



I-895(N) Split to the Delaware State Line

B. RANGE OF MODAL ALTERNATIVES

1. Transportation Model Assumptions

The evaluation of the modal alternatives for the I-95 study area was based on year 2020 travel demand forecasts. Average daily traffic (ADT) volumes were developed using the Baltimore Metropolitan Council's and the Wilmington Area Planning Council's latest approved travel demand models as of the October 2000 study workshop. Model inputs include the socio-economic, roadway network, and transit network data.

Socio-Economic Data

The Baltimore region including Baltimore City, Baltimore County, and Harford County, are in an area of non-attainment from an air quality standpoint. Therefore, only approved data sets for the model inputs were used. The appropriate MPOs approved future socioeconomic projections, developed on a transportation analysis zone basis, were utilized in the traffic modeling effort. The following socioeconomic datasets were used:

- **Baltimore Regional Transportation Board (BRTB/BMC) Round 5B** (approved July, 2000)
- **Wilmington Area Planning Council (WILMAPCO) MTP** (approved March, 2000)

The metropolitan planning organization's approved projected growth in population, households, and employment taken from the regional forecasts are shown in Tables B-1, B-2, and B-3 (see Figure A-2 for MPO boundaries):

Table B-1: POPULATION GROWTH

Jurisdiction	Existing (2000)	Projected (2020)	20-Year Change
Baltimore City	692,300	616,900	-11%
Baltimore County	732,700	771,800	+5%
Harford County	226,600	264,800	+17%
Cecil County	83,700	99,600	+19%
Source: BRTB/BMC and WILMAPCO			

Table B-2: HOUSEHOLD GROWTH

Jurisdiction	Existing (2000)	Projected (2020)	20-Year Change
Baltimore City	243,800	253,700	+4%
Baltimore County	299,700	327,400	+9%
Harford County	81,200	104,400	+29%
Cecil County	30,319	38,875	+28%
Source: BRTB/BMC and WILMAPCO			

Table B-3: EMPLOYMENT GROWTH

Jurisdiction	Existing (2000)	Projected (2020)	20-Year Change
Baltimore City	457,500	480,000	+ 5%
Baltimore County	429,000	492,600	+15%
Harford County	90,300	119,900	+33%
Cecil County	29,600	34,000	+15%
Source: BRTB/BMC and WILMAPCO			



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There are three planned development areas within the I-95 study area where the potential exists for the level of development to exceed the current 20-year projections for employment opportunities. These areas are the White Marsh Employment Center in Baltimore County, the Perryman area in Harford County and the Bainbridge area in Cecil County:

- The White Marsh Employment Center is located to the east of the I-95/MD 43 along the planned MD 43, White Marsh Boulevard extension.
- The Perryman area is located between the I-95/MD 22 and I-95/MD 543 interchanges to the east of I-95, and
- The Bainbridge area is located northwest of the I-95/MD 222 interchange.

The White Marsh East and Perryman areas are planned employment centers. A mixture of office, warehouse and light industrial are generally characterized to be the probable land uses types for the areas. The Bainbridge area is under preliminary study with a mixed use type development (resort, business, park and retirement community) anticipated.

The study reviewed transportation analysis zones where these potential developments exist. Table B-4 details the existing, planned and potential changes to the regional socioeconomic data in those zones. If full build out were to occur, the amount of trips generated from these areas could increase, affecting traffic volumes on both I-95 and the cross roads. **The full build-out for these three areas was not included in the development of the travel demand forecasts for the I-95 study area, as they have not been adopted into the regional MPO plans and models as of October 2000.**

**Table B-4: VARIATIONS BETWEEN MPO MODELS AND POSSIBLE FUTURE DEVELOPMENT**

Potential Development Area	Transpo. Analysis Zone	Existing 2000 Population	Projected 2020 Population	Existing 2000 Employment	Projected 2020 Employment	Total Potential Future Employment
White Marsh East	BMC 617	527	523	331	607	12,000±
White Marsh East	BMC 618	597	593	1566	2878	
Perryman	BMC 872	1259	1882	1319	9643	20,400±
Perryman	BMC 873	1295	1498	1079	1117	
Bainbridge	UES 720	1545	1727	218	382	2,200±

**Base Roadway network:** The assumed base roadway network is in accordance with the latest, approved constrained long-range plan (CLRP) for the transportation networks as approved by the MPOs. The following improvements for roadways within the I-95 study area were included in the base roadway network:

- I-695 from I-95 to I-83 widened from 6 to 8 lanes
- MD 43 extended to MD 150 (Eastern Blvd) with 4 lanes
- MD 7 from MD 543 to MD 159 widened from 2 to 4 lanes
- US 1 from Baltimore County line to MD 147 widened from 4 to 6 lanes
- US 1 from MD 147 to Hickory widened from 2 to 4 lanes
- MD 152 from Edgewood Arsenal to US 40 widened from 2 to 4 lanes
- MD 152 from I-95 to MD 147 widened from 2 to 4 lanes
- MD 7 from MD 43 to Campbell Boulevard widened from 2 to 4 lanes
- MD 272 from I-95 to Northeast Creek widened from 2 to 4 lanes
- MD 24 from Singer Road to MD 7 widened from 4 to 6 lanes
- MD 543 from MD 136 to I-95 widened from 2 to 4 lanes

The base roadway network did not assume planned I-95 improvements.



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**I-95 Roadway network:** The MPOs approved CLRP, as of October 2000, assumed the following I-95 improvements:

- I-95 from I-695 to MD 24 ⇒ Addition of 1 HOV lane (BRTB)
- I-95 from MD 24 to MD 22 ⇒ Addition of 1 General Purpose lane (BRTB)
- I-95 from MD 22 to Susquehanna River ⇒ No new lanes (BRTB)
- I-95 from Susquehanna River to Delaware state line ⇒ Addition of 1 General Purpose lane (WILMAPCO)

**Base Transit network:** The base transit network is in accordance with the transportation network approved by the MPOs. The following improvements were included in the base transit network:

- Express Bus Service: Bel Air to White Marsh
- Express Bus Service: Bel Air to Hunt Valley
- Express Bus Service: Bel Air to Towson
- Express Bus Service: White Marsh to Harford County
- Circulation Bus Service: White Marsh Loop

**Enhanced Transit network:** In addition to the improvements included in the base transit network, the enhanced transit network assumes the following transit improvements which are subject to funding availability and future studies by the Maryland Transit Administration (MTA), Delaware Department of Transportation (DelDOT), SouthEastern Pennsylvania Transportation Authority (SEPTA), and the local jurisdictions:

- Light Rail from Downtown Baltimore to White Marsh (**Note** ⇒ MTA's current Regional Rail Plan does not anticipate that the alignment for this rail transit connection would be within the I-95 median.)
- Reduction in headways for express bus service Route 410, 411, and 420
- Express Bus Service: White Marsh to Hunt Valley
- Express Bus Service: White Marsh to Towson
- Express Bus Service: White Marsh to Owings Mills
- Express Bus Service: White Marsh to Woodlawn
- Circulation Bus Service: Edgewood
- Circulation Bus Service: Bel Air to Abingdon
- Circulation Bus Service: Bel Air to Forest Hill

- Enhanced Maryland Rail Commuter (MARC) Commuter Rail Service including feeder buses
- Unconstrained parking at rail stations
- Extension of SEPTA R-2 Service to Elkton, Maryland

**2. Travel Demand Forecasts**

Seven, year 2020 travel demand scenarios (identified as scenarios A through G) were developed for the I-95 Master Plan study. Five of the travel demand scenarios (C through G) assumed improvements on I-95. The seven travel demand scenarios represent a broad grouping of possible solutions with the goal being to "bracket" the range of future alternatives; further refinements will be completed during the future independent project planning studies. Details on all seven travel demand scenarios, including network assumptions, results, and other comparative information, is presented in Appendix D.5.

Scenario runs were conducted and refined to year 2020 forecasts of Average Daily Traffic (ADT), a.m. Peak Hour **Weekday** Volumes, p.m. Peak Hour **Weekday** Volumes, and **Weekend** Peak Period (Hour) Volumes.



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The following four tables present the findings of these travel demand analyses:

- Table B-5:** Comparison of Screenline Average Daily Traffic Volumes Based on Modeling Analyses
- Table B-6:** Comparison of Screenline Peak Hour Traffic Volumes Based on Modeling Analyses
- Table B-7:** Comparison of Screenline Peak Hour Traffic Volumes Based on Modeling Analyses
- Table B-8:** Comparison of Screenline Transit Patrons - Average Daily Volumes for Transit (2-way trips)

To aid in further understanding these tables, the following definitions are offered:

**Screenline:** An imaginary continuous line drawn across two or more roads, each providing access to/from a common region. The traffic volumes on each of the roads intersecting the imaginary line can be added together to determine the total volume of traffic entering or leaving the region, regardless of the specific road chosen by each motorist. For example, a residential community may have three roads connecting it to an interstate facility, one carrying 2,000 vehicles per day (vpd), one carrying 5,000 vpd and one carrying 10,000 vpd. A screenline drawn across these three roads would show that a total of 17,000 vpd travel between the community and the interstate, regardless of the road traveled. For the I-95 study area, screenlines are an effective tool in analyzing traffic patterns, especially as different concepts are assessed for I-95.

**Constrained Forecast:** Projected traffic volumes for a road or road network that are based on the limited (i.e., "constrained") capacity of the road system. Typically, constrained forecasts account for traffic that might be diverted onto other adjacent roads, or shifts in travel time or mode as a result of peak period congestion.

**Unconstrained Forecasts:** Projected traffic volumes for a road or road network, based purely on demand. Unconstrained forecasts do not account for capacity constraints of the road system; they simply represent the desired demand of the motorists to get from point A to point B in the shortest amount of time and/or the most direct route.



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Table B-5: COMPARISON OF SCREENLINE AVERAGE DAILY TRAFFIC VOLUMES BASED ON MODELING ANALYSES

Location	Existing Daily Traffic Volume (vpd)	Year 2020 Travel Demand Scenarios (See Table D.5.-1 for Descriptions of Scenarios A through G)						
		Scenario A (vpd) No-Build	Scenario B (vpd) No-Build	Scenario C (vpd) Build	Scenario D (vpd) Build	Scenario E (vpd) Build HOV	Scenario F (vpd) Build	Scenario G (vpd) Build All Tolled
		----- Constrained -----	----- Constrained -----	----- Unconstrained -----	----- Constrained -----	----- Unconstrained -----	----- Constrained -----	----- Unconstrained -----
		Base Transit	Enhanced Transit	Base Transit	Base Transit	Enhanced Transit	Enhanced Transit	Enhanced Transit
<b>South of MD 43</b>								
• US 1	34,000	49,000	48,000	44,500	46,000	45,000	45,500	70,000
• I-95	165,000	231,000	227,700	243,100	238,000	236,700	233,600	160,700
• MD 7	13,000	19,000	18,000	17,000	18,000	17,500	17,500	22,000
• US 40	34,000	46,500	45,000	41,500	43,500	42,000	43,000	53,000
<b>South of MD 24</b>								
• US 1	27,000	40,000	39,500	37,000	38,500	37,500	38,000	63,000
• I-95	145,000	207,800	205,400	215,300	212,700	211,700	210,800	143,700
• US 40	25,000	35,000	34,000	31,500	32,500	32,000	32,000	50,000
• MD 7	7,000	13,500	13,000	12,000	12,000	12,000	12,000	20,000
<b>At Susquehanna River</b>								
• US 1	8,000	13,000	13,000	13,000	13,000	13,000	13,000	18,000
• I-95	77,200	118,400	117,300	119,900	119,900	118,800	118,800	88,000
• US 40	25,000	35,000	34,500	34,500	34,500	34,000	34,000	46,000
<b>At Delaware state line</b>								
• I-95	66,600	108,300	107,000	109,200	109,200	107,900	107,900	79,000

Notes: vpd = vehicles per day

**Screenline** – An imaginary straight line which divides an internal study area into parts to compare volumes at a similar location.

**Constrained Forecast** - The projected traffic volumes on a facility would be limited by the capacity of the facility.

**Unconstrained Forecast** - The projected traffic volumes represent the desired demand of motorists to use the facility.

