3

FUTURE CONDITIONS

3.1 Demographics of Areas Near the Bridge

Demographic projections presented in this section are from the Maryland Department of Planning (MDP). These projections are consistent with projections from the Baltimore Metropolitan Council and Metropolitan Washington Council of Governments.

MDP projects that the population of Anne Arundel County will increase 8.7 percent between 2000 and 2010 to approximately 532,200. This is lower than the 11.4 percent growth rate MDP projects for the Washington region but higher than the 5.5 percent growth rate they expect for the Baltimore region. The population of Queen Anne's County is projected to increase 19.6 percent by 2010 to approximately 48,500. This is higher than the projected growth rates for the Baltimore and Washington regions and is the highest of the upper Eastern Shore counties (Caroline, Cecil, Kent, Queen Anne's and Talbot). Population in the upper Eastern Shore counties is projected to grow another 10.8 percent by 2010 to approximately 231,800 people. Similarly, population in the lower Eastern Shore counties (Dorchester, Somerset, Wicomico, and Worcester) is projected to grow an additional 8.2 percent by 2010 to approximately 202,000 people.

Similarly, MDP projects the number of jobs in Anne Arundel County to increase by 11.4 percent between 2000 and 2010 to an approximate 330,900 jobs. This represents a downward trend from the high level of job growth in the 1970s (35.4 percent) and 1980s (43.0 percent). The number of jobs in Queen Anne's County is projected to increase by 20.0 percent by 2010 to an approximate 21,000 jobs. Job growth is projected to continue by 13.4 and 12.2 percent by 2010 for the upper and lower Eastern Shore counties, respectively.

3.2 Bridge Structure

The westbound bridge deck has been undergoing rehabilitation since January 2002. The completion of the work should meet all major reconstruction and maintenance needs on the westbound structure in the foreseeable future.

In general, the deck of the eastbound bridge is in good condition. The concrete deck panels and cast-in-place concrete deck spans exhibit minor cracking. Considering the current condition of the deck and the projected increases in traffic volumes, it is anticipated that the deck will require rehabilitation around 2018. Depending on the type

and method of construction, the rehabilitation could require either long-term single lane closures or complete night time bridge closures. Because the bridge is projected to carry significant traffic volumes by 2018, the rehabilitation would likely result in substantial travel time delays.

3.3 Traffic

Unconstrained Average Daily Traffic (ADT) volume projections for 2025 were developed for a Saturday in summer and an average weekday as described in the *Travel Demand Model Technical Memorandum*, 2003. The projections represent unconstrained demand that does not account for congestion on the local roadway network or the maximum allowable throughput of the bridges or tollbooths. The unconstrained ADT forecasts were converted to unconstrained hourly volumes using hourly distribution K-factors[2] developed from existing (2001) count data. A capacity analysis was then performed based on the hourly volumes. This sketch level traffic analysis was deemed most appropriate for a quick assessment of the future transportation needs at the Bay Bridge and is based on the eastbound origin-destination survey and seasonal count data as well as regional transportation and land use models.

3.3.1 Average Daily Traffic

Consistent with the downward demographic trends, growth in Annual Average Daily Traffic (AADT) has declined over the last two decades from 5.4 percent per year between 1980 and 1985 to 3.2 percent per year from 1995 to 2000[3]. Historical traffic data provided by the Authority also indicates an annual increase in summer daily traffic of approximately one percent per year. While the rate of overall annual traffic growth is expected to continue to decrease, summer Average Daily Traffic volumes are forecasted to increase at a slightly higher rate of approximately two percent per year.

Summer Saturday. The projected two-direction unconstrained daily traffic on the Bay Bridge for year 2025 on a Saturday in summer is 135,000 vehicles. This is a 42 percent increase in traffic from year 2001[4] (95,000 vehicles on a Saturday in August). The daily directional split in traffic based on existing count data for a Saturday in summer is 55 percent eastbound and 45 percent westbound.

