Section 100: I-95, I-895(N) Split to North of MD 43

Alternatives Retained for Detailed Study

March 31, 2004

EXECUTIVE SUMMARY

ALTERNATES RETAINED FOR DETAILED STUDY

John F. Kennedy Memorial Highway
Section 100: I-95, I-895(N) Split to North of MD 43

In July of 2003, the Maryland Transportation Authority (Authority) and the Federal Highway Administration (FHWA) initiated the Section 100: I-95, I-895 (N) split to north of MD 43 project planning study to evaluate the potential environmental impacts of the proposed action under the National Environmental Protection Act (NEPA). This project is referred to in the *I-95 Master Plan*, adopted by the Authority in April 2003, as Section 100.

The stated goal of the project is to address the capacity, safety and economic development needs of the corridor and thereby improve access, mobility and safety for local, regional and inter-regional traffic, including passenger, freight and transit vehicles.

Initial Section 100 project activities focused on developing alternates based on the no-build concept C-1 and two build concepts, C-5 and C-6 that were recommended for further evaluation in the *I-95 Master Plan*. These concepts include:

- Master Plan Concept C-1 / Section 100 Alternate 1: No-Build – This alternate would retain the existing I-95 highway and associated interchanges in their present configurations and allow for routine maintenance and safety upgrades.
- Master Plan Concept C-5 / Section 100 Alternate 3: Managed Lanes – This alternate would provide two managed lanes per direction within the median. Managed lanes provide an opportunity to implement management strategies such as access by time of day, type of vehicle, pricing, or other controls, which may achieve a variety of community and transportation goals. For each of the existing interchanges, two design options were developed.
- Master Plan Concept C-6 / Section 100 Alternate 2: General Purpose Lanes – This alternate would provide additional general purpose lanes as necessary to accommodate the projected traffic demand. For each of the existing interchanges, two design options were developed.

Between the I-695 and the MD 43 interchanges, the Master Plan concepts included two-lane collector-distributor (C-D) roadways in each direction. Traffic analyses and engineering evaluations completed during the project planning studies indicated that C-D roadways are not required. The Section 100 alternates have been modified to reduce anticipated impact levels.

Early in the project, a fifteen-member Focus Group was established to further enhance public participation within the planning process. To date, the Authority has met three times with members of the Focus Group to discuss project issues and obtain feedback on the alternates.

The resulting preliminary alternates were presented to the general public for review and comment at a Public Workshop held on November 18, 2003. Based on comments received, the Project Team recommended that both the General Purpose and the Managed Lanes Alternates be carried forward into detailed engineering and environmental studies. For each alternate, the Project Team also recommended carrying forward one configuration at each interchange location. These alternates are being carried forward because, based on existing information, it appears that each has the potential to meet project objectives with acceptable environmental impacts and costs. However, based on more detailed engineering and environmental studies, these preliminary evaluations may be revised. Determinations of reasonableness, practicability, and prudence will be made (if needed) once more detailed information has been developed.

Alternates Retained for Detailed Study

Table of Contents

Executive Summary

I. Introduction
A. Purpose and Need 1
1. Purpose 1
2. Need 1
B. Study Limits 2
1. Land Use 2
2. Priority Funding Area 3
3. Regional Transportation Plan 3
C. Project Background 3
1. Project Status 3
2. Design Guidelines 3
3. I-95 Master Plan 3

II. Public Involvement/Agency Coordination
A. Public Involvement 5
1. Focus Group 5
2. Public Workshop 6
3. Project Website 6
4. Project Newsletter 6
B. Agency Coordination 7

III. Traffic
A. Travel Demand Forecasting 8
B. Level of Service 8
C. Transit 11
D. Truck Freight 11
E. Freight Rail Service 11

IV. Environmental Overview
A. Socio-Economic Resources 13
B. Historic and Archaeological Resources 13
C. Natural Environmental Resources 13

V. Alternates
A. Existing Conditions 16
B. Master Plan Concepts 16
C. Initial Section 100 Design Concepts with C-D Lanes 19
D. Removal of C-D Lanes 19

Alternates Retained for Detailed Study

Table of Contents (continued)

E. Recommended Alternates Retained for Detailed Study 24
1. Alternate 1: No-Build 24
2. Alternate 2: General Purpose Lanes 24
a. Mainline 24
b. I-95 / I-895 (N) Interchange Option 2B 25
c. I-95 / I-695 Interchange Option 2A 25
d. I-95 / MD 43 Interchange Option 2B 26
3. Alternate 3: Managed Lanes 27
a. Mainline 27
b. I-95 / I-895 (N) Interchange Option 3B 27
c. I-95 / I-695 Interchange Option 3A Modified 28
d. I-95 / MD 43 Interchange Option 3A 30

Alternates Retained for Detailed Study

Table of Contents (continued)

Figures

1. Section 100 Study Area 2
2. I-95 Master Plan Study Area 4
3. C-D Lanes Weave Comparison 21
4. General Purpose Lanes Typical Sections 22
5. Managed Lanes Typical Sections 23
6. Alternate 1: No-Build 32
7. Alternate 2: General Purpose Lanes 33
8. Alternate 3: Managed Lanes 34

Tables

1. Existing and Future No-Build Traffic Volumes for Section 100 10
2. Existing and Future No-Build Level of Service (LOS) for Section 100 10
3. Summary of Impacts – Alternate 2: General Purpose Lanes 14
4. Summary of Impacts – Alternate 3: Managed Lanes 15
5. Recommended Interchange Options 24

ALTERNATES RETAINED FOR DETAILED STUDY
John F. Kennedy Memorial Highway
Section 100: I-95, I-895(N) Split to North of MD 43

I. INTRODUCTION

A. Purpose and Need

The Maryland Transportation Authority (Authority) and the Federal Highway Administration (FHWA) have initiated this project planning study to evaluate the potential environmental impacts of the proposed action under the National Environmental Policy Act (NEPA).

1. Purpose - The purpose of the proposed action is to address capacity and safety needs on Section 100: I-95, I-895(N) Split to North of MD 43 and thereby improve access, mobility, and safety for local, regional, and inter-regional traffic, including passenger, freight, and transit vehicles.

2. Need - The proposed action is intended to address the following capacity and safety needs on Section 100:

- ***Capacity*** - Section 100 is the most congested section of I-95 in Maryland north of Baltimore City. Currently, Section 100, south of MD 43, operates at Level of Service (LOS) F during the morning and evening rush hours. If capacity needs are not addressed, congestion is expected to increase by the planning horizon year of 2025. By 2025, Section 100, south of MD 43, is also expected to operate at Levels of Service E and F during weekend peak periods. Unchecked, increased congestion levels would extend the existing peak hour into a peak period of several hours duration and increase the level of diversion to alternative routes, such as the community-oriented arterials US 1, US 40, and MD 7.

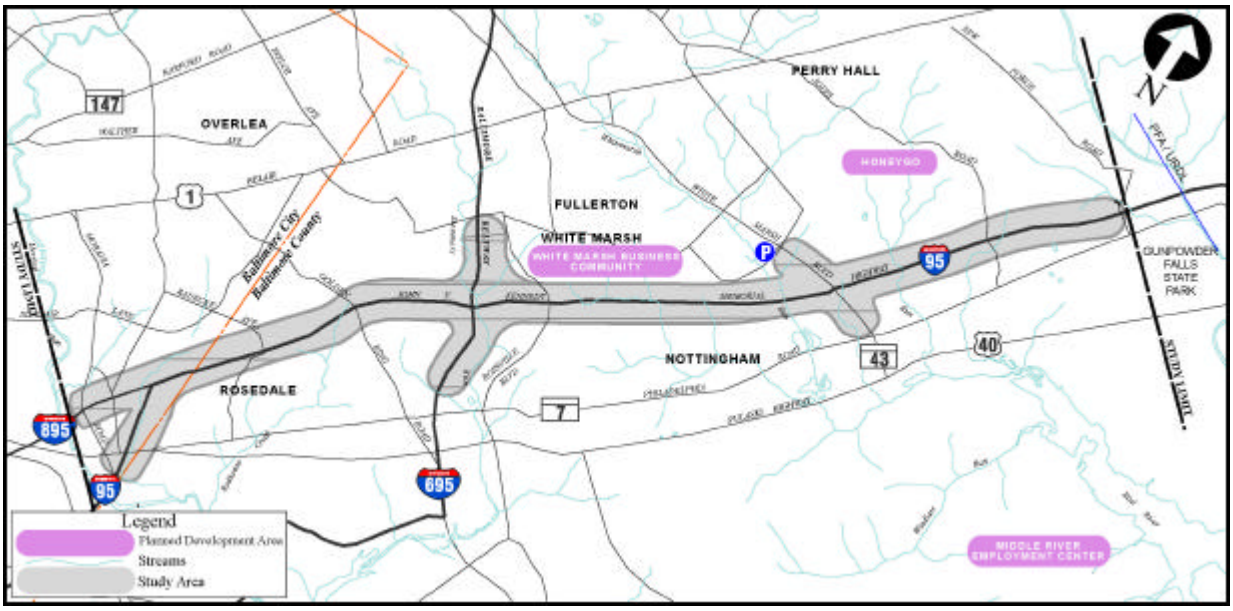
- ***Safety*** - The accident rate on Section 100 currently is lower than the statewide average for comparable urban interstates within Maryland. However, the total number of accidents on Section 100 is increasing, especially in the vicinity of the urban I-895, I-695, and MD 43 interchanges, where large volumes of merging, diverging, and weaving movements occur.

  At some locations, left-hand exit and entrance treatments, limited auxiliary lane lengths and restricted sight distances may increase the potential for accidents to occur. The majority of the reported accidents in Section 100 are of the types normally identified as congestion-related, such as rear-end and sideswipe. If the anticipated congestion levels in Section 100 are not addressed, an increase in the number and severity of congestion-related accidents would likely occur.

B. Study Limits

The Section 100 Project Planning Study is one of four independent projects identified in the I-95 Master Plan Study, which was adopted by the Authority in April of 2003. The Section 100 study area begins in Baltimore City south of the I-95 / I-895 (N) split and continues to approximately 2.7 miles north of MD 43 in the vicinity of New Forge Road ***(See Figure 1)***.

Figure 1.
Section 100 Study Area



1. Land Use - The study area is situated just north of many of Baltimore City's industrial and commercial centers. The Section 100 study area is dominated by residential land use from the I-95/I-895 (N) split, to the I-695 interchange. North of the I-695 interchange, the study area is dominated by a mix of forested, residential, and commercial land use. Forested areas encompass a large amount of the study area. Large forest tracts surround the I-95/I-895 (N) split, the I-695 interchange, and the eastern and northern quadrants of the MD 43 interchange. Additional forested areas are scattered along I-95, with a fairly large tract located between Cowenton Avenue and New Forge Road, at the northern end of the study area. The majority of commercial land use within the study area is located just south of the MD 43 interchange, on the west side of I-95. This would include business areas such as The Avenue and The White Marsh Business Community.

Baltimore County's adopted *Master Plan 2010* incorporates the designation of two land management areas – the urban area and the rural area. The boundary separating these two land management areas is called the Urban Rural Demarcation Line (URDL). Growth management, land use policies, and proposed roadway improvements within the *Master Plan 2010* are designed to focus growth within the URDL. The Section 100 study area lies completely within the urban area.

2. Priority Funding Area - Section 100 lies entirely within a Priority Funding Area (PFA).

3. Regional Transportation Plan - Section 100 is included in the Baltimore Regional Transportation Plan (BRTP).

C. Project Background

1. Project Status - Project planning studies for Section 100 were initiated in Summer 2003. The Section 100 study is listed in the FY 2003-2008 Maryland Consolidated Transportation Program (CTP).

