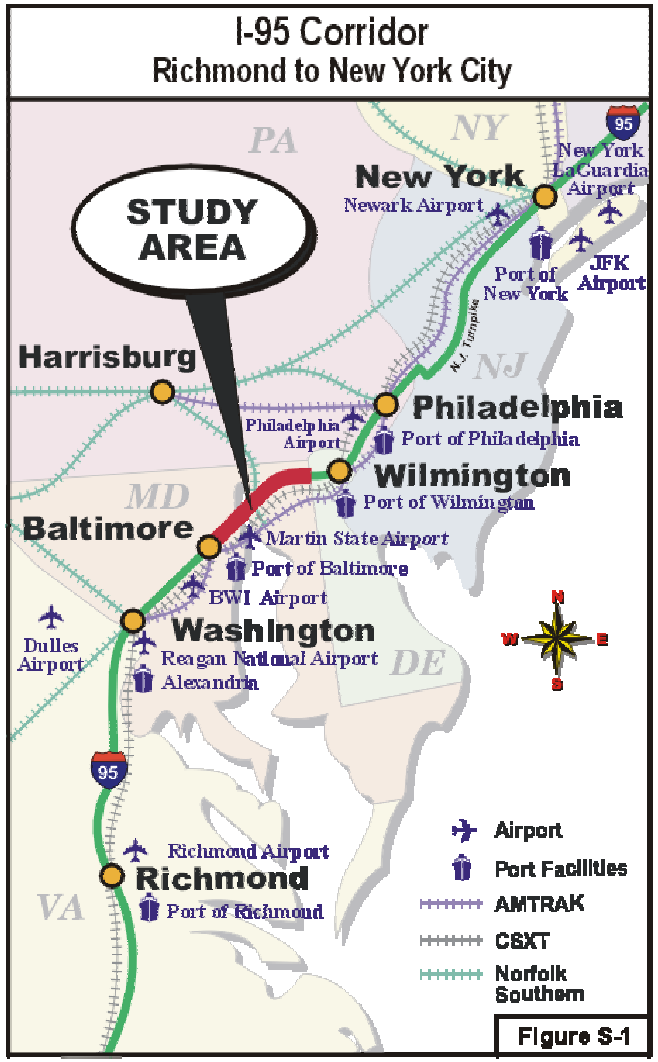
SUMMARY ⇒ RANGE OF MODAL ALTERNATIVES TO BE EVALUATED DURING FUTURE INDEPENDENT PROJECTS



1. **Background ⇒** Flowing virtually uninterrupted along the length of the East Coast, I-95 traverses 1,907 miles through 15 East Coast states, beginning in Miami, Florida and ending in Houlton, Maine, near the Canadian Border. In the State of Maryland, I-95 extends 110 miles from its southern entry point at the Woodrow Wilson Bridge to its northern exit point at the Delaware state line. The Maryland Transportation Authority's (Authority) John F. Kennedy Memorial Highway facility incorporates the 49 mile portion of I-95 from the Baltimore City line northeast to the Delaware state line. In addition, the Authority is also responsible for the US 40 crossing of the Susquehanna River (Thomas J. Hatem Memorial Bridge) as well as three harbor crossings: Fort McHenry Tunnel (I-95), the Baltimore Harbor Tunnel Thruway (I-895), and the Francis Scott Key Bridge (I-695). See Figure A-2.

2. **I-95 Study Area ⇒** The study area for the I-95 Master Plan encompasses 49 miles of I-95 beginning at the I-95/I-895 (N) Split on the northeast side of Baltimore City and extending to the Delaware state line. The study area passes through eastern Baltimore County and southeastern Harford County, crosses the one-mile long Millard J. Tydings Memorial Bridge over the Susquehanna River, and continues through central Cecil County. Tolls are collected along northbound I-95 immediately north of the Susquehanna River Bridge.