Average Weekday. The projected two-direction unconstrained daily traffic on the Bay Bridge for year 2025 on an average weekday is 86,000 vehicles. This is a 41 percent increase in traffic from year 2001[5] (61,000 vehicles). The daily directional split in traffic based on existing count data for an average weekday is 50 percent eastbound and 50 percent westbound.

[2] K-Factor – The proportion of Average Daily Traffic (ADT) occurring in the analysis hour. Source: 2000 Highway Capacity Manual, Transportation Research Board.
[3] Data on AADT provided by the Authority.
[4] Traffic counts conducted in August 2001 were used for comparison purposes. Base year for modeling purposes is 2000.
[5] Traffic counts collected in October 2001 used for comparison purposes. Base year for modeling is 2000.

3.3.2 Peak Hour Traffic

Summer Saturday. Hourly distribution of directional traffic for year 2025 was developed based on K-factors derived from 24-hour counts conducted on Saturday, August 18, 2001. The directional K-factors and hourly distribution for 2025 are shown in **Table 16**. This results in unconstrained hourly volumes that are in excess of the capacity of the toll plaza and the bridges. A separate study conducted for the Authority determined the maximum volumes that can be serviced under LOS E conditions for the toll plaza and bridge. Based on that study, the maximum LOS E volume for eastbound traffic on the Bay Bridge, under contraflow conditions, was calculated to be 5,175 vehicles. Volumes exceeding this limit would result in LOS F conditions.

Table 16. 2025 Unconstrained Hourly Volumes

SUMMER SATURDAY					
START TIME	**WEEKEND EB K-FACTOR**	**2025 EB TOTAL**	**WEEKEND WB K-FACTOR**	**2025 WB TOTAL**	**TOTAL**
12:00 AM	1.02%	770	0.92%	544	1,313
1:00	0.74%	556	0.75%	444	999
2:00	0.50%	379	0.59%	348	727
3:00	0.62%	468	0.82%	489	958
4:00	0.69%	523	1.25%	741	1,263
5:00	1.26%	955	2.74%	1627	2,582
6:00	2.34%	1,769	4.95%	2940	4,709
7:00	3.10%	2,343	6.15%	3652	5,995
8:00	3.57%	2,696	5.02%	2977	5,673
9:00	4.06%	3,065	4.57%	2709	5,774
10:00	5.34%	4,029	4.58%	2717	6,746
11:00	5.99%	4,521	5.33%	3160	7,681
12:00 PM	6.34%	4,784	5.85%	3474	8,258
1:00	6.54%	4,939	6.38%	3785	8,724
2:00	7.23%	5,462	6.32%	3749	9,211
3:00	7.63%	5,762	7.32%	4341	10,103
4:00	7.55%	5,703	6.92%	4107	9,810
5:00	7.63%	5,759	6.16%	3658	9,417
6:00	5.98%	4,517	5.86%	3475	7,992
7:00	5.49%	4,147	5.04%	2988	7,135
8:00	5.27%	3,983	4.25%	2520	6,503
9:00	5.36%	4,048	3.55%	2104	6,151
10:00	3.36%	2,540	2.88%	1708	4,248
11:00	2.38%	1,798	1.82%	1079	2,877
TOTAL	100.0%	75,516	100.0%	59,334	134,850

K-Factor is the proportion of Average Daily Traffic (ADT) occurring in the analysis hour.

The future constrained traffic can be expected to result in longer queues and increased travel times in the vicinity of the Bay Bridge. These longer queues will be compounded by the other existing and growing queues along the US 50 corridor. In addition, it is expected that some drivers would choose alternate departure times (peak spreading),

find alternate routes to their ultimate destination (diversion), or not make certain types of trips.

Average Weekday. Hourly distribution of directional traffic for year 2025 was developed based on K-factors derived from the 24-hour counts conducted on Wednesday, October 17, 2001. The directional K-factors and hourly distribution for 2025 are shown in **Table 17**.