2. Design Guidelines - The proposed roadway improvements would be designed using current freeway design guidelines developed by the American Association of State Highway and Transportation Officials (AASHTO). The posted speed limit for I-95 within the Section 100 study area is 55 mph from the I-895 (N) split to MD 43 and 65 mph north of MD 43. No change in operating speed is proposed. ***See Appendix A*** - *Draft Design Criteria Report* for Section 100 dated July 2003 for project specific design guidelines.

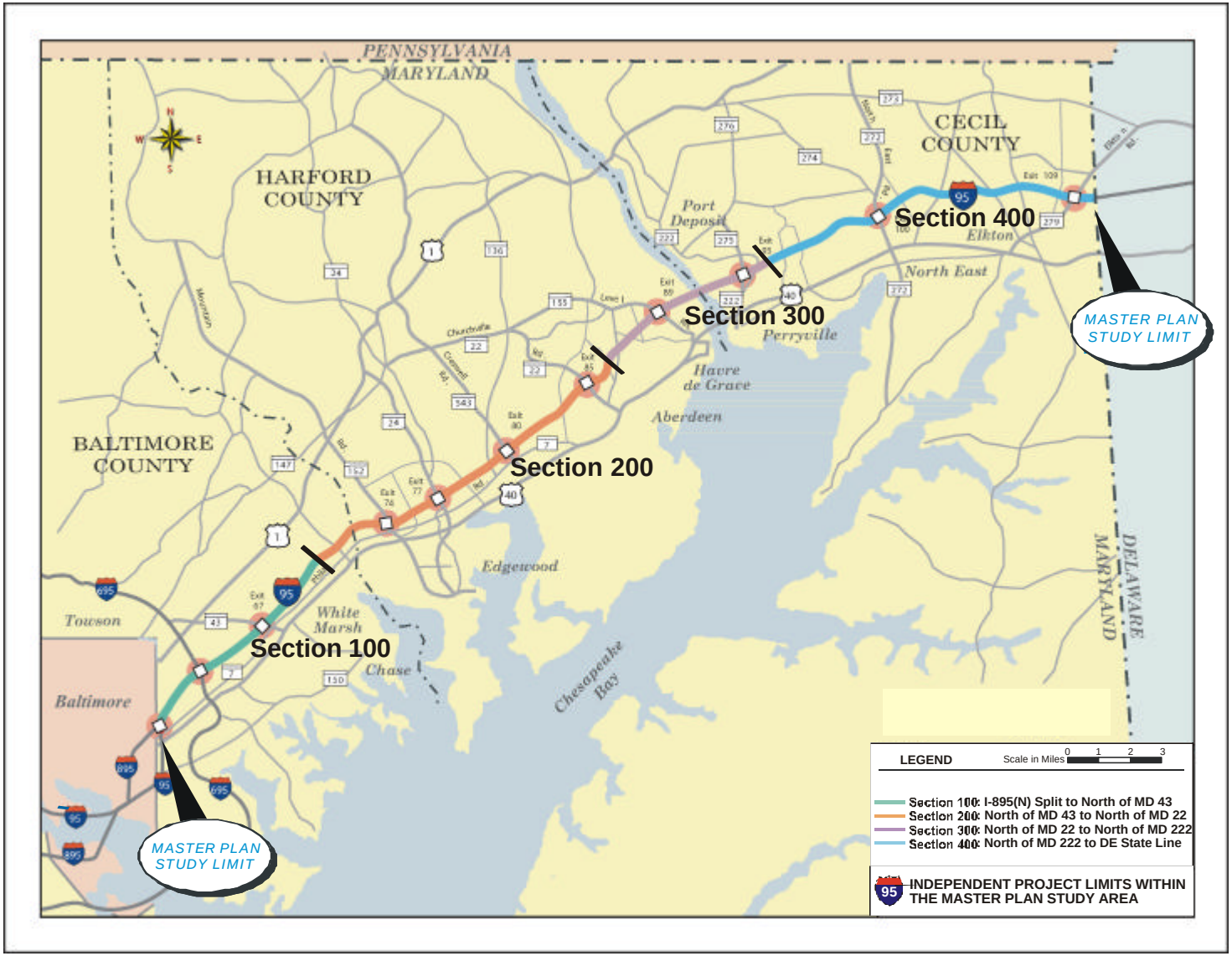
3. I-95 Master Plan - The Authority, in cooperation with the Federal Highway Administration (FHWA) and the Maryland Department of Transportation (MDOT), developed the I-95 Master Plan study approach to comprehensively identify long-range transportation needs that establish clear goals for system maintenance, preservation and enhancement, and ensure the development of environmentally sensitive and intermodal-friendly solutions for the JFK.

The Authority adopted the Master Plan in April 2003. It identified four independent projects including **(See *Figure 2*)**:

Section 100: I-95, I-895 (N) Split to North of MD 43
Section 200: North of MD 43 to North of MD 22
Section 300: North of MD 22 to North of MD 222
Section 400: North of MD 222 to the Delaware State Line

Throughout the Master Plan process, the Authority coordinated with local, state, and federal regulatory and resource agencies. This coordination resulted in agency concurrence on the need for four independent projects and the concepts to be evaluated in the future independent planning studies. Section 100 is the first independent project identified in the I-95 Master Plan to be initiated.

Figure 2
I-95 Master Plan Study Area



II. Public Involvement / Agency Coordination

A. Public Involvement

Public involvement is an integral part of the project planning process through which the public is offered the opportunity to provide input. Public input helps to ensure that the proposed actions respond to the needs and concerns of residents, businesses, motorists, the environment and others. The Section 100 project team has employed several different strategies for involving the public in this study. These strategies include a project focus group, public meetings, a project website and a project newsletter.

1. Focus Group - In Fall 2003, a fifteen-member focus group comprised of local residents, community leaders, and business owners was established. Three Focus Group meetings were held between September 2003 and the November 2003 Public Workshop. At these meetings focus group members were made aware of project activities and given the opportunity to provide feedback on various project issues including the *Purpose and Need Statement*, project alternates and environmental impacts.

- **Focus Group Meeting #1 -** The Focus Group met for the first time on September 11, 2003 at the White Marsh Public Library. Focus Group members were introduced to the Maryland Transportation Authority and the project team. Background information was presented on the I-95 Master Plan. The Section 100 project was introduced and possible concepts for the project were discussed. The project team answered questions and concerns presented by the Focus Group. Members were encouraged to introduce Section 100 to their companies/organizations and note points of concern to be discussed at the next Focus Group meeting.

- **Focus Group Meeting #2 -** The second Section 100 Focus Group meeting was held on September 30, 2003 at the Perry Hall Middle School. Focus Group members were introduced to detailed descriptions of the three alternates under consideration for Section 100. The Alternates included: Alternate 1: No-Build, Alternate 2: General Purpose and Alternate 3: Managed Lanes. Focus Group Members were invited to ask questions and present their concerns to the project team.

- **Focus Group Meeting #3 -** The third Section 100 Focus Group meeting was held on October 27, 2003 at the Perry Hall Middle School. Focus Group members were updated on revisions to the General Purpose and Managed Lanes Alternates. The removal of collector-distributor lanes (C-D lanes) from both the General Purpose Alternate and the Managed Lanes Alternate was discussed with the Focus Group. Members were presented the draft informational displays for the November 18, 2003 Public Workshop. Focus Group Members were encouraged to attend the Public Workshop and invite other interested people to participate.

Members of the Focus Group expressed several questions and comments during the first three meetings. Questions included:

- Where will the funding come from for Section 100 improvements?
- Is the Section 100 project consistent with other area projects and Master Plans?
- What other agencies are involved?

- Would mass transit options such as monorail be more efficient than highway improvements?
- How well would the Section 100 alternates under consideration address the current congestion?

Questions and answers from the Focus Group Meetings are included in the Focus Group meeting minutes (see ***Appendix B***).

- **Future Focus Group Meetings** – Additional meetings with the Focus Group will be scheduled as the project moves through Stage 2 project planning activities.

2. Public Workshop – The Authority held a Public Workshop on November 18, 2003 at the Perry Hall Middle School. The purpose of this workshop was to acquaint the public with the need for the project and the progress of the Section 100 Project Planning Study to date. At the workshop project alternates were introduced to the public including Alternate 1: No-Build, Alternate 2: General Purpose Lanes, and Alternate 3: Managed Lanes. A preliminary assessment of environmental impacts associated with each of the alternates was also presented. Prior to the workshop, a brochure was mailed to individuals on the project mailing list and to property owners within the study area. This brochure was also available for distribution at the workshop. The brochure included background information on the project, as well as an explanation of materials that would be available for viewing at the public workshop.

A comment card was included with the brochure that gave citizens the opportunity to submit comments via mail or in person at the workshop. Eighteen comment cards were received during the thirty-day comment period. See ***Appendix B*** for a summary of the comments received from the November 18, 2003 Public Workshop. General comments include:

- Requests for noise analysis/noise walls
- Concerns for future air pollution
- Requests to be informed of future focus group meetings
- Availability of funding
- Concerns about right-of-way (ROW) impacts
- Concerns about Drainage and Storm-Water Management
- Statements of support/opposition for particular alternates or concepts.

The public input generated as a result of the efforts discussed above was reviewed by the project planning team and, where appropriate, incorporated into development of the alternates retained for detail study. The project planning team will continue to solicit and consider public input throughout the next project-planning phase – analysis of alternates.

3. Project Website - In August 2003, a website was established for the Section 100 Project Planning Study. The website provides information on past, current and upcoming project activities. Topics include project alternates, focus group meetings, environmental issues and the project schedule. In addition, the website provides users the opportunity to submit comments to the study team via e-mail. The website can be accessed through the Authority's home page at *www.mdtransportationauthority.com*.

4. Project Newsletter - In early 2004, a project newsletter will be distributed to individuals on the project mailing list and all property owners in the study area. The newsletter will include the

announcement of the Section 100 Public Hearing planned for Summer 2004 and upcoming Focus Group meetings. It will also provide a summary of comments received at the Public Workshop held November 18, 2003 as well as an overall update on the status of the project.

B. Agency Coordination

The study team has continually coordinated with local, state and federal resource and regulatory agencies since the beginning stages of the project. The purpose of this coordination is to receive agency recommendations and concerns.

The Section 100 project planning study was first presented to resource and regulatory agencies at the July 2003 Interagency Review Meeting held at the Maryland State Highway Administration's headquarters. At this meeting a brief introduction to the project was presented and the agencies were asked to provide comments on the project's *Purpose and Need Statement*.

An Agency Scoping Meeting followed in August 2003. At this meeting, detailed project information was presented including conceptual alternates, environmental inventories, avoidance and minimization strategies, and enhancement and mitigation strategies. Based on comments received following both the Interagency Review Meeting and the Agency Scoping Meeting, the *Purpose and Need Statement* was revised and resubmitted to the agencies. The agencies were asked to provide further comments or to provide their concurrence on the Purpose and Need Statement. Concurring agencies included the Federal Highway Administration (FHWA), the Army Corps of Engineers (COE), the Environmental Protection Agency (EPA), the US Fish and Wildlife Service (FWS), and the National Marine Fisheries (NMF). Final concurrence was received on October 1, 2003.

Following the November 2003 Public Workshop, the *Alternates Retained for Detailed Study* (ARDS) package was submitted for agency review and comment in February 2004. The agencies were asked to provide their concurrence on the study team recommended *Alternates Retained for Detailed Study*. Final Concurrence was requested by late March of 2004.