**Base Transit** - See page B-3 for description.

**Enhanced Transit** - See page B-3 for description.



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**Table B-6: COMPARISON OF SCREENLINE WEEKDAY PEAK HOUR TRAFFIC VOLUMES BASED ON MODELING ANALYSES**

Location	Existing Peak Hour Weekday Traffic Volume (vph)	Year 2020 Travel Demand Scenarios (See Table D.5.-1 for Descriptions of Scenarios A through G)						
		Scenario A (vph) No-Build	Scenario B (vph) No-Build	Scenario C (vph) Build	Scenario D (vph) Build	Scenario E (vph) Build HOV	Scenario F (vph) Build	Scenario G (vph) Build All Tolled
		Constrained Base Transit	Constrained Enhanced Transit	Unconstrained Base Transit	Constrained Base Transit	Unconstrained Enhanced Transit	Constrained Enhanced Transit	Unconstrained Enhanced Transit
<b>WeekDAY Peak Hour Volumes</b>								
<b>South of MD 43</b> (Northbound p.m. Peak Hour)								
• US 1	1,800	3,050	2,850	2,300	2,650	2,350	2,450	3,500
• I-95	9,300	10,200	10,000	12,800	11,475	11,800	11,200	9,250
• MD 7	900	1,475	1,425	1,200	1,425	1,250	1,300	1,550
• US 40	1,600	2,700	2,450	1,950	2,400	2,050	2,300	2,850
<b>South of MD 24</b> (Northbound p.m. Peak Hour)								
• US 1	1,400	2,400	2,300	1,900	2,000	1,925	1,950	2,900
• I-95	7,150	8,875	8,750	10,250	9,900	9,950	9,725	7,300
• US 40	1,400	2,400	2,250	1,800	1,900	1,825	1,825	2,750
• MD 7	550	1,050	1,000	900	900	900	900	1,350
<b>At Susquehanna River</b> (Northbound p.m. Peak Hour)								
• US 1	450	700	700	700	700	700	700	950
• I-95	3,000	4,150	4,050	4,350	4,350	4,275	4,275	3,300
• US 40	1,200	1,750	1,700	1,700	1,700	1,650	1,650	2,100
<b>At Delaware state line</b> (Southbound a.m. Peak Hour)								
• I-95	1,350	2,275	2,250	2,400	2,400	2,375	2,375	1,800
Notes: vph = vehicles per hour								
<p><b>Screenline</b> – An imaginary straight line which divides an internal study area into parts to compare volumes at a similar location.</p> <p><b>Constrained Forecast</b> - The projected traffic volumes on a facility would be limited by the capacity of the facility.</p> <p><b>Unconstrained Forecast</b> - The projected traffic volumes represent the desired demand of motorists to use the facility.</p> <p><b>Base Transit</b> - See page B-3 for description.</p> <p><b>Enhanced Transit</b> - See page B-3 for description.</p>								



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Table B-7: COMPARISON OF SCREENLINE WEEKEND PEAK HOUR TRAFFIC VOLUMES BASED ON MODELING ANALYSES

Location	Existing Peak Hour Weekend Traffic Volume (vph)	Year 2020 Travel Demand Scenarios (See Table D.5.-1 for Descriptions of Scenarios A through G)						
		Scenario A (vph) No-Build	Scenario B (vph) No-Build	Scenario C (vph) Build	Scenario D (vph) Build	Scenario E (vph) Build HOV	Scenario F (vph) Build	Scenario G (vph) Build All Tolled
		----- Constrained -----	----- Constrained -----	----- Unconstrained -----	----- Constrained -----	----- Unconstrained -----	----- Constrained -----	----- Unconstrained -----
		Base Transit	Enhanced Transit	Base Transit	Base Transit	Enhanced Transit	Enhanced Transit	Enhanced Transit
<b>WeekEND Peak Period (Hour) Volumes</b>								
<b>South of MD 43</b> (Northbound Peak Hour) • I-95	6,300	9,050	8,650	9,300	9,300	8,975	8,975	Not Available (1)
<b>South of MD 24</b> (Northbound Peak Hour) • I-95	5,600	8,200	7,950	8,450	8,450	8,250	8,250	Not Available (1)
<b>At Susquehanna River</b> (Southbound Peak Hour) • I-95	4,700	6,900	6,850	7,100	7,100	7,050	7,050	Not Available (1)
<b>At Delaware state line</b> (Northbound Peak Hour) • I-95	4,100	6,100	6,050	6,350	6,350	6,300	6,300	Not Available (1)
Notes: vph = vehicles per hour (1) Under Scenario G, All Lanes Tolled, an assessment of peak period weekend traffic was not completed; see Table B-6 for peak period weekday results.								
<p><b>Screenline</b> – An imaginary straight line which divides an internal study area into parts to compare volumes at a similar location.  <b>Constrained Forecast</b> - The projected traffic volumes on a facility would be limited by the capacity of the facility.  <b>Unconstrained Forecast</b> - The projected traffic volumes represent the desired demand of motorists to use the facility.  <b>Base Transit</b> - See page B-3 for description.  <b>Enhanced Transit</b> - See page B-3 for description.</p>								



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Table B-8 COMPARISON OF SCREENLINE TRANSIT PATRONS - AVERAGE DAILY VOLUME FOR TRANSIT (2-WAY TRIPS)

Location	Existing Transit Usage	Year 2020 Travel Demand Scenarios (See Table D.5.-1 for Descriptions of Scenarios A through G)						
		Scenario A No-Build	Scenario B No-Build	Scenario C Build	Scenario D Build	Scenario E Build HOV	Scenario F Build	Scenario G Build All Tolled
		----- Constrained	----- Constrained	----- Unconstrained	----- Constrained	----- Unconstrained	----- Constrained	----- Unconstrained
		----- Base Transit	----- Enhanced Transit	----- Base Transit	----- Base Transit	----- Enhanced Transit	----- Enhanced Transit	----- Enhanced Transit
South of MD 43	3,100	6,000	9,500	5,000	5,500	7,500	8,500	14,000
South of MD 24	1,200	3,500	6,000	2,500	3,000	4,500	5,500	8,000
South of MD 222	100	300	300	200	300	300	300	800

**Screenline** – An imaginary straight line which divides an internal study area into parts to compare volumes at a similar location.  
**Constrained Forecast** - The projected traffic volumes on a facility would be limited by the capacity of the facility.  
**Unconstrained Forecast** - The projected traffic volumes represent the desired demand of motorists to use the facility.  
**Base Transit** - See page B-3 for description.  
**Enhanced Transit** - See page B-3 for description.



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3. Highway/I-95 System

a. Introduction

The Maryland Transportation Authority (Authority) assists the State in achieving its transportation goals by advancing the safe, secure and convenient movement of people and goods for the benefit of the citizens of Maryland. Tolls, other revenues and bonding capacity are used to develop, operate, provide law enforcement for and maintain the Authority's highways, bridges and tunnels, which serve as vital links in the State's transportation network. Acting on behalf of the Department of Transportation, the Authority also finances and constructs capital projects to improve Maryland's transportation system, including terminal facilities at the Port of Baltimore and the Baltimore/Washington International Airport. The Authority also provides law enforcement at the port and airport facilities.

Conceptual highway alternatives were investigated to identify and assess the advantages and disadvantages of each concept. They were also developed to identify a range of highway alternatives to be evaluated during future independent projects. The highway concepts under consideration generally consist of various combinations of:

*General Purpose (GP) Lanes* - Lanes open to all traffic.

*Tolled Expressway* - Managed highway on which vehicles are charged a toll. Electronic monitoring and payment is anticipated.

*Managed Lanes* - Lanes separated from the General Purpose lanes and operating under some form of restricted use. Management strategies may include restrictions at access locations (i.e., at ramps); restrictions by vehicle class (i.e., cars, buses, or trucks); restrictions by time of day; and/or, a tolled expressway.

*High Occupancy Vehicle (HOV) Lanes* - Lanes on which only vehicles with the driver and at least one or more passengers are permitted. Restricted use could be limited to specific time periods.

*Shared Transit Lane* - Managed lane on which transit vehicles are permitted in combination with another vehicle class.

*Truck Only Lanes* - Managed lanes which are restricted to truck use only. Restricted use could be limited to specific time periods.

*Collector-Distributor (C-D) Roads* - Lanes separated from through traffic on I-95 where reduced speed merge, diverge and weave movements could occur more safely.

Managed lanes could potentially have a shared use, serving commuter and transit traffic during peak hours and trucks only during non-peak hours. Existing truck percentages along I-95 vary between 5 and 50% of the total traffic in the study area, with actual volumes varying between 200 and 600 vehicles per hour per direction. The large percentage variation is primarily due to fluctuations in total vehicle (not truck) volumes. Truck only lanes have been implemented in Europe. In the United States, truck only lanes are under consideration in at least five locations.

As reported in a 2001 issue of *TR News* (published by the Transportation Research Board, National Research Council, May/June 2001, Number 214, page 10) " ... the transportation system in North America has evolved in response to increasing demands, innovative approaches, and new technologies ... managed lanes, and truck lanes represent possible alternatives for managing freeway and roadway space. Many areas throughout the country will consider these approaches and test new concepts and ideas in demonstration projects."



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**b. Criteria for Evaluation of Highway Modal Concepts**

The Authority has developed the following criteria to guide the evaluation of the Highway Modal Alternatives with the goal of improving the John F. Kennedy Memorial Highway (I-95) to promote the safe, secure and convenient movement of people and goods for the benefit of the citizens of Maryland:

1. Wherever it is anticipated that two or more lanes of new capacity are needed, physical separation between the existing and new lanes and access or use restrictions will be included in the range of alternatives analyzed.
2. Identify alternatives that will provide at least a level of service "E" or better during the weekday peak period for the design year traffic levels and at least a level of service "D" during weekday operations on any new lanes physically separated from the existing lanes and operating under a lane management strategy. During normal (non-holiday/event) weekend peak periods, the goal shall be to provide a LOS "D" or better and during peak holiday/event periods the goal shall be to provide at least a LOS "E" or better.

**4. Multi-Modal Systems**

The Maryland Transportation Authority (Authority) has closely coordinated with the Maryland Transit Administration (MTA) throughout the Master Plan Study. The goal of this coordination was to determine the effects that currently programmed MTA facilities and facilities under study in MTA's *Comprehensive Transit Plan* and the *Baltimore Regional Rail Study* may have on future demand along I-95. In addition, the Authority and MTA continue discussions on how, or if, these transit improvements should be coordinated with roadway improvements.

The Master Plan is a multi-modal study to the extent that transit is being evaluated in travel demand scenarios to determine its affect on future I-95 travel demand. It is not the intent of the Master Plan Study to evaluate new transit facilities, but rather to evaluate travel demand results and analyze opportunities to improve or enhance multi-modal connectivity and access within the study area.

**Maryland's Transit Vision**

The Maryland Transit Administration's (MTA's) vision for transit is to provide **modal choices** for people traveling within or through the corridor, thereby **enabling transit ridership to double in the next 20 years.** (The Maryland Comprehensive Transit Plan, December 2000). These transit choices

will be created by enhancing, improving, and building upon the services and infrastructure already in place and by providing completely new transit services where opportunities exist.

To meet the goal of providing modal choices and doubling transit ridership, a wide range of service and infrastructure improvements will need to be considered over the next 20 years in the I-95 study area. The basis for many of these improvements are found in the MTA's *Maryland Comprehensive Transit Plan*. Candidates for improvements over the next five years are part of the (Maryland) Governor's Transit Initiative.

**Regional Transit**

*Amtrak*

Improvements in Amtrak service is dependent on larger, national issues and policies, including Amtrak's fiscal standing. Historically, Amtrak's NorthEast Corridor (NEC) service has been its highest used, most successful rail passenger service. It is anticipated that the market will continue to place a high demand on Amtrak in the NEC and improvements will continue to be made including additional high-speed and regular rail service, station improvements, increased customer amenities, trackwork and other operational or infrastructure improvements to enhance performance and reliability.



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*Private Bus Service*

Service improvements will be market based for these private sector operators. It is likely that the operators will continue to meet specialized regional needs. Improvements which could enhance service in the corridor include improved stations and efficient inter-modal connections with local public transit.

**Commuter Trips to Baltimore, Washington, Wilmington and Philadelphia**

The following options are being considered by state, regional and local transit providers to improve commuter trips to "downtown" areas served by the I-95 study area:

- Restructured and enhanced services on the MTA 410, 411, and 420 Commuter Bus Routes.
- An extension of fixed rail service from Johns Hopkins Hospital to White Marsh, including alternative light rail alignments.
- Increased MARC and SEPTA R2 services. Opportunities include more peak period, midday, evening, and weekend service.
- Infrastructure improvements to improve aesthetics, parking and access at transit stations.

**Commuter Trips to Non-Downtown**

**Locators**

Similarly, the following options are being improved to service commuter trips to "non-downtown" areas:

- Access to Jobs Program - Bus and van transportation for residents to access jobs in more suburban and rural areas. This program could provide Baltimore City residents access to the growing job markets in Harford and Baltimore counties.
- Service to Suburban Activity Centers - New circumferential bus routes from I-95/MD 43 White Marsh area to Towson, Hunt Valley, Owings Mills and other major activity centers. Connectivity to multi-modal centers and regional rail systems are part of the transit mobility plan.

**Local Transit**

MTA, Harford County, Cecil County, and DelDOT/WILMAPCO are expected to continue to expand service to meet demand. Initiatives under consideration include:

- New MARC feeder service routed to Martin State Airport, Aberdeen, Edgewood and Perryville, as part of the green and purple line extensions (Baltimore Regional Rail System, 6.6.2002).

- Expanded service on SEPTA's R2 line.
- Neighborhood shuttles and circulators for:
  - Edgewood
  - Bel Air/Abingdon
  - Bel Air/Forest Hill
  - Foxridge - White Marsh
  - Hawthorne - White Marsh
- Increased frequency of service, hours of operation, and days of service, consistent with Statewide Transit Service Guidelines currently being developed by MTA and local transit operators.
- New county-wide deviated fixed route service (typically a "circuit" bus route, from which drivers may deviate when telephoned requests for "front door" service are received) to Conowingo, Port Deposit, Perryville, and Chesapeake.

**Systemwide Transit Improvements**

The following transit enhancements are being implemented or are under consideration and may apply to multiple modes of transit in the study area:

**SMART Card Technology** - A single fare card that could be used for all transit trips in Maryland. The fare card would have a stored value and riders could use the same card throughout the State. Ultimately, the card could be used interchangeably for other financial purchases, much as credit cards are used today.



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**Security Enhancements** - May include improved lighting at stations, bus stops, and park-and-ride lots, video surveillance cameras, additional transit police, and improved visibility at stations.

**Marketing and Customer Information** - A key to increasing ridership is readily available and understandable route maps, timetables, bus stop signs, station signing, web pages, kiosks with real time transit information at key stations and intermodal facilities, and increased marketing of transit. "Talking buses" which provide passenger information are being added to the MTA fleet and local buses.

**Improved Bus Stops and Shelters** - New shelters, bike racks, sidewalks and concrete waiting areas, landscaping, and customer information to improve pedestrian and bicycle access.

**Bus Rapid Transit** - Bus transit lanes, priority treatment in congested areas, signal pre-emption and queue jumper lanes in the Baltimore and Washington urban areas, are under consideration.

**Freight Rail Service** - In addition to equipment, control, and infrastructure improvements under consideration by the private freight rail operators, the MTA and Port of Baltimore are participating in regional initiatives to enhance and expand both long-haul and short-haul freight rail service, including the Mid-Atlantic Rail Study, which is a

working group of the Freight & Passenger Subcommittee of the I-95 Coalition Intermodal Track. The group, comprised of representatives from Amtrak, Norfolk-Southern and CSX as well as state departments of transportation in the mid-Atlantic region, is working to identify major freight rail and passenger bottlenecks and potential solutions paralleling the north-south corridors of I-81 and I-95.