Table 17. 2025 Unconstrained Hourly Volumes

AVERAGE WEEKDAY					
START TIME	**Weekday EB K-FACTOR**	**2025 EB TOTAL**	**Weekday WB K-FACTOR**	**2025 WB TOTAL**	**Total**
12:00 AM	1.09%	468	0.82%	351	819
1:00	0.77%	330	0.66%	285	615
2:00	0.78%	336	0.54%	234	570
3:00	0.71%	306	0.99%	425	731
4:00	0.86%	368	1.87%	804	1,172
5:00	1.51%	650	4.66%	1,999	2,649
6:00	2.86%	1,227	8.26%	3,547	4,774
7:00	4.02%	1,727	10.12%	4,344	6,071
8:00	4.40%	1,891	8.33%	3,576	5,467
9:00	4.78%	2,054	6.18%	2,653	4,707
10:00	4.98%	2,136	5.16%	2,216	4,352
11:00	5.03%	2,159	5.12%	2,200	4,359
12:00 PM	5.27%	2,263	5.13%	2,201	4,464
1:00	5.15%	2,210	5.05%	2,166	4,376
2:00	6.01%	2,580	5.52%	2,370	4,950
3:00	7.92%	3,402	5.79%	2,484	5,886
4:00	9.71%	4,170	5.75%	2,471	6,641
5:00	9.76%	4,189	5.57%	2,393	6,582
6:00	8.20%	3,520	4.48%	1,925	5,445
7:00	4.96%	2,130	3.30%	1,418	3,548
8:00	3.68%	1,579	2.50%	1,073	2,652
9:00	3.35%	1,437	2.03%	872	2,309
10:00	2.44%	1,049	1.30%	559	1,608
11:00	1.76%	757	0.87%	373	1,130
TOTAL	100.0%	42,938	100.0%	42,939	85,877

3.3.3 Capacity Analysis

Summer Saturday. Future hourly volumes were analyzed for both normal operating conditions as well as contraflow operations.

Capacity Analysis – Normal Operations Eastbound traffic flows across the Bay Bridge were analyzed as a two-lane freeway segment and westbound flows were analyzed as a three-lane freeway segment. The resulting unconstrained levels of service for several of the heaviest volume hours of the day are shown in **Table 18** and on **Figure 8** using LOS threshold volumes. Based on the projected unconstrained hourly distribution, the eastbound bridge will operate at LOS "F" between the hours of 10 AM and 10 PM when

the bridges are operating under normal conditions (two eastbound lanes). The westbound bridge operates at LOS "D" or better for most of the day under normal conditions (three westbound lanes). Capacity analysis worksheets are included in **Appendix G (Volume II)**.

Table 18. 2025 Unconstrained Hourly Level of Service (LOS) – Normal Operations

SUMMER SATURDAY				
START TIME	**2025 EB TOTAL**	**LOS**	**2025 WB TOTAL**	**LOS**
10:00 AM	4,029	F	2,717	B
11:00	4,521	F	3,160	C
12:00 PM	4,784	F	3,474	C
1:00	4,939	F	3,785	C
2:00	5,462	F	3,749	C
3:00	5,762	F	4,341	D
4:00	5,703	F	4,107	C
5:00	5,759	F	3,658	C
6:00	4,517	F	3,475	C
7:00	4,147	F	2,988	C
8:00	3,983	E	2,520	B
9:00	4,048	F	2,104	B