Additional coordination with local officials has been undertaken to obtain data on parklands, emergency services, and potential low-income and minority populations. The study team will continue to coordinate with local, state and federal resource and regulatory agencies throughout the remaining planning stages of this study.

III. Traffic

A. Travel Demand Forecasting

The evaluation of alternates during Stage 1 project planning activities was based on travel demand forecasts that were developed using Round 6 of the adopted Baltimore Regional Transportation Board (BRTB) travel demand models. Model inputs include socio-economic, roadway network and transit network data. These data sets are summarized below:

- Socio-economic data, such as projected changes in population, households and employment, are taken from regional forecasts developed by the metropolitan planning organization (BRTB) with the assistance of local jurisdictions. Planned developments are included in the model's socio-economic data.

- The roadway network in the model reflected the existing and planned roadways included in the Constrained Long-Range Plan (CLRP). Within the Section 100 study area, assumed improvements include the widening of I-695 from 6 to 8 lanes between I-95 and I-83 and the extension of MD 43 to MD 150 as a four-lane roadway.

- The existing and planned transit network in Round 6 of the BRTB model includes express bus service from Bel Air to White Marsh, Hunt Valley, Towson and eastern Baltimore County (along MD 43 extended). Bus service is also assumed to operate from White Marsh to Harford County with a circulation bus service in the White Marsh area. Light rail from White Marsh to Baltimore City is also part of the transit network assumptions for the future year model.

B. Level of Service

The original purpose and need statement developed for the project was based on the 2020 Baltimore Regional Transportation Board Travel Demand Model. It noted that updated data for the year 2025 would be provided as it became available. The following discussion summarizes the updated 2025 volumes, which are set forth in Tables 1 and 2. These are the volumes used to screen the alternates during this stage of the study.

The highest weekday peak hour volume occurs between the I-695 and the MD 43 interchange ***(See Table 1)***. Weekday peak hour volumes are currently at or near capacity. Weekday peak hour traffic volumes exceed weekend peak hour volumes by 1,650 to 3,000 vehicles per hour (27% to 54% percent). By 2025, Average Daily Traffic (ADT) volumes are expected to increase by as much as 37 percent. Weekday peak hour travel demand will continue to exceed weekend peak period demand, even though weekend peak period travel is projected to increase at a higher rate.

Level of Service (LOS) is a means of describing a range of operating conditions on a particular type of facility. Six levels of service are defined with LOS A representing the best operating condition and LOS F representing the worst operating condition. LOS A through C describe varying degrees of operation at or above the posted speed limits. At LOS D, speeds decline slightly. At LOS E, operations are at capacity with little or no room to maneuver. At LOS F, there are breakdowns in vehicular flow.

The highest levels of congestion in the AM peak hour occur along southbound I-95, whereas the highest congestion levels in the PM peak hour occur along northbound I-95 ***(See Table 2)***. By

2025, congestion is expected to spread further north in both the AM and PM peak directions, with both operating at LOS F.

North of I-895, weekend peak period traffic currently operates at LOS D or better. Without improvements, the predicted LOS for 2025 weekend peak period traffic throughout the study area is an undesirable LOS E, with the exception of northbound I-95 between I-695 and north of MD 43, which is predicted to be LOS F.

Table 1
Existing and Future No-Build Traffic Volumes for Section 100

Limits	2002 Volume	2025 Volume [3]	Percent Growth	2002 Volume	2025 Volume [3]	Percent Growth
	Average Daily Traffic (Vehicles/Day)			Weekend [2] (Vehicles/Hour)		
South of I-895(N)	101,000	138,000	37%	3,900	5,550	42%
I-895(N) – I-695	161,000	219,000	36%	5,800	8,100	40%
I-695 – MD 43	166,000	225,000	35%	6,650	9,075	37%
North of MD 43	161,000	221,000	37%	6,150	8,475	38%
	AM Peak [1] (Vehicles/Hour)			PM Peak [1] (Vehicles/Hour)		
South of I-895(N)	5,200	6,350	22%	5,075	5,825	15%
I-895(N) – I-695	8,550	10,200	19%	8,575	9,725	13%
I-695 – MD 43	7,850	9,600	22%	8,650	9,850	14%
North of MD 43	7,700	9,575	24%	7,950	9,300	17%

Source: Year 2002 volumes from various Maryland State Highway Administration/Maryland Transportation Authority traffic counts.
Year 2025 volumes developed from the Baltimore Regional Transportation Board Regional Travel Demand Model, Round 6.

[1] AM and PM peak hour volumes represent the highest hourly volumes in the peak direction that occur on an average weekday (Monday though Friday).

[2] Weekend peak period volumes represent approximately the 50th highest weekend hour that occurs in a calendar year.

[3] The 2025 volumes assume improvements to MD 43, I-695, and expanded transit service as shown in the constrained long range plan. 2025 traffic volumes will be used in the analysis of the alternatives.

Table 2
Existing and Future No-Build Levels of Service (LOS) for Section 100[4]

Limits	I-895 to I-695		I-695 to MD 43		North of MD 43	
	2002	2025 [3]	2002	2025 [3]	2002	2025 [3]
	Northbound					
AM Peak [1]	LOS A-C	LOS D	LOS A-C	LOS D	LOS A-C	LOS D
PM Peak [1]	LOS F	LOS F	LOS F	LOS F	LOS E	LOS F
Weekend [2]	LOS A-C	LOS E	LOS D	LOS F	LOS A-C	LOS F
	Southbound					
AM Peak [1]	LOS F	LOS F	LOS E	LOS F	LOS E	LOS F
PM Peak [1]	LOS A-C	LOS D	LOS A-C	LOS E	LOS A-C	LOS D
Weekend [2]	LOS A-C	LOS E	LOS D	LOS E	LOS A-C	LOS E

Source: Year 2002 volumes from various Maryland State Highway Administration/Maryland Transportation Authority traffic counts.
Year 2025 volumes developed from the Baltimore Regional Transportation Board's Regional Travel Demand Model, Round 6.

[1] AM and PM peak hour volumes represent the highest hourly volumes in the peak direction that occur on an average weekday (Monday though Friday).

[2] Weekend peak period volumes represent approximately the 50th highest weekend hour that occurs in a calendar year.

[3] The 2025 volumes assume improvements to MD 43, I-695, and expanded transit service as shown in the constrained long range plan.

[4] LOS A-C describes varying degrees of operation at or above posted speed limits. At LOS D, speeds decline slightly. LOS E describes operations at capacity, with little room to maneuver in the traffic stream. LOS F describes breakdowns in vehicular flow (Source: *2000 Highway Capacity Manual)*.

C. Transit

I-95 is located within a multi-modal corridor. The Section 100 project planning study has been initiated to address needs related to highway capacity, which will serve passenger vehicles, transit vehicles, and freight vehicles. The Authority is working with the Maryland Transit Administration (MTA) during the Section 100 project planning study to coordinate planned highway improvements with planned transit services and strategies. The effect of transit on JFK travel demand has been evaluated through the use of travel demand scenarios.

MTA is addressing additional transit needs in the vicinity of the I-95 corridor. They have developed the Baltimore Regional Transit Plan, a long-term plan for meeting transit needs within the Baltimore region. The plan calls for expanding transit service along a Green Line from Johns Hopkins Medical Center to the White Marsh area. Metro and bus options will be considered. The plan also calls for the existing Maryland Rail Commuter (MARC) service in the I-95 corridor to be supplemented as part of a Purple Line service between Edgewood and Odenton using the Amtrak corridor right-of-way.

Historically, Amtrak's North East Corridor (NEC), which parallels the JFK, has been its highest used, most successful rail passenger service in the United States. It is anticipated that the market will continue to place a high demand on Amtrak in the NEC and that improvements will continue to be made. These improvements could include additional high-speed and regular rail service, station improvements, increased customer amenities, track installation and maintenance, and other operational or infrastructure improvements to enhance performance and reliability. Improvements in Amtrak service are dependent on larger, national issues and policy decisions, including Amtrak's fiscal standing.

D. Truck Freight

Data collected at the I-95 Toll plaza just north of the Susquehanna River showed the following truck movements on an average weekday in the year 2000:

- <u>Number of Trucks</u>
  About 1,200 light (3 axles) trucks (1.6%)
  About 1,100 medium (4 axles) trucks (1.4%)
  About 8,500 heavy (5+ axles) trucks (11%)

- <u>Total Freight Movement</u>
  About 190,000 tons per day

E. Freight Rail Service

The existing railroad network in the project study area consists of two major rail lines. These north-south oriented lines are generally parallel to I-95: the Amtrak Northeast Corridor (NEC) and the CSX Transportation (CSXT) Philadelphia Subdivision. Both lines connect Baltimore with Wilmington and Philadelphia. Both lines are located east of the I-95 Master Plan Study Area.

Although Amtrak's priority service is to their rail passengers, Amtrak also carries high priority/low bulk and weight packages on their trains. Norfolk Southern Railway (NS) has obtained track rights to carry freight on Amtrak's Northeast Corridor and operates 10 to 15 freight trains daily through the study area. Freight movement on the NEC typically occurs

between 10:00 p.m. and 6:00 a.m. to minimize conflicts between slower-moving freight trains and high-speed passenger trains.

NS serves the Port of Baltimore, the Port of Wilmington, auto manufacturing plants, and other shippers along the I-95 corridor. In addition, NS provides rail access to the Delmarva Peninsula from the NEC.

The Philadelphia Subdivision is a major link in CSXT's network, linking the Northeast with the Southeast as well as the Mid-Atlantic region with the Midwest. CSXT operates 30 to 35 trains through the I-95 Master Plan Study Area. CSXT serves the Port of Baltimore, the Port of Wilmington, auto manufacturing and distribution facilities, and connects with various short line railroads.

As noted, the Section 100 study is intended to address highway capacity needs along I-95. The MTA and the Maryland Port Administration are addressing additional freight needs through regional studies to enhance and expand long and short-haul freight rail service. These studies include the Mid-Atlantic Rail Study, which identified major freight and passenger rail bottlenecks and potential solutions paralleling the north-south corridors of I-81 and I-95.

IV. Environmental Overview

An environmental inventory was performed to identify existing socio-economic, cultural and natural environmental resources within the study area. A preliminary assessment of impacts that could result from the build alternates under consideration is shown in ***Tables 3 and 4***. A detailed evaluation of environmental impacts will be developed during the next phase of the study. The map of environmental resources within the study area can be found in ***Appendix C*** and on the project website.

A. Socio-Economic Resources

Socio-economic resources within the study area include residences and communities, community facilities, businesses and commercial areas. The residential areas include single-family homes, townhouses, apartments and condominiums. The business community consists of individual businesses, retail shopping areas and industrial / business parks. Community related facilities include schools, places of worship, cemeteries, post offices, libraries, police stations, fire stations, health care facilities, and parks and recreational facilities.