**5. Conceptual Highway and Transit Alternatives**

Six (6) conceptual highway alternatives were evaluated as a part of the I-95 Master Plan study. Beginning with a No-Build, these alternatives represent a broad range of potential highway concepts for the I-95 study area. The following information is presented for each of the concepts studied:

- a generalized plan (not to scale) and typical sections showing existing versus potential future lanes.
- a brief overview and identification of the modeled scenario's transit assumptions.
- a general description of the conceptual highway alternative, within each of the four independent project sections. The four independent project sections include (see Figure A-7 for limits):
  - Section 100:** I-895 Split to north of MD 43 (8 miles)
  - Section 200:** north of MD 43 to north of MD 22 (16 miles)

**Section 300:** north of MD 22 to north of MD 222 (9 miles)

**Section 400:** north of MD 222 to Delaware state line (16 miles)

- a generalized description of each conceptual alternatives' effectiveness in addressing future travel demand and a brief description of the Year 2020 level of service (LOS) based on the volume to capacity (v/c) ratio method (detailed charts on traffic operations are presented in the appendices).
- a generalized sketch of Year 2020 mainline levels of service along I-95 (between interchanges) for Concepts C-1, C-3, C-4, C-5, and C-6. Photographic examples of levels of service are also shown. The existing levels of service for I-95 (year 2000) are shown on Figure A-4.

The six (6) conceptual alternatives which were tested as a part of the Master Plan study may be grouped as follows:

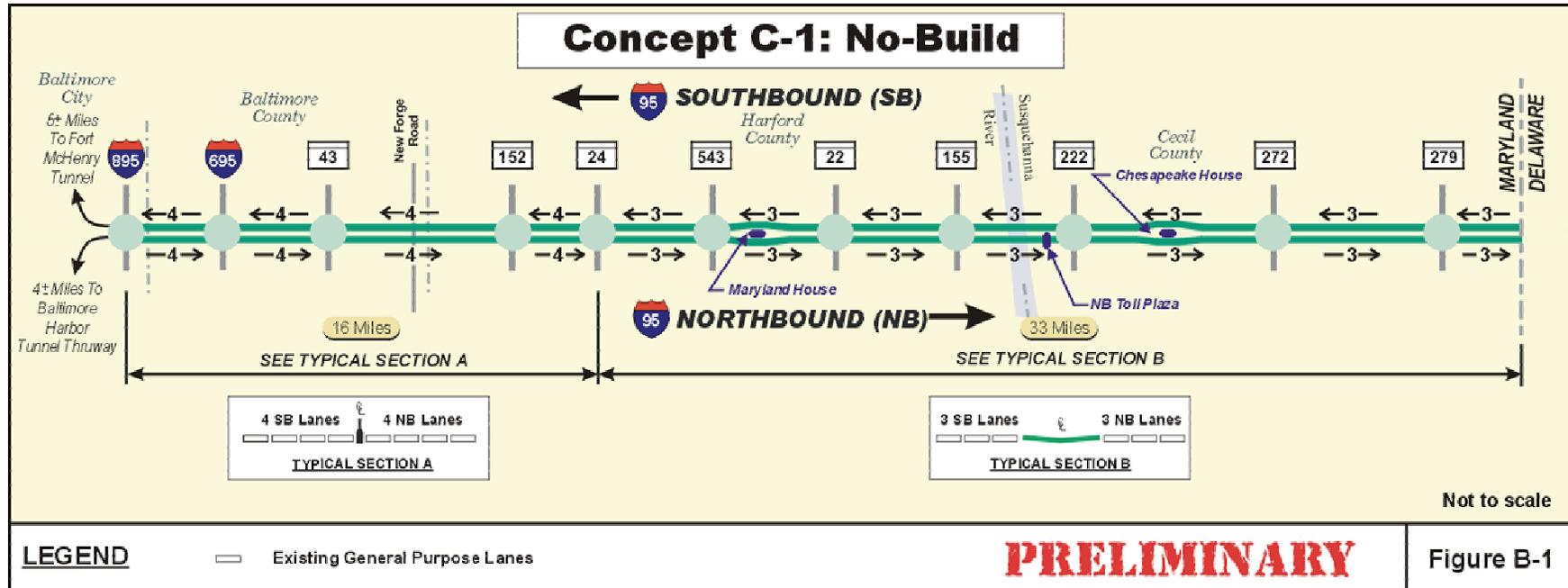
- **No-Build** ⇒  
C-1 No Build
- **Minimal Build** ⇒  
C-2 All Tolled Lanes  
C-3 High Occupancy Vehicle Lanes  
C-4 Reversible Roadway in Median
- **Managed Lanes** ⇒  
C-5 Separated Roadway in Median
- **All General Purpose Lanes** ⇒  
C-6 Full Build

# CONCEPT C-1 NO-BUILD





I-895(N) Split to the Delaware State Line



**Overview** ⇒ The No-Build Concept C-1 would retain the existing I-95 mainline lanes and associated interchanges in their present configuration. Except for routine maintenance and safety upgrades, no additional improvements were anticipated.

**Transit Assumptions**

The Concept C-1 No-Build was studied under two transit assumptions:

- C-1 ⇒ Base Transit using Travel Demand Scenario A
- C-1 ⇒ Enhanced Transit using Travel Demand Scenario B

The following description, presented by the logical termini limits, summarizes Concept C-1.

**Section 100 ⇒ I-895 Split to north of MD 43 (8 miles)**

⇒ The existing four travel lanes per direction (with three lanes through the I-695/Baltimore Beltway interchange) would be retained as they exist today. The existing partial directional interchange at the I-95 – Fort McHenry Tunnel/I-895 – Baltimore Harbor Tunnel Thruway split would be retained. At the I-695/Baltimore Beltway interchange, the existing fully directional interchange with left- and right-hand exits and lane drops through the interchange

would remain. The existing full cloverleaf interchange at MD 43 would remain.

**Section 200 ⇒ north of MD 43 to north of MD 22 (16 miles)**

⇒ The existing four travel lanes per direction between New Forge Road and MD 24 would remain, as would the existing three lanes per direction between MD 24 and MD 22. The existing simple diamond interchange at MD 152 would remain as would the partial cloverleaf interchange at MD 24. The existing full diamond interchange at MD 543 would remain.



### I-895(N) Split to the Delaware State Line

The existing MD 22 diamond interchange is currently being reconstructed as a partial cloverleaf interchange.

**Section 300 ⇒ north of MD 22 to north of MD 222 (9 miles)** ⇒ The existing three lanes per direction between MD 22 and MD 222 interchange would remain, including the three lanes per direction/no shoulder crossing of the Susquehanna River on the Millard E. Tydings Memorial Bridge. The existing diamond interchanges at MD 155 and MD 222 would remain.

**Section 400 ⇒ north of MD 222 to Delaware state line (16 miles)** ⇒ The existing three lanes per direction from MD 222 to the Delaware state line would remain. Except for routine maintenance and safety upgrades, no additional improvements would be anticipated. The full diamond interchange at MD 272 and the full cloverleaf interchange at MD 279 would remain.

#### **Concept C-1 Level of Service (See Figure B-2)**

Level of service analyses were conducted for the year 2020 **weekday** a.m. and p.m. and **weekend** peak periods for the No-Build Highway Concept C-1. The mainline levels of service are illustrated on Figure B-2 and Appendix D.5 contains a detailed table showing the volumes and level of service with volume to capacity (v/c) ratios for LOS E and F segments.

The traffic analyses for the no-build condition with enhanced transit showed similar results to that of the no-build with base transit. In general, enhanced transit is expected to reduce travel demand on I-95 by 200 to 225 vehicles during the **weekday** peak hour in the peak direction. As trips shift to transit, vehicle trips are expected to divert from US 40 or US 1 to I-95. This diversion results in a minimal change to overall travel demand along I-95 when compared to the base transit condition. It is anticipated that enhanced transit options selected by the MTA during the Maryland Comprehensive Transit Study will be added to the metropolitan planning organization's long-range plan, and thus be a part of the base transit for future independent project planning studies.

The **weekday** a.m. and p.m. peak hour traffic and **weekend** peak hour traffic is projected to operate very near or above capacity (i.e., LOS E and F) in the southern section of the study area (I-895 Split north to MD 543). The off peak direction in the southern section would operate at LOS D and E. North of the MD 543 interchange, the a.m. and p.m. peak hour traffic is projected to operate at LOS C and D, however, the **weekend** traffic will operate at or above capacity (LOS E and F).

#### **Conclusions**

**Concept C-1** ⇒ The No-Build concept retains the existing I-95 highway and associated interchanges in their present configurations and allows for routine maintenance and safety upgrades. Existing I-95 remains four lanes per direction between I-895 and MD 24 and three lanes per direction between MD 24 and the Delaware state line. Under Concept C-1, there are a total of 326 existing General Purpose lane miles along I-95.

The traffic analyses indicate that during the **weekday** the peak hour/peak direction will operate at or above capacity in the southern section of the study area (I-895 split north to MD 543). The **weekend** traffic will operate at or above capacity (LOS E and LOS F) throughout the entire 49 mile study area.

The analysis of the No-Build condition showed similar results with both the base transit and enhanced transit assumptions. Despite an increase in transit ridership with the enhanced transit assumption, motorists who used different routes or varied their travel time were attracted back to I-95; therefore, levels of service remained virtually the same as the No-Build with base transit assumption.

Retention of Concept C-1 for further study is recommended as a baseline for comparison with other concepts.



I-895(N) Split to the Delaware State Line

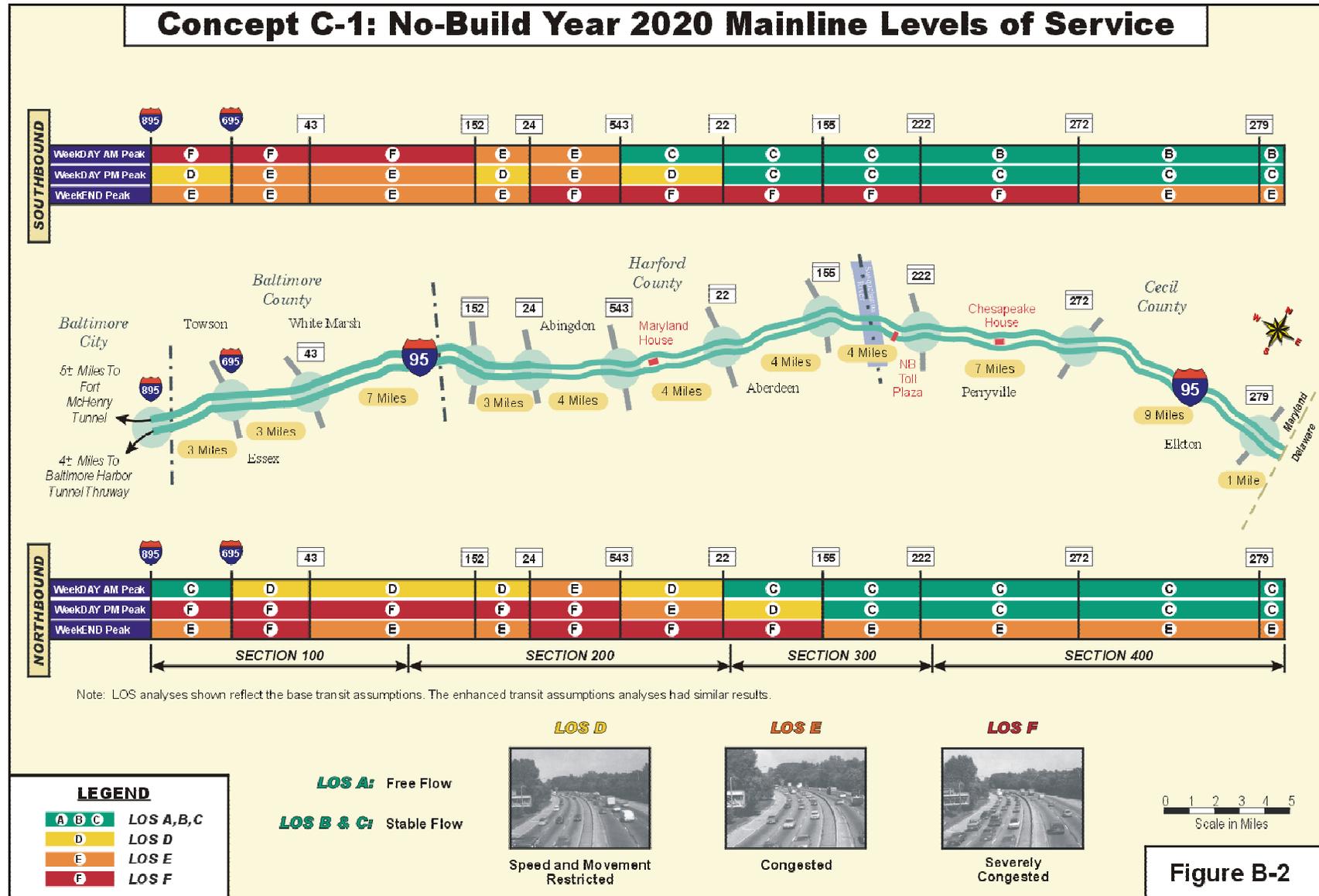
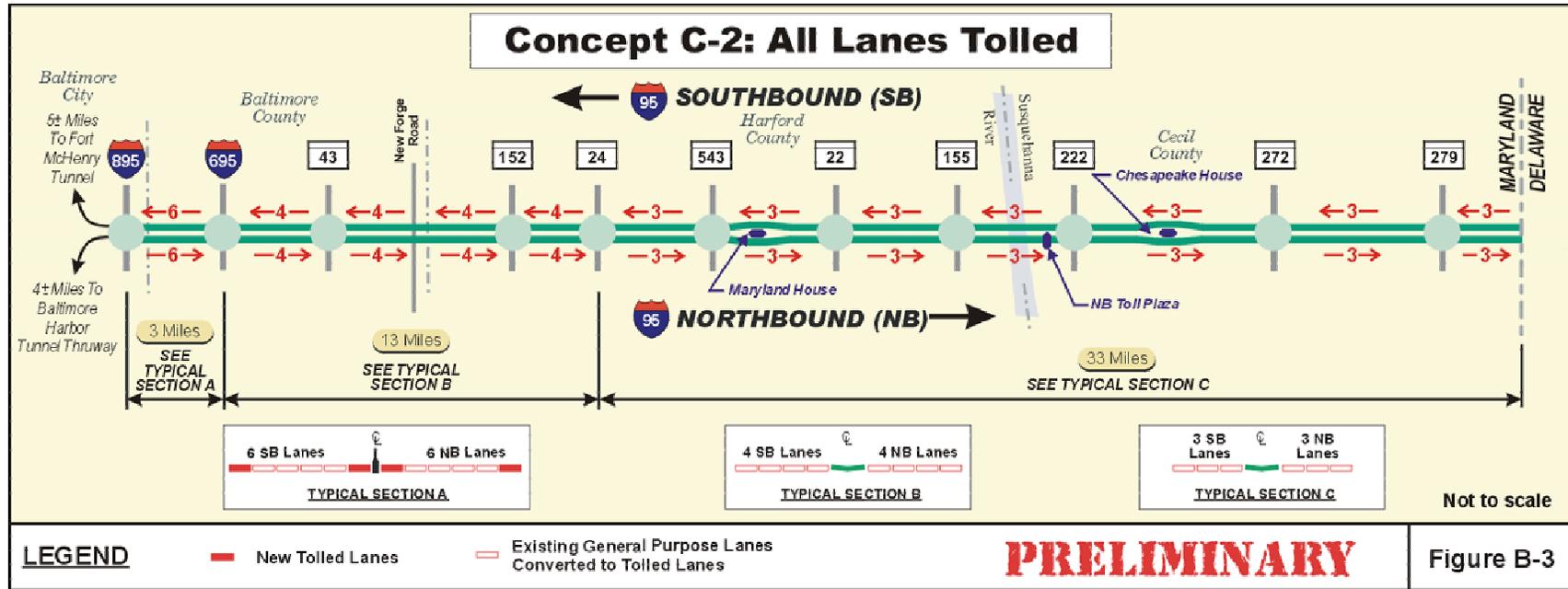