   The I-95 study area includes eleven (11) interchanges; two rest areas located in the median (Maryland House and Chesapeake House); and a northbound/southbound truck weigh station just north of the Susquehanna River in the vicinity of the northbound toll plaza. Although the majority of I-95 within Maryland is four (4) lanes per direction, the southern 16 miles of the study area [from I-895 (N) to MD 24] consists of four (4) travel lanes per direction; the northern 33 miles provides three (3) travel lanes per direction. See Figure A-3.

3. **Highway Network ⇒** I-95 is paralleled by US 40, US 1, and MD 7 through Baltimore, Harford, and Cecil counties. An extensive network of roadways provide cross connections, interchanging with I-95 including I-895, I-695, MD 43, MD 152, MD 24, MD 543, MD 22, MD 155, MD 222, MD 272, and MD 279. See Figure A-3.

4. **Transit Network ⇒** The I-95 study area is served by an extensive network of rail and bus services for both through travelers and local commuters. In addition to Amtrak's high-speed passenger rail and priority freight service along the NorthEast Corridor (NEC), the Maryland Transit Administration (MTA) provides passenger rail service from Perryville, Maryland south to Penn Station in Baltimore and Union Station in Washington, D.C. through their Maryland Rail Commuter (MARC) system. MARC daily ridership on the line between Perryville in Cecil County and Baltimore's Penn Station is approximately 740 trips. The SouthEastern Pennsylvania Transportation Authority's (SEPTA) R2 line provides service from Wilmington south to Newark, Delaware (the portion of this service within Delaware is funded by the Delaware Department of Transportation). In Fiscal Year 2001, SEPTA trains serving Delaware carried a total of 2,750 trips per average weekday. See Figure A-5.

   MTA operates commuter bus service throughout the study area and local bus service in Baltimore County. Harford County and Cecil County provide local bus service which connect to MTA bus, MARC rail lines and Delaware Administration for Regional Transit (DART) lines respectively. Several privately owned bus companies also provide transit service along I-95.

5. **Freight Rail Systems ⇒** The existing freight rail network in the study area includes three major rail lines: two north/south oriented lines generally parallel to I-95 [Amtrak's NEC and CSX Transportation's (CSXT) Philadelphia subdivision], and the Norfolk Southern Railroad (NS) Port Road Line, a line parallel to the Susquehanna River. Bulk and long distance freight cargo service is provided along this extensive rail network. Two freight switching railroads ("short haul") also operate in the Baltimore area - the Canton Railroad and the Patapsco & Back Rivers Railroad. See Figure A-6.

6. **Population Growth** ⇒ Analyses of projected population/ households and employment data within the I-95 study area, utilized year 2020 forecasts adopted by the two regional Metropolitan Planning Organizations (MPOs) whose areas of concern include the study area (see Figure A-2). The combined MPO forecasts are predicting the following growth rates for the I-95 study area between 2000 and 2020:
   - **Baltimore County:** 9% increase in household growth and 15% increase in employment growth;
   - **Harford County:** 29% increase in household growth and 33% increase in employment growth;
   - **Cecil County:** 28% increase in household growth and 15% increase in employment growth.

7. **Traffic Growth Along I-95 ⇒** In the 1970s and 1980s, traffic growth along I-95 within the study area averaged approximately 6% per year. In the 1990s, traffic growth averaged 3% per year. The MPOs are projecting an average annual traffic growth rate of approximately 2.6% over the next two decades; between 2020 and 2025, traffic growth is anticipated to occur at a slightly lower rate.

8. **Traffic Characteristics Along I-95 ⇒** Within Maryland, existing average daily traffic volumes range from approximately 165,000 vehicles per day south of MD 43 to approximately 67,000 vehicles per day at the Delaware state line. Based on an analysis of existing traffic volumes along I-95, approximately 75 percent of the total traffic crossing the Susquehanna River is through traffic, originating or destined to points into Delaware or further north. Through traffic constitutes approximately 40 percent of the

total traffic volume at the Baltimore/Harford county line. Today, the highest week**day** peak period (i.e., commuter) traffic volumes within the study area are south of MD 543; ; north of MD 543, the highest traffic volumes along I-95 occur during the week**ends** (i.e., through traffic). **Trucks** account for approximately 10 to 15 percent of the total week**day traffic** along I-95 and approximately 5 to 6 percent of the total week**end** peak period traffic.