B. Historic and Archaeological Resources

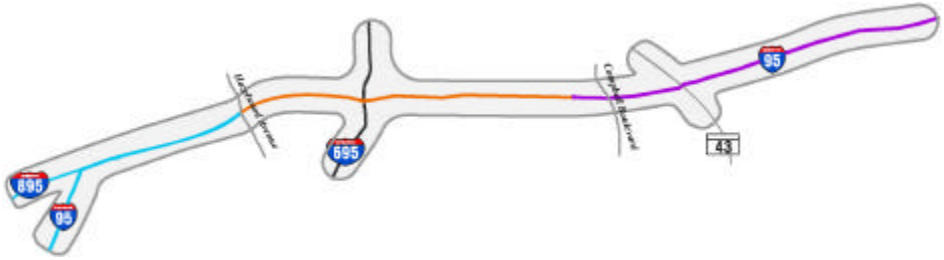
Cultural resource studies are being conducted to document potential historic and archaeological resources (i.e., buildings, sites, districts, structures and significant cultural objects) within the study area. Historic and archaeological files of the Maryland Historical Trust (MHT) and the Baltimore County Historical Society have been reviewed and limited field surveys performed. Upcoming detailed cultural resource studies will include "determination of eligibility" for potential historic properties, as well as assessment of potential effects. An archaeological site survey and assessment will also be conducted.

Background research was conducted at the MHT and at local repositories to identify potential historic resources within the Area of Potential Effect (APE). At MHT, pertinent structure inventories and survey reports were reviewed. Various in-house materials and documents available via the internet/world-wide-web were also consulted. A review of MHT files reveals that no historic resources have been identified within the proposed APE. Furthermore, no historic resource surveys have been conducted within the APE.

C. Natural Environmental Resources

Natural environmental resources within the study area include forests, forest interior dwelling species (FIDs), other wildlife habitat, floodplains, wetlands and streams. Streams within and near the study area include Moores Run, Redhouse Creek, Stemmers Run, White Marsh Run, Bird River and Gunpowder River. During the next phase of the study, detailed natural environmental investigations will be conducted to assess both the quantity and quality of impacted resources.

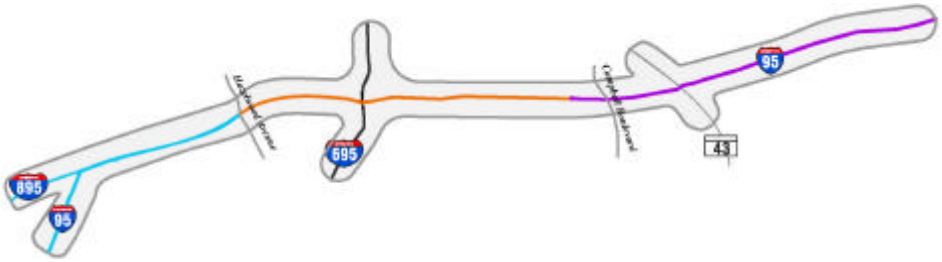
Table 3
Summary of Impacts
Alternate 2: General Purpose Lanes



Category	Alternate 1 No-Build	Alternate 2: General Purpose Lanes*							
		I-895 (N) Split to Hazelwood Avenue		Hazelwood Avenue to 2,700 Feet South of Campbell Boulevard		2,700 Feet South of Campbell Boulevard to New Forge Road			
		Option A	Option B***	Option A***	Option B	Option A	Option B***	Range	Total
Natural Environment									
100-year Floodplain Impacts (acres)	0	2.7	4.5	34.1	36.3	1.85	0.70	37.51 - 42.65	39.30
Wetlands Impacted (acres)	0	0.06	0.06	3.30	4.00	1.52	0.47	3.83 - 5.58	3.83
Stream Impacts (linear feet)	0	461	844	4,470	5,024	4,705	6,153	9636 - 12021	11,467
Woodlands Impacted (acres)	0	5.40	4.20	67.0	70.4	44.32	39.08	110.28 - 120.12	110.28
Forest Interior Dwelling Species Habitat (acres)	0	0	0	0	0	1.30	1.62	1.30 - 1.62	1.62
Right-of-Way Required (acres)									
Residential	0	0.10	0.10	1.00	3.50	1.45	1.21	2.31 - 5.05	2.31
Business	0	0.00	0.00	0.10	0.10	0.53	2.00	0.63 - 2.10	2.10
Undeveloped	0	0.00	1.10	9.50	12.90	0.87	0.05	9.55 - 14.87	10.65
Historic/Archeological Sites Affected (each)	0	0	0	0	0	0	0	-	0
Parklands/Recreational Areas Affected (each)	0	0	0	0	0	0	0	-	0
Displacements (each)									
Residential	0	0	0	1	1	2	0	1 - 3	1
Business	0	0	0	0	0	0	0	0	0
Preliminary Neat Construction Cost (millions)**	**$0**	**$40**	**$43**	**$236**	**$208**	**$98**	**$91**	**$339 - $377**	**$370**

*** Work in progress. Estimates of impacts are based on conceptual alternates and preliminary interchange options.**
**** Does not include right-of-way costs.**
***** Options recommended for detailed study**

Table 4
Summary of Impacts
Alternate 3: Managed Lanes



Category	Alternate 1 No-Build	Alternate 3: Managed Lanes*								
		I-895 (N) Split to Hazelwood Avenue		Hazelwood Avenue to 2,700 Feet South of Campbell Boulevard			2,700 Feet South of Campbell Boulevard to New Forge Road			
		Option A	Option B***	Option A	Option A Mod***	Option B	Option A***	Option B	Range	Total
Natural Environment										
100-year Floodplain Impacts (acres)	0	4.20	4.30	36.10	36.00	37.10	5.97	5.82	46.02 - 47.73	46.27
Wetlands Impacted (acres)	0	0.50	0.50	4.10	4.00	4.30	2.34	2.34	6.84 - 7.14	6.84
Stream Impacts (linear feet)	0	1,197	955	5,356	5356	5647	6,262	6276	12573 - 13120	12,573
Woodlands Impacted (acres)	0	8.40	7.70	93.80	94.00	95.80	54.16	70.14	155.86 - 174.34	155.86
Forest Interior Dwelling Species Habitat (acres)	0	0	0	0	0	0	5.18	4.95	4.95 - 5.18	5.18
Right-of-Way Required (acres)										
Residential	0	0.10	0.10	4.80	5.00	7.00	0.23	1.91	5.13 - 9.01	5.33
Business	0	0.00	0.04	0.30	0.30	0.30	5.54	6.28	5.84 - 6.62	5.88
Undeveloped	0	3.00	1.40	27.10	27.00	31.00	0.38	1.15	28.78 - 35.15	28.78
Historic/Archeological Sites Affected (each)	0	0	0	0	0	0	0	0	-	0
Parklands/Recreational Areas Affected (each)	0	0	0	0	0	0	0	0	-	0
Displacements (each)										
Residential	0	0	0	3	5	1	0	2	1 - 7	5
Business	0	0	0	3	3	3	0	0	3 - 3	3
Preliminary Neat Construction Cost (millions)**	**$0**	**$75**	**$73**	**$363**	**$406**	**$344**	**$166**	**$188**	**$339 - $377**	**$645**

*** Work in progress. Estimates of impacts are based on conceptual alternates and preliminary interchange options.**
**** Does not include right-of-way costs.**
***** Options recommended for detailed study**

V. Alternates

A. Existing Conditions

Mainline – Within the Section 100 study area, I-95 is an eight-lane divided highway comprised of four general-purpose lanes in each direction.

I-95 / I-895(N) Split – Approaching the I-95 / I-895 (N) split from the north, I-95 expands to five general purpose lanes. The two leftmost lanes become southbound I-895, while the three rightmost lanes continue on as I-95 south. I-895 remains the through movement, even though I-95 is the primary interstate route. Approaching the split from the south, I-895 becomes the two left most lanes of I-95 north as the two highways converge.

The existing I-95 / I-895 interchange does not meet AASHTO criteria for route continuity (AASHTO Green Book 2001 pp. 811-812). The through driver in the left lanes of southbound I-95 may expect to remain on southbound I-95 without making lane changes however, the current interchange design requires drivers in the left lane to move right in order to remain on I-95 southbound.

The existing I-95 / I-895 interchange also has less than desireable lengths of superelevation runoff and tangent runout. Widening I-95 through the interchange would exacerbate the problem.

I-95 / I-695 Interchange – Within the interchange area, both I-95 and I-695 incorporate braided mainline roadways. Half of the entrances and exits connect to or from the left. AASHTO recommends that left-hand entrances and exits be avoided in interchange design (AASHTO Green Book 2001 pp. 845-846) because they violate driver expectancy and require trucks and other slower moving vehicles entering or exiting the facility to weave across multiple lanes of traffic.

The existing I-95 / I-695 interchange also has less than desireable lengths of superelevation runoff and tangent runout between reverse curves. Additional widening of I-95 and I-695 through the interchange would exacerbate the problem.

I-95 / MD 43 Interchange – The existing configuration is a full cloverleaf with minimal weave distances between the entrance and exit loop ramps.

B. Master Plan Concepts

Six highway concepts, representing a broad range of potential improvements, were developed, evaluated and presented in the *I-95 Master Plan*. All six concepts were evaluated with base or enhanced transit assumptions *("I-95 Master Plan Study - Range of Modal Alternates to be Evaluated during Future Independent Projects,"* June 2002). Three concepts (C-1: No Build, C-5: Managed Lanes and C-6: General Purpose Lanes) were recommended for further evaluation in an independent Section 100 project planning study. See ***Appendix D*** for the *I-95 Master Plan* based typical sections. The three concepts were presented to the Focus Group at their first meeting in September, 2003. A brief summary of each concept is provided below:

Master Plan Concept C-1: No-Build **-** The No-Build concept would retain the existing I-95 highway and associated interchanges in their present configurations and allow for routine

maintenance and safety upgrades. Existing I-95 would remain four-lanes per direction between I-895 and MD 24 and three-lanes per direction between MD 24 and the Delaware State Line. There would be no increase in roadway capacity or any significant reduction in the accident rate.

Therefore, Master Plan Concept C-1 was recommended for further evaluation during project planning studies as a baseline for comparison with other concepts.

Master Plan Concept C-2: All Lanes Tolled – This concept would reduce pavement expansion by managing the existing travel lanes. In this concept, it was assumed that all existing and any additional travel lanes throughout the entire 49-mile length of the JFK would be tolled. In addition, it was assumed that auxiliary or collector-distributor (C-D) lanes would be provided to improve traffic operations and safety where needed.

This concept assumed six-lanes per direction between I-895 and I-695; four-lanes per direction between I-895 and MD 24; and three-lanes per direction between MD 24 and the Delaware State Line.

Tolling of all lanes was expected to increase peak hour traffic volumes on parallel routes (primarily US 40, US 1 and MD 7) by 25% to 70% causing operational failures along the entire highway network. Improvements to the parallel routes may increase environmental and community impacts related to transportation needs.

Therefore, Master Plan Concept C-2 was not recommended for further evaluation.

Master Plan Concept C-3: HOV Lanes - This concept would include two additional general purpose lanes per direction between the I-895 split and I-695, one High Occupancy Vehicle (HOV) lane per direction between I-695 and MD 24, and one additional general purpose lane per direction north of MD 24.

Level of Service (LOS) F was anticipated during the weekday on sections of the general purpose lanes with no dramatic relief provided by the single HOV lane. In addition, the existing average auto occupancy rate for vehicles on I-95 exceeded the average rate for other freeways with dedicated HOV lanes, limiting the potential for increased vehicle occupancy.

During the weekend peak periods, when the HOV lane is open to all traffic, the JFK was projected to operate between LOS C and LOS E throughout the study area, resulting in only somewhat improved traffic operations in comparison to Concept C-1.

Therefore, Master Plan Concept C-3 was not recommended for further evaluation.

Master Plan Concept C-4: Reversible Lanes - This concept would provide a two-lane separated and reversible roadway in the median of the JFK from south of I-695 to MD 543 and one new general purpose lane per direction north of MD 543. The reversible roadway would be dedicated to the peak direction during weekday and weekend peak periods.