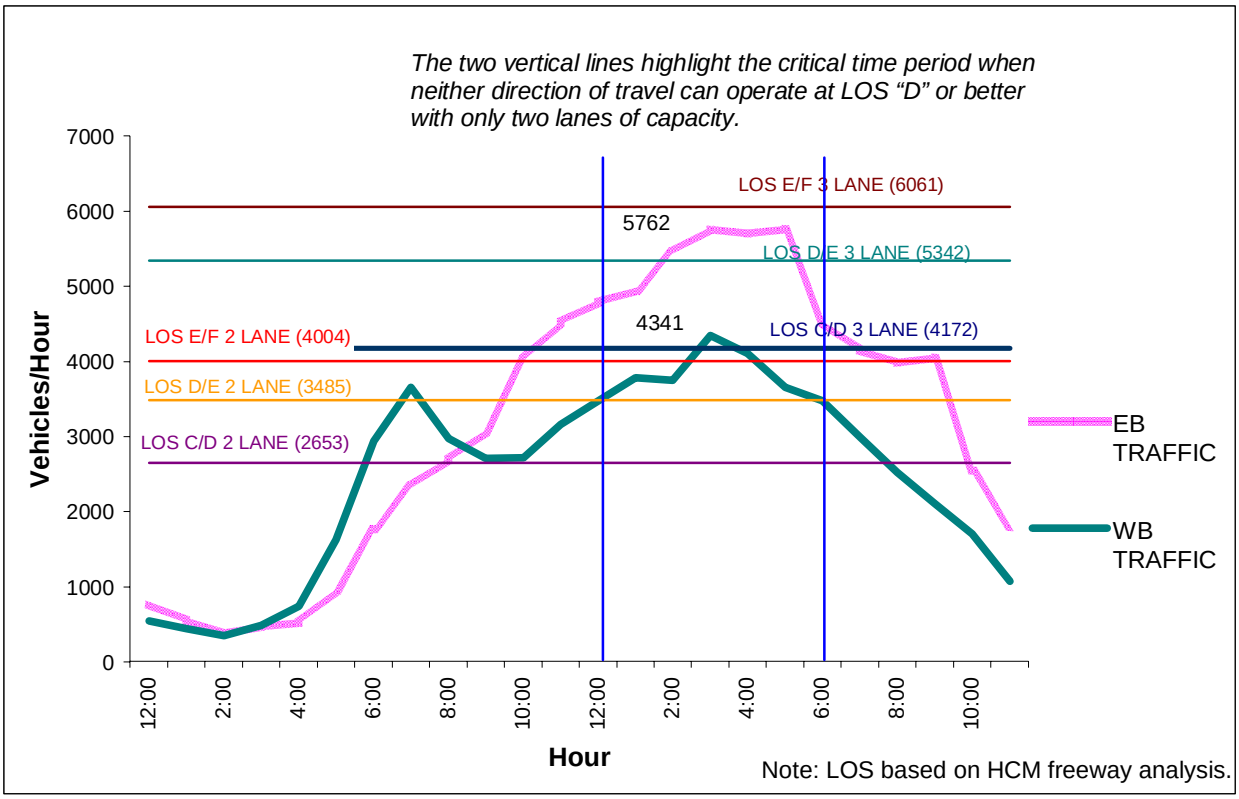

Figure 8. 2025 Unconstrained Hourly Volume Distribution Summer Saturday – Normal Operations

Capacity Analysis – Reversible Lane Operations For contraflow lane operations during times of peak directional flow, two of the lanes on the three-lane westbound bridge remain open for westbound traffic and the third lane is opened to eastbound traffic. The Highway Capacity Manual does not have a set of procedures to evaluate this type of reversible lane operation. Therefore, to calculate LOS for multi-lane traffic with adjacent opposing traffic, the LOS for westbound traffic was estimated by analyzing the traffic as a two-lane, two-way highway (for the middle lane on the westbound bridge) and a multi-lane highway (for the outside westbound lane). Actual percentage volumes per lane were used for this analysis. Similarly, the eastbound traffic was analyzed as a two-lane, two-way highway for the traffic on the westbound bridge and a two-lane freeway for traffic on the eastbound bridge. **Figure 7**, shown on page 2-18, shows typical reversible lane usage on the Bridge.

The unconstrained levels of service for the period from 10 AM to 10 PM are shown in **Table 19** for both contraflow lane operations and normal operations. As seen from this table, during periods of peak flow in both directions, contraflow operations only slightly improve the LOS for four of the 12 hours (6 PM to 10 PM) in the eastbound direction and a majority of the hours remain at undesirable levels of service. In the westbound direction the LOS deteriorates to undesirable levels for seven hours in the westbound direction due to the contraflow lane operations. On **Figure 8**, the two vertical lines highlight the critical time period when neither direction of travel can operate at LOS "D" or better with only two lanes of capacity. Therefore, during this time contraflow operations would fail to meet the capacity needs. As with the existing conditions, westbound congestion on a typical Saturday in the summer would occur as the result of contraflow operations.