At the I-95 crossing of the Susquehanna River, during a week**day** period sampled in April, 2001, approximately 32 to 37 percent of the passenger vehicles had an **auto occupancy** of two or more people. During a concurrent count along I-95 north of MD 43, 12 to 16 percent of the peak period week**day** passenger vehicles carried two or more passengers; this percentage increased to 27 percent during the mid-day period. During an afternoon sample count on a week**end** in May 2001, more than 60 percent of the passenger vehicles on I-95 at the Susquehanna River toll plaza had two or more people. Appendix D.6 further explains/ details this sampling information.

Table S-1 presents the percentage of vehicles by state of registration along I-95 at the Maryland-Delaware state border.

Table S-1: I-95 Vehicle Registration by State at the Maryland-Delaware border

STATE	PERCENTAGE
Maryland	29.9%
New Jersey	16.7%
Pennsylvania	11.9%
New York	7.4%
Delaware	5.4%
All Other States	28.7%

Source: August 24th, 2001 pm peak period traffic observation.

9. TDM/CMS Options For I-95 ⇒

Transportation Demand Management (TDM) and Congestion Management Strategy (CMS) options were evaluated in 1996 for the Harford and Baltimore county portions of I-95. The Corridor #17 Report was approved by the Baltimore Region Transportation Board (BRTB) in 1999. A copy of the report's Executive Summary is included in Appendix D.3.

10. Transit Concepts for I-95 Study Area ⇒

Under the leadership of the Maryland Transit Administration (MTA), the vision for transit in the I-95 study area is to provide modal choices for people traveling within or through the study area, thereby enabling transit ridership to double in the next twenty years (**Maryland Comprehensive Transit Plan**, 2000). MTA and other transit providers intend to provide these transit choices by enhancing, improving and building upon the services and infrastructure in place today, as well as providing completely new transit services where opportunities exist.

Transit concepts are being developed, evaluated and selected under MTA's **Maryland Comprehensive Transit Plan** and MTA's **Baltimore Regional Rail Plan.** Potential transit concepts were tested as a part of the overall I-95 Master Plan Study travel demand modeling; while benefits could be anticipated from these potential transit concepts, the effect of transit improvements on I-95 travel demand was not significant. This may be the result of the extremely strong and diverse range of existing transit opportunities in the study area (regional rail, commuter rail, regional buses, commuter buses, and local buses) and the parallel roadway system. As transit options are adopted into the region's approved constrained long range plan, their effect will be incorporated into future project planning efforts for I-95.

11. **Highway Concepts for I-95** ⇒ Utilizing various combinations of existing lanes, new travel lanes, auxiliary lanes, collector-distributor lanes, high occupancy vehicle (HOV) lanes, and/or managed lanes (tolled expressways utilizing electronic monitoring and payment, access controls - limited entrance/exit points, vehicle class restrictions, and/or time restrictions), a **preliminary** assessment of six (6) highway concepts for the I-95 study area has been completed. These concepts are more fully described in Section B of this paper. Based on the preliminary analyses of the transportation consequences of Concepts C-1 through C-6, the following broad assessments and conclusions were drawn:

Concept C-1: No-Build ⇒ A concept involving use of the existing I-95 highway, with no major improvements or lane additions. As a part of this analysis, the effects of an enhanced transit concept were also evaluated. In general, enhanced transit is expected to reduce I-95 travel demand by 200 to 225 vehicles during week**day** peak periods/peak direction. Enhanced transit is expected to attract more trips, however, as trips shift to transit; vehicles not previously on I-95 are expected to divert from the parallel arterial routes (US 40, US 1, or MD 7) to I-95. This diversion results in a minimal change to overall travel demand along I-95. **Retention of this No-Build highway concept is recommended for further study as a baseline for comparison with other concepts.** See Figures B-1 and B-2.