Since the peak traffic volumes on the JFK during holidays and weekends are evenly distributed between directions (50% north/50% south), this concept did not offer the necessary flexibility for successful traffic management of interstate traffic flows. In addition, extensive geometric

modifications would be essential at connecting interchanges and capital intensive bridge replacements would be required due to restricted placement opportunities for structural piers.

Therefore, Master Plan Concept C-4 was not recommended for further evaluation.

Master Plan Concept C-5: Managed Roadways - This concept would include two managed lanes per direction between I-895 and MD 543, and one additional general purpose lane (lanes open to all traffic) per direction north of MD 24.

Managed Lanes are lanes, which are separated from the general-purpose lanes and operate under some form of restricted use. In the *I-95 Master Plan*, the managed lanes were assumed to operate under a single management strategy 24-hours per day, or on a "time-share basis" with different restrictions at different times of day. Management strategies could include restrictions at access locations (ramps), by time of day (peak, off-peak), by vehicle type (trucks, buses), by type of use (commercial or occupancy-HOV), by price (tolling) or by direction (reversible). Managed lanes could be designed for flexibility so that management strategies could be modified over time to maximize person moving capacity, optimize vehicle carrying capacity, and/ or achieve other transportation and community goals.

During the weekday, the peak hour/peak direction traffic in the general purpose lanes was projected to operate at or above capacity (between LOS E and LOS F), while capacity was available in the managed lanes which are projected to operate between LOS A and LOS B. Modification of the management strategy to improve the traffic split between the general purpose and managed lanes should provide a better level of service for all lanes.

Periods of congestion were expected on the general-purpose lanes; however, it was anticipated that travel demand management could be achieved through successful operation of the managed lanes.

Therefore, Master Plan Concept C-5 was recommended for further evaluation.

Master Plan Concept C-6: General Purpose Lanes - This concept would increase the number of general purpose lanes as needed, to accommodate the projected traffic demand, including six-lanes between I-895 and I-695; five mainline and two C-D lanes between I-695 and north of MD 43; six-lanes between north of MD 43 and MD 152; five-lanes between MD 152 and MD 543; and four-lanes north of MD 543. C-D lanes could provide the ability for merge, diverge and weave movements to occur in a safer manner by separating these movements from the mainline traffic.

Due to the number of accessible travel lanes provided, it was anticipated that there would be no readily available means to implement a travel demand management program and limited potential to create incentives for transit or carpooling. However, this concept provides good overall traffic operations for both weekday and weekend peak periods.

Therefore, Master Plan Concept C-6 was recommended for further evaluation.

In summary, Master Plan Concepts C-1, C-5 and C-6 were carried forward to the project planning phase for Section 100. Master Plan Concepts C-2, C-3, and C-4 were eliminated from

further review. The regulatory and resource agencies participating in the Master Plan process concurred in the selection and rejection of these concepts.

C. Initial Section 100 Design Concepts with C-D Lanes

At the second Focus Group meeting, the project team presented their initial designs for both the General Purpose and Managed Lanes Alternates. For each of these alternates, two interchange options were presented for the I-95/I-895 (N) split, the I-95/Baltimore Beltway (I-695) interchange and for the I-95/White Marsh Boulevard (MD 43) interchange. See ***Appendix E*** for detailed concept descriptions for the initial I-95 Master Plan Concepts carried forward into the Section 100 Project Planning Study (prior to the design refinements discussed below).

D. Removal of C-D Lanes

At the third Focus Group meeting, the project team presented the results of their preliminary design refinements for both the General Purpose and Managed Lanes Alternates. The primary change to both alternates was the elimination of the collector-distributor lanes between the Baltimore Beltway (I-695) and White Marsh Boulevard (MD 43). This decision was made because traffic and engineering analyses showed that:

- By developing single point exit interchange designs, conflict points along the mainline could be reduced to a maximum of three. The use of C-D lanes would only reduce the number of conflict points by one.
- Traffic counts and traffic forecasts indicated little interaction between the traffic using the I-695 and MD 43 Interchanges. Typically continuous, C-D Lanes are required where there is high traffic interaction between closely spaced adjacent interchanges.
- The spacing between the I-695 and MD 43 interchanges is insufficient to satisfactorily accommodate movements between the through lanes and the C-D lanes forcing traffic that would be better served in the through lanes to use the C-D lanes.
- The cross-section for the CD lane option requires a 20' minimum width median (4' CD roadway shoulder, 2' barrier and 14' mainline shoulder) to separate the CD roadway from the general purpose lanes. An additional lane in each direction on the CD roadway is also required to accommodate the heavy movements between the I-95 (to and from the north) and I-695 (to and from the west). Additional right of way would also be required in this section to include slip ramp connections between I-95 and the CD roadway in this area. All of these factors significantly increase the footprint of the I-95 mainline between I-695 and MD 43, resulting in significantly more right-of-way and impacts than options without the CD roadway.
- The additional right-of-way would further increase impacts to both the natural and man-made environments.

Figure 3 illustrates how weaving can adversely affect overall operations of an interchange. The top graphic shows a typical cloverleaf interchange (for example - the I-95/MD 43 interchange). The distance between the inside loops is limited and traffic exiting the freeway conflicts with traffic entering the freeway. The resulting weave condition causes mainline speeds to drop, congestion to develop and accidents to rise.

The middle graphic shows the same cloverleaf interchange with a C-D roadway added. The weave condition now occurs on the C-D roadway, off of the mainline. The mainline operations

are unaffected, but the extra width required for the C-D roadway takes more right of way and potentially creates more environmental impacts.

The bottom figure shows a fully directional interchange with no C-D roadway and single point exit ramps in each quadrant. This configuration eliminates the weave condition and keeps right of way requirements to a minimum.

Figures 4 and 5 show the typical sections for Alternate 2: General Purpose Lanes and Alternate 3: Managed Lanes with and without C-D lanes.

