:00:00	2:20:00 AM	
MOT Break-Down	1:00:00	3:20:00 AM	
End Time		**3:20:00 AM**	
Total Elapsed Time	6:20:00		

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders set on temporary shoring will take 30 minutes to pick and set.
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

1. No time was included for crane mobilization or de-mobilization as cranes all located behind the barriers.
2. Per the narrative these activities will take place simultaneously, resulting in the need for NB I-95 to be closed and traffic to be detoured. (must close any lane that is being worked over as well as adjacent lane) If we construct separately, we would only need 2 lane closure for the work pier 1, resulting in an additional 2 hour window, and while working over pier 3 we could shift traffic onto the shoulder and only close 1 lane, resulting in an additional 4 hour window.

Comments made by DWD

Reduced erection time to 20 minutes per girder

Comments made by RFK

1. Is the first girder held by a crane while the second girder is being set?
2. Do we normally erect the center girders first?

STAGE 9 - Ramp B

Activity	Duration	Time
Night 1 (SATURDAY NIGHT ONLY)		
Start Time		**12:00:00 AM**
MOT Set-up	1:00:00	1:00:00 AM
Mobilize Crane	0:00:00	1:00:00 AM
Erect Cross Girder	2:00:00	3:00:00 AM
Attach Cross Girder to Columns *	0:00:00	3:00:00 AM
Erect G4-3 **	0:00:00	3:00:00 AM
Field Splice 5 and @ Cross Girder	0:45:00	3:45:00 AM
Mobilize Additional 250T Crane onto NB I-95***	0:00:00	3:45:00 AM
Erect G4-2 ****	0:15:00	4:00:00 AM
Field Splice 5 and at Cross Girder / cross frames*****	0:45:00	4:45:00 AM
De-mobilize Crane	0:30:00	5:15:00 AM
MOT Break-Down	1:00:00	6:15:00 AM
End Time		**6:15:00 AM**
Total Elapsed Time	6:15:00	

* No additional time was added for attaching the cross girder to the columns as the cross girder is being held by the 350T crane and the bolting activity can happen simultaneously with the filed splices and cross frame attachment operations.

** The narrative calls for 1 hour of time to pick and set the girders in this stage. It is assumed th this operation will start prior to the completion of the cross girder erection as the crane can attach and lift the girder simultaneously with the cross girder erection. For the purposes of this estimate it was assumed that this will save approximately 15 minutes, and reduced the pick and set time to 45 minutes.
zero time to erect g4-3 because it will be ready to connect to the cross frame by the end of 2 hours, therefore start splice at end of cross girder erection

*** No additioanl time was added for the mobilization of the 250T crane onto NB I-95 as this can take place simultaneously with the construction of the cross girder.

**** No additioanl time was added to pick and set G4-2 as this can take place simultaneously with the erection of G4-3 and the addition of the additional 250T crane on NB I-95.
I would add 15 minutes to fly this girder only because of the complexity in the air of all of the connections, this is too complex of a connection to assume thata K' or will work simultaneous while erecting the other girder.

***** No additional time was added as this operation will take simultaneously with the field splice connections for G4-3.

Night 2

Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Erect G4-4	1:00:00	1:00:00 AM
Field Splice/Connect cross frames	0:45:00	1:45:00 AM
Erect G4-1******	0:00:00	1:45:00 AM
Field Splice/Connect cross frames******	0:00:00	1:45:00 AM
De-mobilize Crane	0:00:00	1:45:00 AM
MOT Break-Down	1:00:00	2:45:00 AM
End Time		**2:45:00 AM**
Total Elapsed Time	3:45:00	

****** No additional time was added for erecting G4-1 or making the field spices and cross frame as this work can be completed simultaneously with the erection of G4-4.

Assumptions:

1. Crane will take 1 hour to mobilize and set in position.
2. Girders will take 60 minutes to pick and set (from narrative)
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.
5. Cross girder would take 2 hours to pick and set (from narrative)

Assumptions made by RLS

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in place.
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

1. No time was included for crane mobilization or de-mobilization as cranes all located behind the barriers, except for the additioanl crane on night 1. See comment *** above.
2. Assumed that the gross girder would be tied to the columns prior to attachment of G4-4 and would take approximately 15 minutes. This work could take place while crane 1 is lifting G4-4, resulting in no additional time.
3. Assumed that field splice 5 and at cross girder would take place simultaneously.

STAGE 10 - Ramp B

Activity	Duration	Time
Night 1		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Erect G3-3	1:00:00	1:00:00 AM
Field Splice 2 and at Cross Girder	0:45:00	1:45:00 AM
Erect G3-2	1:00:00	2:45:00 AM
Field Splices/Connect cross frames	0:45:00	3:30:00 AM
De-mobilize Crane	0:00:00	3:30:00 AM
MOT Break-Down	1:00:00	4:30:00 AM
End Time		**4:30:00 AM**
Revised October 21, 2009(rls)	5:30:00	
Revised October 28, 2009(dwd)		
Night 2		
Start Time		**11:00:00 PM**
MOT Set-up	1:00:00	12:00:00 AM
Mobilize Crane	0:00:00	12:00:00 AM
Erect G3-4	1:00:00	1:00:00 AM
Field Splices/Connect cross frames	0:45:00	1:45:00 AM
Erect G3-1	1:00:00	2:45:00 AM
Field Splices/Connect cross frames	0:45:00	3:30:00 AM
De-mobilize Crane	0:00:00	3:30:00 AM
MOT Break-Down	1:00:00	4:30:00 AM
End Time		**4:30:00 AM**
Total Elapsed Time	15:30:00	

This Stage could happen concurrently with the 2nd and 3rd nights of Stage 9.
Possible but I would error on the conservative side and work separate from Stage 9.

The 350T crane is only required for lifting the cross girder on night 1 and then for setting the girders in Stage 10.

This would minimize the number of lane detours and maximize the use of the 350T crane.

Prepared By: RKK/rls/dwd

1. Crane will take 1 hour to mobilize and set in position.
2. Girders will take 60 minutes to pick and set (from narrative)
3. Girder splices will take 45 minutes to make 50% of the bolts.
4. Girder cross frames will take 15 minutes to complete.

Assumptions made by RLS

1. MOT set-up will take 1 hour.
2. MOT Break down will take 1 hour.
3. De-mobilize crane will take 30 minutes.
4. Cranes located in roadways will begin set-up after Detour is in plac
5. Ties to abutments and temporary shoring towers will take 15 minutes.
6. Mid air field spices and connnection of cross frames to take place simultaneously.
7. Pick and hold girders for work to performed on the ground will take 15 minutes.
8. Field splices completed on the ground will take 30 minutes.

Additional Comments by RLS:

1. No time was included for crane mobilization or de-mobilization as cranes all located behind the barriers.
2. Assumed that the time to set the girders was similar to that for Stage 9 (1 hour). If it is actually 30 minutes then we can reduce the time by 2 hours.

Comments made by DWD

Total time for erection and splice connections of 1:45 minutes for each girder are realistic given the amount of complexity