Concept C-2: All Lanes Tolled ⇒ A concept involving electronic tolling of all lanes along the entire length of I-95 within the study area. The tolling of all lanes on I-95 is expected to divert a significant volume of traffic (1,000 to 1,500 peak period trips) from I-95 to the parallel arterial routes (US 40, MD 7 and US 1). Peak period traffic volumes along I-95 in the design year 2020 are expected to be less than today's volumes, with enhanced transit and tolling of all I-95 lanes. Traffic growth on the parallel routes, however, is expected to be 25 to 70 percent higher. The forecasted traffic volumes on the parallel routes would create significant and adverse transportation impacts. Improvements to these parallel routes may increase potential environmental impacts related to transportation needs. **Further evaluation of Concept C-2 is not recommended.** See Figure B-3.

Concept C-3: High Occupancy Vehicle (HOV) Lanes South of MD 24 ⇒ A concept involving the addition of one HOV lane per direction south of MD 24. Traffic operations along I-95 would be slightly improved in comparison to Concept C-1. During the week**day**, however, the General Purpose lanes would operate at Level of Service F. Surveys of vehicle occupancy indicate that existing week**end** HOV (2+) demand exceeds the capacity of a single HOV lane. In addition, a median HOV system would have limited value as drivers would be required to cross over three or more general purpose lanes in order to access the HOV system. **Concept C-3 is not recommended for further study.** See Figures B-4 and B-5.

Concept C-4: Two-Lane Separated and Reversible Roadway in Median South of MD 543 ⇒ A concept involving the provision of a two-lane separated and reversible facility in the median of I-95 south of MD 543. During week**day** peak periods, acceptable levels of service could be achieved. However, geometric challenges would exist at all interchange connections, especially at I-695 and significant operational controls would be needed to safely reverse traffic flow. The directional flow of peak traffic volumes on I-95 during holidays and week**end**s alternate frequently, therefore, this concept would require extensive maintenance and operational management. This concept does not seem to offer the necessary flexibility for successful traffic management of the non-commuter peak traffic flows. If "moveable barriers" were utilized to implement this concept, the current level of technology only allows for relocation of the barriers at a maximum speed of 10 MPH. Given the length of roadway (20 miles) over which the barrier would need to be shifted, Concept C-4 was considered to be

operationally impractical. A 1-1 lane split for the week**end** peak periods was considered, but structural span lengths became excessively long on perpendicular roadways. Additionally bridge piers and sign supports would need to be located within the center of the reversible facility for the crossings and general signing. **Concept C-4 is not recommended for further study due to the potential for operational failures during holiday and weekend peak periods, as well as severe restrictions on operational flexibility.** See Figures B-6 and B-7.

Concept C-5: Separated Two-Lane Managed Roadway in Median South of MD 543 ⇒ A concept involving the provision of two managed lanes per direction (a tested management strategy was a tolled expressway). This concept seems to provide the potential to achieve lane balance and inducements for transit usage. Periods of congestion could be expected on the General Purpose lanes, however, travel demand management may be achieved through successful operation of the managed lanes. As a part of the analysis for this concept, options assessing enhanced transit and Trucks Only lanes in the off-peak weekday periods were also evaluated. The enhanced transit option is expected to reduce I-95 travel demand by 700 vehicles during week**day** peak periods. The Trucks Only option is expected to enhance overall traffic and safety by reducing the potential for conflicts between heavy vehicles and passenger vehicles. The Trucks Only option may also reduce the potential induced demand created by the new capacity's off-peak "empty lane" syndrome. **Due to the potential to affect travel demand and mode choice, this concept is recommended for further study.** See Figures B-8 and B-9.

Concept C-6: All General Purpose Lanes ⇒ A Full-Build concept involving the provision of additional General Purpose lanes as necessary to meet travel demand. This concept should provide good levels of service for both week**day** and week**end** peak periods. However, environmental consequences could be larger compared to the other concepts. **This concept is recommended for further study as a base line for comparison.** See Figures B-10 and B-11.