Figure 3
C-D Lanes Weave Comparison

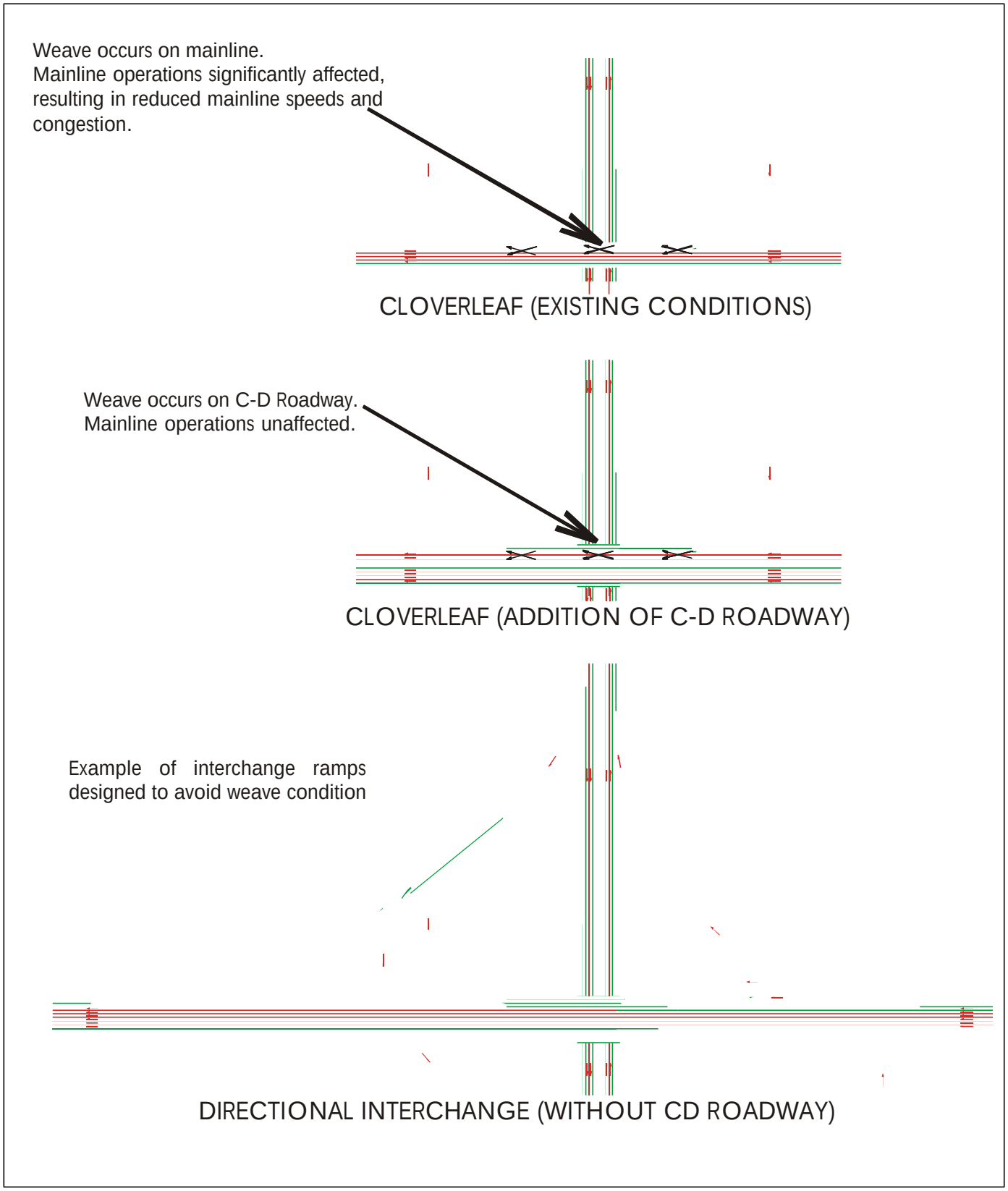


Figure 4
General Purpose Lanes Typical Sections

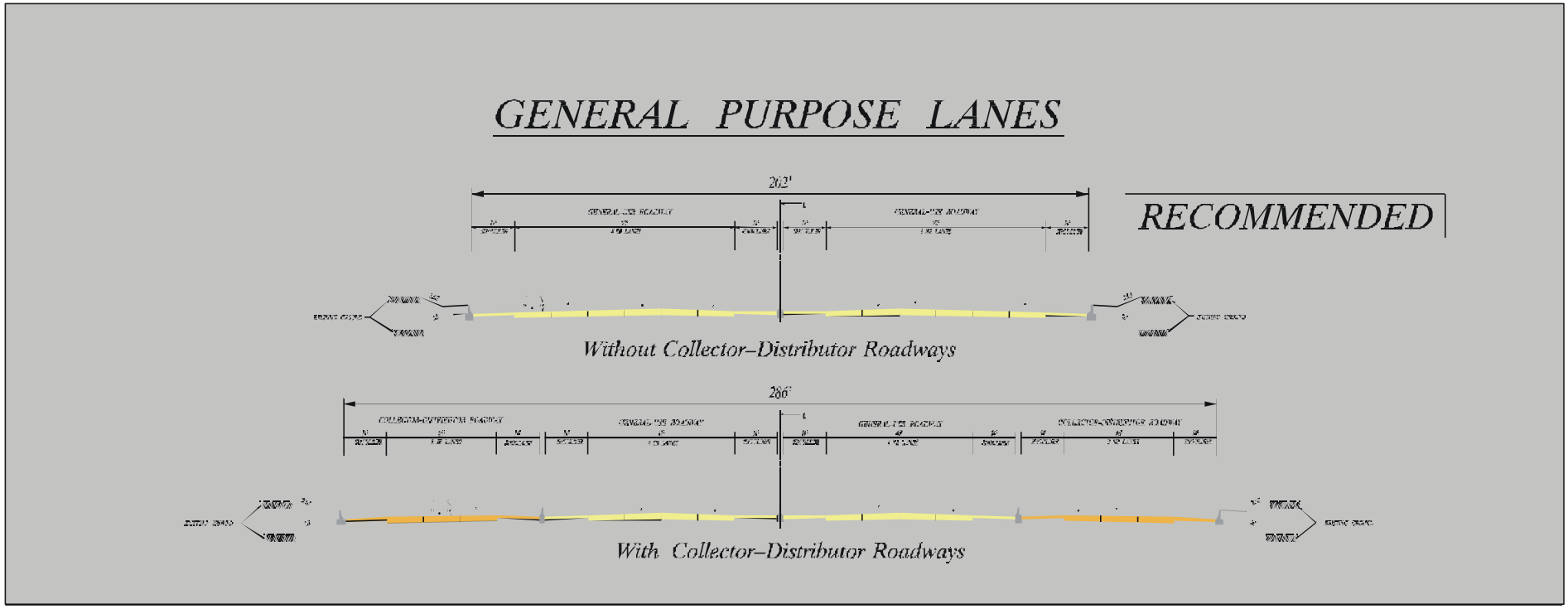
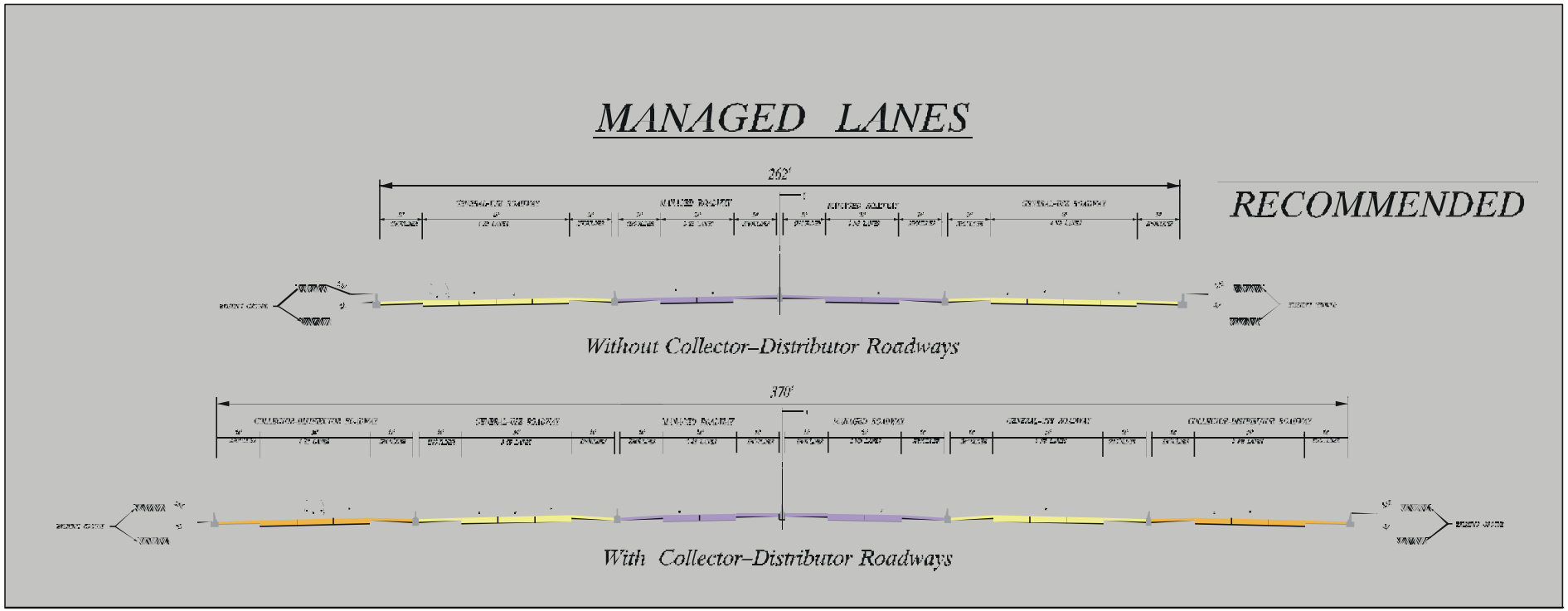


Figure 5
Managed Lanes Typical Sections



E. Recommended Alternates Retained for Detailed Study

The alternates (without C-D lanes) were presented for public review and comment at the November 18, 2003 Public Workshop. Following the Public Workshop, the project team carefully reviewed each alternate and interchange option with respect to safety, capacity and potential environmental impacts. The recommendation was made to carry both the General Purpose Lanes and the Managed Lanes Alternates forward into detailed studies. For each interchange location (I-895, I-695 and MD 43), the project team also recommended which interchange option should be carried forward into detailed studies for each alternate (See **Table 5**). The evaluation criteria and site-specific information considered in selecting the interchange configurations can be found in the Interchange Comparison Matrices (See **Appendix F**).

These alternates are being carried forward because, based on existing information, it appears that each has the potential to meet project objectives with acceptable environmental impacts and costs. However, based on more detailed engineering and environmental studies, these preliminary evaluations may be revised. Determinations of reasonableness, practicability, and prudence will be made (if needed) once more detailed information has been developed.

Table 5
Recommended Interchange Options

	Interchange		
	I-895	**I-695**	**MD 43**
Alternate 2: General Purpose Lanes	2B	2A	2B
Alternate 3: Managed Lanes	3B	3A Modified	3A

The following is a description of the recommended alternates retained for detailed study.

1. Alternate 1: No-Build - The No-Build Alternate would include normal maintenance and minor safety improvements. There would be no increase in roadway capacity or any significant reduction in the accident rate (See ***Figure 6***).

Under the no-build condition, all sections of I-95 within the study area would operate at level of service "F" in the peak direction. In addition, approximately six to ten thousand trips would be diverted to other routes or change their method of travel.

2. Alternate 2: General Purpose Lanes

a. Mainline – (See ***Figure 7***). This concept would include the provision of additional general-purpose lanes to accommodate the projected traffic demand. In order to reach an acceptable weekday and weekend level of service E and D, respectively, this concept would consist of:

- Four-lanes in each direction of I-95 from approximately ¼ mile south of the I-895 interchange to the point where I-95 merges with I-895,
- Six-lanes in each direction between the I-895(N) Split and MD 43,

- And north of MD 43, the roadway would transition from five-lanes in each direction to four-lanes in each direction.

b. I-95 / I-895 (N) Interchange – General Purpose Lanes/ Option 2B (S*ee Appendix G Sheet 1B)* - This option reconfigures the existing interchange by relocating the southbound roadway of I-95 and the northbound roadway of I-895 to make I-95 the through movement in the interchange. Southbound I-95 is relocated immediately adjacent to the existing northbound roadway of I-95, whereas northbound I-895 is relocated to cross over the proposed northbound and southbound roadways of I-95.

Approaching from the south, I-95 northbound would be widened by one lane approximately ¼ mile south of the interchange. The resulting four-lanes would merge with the two-lanes of northbound I-895 to form six-lanes on I-95 northbound. The two northbound lanes of I-895 would diverge from southbound I-895, cross over both the northbound and southbound roadways of I-95, and merge with I-95 from the right.

Approaching from the north, I-95 southbound splits into three-lanes for southbound I-895 and four-lanes for southbound I-95. The fourth lane on southbound I-95 continues to approximately ¼ mile south of the interchange. The third lane of southbound I-895 ends with the off-ramp to Moravia Road.

Option 2B realigns southbound I-95 to be the through movement. This improvement in route continuity is more consistent with a driver's expectation that exits will be made to the right side of the freeway. Option 2B is recommended for detailed study.

c. I-95 / I-695 Interchange – General Purpose Lanes / Option 2A (*See Appendix G, Sheet 3B*) - This interchange option is a fully directional interchange which removes the braided mainline roadways on both I-95 and I-695 and replaces them with mainline roadway alignments that remain side-by-side. This improves the interchange geometry and improves driver expectancy by replacing all left-hand entrances and exits with more conventional right-hand entrances and exits.

I-95 northbound, south of the interchange consists of six general-purpose lanes. Four-lanes carry through the interchange northbound, while three-lanes exit to become the two-lane ramp to westbound I-695 and the one-lane ramp to eastbound I-695.

I-95 northbound, north of the interchange, consists of six general-purpose lanes. Four-lanes carry through the interchange to merge with the two-lane ramp from eastbound I-695 and the single-lane ramp from westbound I-695.

I-95 southbound, north of the interchange, consists of six general-purpose lanes. Four general-purpose lanes carry through the interchange while three-lanes exit to become the two-lane ramp to westbound I-695 and the one-lane ramp to eastbound I-695.

I-95 southbound, south of the interchange, consists of four general-purpose lanes and a three-lane entrance formed from the two-lane ramp from eastbound I-695 and the single-lane ramp from westbound I-695. This three-lane ramp drops the outside lane before merging with the four southbound general-purpose lanes. Traffic continuing south on I-95 past I-895 will have to

merge into one of the four left lanes, weaving across traffic exiting from southbound I-95 to southbound I-895. I-695 traffic destined for I-895 will stay in either of the right two lanes. The volume of weaving traffic on southbound I-95 between I-695 and I-895 will be reduced because the heaviest movement, the southbound I-95 through movement, will no longer have to weave. Approaching from the east, the four westbound lanes of I-695 divide. Two-lanes carry through the interchange on I-695 and two-lanes exit, forming a one-lane ramp to I-95 northbound and a one-lane ramp to I-95 southbound.

West of the interchange, a two-lane ramp from southbound I-95 and a two-lane ramp from northbound I-95 join the I-695 westbound roadway, forming a 6-lane section westbound on I-695. This six-lane section tapers to meet the existing three lane section in the vicinity of the US 1 interchange.

Approaching from the west, the existing three-lanes of I-695 transition to four-lanes. Two-lanes then proceed through the interchange while three-lanes exit, forming the two-lane ramp to I-95 northbound and the two-lane ramp to I-95 southbound.

East of the interchange, a one-lane ramp from southbound I-95 and a one-lane ramp from northbound I-95 are merged to a two-lane section before joining with the eastbound I-695 roadway. The resulting four-lane section tapers to meet the existing three-lanes of eastbound I-695.

Option 2A significantly improves positive guidance and driver expectancy by removing the braided roadways and relocating left-hand entries and exits to the right of the I-95 and I-695 roadways, whereas Option 2B largely retains the existing geometry through base widening. Option 2A also has less environmental impacts than Option 2B. Option 2A is recommended for detailed study.

d. I-95 / MD 43 Interchange – General Purpose Lanes / Option 2B (*See Appendix G, Sheet 5B*) - This interchange concept is a partial cloverleaf configuration, with two half-signals on MD 43 at the spur ramps. All weaving within the interchange is eliminated.

I-95 through the interchange consists of five general-purpose lanes. Two through lanes are generally provided on MD 43, with additional lanes added or dropped at interchange ramps.

Approaching from the south, the single-point exit leads to a single-lane ramp to eastbound MD 43 and a single lane loop ramp to westbound MD 43.

The southbound approach to the interchange is a similar configuration. A single-lane ramp exits to westbound MD 43 and a single lane loop ramp exits to eastbound MD 43.

Approaching from the west a single lane exit ramp connects MD 43 to southbound I-95 and a signalized left turn lane with the median of MD 43 feeds a two-lane ramp onto northbound I-95.