Table 19. 2025 Unconstrained Hourly Level of Service- Contraflow Operations

SUMMER SATURDAY								
	EASTBOUND				WESTBOUND			
START TIME	2025 EB TOTAL TRAFFIC VOLUME	Level of Service			2025 WB TOTAL TRAFFIC VOLUME	Level of Service		
		Normal Operations (Lanes 4, 5)	Contraflow Operations			Normal Operations (Lanes 1,2,3)	Contraflow Operations	
			Lane 4, 5[1]	Lane 3[2]			Lane 1[3]	Lane 2[4]
10:00 AM	4,029	F	E	E	2,717	B	D	E
11:00	4,521	F	E	E	3,160	C	D	E
12:00 PM	4,784	F	F	F	3,474	C	E	F
1:00	4,939	F	F	F	3,785	C	E	F
2:00	5,462	F	F	F	3,749	C	E	F
3:00	5,762	F	F	F	4,341	D	F	F
4:00	5,703	F	F	F	4,107	C	F	F
5:00	5,759	F	F	F	3,658	C	E	F
6:00	4,517	F	E	F	3,475	C	E	F
7:00	4,147	F	E	E	2,988	C	D	E
8:00	3,983	E	D	E	2,520	B	C	E
9:00	4,048	F	E	E	2,104	B	C	E

Lane numbers correspond to lanes shown in Figure 7.

Average Weekday. Future hourly volumes were analyzed for both normal operating conditions as well as contraflow operations.

Capacity Analysis – Normal Operations Eastbound traffic flows across the Bay Bridge were analyzed as a two-lane freeway segment and westbound flows were analyzed as a three-lane freeway segment. The resulting unconstrained levels of service for several of the heaviest volume hours of the day are shown in **Table 20** and on **Figure 9** using LOS threshold volumes.

The eastbound bridge would experience queuing and delays operating at LOS "F" between 4 PM and 6 PM and at LOS "E" from 6 PM to 7 PM. The westbound bridge operates at satisfactory levels of service during most of the day. Capacity analysis worksheets are included in **Appendix G (Volume II)**.

Table 20. 2025 Unconstrained Hourly Level of Service (LOS) – Normal Operations

AVERAGE WEEKDAY				
START TIME	**2025 EB TOTAL**	**LOS**	**2025 WB TOTAL**	**LOS**
6:00 AM	1,227	B	3,547	C
7:00	1,727	B	4,344	D
8:00	1,891	C	3,576	C
9:00	2,054	C	2,653	B
10:00	2,136	C	2,216	B
11:00	2,159	C	2,200	B
12:00 PM	2,263	C	2,201	B
1:00	2,210	C	2,166	B
2:00	2,580	C	2,370	B
3:00	3,402	D	2,484	B
4:00	4,170	F	2,471	B
5:00	4,189	F	2,393	B
6:00	3,520	E	1,925	B
7:00	2,130	C	1,418	A
8:00	1,579	B	1,073	A
9:00	1,437	B	872	A