Figure B-2

**CONCEPT C-2**  
**ALL LANES TOLLED**



I-895(N) Split to the Delaware State Line



Not to scale

Figure B-3

**Overview** ⇒ The basic premise of Concept C-2 is to reduce pavement expansion by managing the existing travel lanes. In this concept, all existing and any additional travel lanes throughout the entire 49-mile length of the I-95 study area would be tolled. In addition, auxiliary (collector-distributor) lanes would be provided to improve traffic operations and safety where needed.

**Transit Assumptions**

- C-2 ⇒ Enhanced Transit using Travel Demand Scenario D

The following description, presented by the logical termini limits, summarizes Concept C-2.

**Section 100 ⇒ I-895 Split to north of MD 43 (8 miles)** ⇒ From north of the I-895 Split to I-695, Concept C-2 would provide two additional tolled travel lanes per direction and convert the existing four travel lanes per direction into tolled lanes. North of I-695 the existing four travel lanes per direction would be converted into four tolled lanes.

**Section 200 ⇒ north of MD 43 to north of MD 22 (16 miles)** ⇒ The existing four travel lanes per direction between New Forge Road and MD 24 would be converted into tolled lanes, as would the existing three lanes per direction between MD 24 and MD 22. The number of lanes and

interchanges at MD 152, MD 24, MD 543, and MD 22 would be as described under Concept C-1.

**Section 300 ⇒ north of MD 22 to north of MD 222 (9 miles)** ⇒ The existing three lanes per direction between MD 22 and MD 222 interchange would be converted into tolled lanes. The number of lanes and interchanges at MD 155 and MD 222 would be as described under Concept C-1.

**Section 400 ⇒ north of MD 222 to Delaware state line (16 miles)** ⇒ The existing three lanes per direction from MD 222 to the Delaware state line would be converted into tolled lanes. The



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I-895(N) Split to the Delaware State Line

number of lanes and interchanges at MD 272 and MD 279 would be as described under Concept C-1.

**Concept C-2 Level of Service**

The concept of converting the existing I-95 general purpose lanes to a tolled expressway was analyzed. The analysis indicated that in the southern section, LOS D to F conditions would exist in the peak direction in the peak hour. In the off peak direction during the peak hour, LOS B to C conditions would exist. Because these year 2020 levels of service for Concept C-2 are very similar to the existing levels of service along I-95, a separate graphic for Concept C-2 in the year 2020 was not prepared. Figure A-4 presents the year 2000 existing levels of service for the I-95 study area.

Screenline analyses were performed at selected locations and LOS D to LOS F is anticipated on the mainline during the peak period in the peak direction. It is anticipated that tolling all lanes on I-95 will force the diversion of significant volumes of traffic (1,000 to 1,500 peak hour trips) to the parallel roadways (US 40, MD 7 and US 1) and some trips to transit. Concept C-2 peak hour traffic volumes along I-95 in the design year 2020 are expected to be less than existing traffic volumes. Traffic volumes on parallel routes are

expected to be 25 to 70 percent higher which will result in significant and adverse transportation impacts.

**Conclusions**

*Concept C-2* ⇒ The all lanes tolled with enhanced transit concept reduces pavement expansion by managing travel demand and increasing transit demand. This concept assumes six lanes per direction between I-895 and I-695; four lanes per direction between I-695 and MD 24; and three lanes per direction between MD 24 and the Delaware state line.

Under Concept C-2, there would be a total of 338 lane miles along I-95 reflecting the addition of two-lanes per direction within the 3-mile section between I-895 and I-695.

Analysis of tolling all I-95 lanes identifies an impact to other parallel routes in the south. MD 7, which currently operates at LOS E, is anticipated to operate at LOS F, while U.S. 40 and U.S.1, which currently operate at LOS C/D, will operate at capacity or fail throughout the study area. Improvements to these parallel routes may increase potential environmental impacts related to transportation needs. Consequently, further study of Concept C-2 is not recommended.

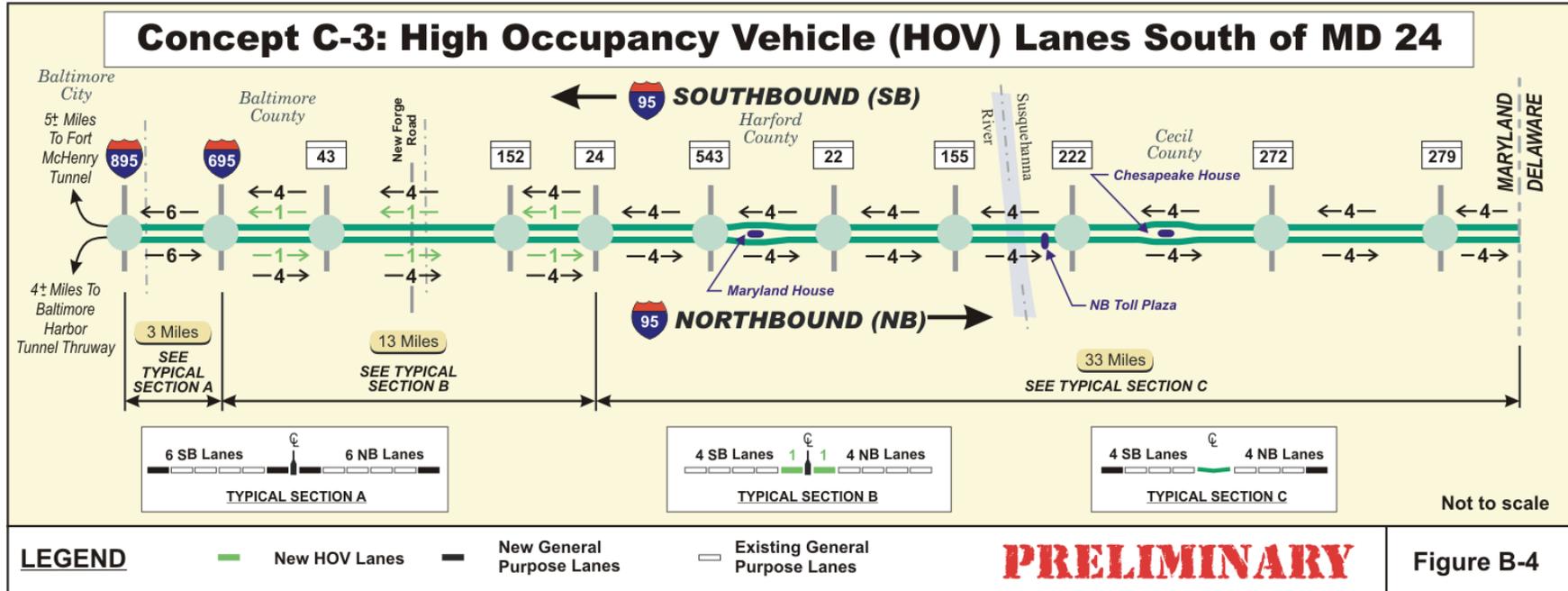
**CONCEPT C-3**

**HIGH OCCUPANCY VEHICLE (HOV)**

**LANES SOUTH OF MD 24**



I-895(N) Split to the Delaware State Line



**Overview** ⇒ Concept C-3 would provide two additional general purpose or auxiliary 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.

**Transit Assumptions**

- C-3 ⇒ Enhanced Transit using Travel Demand Scenario E

The following description, presented by the logical termini limits, summarizes Concept C-3.

**Section 100 ⇒ I-895 Split to north of MD 43 (8 miles)** ⇒ From the I-895 Split to I-695, two additional general purpose lanes per direction would be added to the existing four general purpose lanes per direction. North of I-695, Concept C-3 would provide one HOV lane per direction adjacent to the inside lanes. The four existing general purpose lanes per direction would remain. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 200 ⇒ north of MD 43 to north of MD 22 (16 miles)** ⇒ The one HOV lane per direction would be extended north to the MD

24 interchange; the existing four general purpose lanes per direction between New Forge Road and MD 24 would remain. An additional general purpose lane would be added between MD 24 and MD 22. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 300 ⇒ north of MD 22 to north of MD 222 (9 miles)** ⇒ North of MD 22, Concept C-3 would include one additional travel lane per direction. The addition of a fourth travel lane per direction would require the construction of a new crossing of the Susquehanna River. Interchanges and cross



I-895(N) Split to the Delaware State Line

roads would be modified as needed to accommodate the new I-95 cross section.

**Section 400 ⇒ north of MD 222 to Delaware state line (16 miles)** ⇒ Concept C-3 would include one additional travel lane north of MD 222. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Concept C-3 Level of Service (see Figure B-5)**

Level of service analyses were conducted for the year 2020 **weekday** a.m. and p.m. and **weekend** peak periods for the Concept C-3. These analyses assumed that the HOV lanes were restricted to vehicles of two or more persons during the peak period in the peak direction. The mainline levels of service are illustrated on the following figure; and Appendix D.5 contains a detailed table showing the volumes and level of service with volume to capacity (v/c) ratios for LOS E and F segments.

In summary, Concept C-3 **weekday** a.m. and p.m. peak hour traffic in the general purpose lanes is projected to operate very near or above capacity (i.e. LOS E and LOS F) in the southern section of the study area (I-895 Split north to MD 543). North of MD 543, the a.m. and p.m. peak hour traffic is projected to operate between LOS A and LOS D. During

the **weekend** peak hour when the HOV lane is open to all traffic, the mainline lanes are projected to operate at LOS D throughout the corridor, except between I-895 and I-695, where LOS C is anticipated and between MD 24 and MD 543 where they would operate at LOS E.

**Auto Occupancy**

Auto occupancy data along I-95 is provided in Appendix D.6. Surveys of vehicle occupancy indicate that existing **weekend** HOV demand exceeds the capacity of a single HOV lane.

**Conclusions**

**Concept C-3** ⇒ The HOV with enhanced transit concept includes two additional general purpose lanes per direction between the I-895 Split and I-695, one new HOV lane per direction in the southern section of the corridor (I-695 to MD 24) and one additional general purpose lane per direction north of MD 24. The new HOV lane is expected to create an incentive for carpooling in the southern section. However, since the HOV lanes are located along the median, the HOV lanes may have a limited value for short trips, as motorists must cross three or more General Purpose lanes in order to access the HOV lanes.

Under Concept C-3 there would be approximately 404 General Purpose lane miles and 26 HOV lane miles reflecting an increase of approximately 204 lane miles over existing conditions

The traffic analyses indicate that during the **weekday** the peak hour/peak direction traffic in the general use lanes would operate at or above capacity (LOS E and LOS F) in the southern section of the study area (I-895 to MD 543), while the projected HOV lane would operate between LOS B and LOS C.

During the **weekend** peak periods, when the HOV lane is open to all traffic, the mainline is projected to operate between LOS C and LOS E throughout the study area. During the **weekend** peak, this concept results in somewhat improved traffic operations along I-95 in comparison to Concept C-1.

In summary, LOS F is 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 already exceeds the average rate for other freeways with dedicated HOV lanes. Therefore, this concept is not recommended for further consideration.