Recommendations: The concepts highlighted in green (Concepts C-1, C-5, and C-6) on Table S-2 are those which have been identified as meriting further evaluation during future independent project planning studies. It should be noted that Concepts C-5 and C-6 could each represent a "family" of potential project planning alternatives based on geometric or operational strategies.

Table S-2: PRELIMINARY ⇒ Comparison of Transportation Concepts

Concept	I-95 Highway Concept (1) and Lane Miles (2)	Overall Traffic Operations In Year 2020 (3)				Comments / Observations on Traffic and Transit Operations
		WeekDAY Peaks LOS		WeekEND Peaks LOS		
		General Purpose Lanes	Managed Lanes	General Purpose Lanes	Managed Lanes	
C-1	**No-Build** 326 General Purpose lane miles	**E to F**	none	E to F	none	■ Extended week**end** peak periods of heavy congestion ■ Extensive week**day** peak period congestion. ■ Extended week**day** peak periods. ■ Transit ridership increases with "Enhanced Transit" option, however, motorists who used parallel routes (US 40, US 1 or MD 7) or traveled in a different time period would be attracted back to I-95.
C-2	**All lanes Tolled** 338 Tolled lane miles	**none**	D to F (4)	none	not available	■ Tolling of all lanes is expected to increase trips hour peak on adjacent roadways in the network (primarily US 40, US 1 and MD 7) by 25% to 70%, causing operational failures along these roadways.
C-3	**One-lane High Occupancy Vehicle (HOV) south of MD 24** 404 General Purpose lane miles[6] 26 HOV lane miles	**D to F**	(5)	C to E	none	■ Operates slightly better than Concept C-1. ■ HOV (2+) week**day** volume is expected to exceed 1,000 vehicles in the peak hour/peak direction. ■ Extended periods of congestion are expected in General Purpose lanes. ■ All HOV would not be able to/or desire to access the designated lanes.
C-4	**Two-lane Separated and Reversible median facility south of MD 543** 392 General Purpose lane miles[6] 80 Managed lane miles	**E to F**	2 lane roadway A to B (4)	D to F	2 lane roadway B (4)	■ Reversible facility generally works well during week**day** peak periods, but fails during week**end** peak periods in the "off-peak" direction (the week**end** peak hour traffic is split approximately 50% NB/50% SB while the week**day** is approximately 65% in the peak direction). ■ Significant operational, safety and maintenance constraints.
C-5	**Two-lane Separated Managed facility south of MD 543** 382 General Purpose lane miles[6] 80 Managed lane miles 20 Collector-Distributor lane miles	**C to F**	A to B (4)	D to E	B (4)	■ Congestion expected in General Purpose lanes. ■ Desirable levels of service expected in managed lanes. ■ Enhanced transit could reduce peak hour week**day** traffic volumes on I-95 by approximately 700 trips. ■ TRUCKS ONLY option is predicted to enhance overall safety by reducing conflicts between trucks and cars. ■ Improves incident management opportunities.
C-6	**All General Purpose lanes necessary to meet demand** 448 General Purpose lane miles[6] 20 Collector-Distributor lane miles	**C to E**	none	C to D	none	■ While overall week**day** and week**end** peak period is expected to operate well, the number of accessible lanes provided offers limited inducement for transit and carpooling.

NOTES:
(1) Base transit and Enhanced transit were evaluated for Concepts C-1 and C-5. Only Enhanced transit was evaluated for Concepts C-2, C-3, and C-4. Please see Section B.1 for a description of Base transit and Enhanced transit.
(2) Lane miles shown include all existing and new lanes along I-95.
(3) Level of Service (LOS) displayed is for I-95 mainline traffic operations between I-895(N) and MD 543. LOS north of MD 543 is the same or better than the displayed LOS. See Figures B-2, B-5, B-9 and B-11 for descriptions of LOS. Calculation of LOS based on "volume to capacity" (v/c) ratio method.
(4) Tolled expressway was analyzed.
(5) LOS cannot be determined for a one lane segment. HOV lane LOS is approximated to operate between LOS B to C.
(6) A 4th general purpose lane per direction was assumed north of MD 24.

Concepts recommended for further study during future independent projects