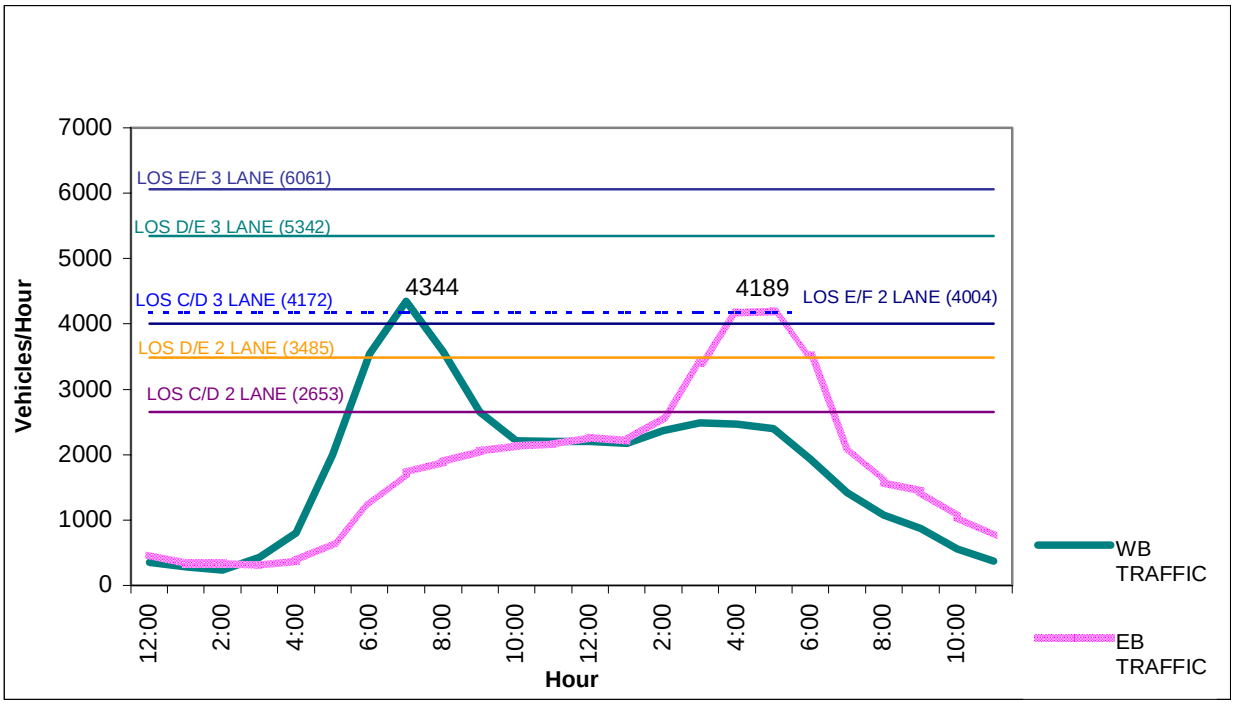

Figure 9. 2025 Unconstrained Hourly Volume Distribution Average Weekday – Normal Operations

Capacity Analysis - Reversible Lane Operations The reversible lane operation is currently utilized for normal weekday operation only on an "as-needed" basis. The same methodology that was used for the existing analysis was applied for the future analysis and only the peak periods where the volumes were at or beyond capacity for normal operation were analyzed.

The unconstrained levels of service for the period from 4 PM to 7 PM are shown in **Table 21** and compared to LOS for normal operations. As seen from this table, during periods of peak flow in both directions, contraflow lane operations improve the LOS for two of the three hours in the eastbound direction but the westbound direction LOS deteriorates to near capacity for the same two hours for the inner lane of travel.

Table 21. 2025 Unconstrained Hourly Level of Service (LOS) - Contraflow Operations

AVERAGE WEEKDAY								
	EASTBOUND				WESTBOUND			
START TIME	2025 EB Total Traffic Volume	Level of Service			2025 WB Total Traffic Volume	Level of Service		
		Normal Operations (Lanes 4, 5)	Reversible Operations			Normal Operations (Lanes 1, 2 & 3)	Reversible Operations	
			Lanes 4 & 5[1]	Lane 3[2]			Lane 1[3]	Lane 2[4]
4:00 PM	4,170	F	D	D	2,471	B	C	E
5:00	4,189	F	D	D	2,393	B	C	E
6:00	3,520	E	E	D	1,925	B	C	D

Lane numbers correspond to lanes shown in Figure 7.
[1] 80 Percent of Eastbound Traffic on Eastbound Bridge (Lanes 1 & 2).
[2] 20 Percent of Eastbound Traffic on Westbound Bridge (Lane 3).
[3] 55 Percent of Westbound Traffic in Outer Lane (Lane 1).
[4] 45 Percent of Westbound Traffic in Inner Lane (Lane 2).