I-895(N) Split to the Delaware State Line

**Concept C-3: HOV Lanes - Year 2020 Mainline Levels of Service**

SOUTHBOUND	895 695 43 152 24 543 22 155 222 272 279												
	WeekDAY AM Peak	GP	E	F	F	E	D	C	B	B	B	B	A
	WeekDAY AM Peak	HOV		C	C	B							
	WeekDAY PM Peak	GP	C	D	D	C	D	C	B	B	B	B	B
WeekEND Peak	GP	C	D	D	D	E	D	D	D	D	D	D	



NORTHBOUND	895 695 43 152 24 543 22 155 222 272 279												
	WeekDAY AM Peak	GP	B	C	C	C	C	C	B	B	B	B	B
	WeekDAY PM Peak	GP	E	F	F	F	E	D	C	C	C	C	D
	WeekDAY PM Peak	HOV		C	C	B							
WeekEND Peak	GP	C	D	D	D	E	D	D	D	D	D	D	

**LEGEND**

A B C	LOS A, B, C
D	LOS D
E	LOS E
F	LOS F

**LOS A:** Free Flow

**LOS B & C:** Stable Flow

**LOS D:** Speed and Movement Restricted

**LOS E:** Congested

**LOS F:** Severely Congested

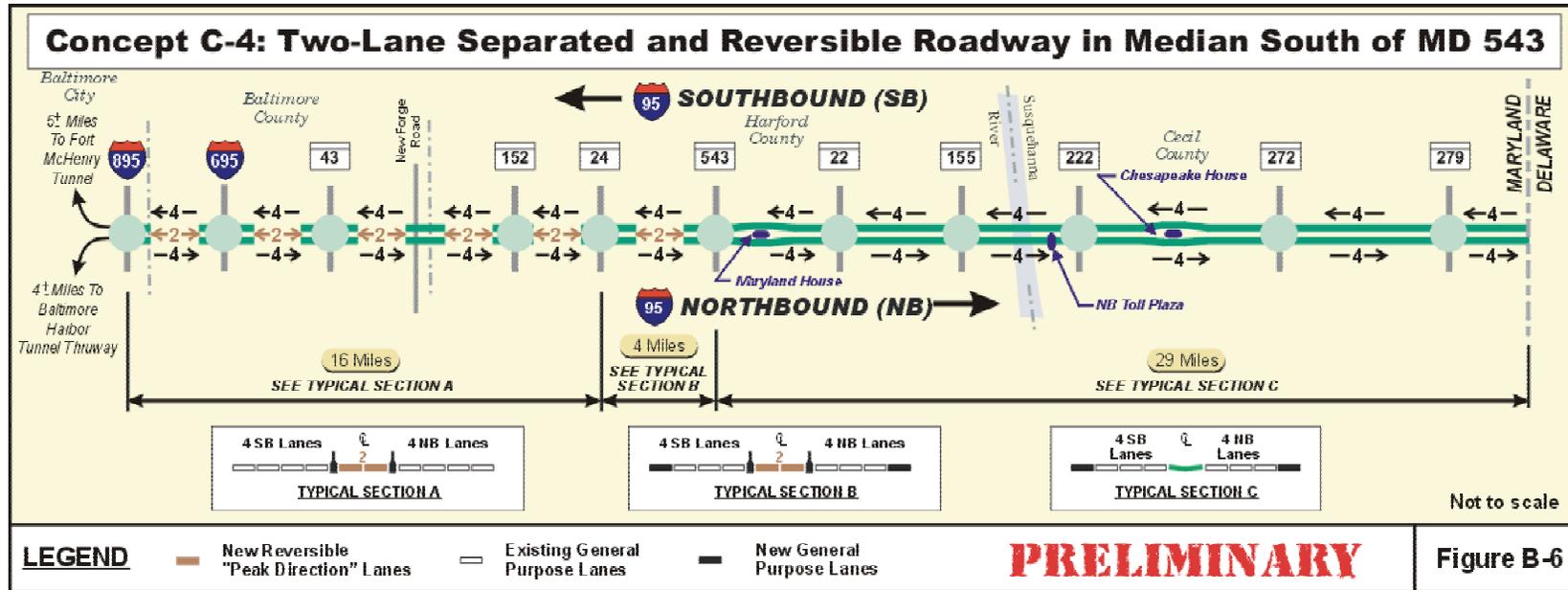
Scale in Miles: 0 1 2 3 4 5

Figure B-5

**CONCEPT C-4**  
**TWO-LANE SEPARATED**  
**REVERSIBLE ROADWAY IN MEDIAN**  
**SOUTH OF MD 543**



I-895(N) Split to the Delaware State Line



**Overview** ⇒ Concept C-4 provides a two-lane separated and reversible roadway in the median from south of I-695 to MD 543 and one additional general purpose lane per direction north of MD 543.

**Transit Assumptions**

- C-4 ⇒ Enhanced Transit using Travel Demand Scenario E

The following description, presented by the logical termini limits, summarizes Concept C-4.

**Section 100 ⇒ I-895 Split to north of MD 43 (8 miles)** ⇒ Concept C-4 retains the existing highway system and interchange configuration, with widening as required to accommodate the addition of a two-lane separated and reversible facility in the median. Direct access ramps from the new reversible facility could be provided for selected interchange movements. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 200 ⇒ north of MD 43 to north of MD 22 (16 miles)** ⇒ The two-lane separated and reversible roadway in the median would be

extended north to the MD 543 interchange; an additional general purpose lane per direction would be added between MD 543 and MD 22. Direct access ramps could be provided to connect the new reversible roadway with selected interchange movements. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 300 ⇒ north of MD 22 to north of MD 222 (9 miles)** ⇒ North of MD 22, Concept C-4 would include one additional travel lane per direction. The addition of a fourth travel lane per direction would require the construction of a new crossing of the



I-895(N) Split to the Delaware State Line

Susquehanna River. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

Section 400 => north of MD 222 to Delaware state line (16 miles) => Concept C-4 would include one additional travel lane per direction north of MD 222. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

Concept C-4 Level of Service (See Figure B-7)

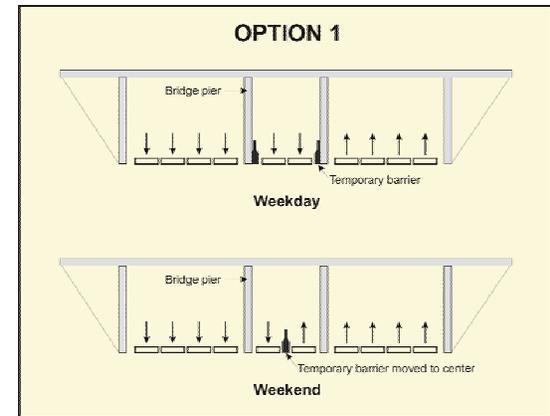
Level of service analyses were conducted for the year 2020 weekday a.m. and p.m. and weekend peak periods for Concept C-4. The mainline levels of service are illustrated on the following figure; and Appendix D.5 contains a detailed table showing the traffic volumes and level of service with volume to capacity (v/c) ratios for LOS E and F segments.

The weekday a.m. and p.m. peak hour traffic in the general purpose lanes is projected to operate very near or above capacity (i.e. LOS E and F) in the southern section of the study area (I-895 Split north to MD 24); however, capacity is available in the reversible lanes, which are projected to operate at LOS A and B. North of MD 24, the a.m. and p.m. peak hour traffic is projected to operate between LOS A

and LOS D. South of MD 543, the weekend peak periods will operate near or above capacity (LOS E and F) in the direction in which the reversible lanes are not in operation. The weekend peak hour volumes are evenly distributed (50/50) between the northbound and southbound directions. LOS E or F is expected even if one lane of the reversible facility is devoted to each direction of travel during weekend peak periods. North of MD 543, the weekend peak hour is projected to operate at LOS D.

Weekend levels of service could conceivably be improved by operating one lane of the two lane reversible roadway in each direction, however, operational and logistical issues would be difficult to overcome. For safety reasons, the reversible roadway would require a barrier to separate the opposing directions of traffic. One option is to place temporary barrier on both sides of the reversible roadway for weekday peak periods and move these barriers to the center of the reversible roadway for weekend traffic. This option would necessitate one continuous stretch of pavement across the northbound and southbound lanes with no accommodation for the bridge piers and signing. In this option, bridge piers which are adjacent to the barrier during the weekday, would be located between lanes during the

weekend. This arrangement would not be desirable for safety reasons (see illustration Option 1).

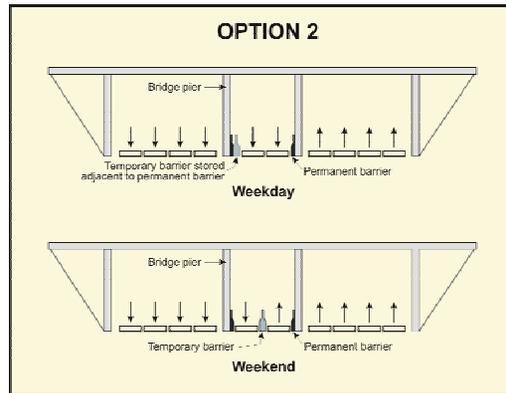


A second option would be to operate the reversible roadway as a two-lane roadway. For safety, this option would also require barrier to separate opposing traffic on the two-lane roadway (see illustration Option 2). "Movable barrier" technology allows for relocation of traffic barrier by machine at speeds up to 10 mph. Given the length of roadway (20 miles) over which the barrier would need to be shifted, this concept would require both significant time and high cost for equipment. In addition, a barrier separated roadway such as this would not provide for passing of vehicles, maneuvering of emergency vehicles nor the ability to route traffic around an accident;



I-895(N) Split to the Delaware State Line

signing such a roadway would also be difficult and costly.



Conclusions

Concept C-4 ⇒ This concept combines enhanced transit with a two-lane separated and reversible roadway in the median from south of I-695 to MD 543 and an additional general purpose lane per direction north of MD 24. The reversible roadway could be operated as managed lanes (HOV, tolled expressway, or other) in the peak direction during both weekdays and weekends.

Under Concept C-4 there would be approximately 392 General Purpose lane miles and 80 reversible lane miles, reflecting an increase of approximately 146 lane miles beyond existing conditions.

While this “minimal improvement” concept attempts to serve the weekday commuter traffic, analysis indicated that serious operational problems could result in the southern portion of the corridor during weekend periods.

During the weekday, the peak hour/peak direction traffic in the general purpose lanes is projected to operate at or above capacity (between LOS E and LOS F), while capacity is available in the reversible lanes which are projected to operate between LOS A and LOS B. Acceptable levels of service could be achieved during weekday peak hours, however, extensive geometric modifications would be needed at the interchanges to accommodate a reversible roadway, especially at I-695.

During the weekend, the section south of MD 543 is projected to operate at or above capacity (between LOS E and LOS F) in the direction in which the reversible roadway is not in operation.

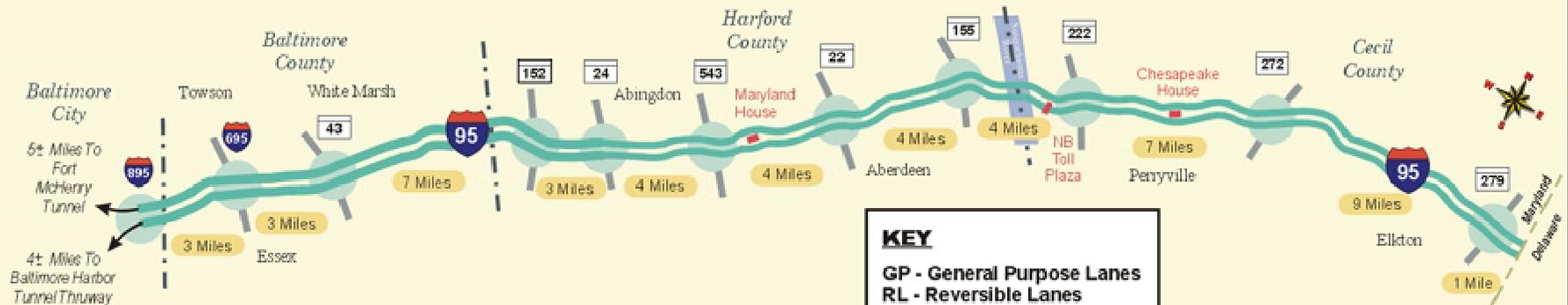
Since the peak traffic volumes on I-95 during holidays and weekends are evenly (nearly) distributed between directions, this concept does not seem to offer the necessary flexibility for successful traffic management of the interstate traffic flows. Concept C-4 is not recommended for further study due to the potential for operational failures during holiday and weekend peak periods.



I-895(N) Split to the Delaware State Line

**Concept C-4: Reversible Lanes - Year 2020 Mainline Levels of Service**

SOUTHBOUND			Mileposts										
			895	695	43	152	24	543	22	155	222	272	279
WeekDAY AM Peak	GP		F	F	F	E	C	C	B	B	B	B	A
	RL		B	B	B	A	A						
WeekDAY PM Peak	GP		D	E	E	D	D	C	B	B	B	B	B
	RL												
WeekEND Peak	GP		D	D	D	D	D	D	D	D	D	D	D
	RL		B	B	B	B	B						



**KEY**  
 GP - General Purpose Lanes  
 RL - Reversible Lanes

NORTHBOUND			Mileposts										
			895	695	43	152	24	543	22	155	222	272	279
WeekDAY AM Peak	GP		C	D	D	D	C	C	B	B	B	B	B
	RL												
WeekDAY PM Peak	GP		F	F	F	F	D	D	C	C	C	C	B
	RL		B	B	B	A	A						
WeekEND Peak	GP		E	F	F	E	E	D	D	D	D	D	D
	RL												