Similarly, approaching from the east a signalized left turn lane within the median of MD 43 feeds a two-lane ramp onto southbound I-95 and a single land exit ramp connects MD 43 to northbound I-95.

Option 2B requires two less structures, has less displacements and costs less to construct. Option 2B is recommended for detailed study.

*See **Appendix H** for a description of the General Purpose Lanes options that were dropped from consideration.*

3. Alternate 3: Managed Lanes

a. Mainline – (See ***Figure 8***). In addition to the general-purpose lanes, this concept includes two managed lanes per direction in the median from I-895 to north of MD 43:

- Four general purpose lanes in each direction of I-95 from approximately ¼ mile south of the I-895 interchange to the point where I-95 merges with I-895,
- Two managed lanes and four general purpose lanes in each direction between the I-895 split and MD 43,
- And north of MD 43, the roadway would transition from the six-lane section (two-lane managed and four-lane general-purpose in each direction) into the existing four-lanes in each direction.

The managed lanes are anticipated to operate at or above level of service "D" in the peak direction while the general purpose lanes will operate generally at LOS "E".

Managed lane strategies preserve a portion of the highway capacity for priority needs by providing opportunities for eligible vehicles to maintain generally free-flow travel speeds on designated lanes or facilities. The managed lanes could operate under a single management strategy 24-hours per day, or on a "time-share basis" with different restrictions at different times of day. Management strategies could include restrictions at access locations (ramps), by time of day (peak/off-peak), by vehicle-type (trucks/buses), by type of use (commercial / high occupancy vehicle (HOV)), or by price (variable or fixed). Managed lanes would be designed for flexibility so that management strategies can be modified over time to maximize person moving capacity, optimize vehicle carrying capacity and achieve transportation and community goals.

Management strategies are usually established to constrain demand (i.e., the number of motorists desiring to use a lane) for the managed lanes at or below the available supply (i.e., highway lane capacity). The strategies may be adjusted over time to reflect changes in regional transportation goals and the proposed managed lanes are designed to maintain the viability of the maximum number of strategy choices. The success of a managed lane system hinges on a user's ability to consistently experience a predictable travel time and a facility operator's ability to consistently manage traffic volumes to provide the expected travel speed and travel time with a high degree of certainty. Predictable travel times create advantages for transport fleets with schedules to meet such as those engaged in transit services or commercial "just in time" freight delivery services.

b. I-95 / I-895 Interchange - Managed Lanes / Option 3B (*See Appendix I, Sheet 1B*) - This option adjusts the configuration of the existing interchange by relocating the southbound roadway of I-95 and the northbound roadway of I-895 to make I-95 the through movement in the

interchange. Southbound I-95 would be relocated adjacent to the existing northbound roadway of I-95, whereas the northbound general purpose lanes of I-895 would be relocated to a grade-separated crossing over both the proposed northbound and southbound roadways of I-95. Traffic moving from the southbound managed roadway to southbound I-895 must merge with southbound I-895 general-purpose traffic and weave across southbound I-895 traffic to exit via Moravia Road.

Approaching from the south, I-95 would be widened beginning approximately ¼ mile south of the interchange to form the managed lane. The three northbound general purpose lanes of I-95 would merge with the two general purpose lanes of northbound I-895 before transitioning from a five-lane to a four-lane general purpose roadway approximately ¼ mile north of the merge point. A separate one-lane ramp exiting from the left side of northbound I-895 would be grade-separated over the southbound lanes of I-95 and merge with the I-95 managed lanes within the median of I-95.

Approaching from the south, the two-lanes of I-895 northbound would diverge from southbound I-895, cross over the northbound and southbound roadways of I-95 and merge with I-95 from the right, north of the interchange.

Approaching from the north, the four general-purpose lanes roadway of I-95 split into a two-lane southbound general-purpose roadway for I-895 and a three-lane general-purpose roadway for I-95. The two-lane managed roadway in the median of I-95 would split to a single-lane off-ramp to southbound I-895 that crosses over southbound I-95 and a single-lane managed lane that remains in the median of the southbound I-95 general-purpose roadway. The fourth lane of southbound I-95 (most likely the outside general purpose lane) would be carried through the interchange and dropped at a point approximately ¼ mile south of the interchange. By dropping the outside general purpose lane, the managed lanes will be given preference over the general purpose lanes and will operate more free flowing. It also meets driver expectancy by having the lane drop on the right side of the roadway past the interchange (AASHTO Lane Balance).

A short weaving distance may be created from the southbound managed lane of I-895 to the Moravia Road interchange, as well as from Moravia Road to the northbound managed lane of I-895. This weaving distance would be further examined.

Option 3B is easier to construct than Option 3A because the span lengths and skew for the overpass bridges are greatly reduced. There is not a significant difference in cost or environmental impacts between Option 3A and Option 3B. Option 3B is recommended for detailed study.

c. I-95 / I-695 Interchange - Managed Lanes/ Option 3A Modified (*See Appendix I, Sheet 3E)* - This option improves the geometry and driver expectancy on I-95 and I-695 by untwisting the braided mainline of both roadways and replacing many of the existing left-hand entrances and exits with more conventional right-hand entrances and exits. The exit ramps typically split to separate ramps in opposite directions of travel for the destination route. Some left-hand exit and entrance ramps are retained for the managed lane ramps within the median of I-695, but all ramp movements for the general purpose roadways merge to and from the outside of I-95 and I-695. Most of the merges and diverges occur off of the mainline roadways for I-695 and I-95 (on the ramps themselves), limiting the number of lane drops that must occur on the mainline. A

six-level interchange is required for this option, consisting of 2 mainline levels, 2 general purpose ramp levels, and 2 managed ramp levels. This option would tie into the possible future HOV lanes along I-695 to the west of I-95.

Three general purpose lanes are generally provided on I-95 through the interchange, with the fourth (outermost) lane in each direction of I-95 dropping to off-ramps to I-695. A minimum of two managed through lanes are provided in each direction of travel for I-95 throughout the interchange. Two through lanes are generally provided on the mainline of I-695, with additional lanes added or dropped at interchange ramps.

Approaching from the south on northbound I-95, the four-lane general purpose roadway of northbound I-95 splits into a three-lane northbound general purpose roadway for I-95 and a three-lane, right-hand exit that ultimately splits to eastbound and westbound I-695. North of the I-695 interchange, a two-lane entrance ramp from I-695 merges together with the three-through lanes of I-95 through a series of acceleration lanes and lane drops to form a four-lane general purpose roadway.

Approaching from the south on northbound I-95, the two-lane managed roadway runs parallel and adjacent to the median edge of the northbound general purpose roadway of I-95. South of the interchange, traffic in the northbound managed roadway would have the option of continuing through the interchange on the two-lane managed roadway or exiting to either direction of I-695 through a common right-hand, single-lane exit. North of the interchange, traffic will enter the managed roadway through a common right-hand, two-lane entrance that merges back into a two-lane managed roadway via a series of lane drops.

Approaching from the north on the southbound general purpose roadway of I-95, traffic would have the option of remaining on the 3-lane general purpose roadway through the interchange or exiting to I-695 via a two-lane exit. South of the interchange, traffic from both directions of I-695 would enter from the right at a single point with a three-lane entrance ramp and merge via a series of lane drops into a four-lane general purpose roadway.

Approaching from the north on the southbound managed roadway of I-95, the two-lane managed roadway runs adjacent to the median edge of the southbound general purpose roadway of I-95. North of the interchange, traffic would have the option of remaining on the 2-lane managed roadway through the interchange or exiting to either direction of I-695 through a common right-hand, single lane exit. South of the interchange, traffic will enter the managed roadway through a common right-hand, two-lane entrance that merges back into a two-lane managed roadway via a series of acceleration lanes and lane drops.

Approaching the interchange from the west, traffic on eastbound I-695 would have the option of continuing through the interchange on the 2-lane eastbound general purpose roadway, entering either the northbound or southbound managed lane of I-95 from a common left-hand, single-lane exit in the median or entering the northbound or southbound general purpose lanes of I-95 through a common right-hand, three-lane exit on the outside of the eastbound roadway. East of the interchange, two lanes of general purpose traffic from I-95 will merge from the right and one lane of managed traffic will merge from the median with the 2 lanes of I-695 traffic, eventually dropping to 4 eastbound lanes.

Approaching the interchange from the east, traffic on westbound I-695 would have the option of remaining on the 2-lane westbound general purpose roadway or entering the managed or general purpose lanes of I-95 from a common right-hand, two-lane ramp. Traffic on this common ramp would ultimately split between a two-lane ramp to the northbound managed/general purpose roadways of I-95 and a single-lane southbound ramp to the southbound managed/general purpose roadways of I-95. West of the interchange, traffic from both the northbound and southbound directions of the I-95 managed roadway would drop into a dedicated interior lane for westbound I-695. Traffic from both the northbound and southbound directions of the I-95 general purpose roadway would merge from right side of westbound I-695 through a series of acceleration lanes and lane drops.

I-95 south of I-695 is anticipated to operate at capacity. The provision for managed lanes from I-695 to the I-895 Split will allow motorists to bypass the congestion. This is especially true of movements to and from the west on I-695, which are high volume ramps.

The weaving distance between the entrance from southbound I-95 onto eastbound I-695 and the exit to MD 7 will be examined. Weaving distances between the managed lane median ramps and the US 1 interchange (0.7 miles) will be also be evaluated.

Option 3A retains the braided alignment on I-695 and several left-hand entries and exits on I-695, and Option 3B largely retains the geometry of the existing interchange including most of the existing left-hand entrances and exits on both I-95 and I-695.

Option 3A Modified facilitates maintenance of traffic by building the managed roadway and managed left turn movements over the existing interchange while it remains in service, and then diverting traffic to the managed facility while the lower general purpose ramps are constructed. Option 3A Modified offers significant improvements in positive guidance and driver expectancy over Options 3A and 3B by removing the braids, eliminating left-hand entrances and exits on I-95, and reducing the number of left-hand entrances and exits on I-695. Option 3A Modified is recommended for detailed study.

d. I-95 / MD 43 Interchange - Managed Lanes Alternate / Option 3A (*See Appendix I, Sheet 5A*) –The features of this option include single exit points for each approach with direct connections provided for all interchange movements. All weaving within the interchange is eliminated under this concept. Single-lane ramps provide for all movements to and from the managed lanes, with the lanes connecting directly to MD 43 at a signalized intersection on the structure over I-95.

I-95 through the interchange consists of two managed lanes and four general-purpose lanes. Two through lanes are generally provided on MD 43, with additional lanes added or dropped as necessary at interchange ramps.