**LEGEND**

A B C	LOS A, B, C
D	LOS D
E	LOS E
F	LOS F

**LOS A:** Free Flow  
**LOS B & C:** Stable Flow

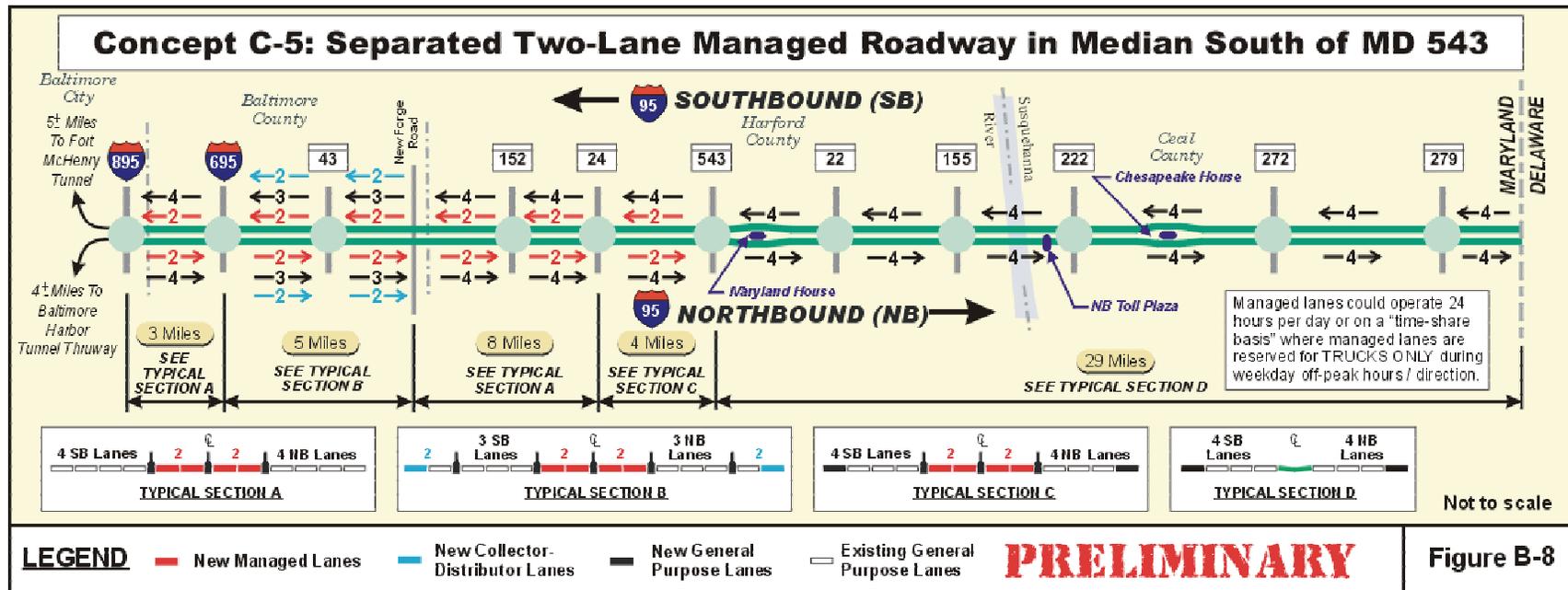


**Figure B-7**

**CONCEPT C-5**  
**SEPARATED TWO-LANE**  
**MANAGED ROADWAY IN MEDIAN**  
**SOUTH OF MD 543**



I-895(N) Split to the Delaware State Line



**Overview** ⇒ Concept C-5 would provide managed lanes between I-895 and MD 543 and provide one additional general purpose lane per direction north of MD 543, thus providing at a minimum four general purpose lanes per direction throughout the entire 49-mile study area. The managed lanes concept was evaluated as a two-lane per direction, barrier separated tolled expressway between I-895 and MD 543. The managed lanes could operate 24-hours per day under a one management strategy or on a “time-share basis” with different management strategies implemented at different times of the day. The “time-share basis” concept was evaluated as a

peak hour/peak direction tolled expressway with an off-peak Truck Only use restriction. Concept C-5 potentially represents a broad family of geometric and operational alternatives.

**Transit Assumptions**

- C-5 ⇒ Base Transit using Travel Demand Scenario C (assumed Tolled Expressway) using Travel Demand Scenario D (assumed Tolled Expressway with off-peak Truck Only use restriction)

- C-5 ⇒ Enhanced Transit using Travel Demand Scenario E (assumed Tolled Expressway) using Travel Demand Scenario F (assumed Tolled Expressway with off-peak Truck Only use restriction)

The following description, presented by the logical termini limits, summarizes Concept C-5.

**Section 100 ⇒ I-895 Split to north of MD 43 (8 miles)** ⇒ From north of the I-895 Split to I-695, Concept C-5 would provide a two-lane per direction barrier separated managed facility



### I-895(N) Split to the Delaware State Line

adjacent to the inside lanes. The existing four general purpose lanes would remain in number but would be shifted to provide space for the managed facility.

North of the I-695 interchange, Concept C-5 would provide a two-lane per direction barrier-separated managed facility adjacent to the inside lanes. Three of the four existing general purpose lanes per direction remain although they would be shifted to provide space for the managed facility. The fourth general purpose lane would become one of the lanes on a two-lane collector-distributor roadway that would be provided from north of the MD 43 interchange to the I-695 interchange.

Direct access ramps could be provided to connect the managed facility with selected interchange movements, transit stations or development centers. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 200 ⇒ north of MD 43 to north of MD 22 (16 miles)** ⇒ The two-lane per direction barrier-separated managed facility would be extended north from MD 43 to the MD 543 interchange; the existing four general purpose lanes per direction between MD 43 and MD 24 and the existing three general purpose lanes per

direction between MD 24 and MD 543 would remain in number but would be shifted to provide space for the managed facility. An additional general purpose lane would be added between MD 543 and MD 22. Direct access ramps could be provided to connect the new managed facility with selected interchange movements (for example, at transit stations). Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 300 ⇒ north of MD 22 to north of MD 222 (9 miles)** ⇒ North of MD 22, Concept C-5 would include one additional travel lane per direction. The addition of a fourth travel lane per direction would require the construction of a new crossing of the Susquehanna River. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 400 ⇒ north of MD 222 to Delaware state line (16 miles)** ⇒ Concept C-5 would include one additional travel lane north of MD 222. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

#### **Concept C-5 Levels of Service (See Figure B-9)**

Level of service analyses were conducted for the Year 2020 **weekday** a.m. and p.m. and **weekend**

peak periods for the Two-Lane Separated Managed Facility as a Tolloed Expressway with both base transit and enhanced transit assumptions. Analyses were also conducted assuming a "time share basis" management strategy of "off-peak" Truck Only restrictions under the base and enhanced transit assumptions. The only difference in the levels of service between the four scenarios occurred on the northbound C-D roadway between I-695 and MD 43 (Scenario C) and the northbound general purpose lanes between MD 152 and MD 24 (Scenario F). Figure B.9 presents the mainline levels of service for Concept C-5.

Concept C-5 **weekday** a.m. and p.m. peak hour traffic in the general purpose lanes is projected to operate very near or above capacity (i.e., LOS E and LOS F) in the southern section of the study area (I-895 Split north to MD 152); however, capacity is available in the managed lanes that are projected to operate between LOS A and LOS B. Northbound between MD 152 and MD 24, the general purpose lanes are projected to operate at LOS F (LOS E,  $v/c=1.00$  with Scenario F traffic volumes).

The C-D lanes between I-695/Baltimore Beltway and MD 43 are projected to operate at LOS D (LOS E with Scenario C traffic volumes). North of MD 543, the a.m. and p.m. peak hour traffic is



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projected to operate between LOS A and LOS D. During the **weekend** peak hour, the mainline general purpose lanes are projected to operate at LOS D throughout the study area, except between I-695 and MD 43 where the general purpose lane would operate at LOS E and the C-D lanes at LOS B. The managed lanes between I-895 and MD 543 are projected to operate at LOS B.

Appendix D.5 presents detailed tables showing the volumes and level of service with volume to capacity (v/c) ratios for LOS E and F segments.

**Conclusions**

*Concept C-5* ⇒ This concept provides two managed lanes per direction between I-895 and MD 543 and one additional general purpose lane per direction north of MD 543. The managed lanes could operate under one management strategy 24-hours per day or on a “time-share basis” with different restrictions at different times of day. In addition, a C-D roadway is provided between I-695 and north of MD 43.

Under Concept C-5 there would be approximately 382 General Purpose lane miles, 80 managed lane miles, and 20 Collector-Distributor lane miles reflecting an increase of approximately 156 lane miles beyond the existing lane miles.

During the **weekday**, the peak hour/peak direction traffic in the general purpose lanes is projected to operate at or above capacity (between LOS E and LOS F), while capacity is 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.

During the “time-share basis” scenario tested for the **weekday** a.m. and p.m. off-peak direction, the general purpose lanes are projected to operate between LOS C and LOS D; and the truck only lanes are projected to operate at LOS A.

During the **weekend** peak hour, the mainline general purpose lanes are projected to operate between LOS D and LOS E throughout the corridor.

Although there is no difference in the level of service between the base transit and enhanced transit assumptions, enhanced transit is expected to reduce I-95 travel demand by approximately 700 autos during **weekday** peak periods.

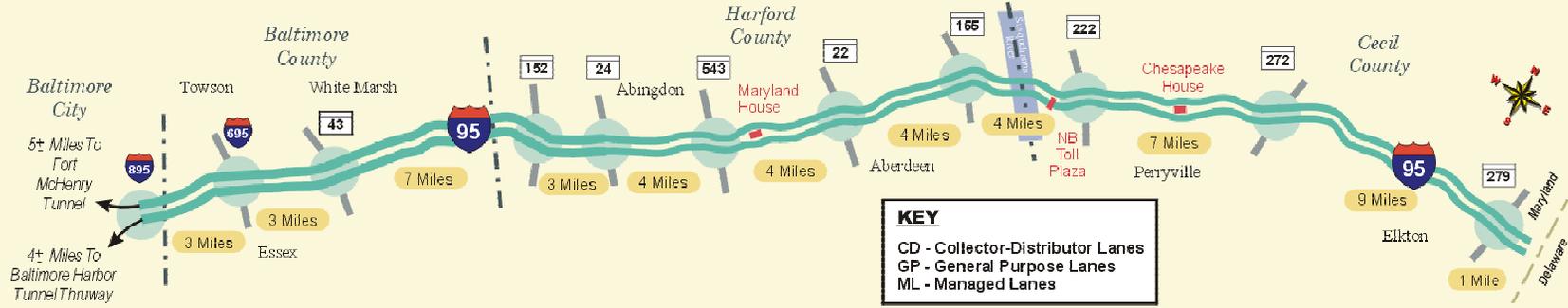
This concept appears to offer inducements for transit and HOV usage. Periods of congestion are still expected in the general purpose lanes; however, travel demand management may be achieved through successful operation of the managed lanes. The operation of the managed lanes on a “time-shared basis” with the tested Trucks Only strategy is expected to enhance overall traffic safety by reducing the potential for conflicts between heavy vehicles and passenger vehicles. Due to the potential to affect travel demand, mode choice, and safety this concept is recommended for further study.



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**Concept C-5: Managed Roadway - Year 2020 Mainline Levels of Service**

		895	695	43	New Forge Road	152	24	543	22	155	222	272	279
<b>SOUTHBOUND</b>	<b>WeekDAY AM Peak</b>	CD	F	D	C <sup>(1)</sup>	F	E	C	C	E	E	E	E
		GP	F	F	F	F	E	A	C	C	E	E	E
		ML	E	E	E	E	A	A	C	C	E	E	E
	<b>WeekDAY PM Peak</b>	CD	C	C	C	C	C	C	C	C	E	E	E
		GP	D	D	D	D	D	D	C	C	E	E	E
		ML	A	A	A	A	A	A	C	C	E	E	E
	<b>WeekEND Peak</b>	CD	C	C	C	C	C	C	C	C	C	C	C
		GP	D	D	D	D	D	D	D	D	D	D	D
		ML	D	E	D	D	D	D	C	C	D	D	D



		895	695	43	New Forge Road	152	24	543	22	155	222	272	279
<b>NORTHBOUND</b>	<b>WeekDAY AM Peak</b>	CD	C	D	B	D	D	C	C	E	E	E	E
		GP	A	A	A	A	A	A	C	C	E	E	E
		ML	A	A	A	A	A	A	C	C	E	E	E
	<b>WeekDAY PM Peak</b>	CD	D <sup>(2)</sup>	D <sup>(3)</sup>	D <sup>(3)</sup>	F	F <sup>(4)</sup>	A	C	C	C	C	C
		GP	F	F	F	F	F	A	C	C	C	C	C
		ML	E	E	E	E	E	A	C	C	C	C	C
	<b>WeekEND Peak</b>	CD	C	C	C	C	C	C	C	C	C	C	C
		GP	D	D	D	D	D	D	D	D	D	D	D
		ML	D	E	D	D	D	D	C	C	D	D	D

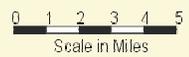
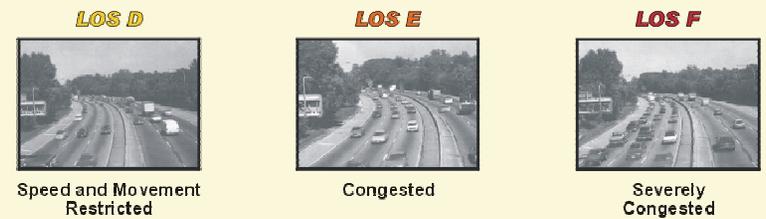
Footnote: (1) Between MD 43 and New Forge Road, the southbound Collector-Distributor road operates at LOS D with travel demand Scenario C.  
 (2) Between I-695 and MD 43, the northbound Collector-Distributor road operates at LOS E with traffic demand Scenario C.  
 (3) Between MD 43 and New Forge Road, the northbound Collector-Distributor road operates at LOS C with travel demand Scenario D and with travel demand Scenario F.  
 (4) Between MD 152 and MD 24, the northbound General Purpose lane operates at LOS E with travel demand Scenario F.

Note: During the tested "time-share basis" concept when managed lanes were reserved for TRUCKS only: southbound PM peak between I-695 and I-695 and between MD 24 and MD 543, and northbound AM peak between I-695 and MD 24 will operate at LOS C; all other LOS are as shown.