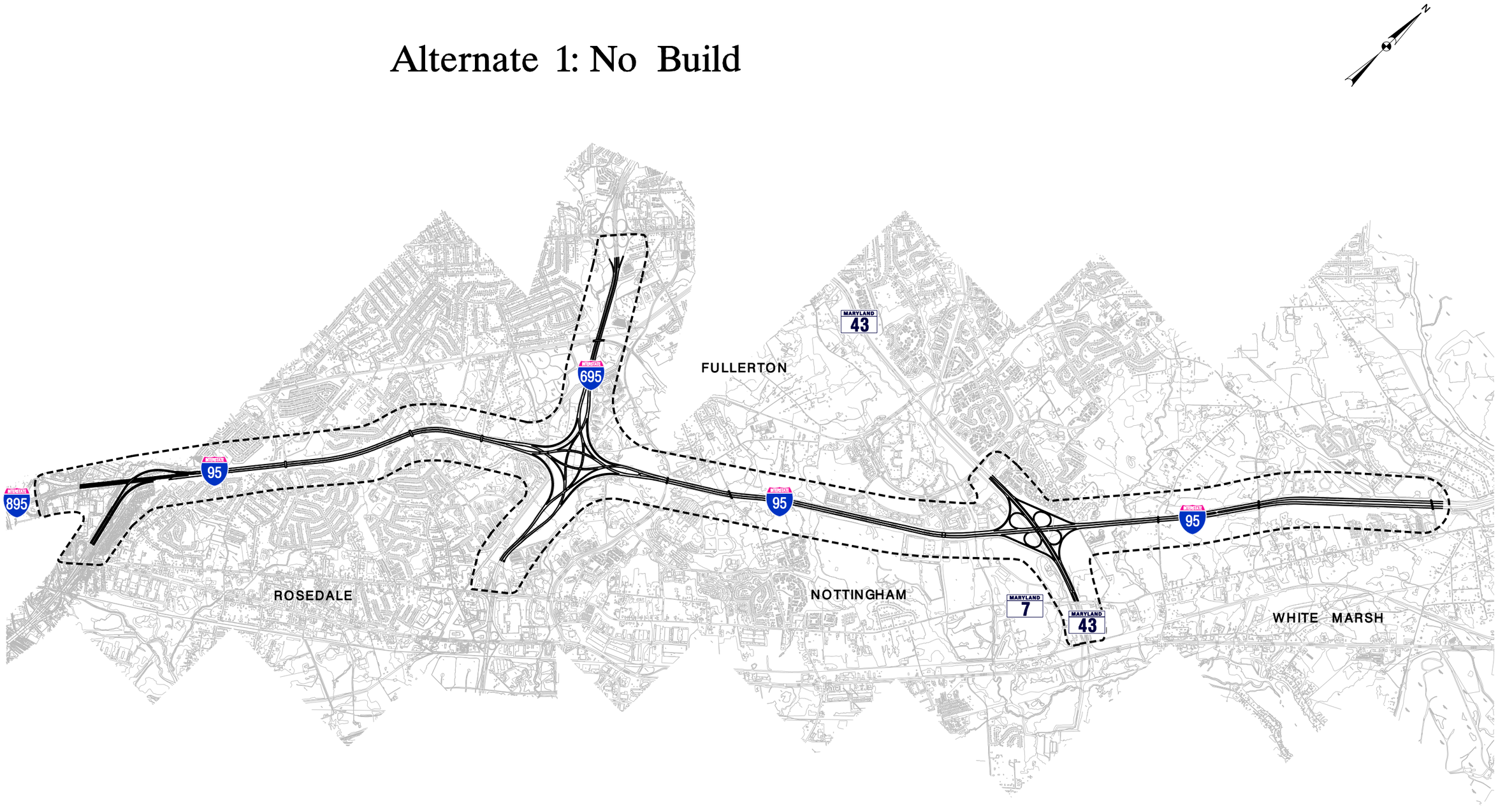
Approaching from the south, there is a two-lane single-point exit ramp from I-95 northbound to MD 43 that splits into a single-lane ramp to eastbound MD 43 and a single-lane loop ramp to westbound MD 43. The single-point two-lane on-ramp from westbound MD 43 splits into a single-lane ramp to southbound I-95 and a single-lane ramp to northbound I-95.

Approaching from the north, there is a two-lane single-point exit ramp that splits from I-95 southbound to MD 43 into a single-lane ramp to westbound MD 43 and single-lane loop ramp to westbound MD 43 and a single-lane loop ramp to eastbound MD 43. The single-point two-lane on-ramp from eastbound MD 43 splits into a single-lane ramp to southbound I-95 and a single-lane ramp to northbound I-95.

Option 3A has three less displacements, reduced impacts to the rubble landfill, no impacts to the overhead power lines and lower construction cost than Option 3B. Option 3A is recommended for detailed study.

*See **Appendix J** for a description of the Managed Lanes options that were dropped from consideration.*

Alternate 1: No Build



JFK SECTION 100

Figure 6 – Alternate 1: No Build

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Alternate 2: General Purpose Lanes

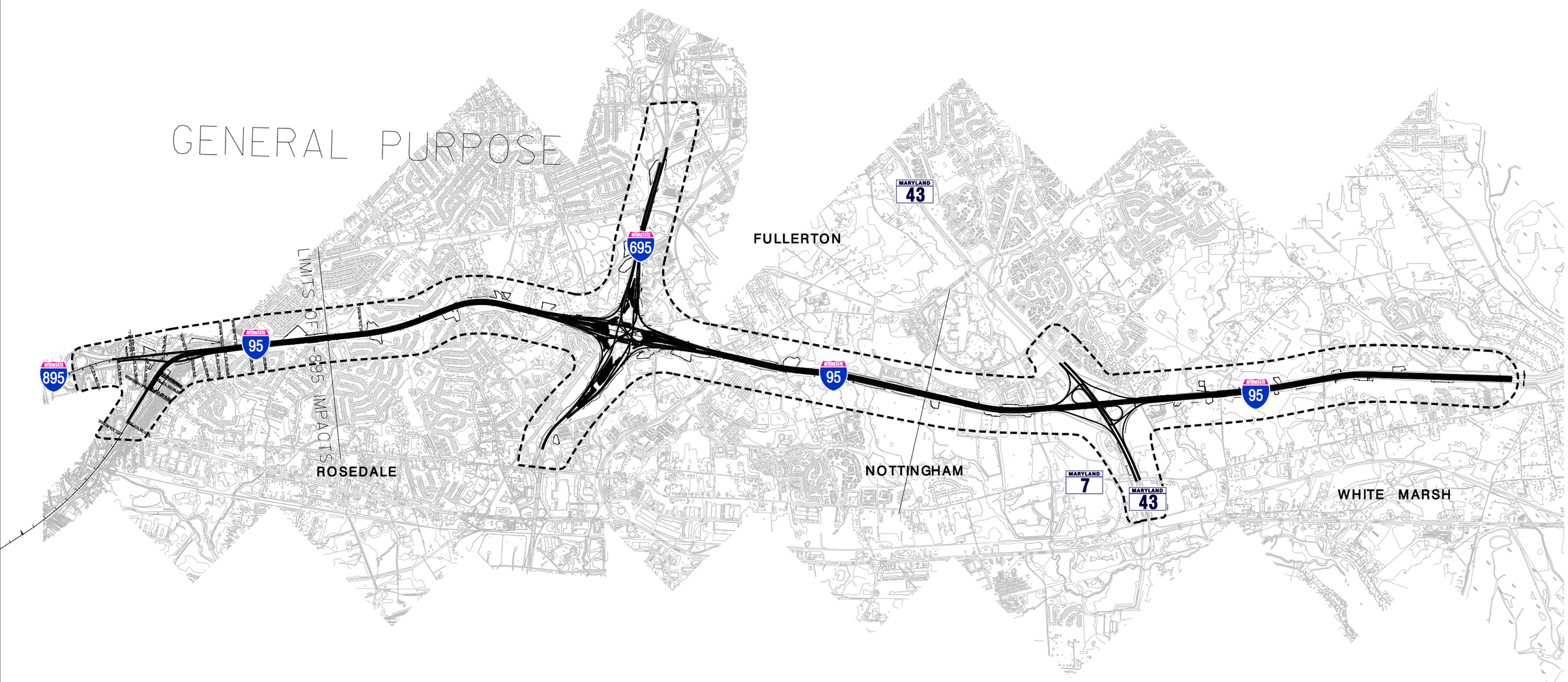

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Figure 7 – Alternate 2: General Purpose Lanes

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Alternate 3: Managed Lanes

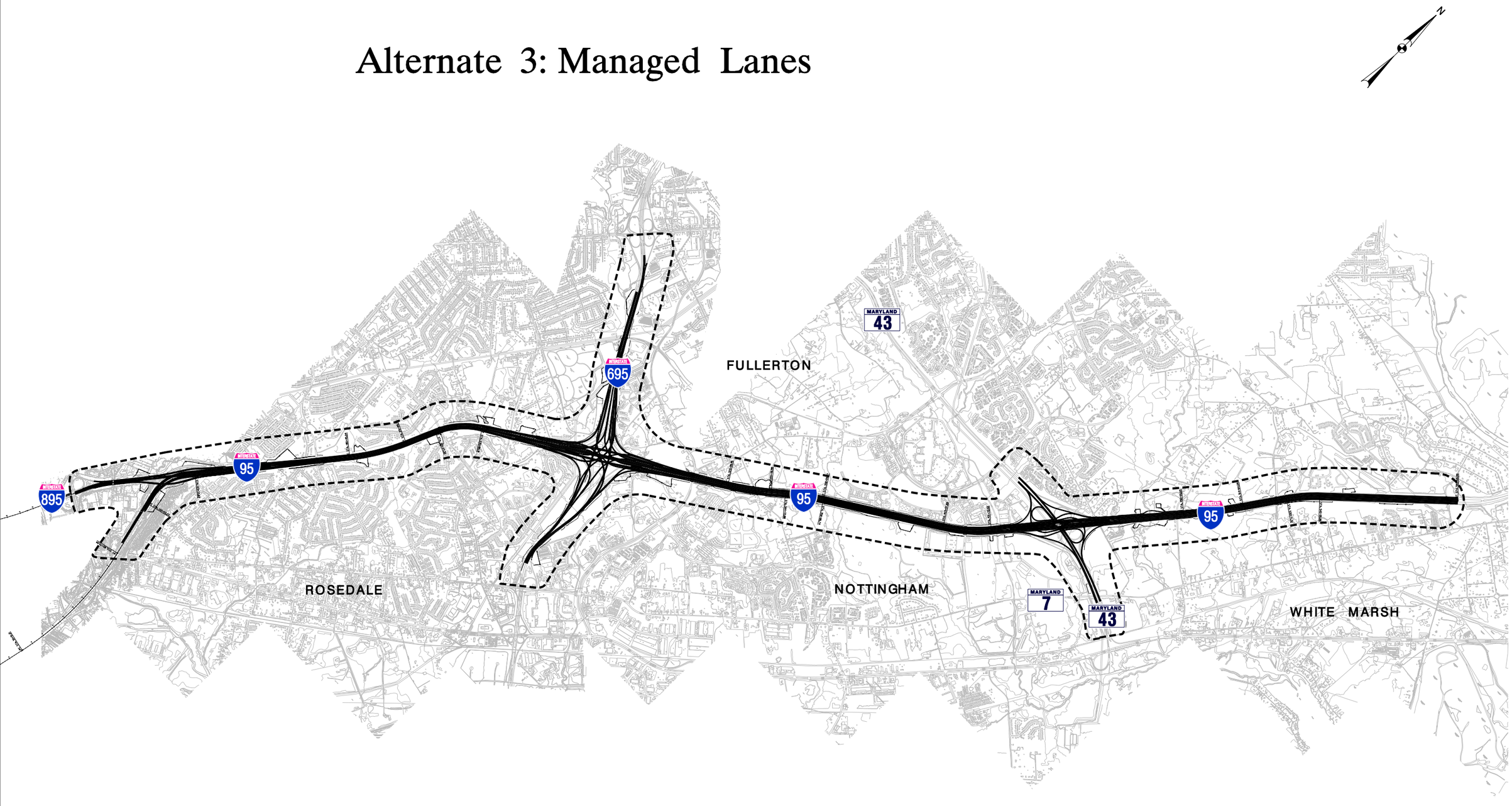

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Figure 8 – Alternate 3: Managed Lanes

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