**LEGEND**

A B C	LOS A, B, C
D	LOS D
E	LOS E
F	LOS F

**LOS A:** Free Flow  
**LOS B & C:** Stable Flow



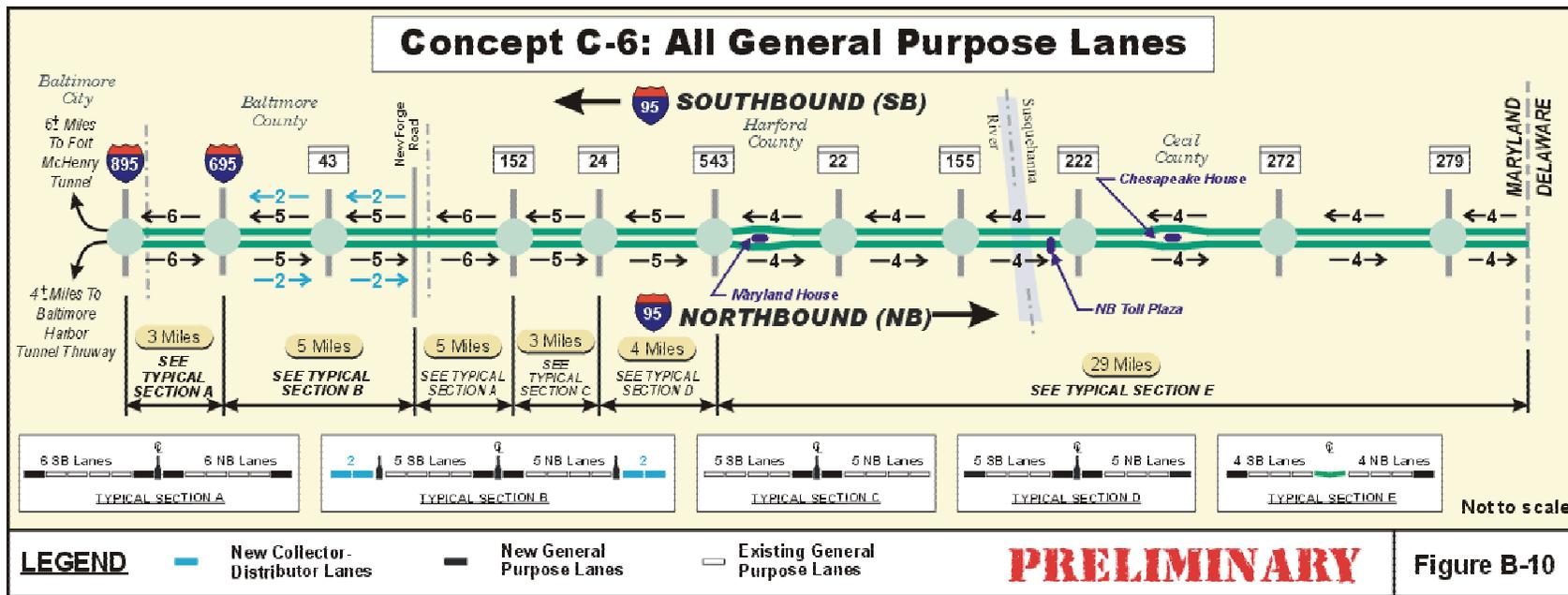
**Figure B-9**

**CONCEPT C-6**

**ALL GENERAL PURPOSE LANES**



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**Overview** ⇒ Concept C-6 would increase the number of general purpose lanes as needed, to accommodate the projected traffic throughout the 49-mile study area. In addition, a two-lane collector-distributor roadway would be provided from north of MD 43 to I-695 to improve traffic operations and safety.

**Transit Assumptions**

- C-6 ⇒ Base Transit using Travel Demand Scenario C

The following description, presented by the logical termini limits, summarizes Concept C-6.

**Section 100** ⇒ I-895 Split to north of MD 43 (8 miles) ⇒ From north of the I-895 Split to I-695, Concept C-6 would provide two additional travel lanes per direction. This six lane section would transition to two lanes for the I-895/Baltimore Harbor Tunnel Thruway connection and four lanes for the I-95/Fort McHenry Tunnel connection. North of I-695, one additional travel lane per direction would be provided. In addition, a two-lane collector-distributor roadway would be provided from I-695 to north of MD 43. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 200** ⇒ north of MD 43 to north of MD 22 (16 miles) ⇒ North of MD 43 to MD 152, and MD 24 to MD 543, Concept C-6 would provide two additional travel lanes per direction. Between MD 152 and MD 24, and between MD 543 to MD 22, Concept C-6 would provide one additional travel lane per direction. This would provide a total of six lanes per direction between MD 43 and MD 152, five lanes per direction between MD 152 and MD 543, and four lanes per direction between MD 543 and MD 22. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.



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**Section 300 ⇒ north of MD 22 to north of MD 222 (9 miles)** ⇒ North of MD 22, Concept C-6 would include one additional travel lane per direction. The addition of a fourth travel lane per direction would require the construction of a new crossing of the Susquehanna River. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Section 400 ⇒ north of MD 222 to Delaware state line (16 miles)** ⇒ Concept C-6 would include one additional travel lane north of MD 222. Interchanges and cross roads would be modified as needed to accommodate the new I-95 cross section.

**Concept C-6 Level of Service (See Figure B-11)**

Level of service analyses were conducted for the Year 2020 **weekday** a.m. and p.m. and **weekend** peak periods for Concept C-6. The mainline levels of service are illustrated on the following figure; and Appendix D.5 contains a detailed table showing the volumes and level of service with volume to capacity (v/c) ratios for LOS E and F segments.

Concept C-6 operates near or below capacity during the **weekday** a.m. and p.m. peak hour and below capacity during the **weekend** peak hour because the number of lanes in this concept were developed based on reaching a “desirable” **weekday** and **weekend** level of service of LOS E and LOS D, respectively.

**Conclusions**

**Concept C-6** ⇒ The Full-Build concept includes base transit assumptions and the provision of additional General Purpose lanes as necessary to accommodate the projected traffic demand. In order to reach a “desirable” **weekday** and **weekend** level of service of LOS E and LOS D, respectively, this concept contains the following number of lanes per direction: six lanes between I-895 and I-695; five mainline and two CD 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.

Under Concept C-6 there would be approximately 448 General Purpose lane miles and 20 Collector-Distributor lane miles reflecting an increase of approximately 142 lane miles over existing conditions.

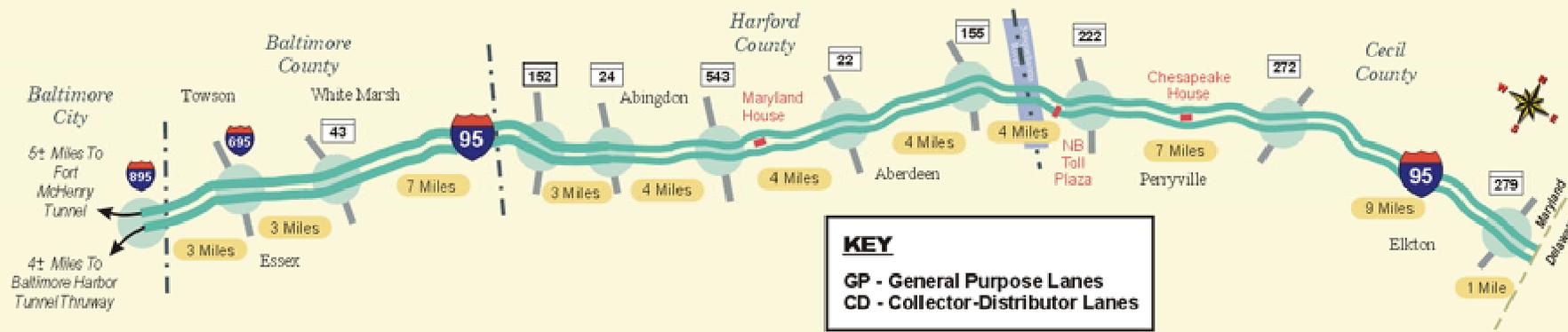
This concept provides good overall traffic operations for both **weekday** and **weekend** peak periods. Environmental and socio-economic consequences, however, could be larger than that anticipated for all of the other concepts except Concept C-2. This concept is recommended for further study as a baseline for comparison with other concepts.



I-895(N) Split to the Delaware State Line

**Concept C-6: General Purpose Lanes - Year 2020 Mainline Levels of Service**

		895	695	43	New Forge Road	152	24	543	22	155	222	272	279	
<b>SOUTHBOUND</b>	WeekDAY AM Peak	GP	E	D	D	E	D	C	C	D	B	B	B	A
		CD		E	D									
	WeekDAY PM Peak	GP	C	C	C	C	C	C	C	D	D	B	B	B
		CD		C	C	C								
WeekEND Peak	GP	C	C	C	C	D	D	D	D	D	D	D	D	
	CD		C	B										



		895	695	43	New Forge Road	152	24	543	22	155	222	272	279
<b>NORTHBOUND</b>	WeekDAY AM Peak	GP	B	B	B	C	C	C	C	B	B	B	B
		CD		C	C								
	WeekDAY PM Peak	GP	E	D	D	E	E	D	D	C	C	C	C
		CD		E	D								
WeekEND Peak	GP	C	C	D	C	D	D	D	D	D	D	D	D
	CD		C	B									

**LEGEND**

A B C	LOS A, B, C
D	LOS D
E	LOS E
F	LOS F

**LOS A:** Free Flow  
**LOS B & C:** Stable Flow

**LOS D:** Speed and Movement Restricted  
**LOS E:** Congested  
**LOS F:** Severely Congested

**Figure B-11**



I-895(N) Split to the Delaware State Line

6. Conclusions

On the basis of the preliminary analyses completed, the following conclusions regarding the I-95 study area are offered:

**Current traffic operations along I-95:** South of MD 43, I-95 currently operates at an undesirable level of service F ("severe congestion") during the a.m. and p.m. peak periods, in the peak direction of travel. Worsening levels of congestion increase the potential for accidents.

**Current transit operations:** A wide array of bus and rail transit options are available to travelers within the I-95 study area. Service along existing rail lines accommodates both regional travelers and local commuters. An extensive network of park-and-ride facilities and regional and local bus service further strengthens transit service within the study area.

**Current freight operations:** Freight crossings of the Susquehanna River include more than 10,000 trucks per day along I-95, 1,000 to 1,500 freight rail cars per day along the NorthEast Corridor tracks, and approximately 600 freight rail cars per day along the CSXT tracks. Collectively, this highway and rail system supports national, regional and local commercial interests, including

the Port of Baltimore and Baltimore-Washington International (BWI) Airport.

**Population/Household/Employment growth:**

The Metropolitan Planning Organizations (MPO's) are predicting continued growth for the I-95 study area between 2000 and 2020 for Baltimore County (9% growth in households and 15% growth in employment), Harford County (29% growth in households and 33% growth in employment), and Cecil County (28% growth in households and 15% growth in employment).

**Economic growth:** Nationwide, business decisions on new facility locations and expansion of existing facilities are including an assessment of relative levels of traffic congestion. Increasing levels of traffic congestion within the study area is expected to have a negative effect on economic growth within the study area and the adjacent regions.

**Year 2020 traffic operations along I-95:**

Combining the effected projected growth in population and employment, with continued expansion of statewide economic generators of traffic (such as the Port of Baltimore and BWI Airport), traffic operations along I-95 in the year 2020 are expected to deteriorate from that being experienced today. The extent of undesirable weekDAY level of service F ("severe

congestion") operations are anticipated to double along southbound I-95 in the a.m. peak and triple along northbound I-95 in the p.m. peak period. In addition, traffic operations during weekEND peak periods will be undesirable at either level of service E ("capacity") or level of service F ("severe congestion"). LOS F conditions are expected to extend northward from Baltimore City. The Baltimore County section of I-95 is expected to operate at LOS F by 2005, the Harford County section of I-95 is expected to operate at LOS F by 2015 and the Cecil County section of I-95 is expected to operate at LOS F by 2020.

**No-Build - Concept C-1:** Under the No-Build, concept, levels of service in the year 2020, during both the a.m. and p.m. weekDAY peak periods and weekEND peak periods will be an undesirable LOS F. The potential for congestion related accidents is expected to increase.

**Minimal Build Concepts C-2 (Tolled Lanes), C-3 (HOV Lanes) and C-4 (Reversible Lanes in Median):**

While some traffic operational improvements would be anticipated with these concepts tolling all lanes, lanes are unlikely to meet transportation needs.



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I-895(N) Split to the Delaware State Line

**Managed Lanes Concept C-5:** The managed lanes concept offers significant traffic operational benefits and operational flexibility. This concept may also enhance incident management capabilities by providing a parallel road system for detours and emergency response access. Concept C-5 represents a broad range of potential geometric and operational alternatives that merit continued evaluation during future independent projects.

**General Purpose Lanes Concept C-6:** This concept offers the best overall week**DAY** and week**END** peak period traffic operations however the number of lanes provided offers limited inducement for transit and other alternative mode choices.

**Introduction to Figures B-13 and B-14**

On the basis of the travel demand analyses discussed in Section B.2 of this report and the six (6) evaluated concept, the pie charts presented on Figures B-12 (Southbound I-95) and B-13 (Northbound I-95) graphically depict the percentage of lane miles along I-95 anticipated to operate at a particular level of service. The figures permit easy comparison of traffic operations by direction (southbound versus northbound), day (week**day** versus week**end**), and time period (a.m. peak period versus p.m. peak period). The basis for these comparisons is the anticipated design year levels of service (calculated on the basis of the volume to capacity "v/c" ratio method) as well as the anticipated lane miles.



I-895(N) Split to the Delaware State Line

Figure B-12: Comparison of Concepts **Southbound** I-95

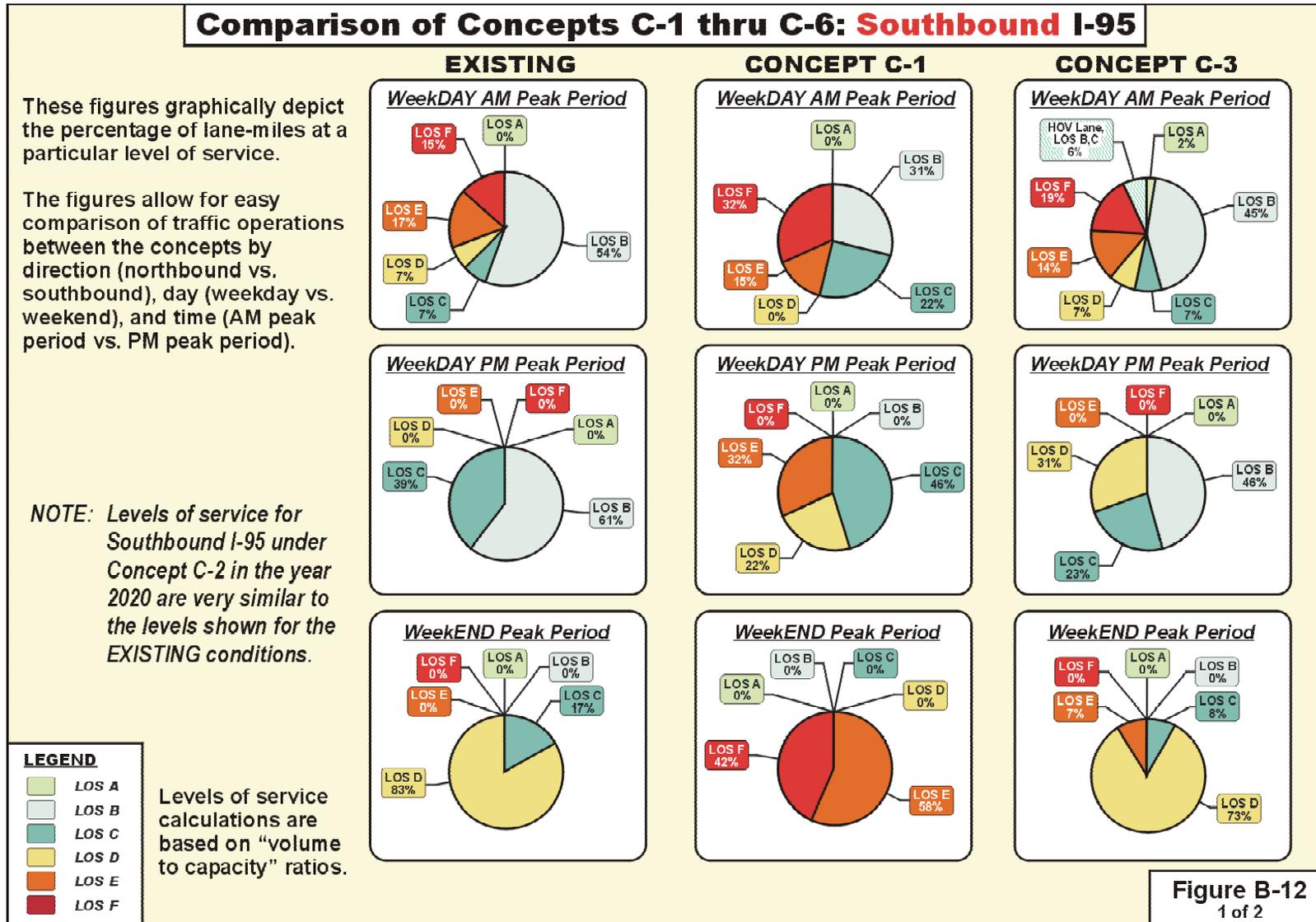


Figure B-12: Continued

**Comparison of Concepts C-1 thru C-6: Southbound I-95**

These figures graphically depict the percentage of lane-miles at a particular level of service.

The figures allow for easy comparison of traffic operations between the concepts by direction (northbound vs. southbound), day (weekday vs. weekend), and time (AM peak period vs. PM peak period).

**LEGEND**

- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F

Levels of service calculations are based on "volume to capacity" ratios.

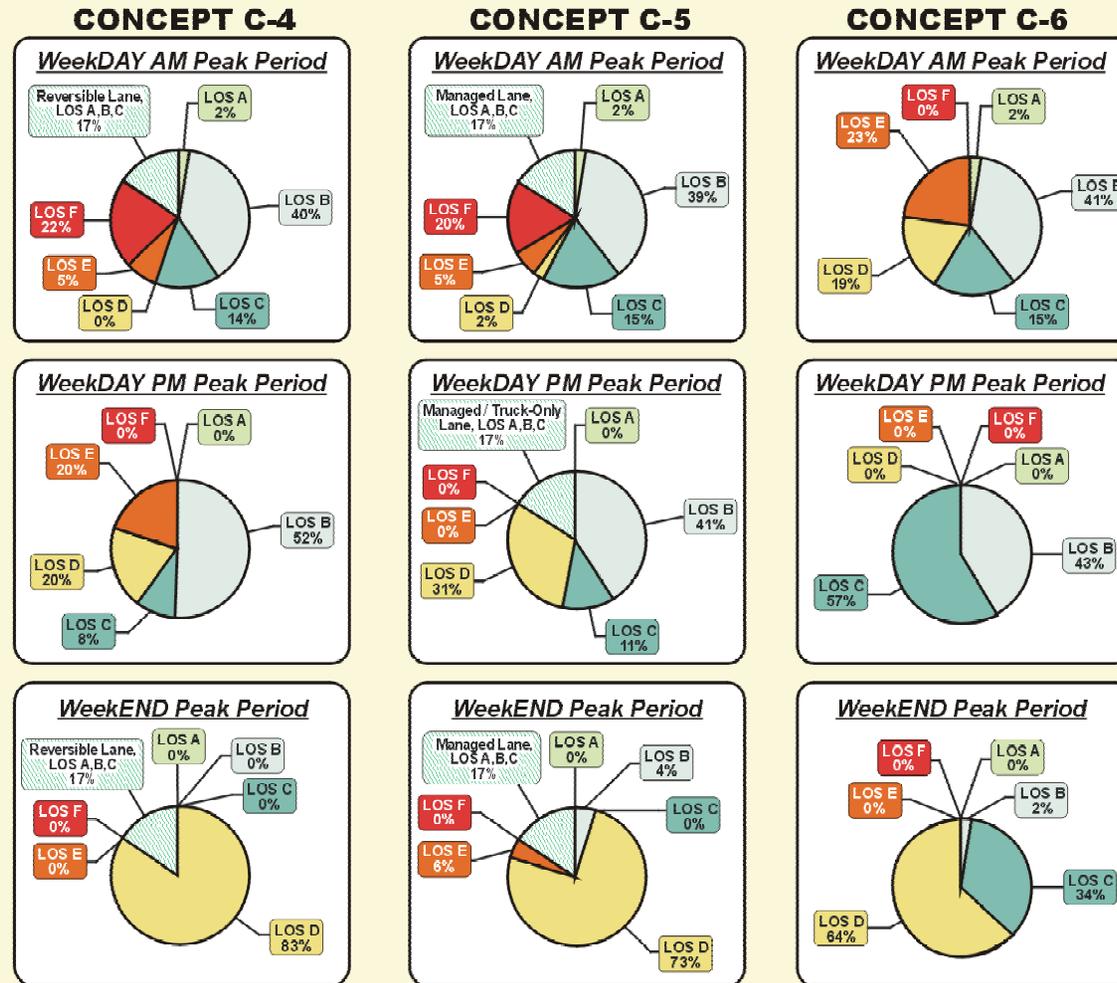


Figure B-12  
2 of 2



I-895(N) Split to the Delaware State Line

Figure B-13: Comparison of Concepts **Northbound** I-95

**Comparison of Concepts C-1 thru C-6: Northbound I-95**

These figures graphically depict the percentage of lane-miles at a particular level of service.

The figures allow for easy comparison of traffic operations between the concepts by direction (northbound vs. southbound), day (weekday vs. weekend), and time (AM peak period vs. PM peak period).

*NOTE: Levels of service for Northbound I-95 under Concept C-2 in the year 2020 are very similar to the levels shown for the EXISTING conditions.*

**LEGEND**

- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F

Levels of service calculations are based on "volume to capacity" ratios.

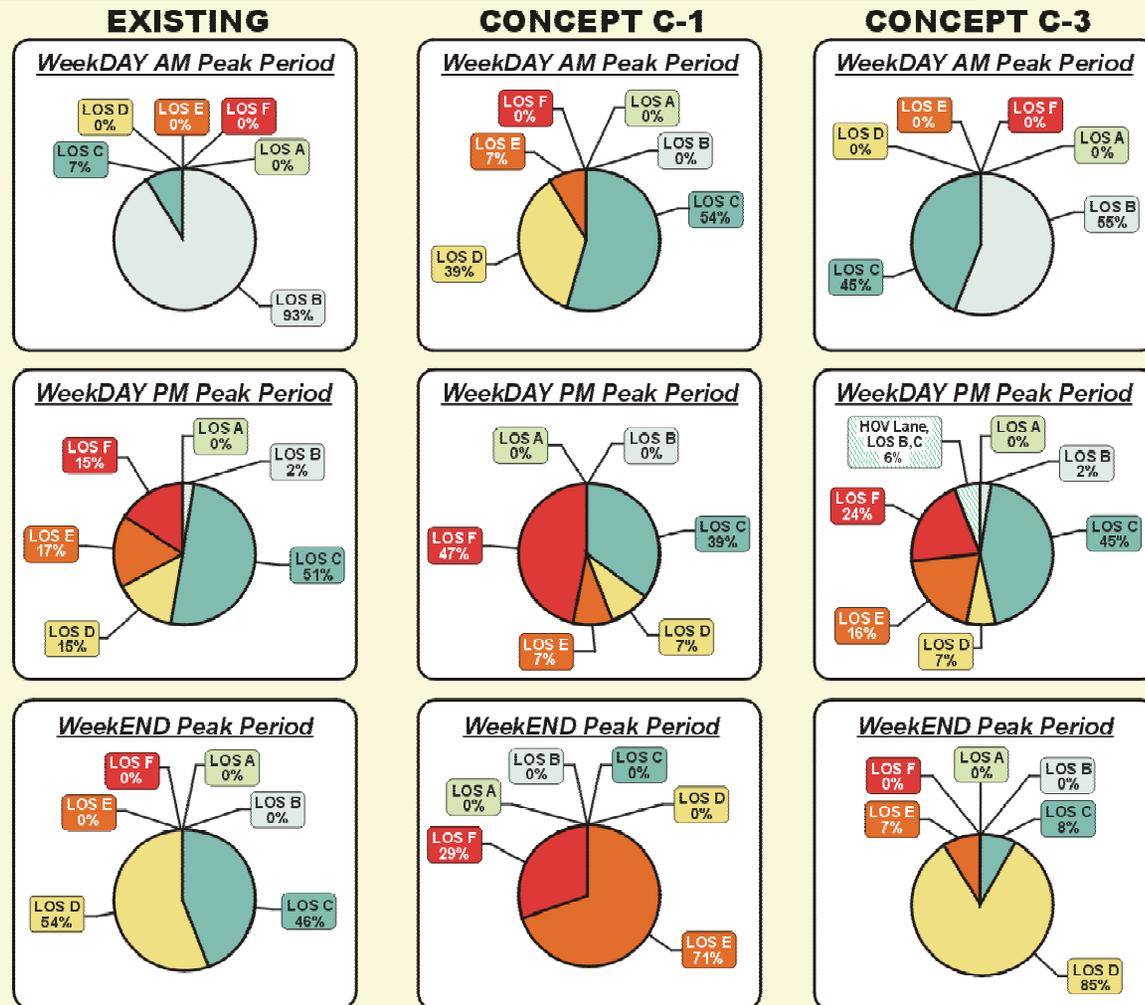


Figure B-13  
1 of 2



I-895(N) Split to the Delaware State Line

Figure B-13: Continued

**Comparison of Concepts C-1 thru C-6: Northbound I-95**

These figures graphically depict the percentage of lane-miles at a particular level of service.

The figures allow for easy comparison of traffic operations between the concepts by direction (northbound vs. southbound), day (weekday vs. weekend), and time (AM peak period vs. PM peak period).

**LEGEND**

- LOS A
- LOS B
- LOS C
- LOS D
- LOS E
- LOS F

Levels of service calculations are based on "volume to capacity" ratios.

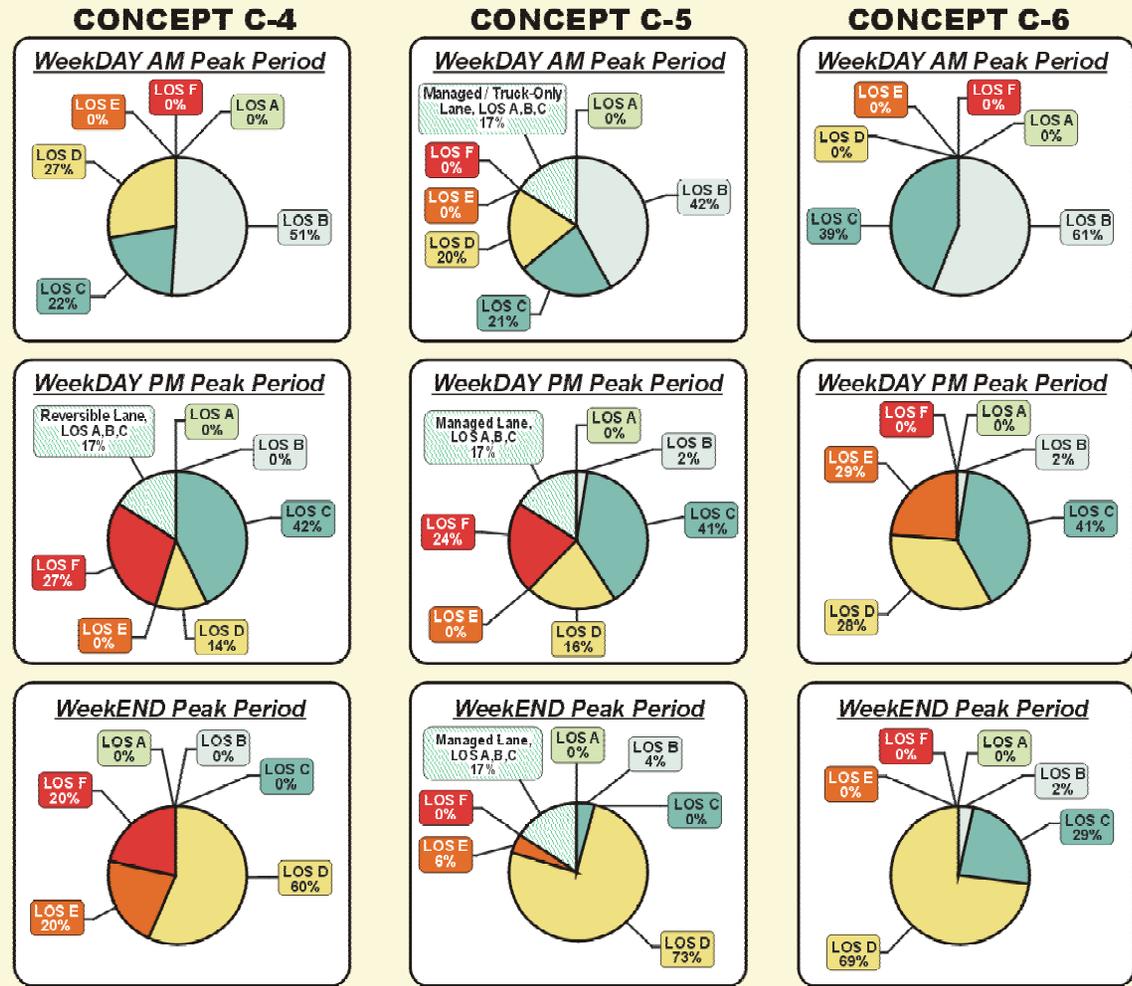


Figure B-13  
2 of 2