EXECUTIVE SUMMARY

The Fredericksburg area has been experiencing a large amount of growth in recent years. Similarly, the Fredericksburg area is projected to continue to be the fastest growing area in the Commonwealth over the next 20 years. The population of commuters to the greater Washington, D.C. area has also significantly increased, prompting the Fredericksburg Area Metropolitan Planning Organization (FAMPO) to undertake a number of transportation planning studies to address growing demand on the region's transportation network. This study, defined as the I-95 Corridor Needs Analysis, is intended to be an integral piece of this planning effort, as it helps identify and assess problem locations along the I-95 corridor.

The study corridor spans approximately 35 miles, from the Garrisonville Road (Route 610) interchange in the north to the Ladysmith Road (Route 639) interchange in the south. The mainline segment of the corridor is a six-lane divided highway, with three (3) lanes of travel in each direction. Eight interchanges are encompassed within the study area.

In order to evaluate existing operating conditions, VHB reviewed available 2007 traffic count data compiled by VDOT and MCV Associates, Inc. From the 2007 count data, balanced traffic volumes were generated for the entire study corridor network. Balanced volumes were generated for four (4) peak hour scenarios: AM weekday, PM weekday, Friday before a holiday (August 31st), and Monday of a holiday (September 3rd).

Level of service analyses were performed for each of the mainline segments using the Highway Capacity Software (HCS) 2000. The results of the analysis provided the following key findings:

- During weekday AM northbound (NB) operation, LOS E is exhibited from Warrenton Rd (Rt. 17) to Garrisonville Rd (Rt. 610) on the mainline; LOS F is exhibited at the Plank Rd (Rt 3) weaving section and north of Garrisonville Rd on the mainline (Rt 610).
- During weekday PM southbound (SB) operation, LOS E is exhibited from the northernmost point of the study corridor to Centreport Pkwy (Rt. 627) & between Warrenton Rd (Rt. 17) and Plank Rd (Rt. 3) on the mainlines.
- During holiday weekend operations,
    - LOS E is exhibited between Plank Rd (Rt. 3) and Warrenton Rd (Rt. 17) in the NB direction,
    - LOS E is exhibited between Warrenton Rd (Rt. 17) and Jefferson Davis Hwy (US 1) in the SB direction, and
    - LOS F is exhibited at the Plank Rd (Rt. 3) weaving section in the SB direction.

Traffic engineers from VHB conducted site visits of all locations within the study corridor to verify all input parameters required for the HCS analysis (number of lanes, speeds, ramp configurations, etc.), as well as to identify contributing factors to the congested locations highlighted in the analysis. Overall, a few congestion points were observed, but nothing so significant to corroborate the analysis results of LOS E or F.

The freeway capacity analysis procedures of the *Highway Capacity Manual* (*HCM*) were investigated in an attempt to provide guidance on the discrepancy between observed and simulated corridor performance. It was discovered that *HCM* procedures use a mainline capacity flow rate that is less than the typical mainline capacity flow rate for heavily traveled metropolitan interstates, such as those within

the greater Washington, D.C. area. Taking factors such as increased speeds and reduced headways into consideration, new threshold flow rates for LOS E and LOS F were adopted. Using the new threshold rates, several mainline locations exhibiting HCS-calculated LOS E or LOS F could be considered as exhibiting LOS D or LOS E, respectively, for many locations. In reviewing the existing condition analysis results, it should be understood that drivers within the region have become accustomed to greater levels of congestion; therefore, the results provided by the HCS analysis are accurate, but should be accompanied by the caveat that HCS-calculated LOS E or LOS F does not necessarily equate to operating conditions indicative of the *HCM* definitions for LOS E or LOS F.

The analyses of future conditions (2015 and 2035) were based on the new planning horizon for Virginia and the Metropolitan Washington Council of Governments (MWCOG). The analysis assumed current socioeconomic data forecasts and improvement projects contained within the FAMPO 2035 Long Range Transportation Plan (LRTP), including the construction and operation of the HOT Lanes along the study corridor. Analysis volumes were forecasted using the CUBE/TP+ model for 2006 and 2035. VHB developed a simplified approach of NCHRP 255 to generate a balanced network of 2035 volumes for the corridor. The 2015 volumes were developed by interpolating between the 2006 model output and the 2035 volumes, with slight modifications to ensure a balanced network. Volumes for each analysis year were developed for the same four (4) peak hours as in the existing conditions analysis.

Level of service analyses were performed for each of the four peak hours using HCS 2000. The results of the analysis revealed the following:

- During weekday AM operation (NB),
    - In 2015: LOS E extends south from segment identified for existing conditions to Plank Rd (Rt. 3)
    - In 2035: segments that exhibited LOS E under existing and 2015 conditions deteriorate to LOS F in 2035
- During weekday PM operation (SB),
    - In 2015: same operating level of performance as exhibited as under existing conditions
    - In 2035: several locations that exhibited LOS E under existing and 2015 conditions deteriorate to LOS F in 2035
- During holiday operation,
    - LOS E exhibited between Plank Rd (Rt. 3) and Warrenton Rd (Rt. 17) in NB direction
    - LOS E exhibited between Warrenton Rd (Rt. 17) and Jefferson Davis Hwy (US 1) in SB direction
- General
    - Weaving section at Plank Rd (Rt. 3) exhibits LOS F during weekday AM operation (NB) and holiday SB operation

The future analyses were also conducted using an *HCM* mainline capacity flow rate that is less than a typical mainline capacity flow rate for interstates in the area. Taking the same factors into consideration, mainline locations exhibiting LOS E or F could be considered as exhibiting LOS D or E, respectively, for many locations. Again, it should be understood that drivers within the area have become accustomed to greater levels of congestion; therefore, the results provided by the HCS analysis

are accurate, but should be accompanied by the caveat that HCS-calculated LOS E or LOS F does not necessarily equate to operating conditions indicative of the *HCM* definitions for LOS E or LOS F.

A more in-depth review of the HCS results for the three analysis years has shown that the majority of the poor operational performance is related to capacity issues on the I-95 mainline. The degraded level of service displayed for the ramp merge and diverge points is a result of the mainline capacity limitations. From these results, the following improvement alternatives have been suggested for further consideration:

- *Ramp metering* is used to smooth traffic flow by reducing the amount of "turbulence" (i.e., speed variations, lane changing maneuvers, etc.) introduced to the mainline traffic stream by platoons of merging vehicles, thus increasing vehicle throughput and overall performance.
- *Limited use of the right shoulder* can provide additional mainline capacity by increasing the number of travel lanes from three (3) to four (4) during limited peak travel periods, also increasing overall operational performance.
- *Variable speed limit systems* adjust posted speed limits according to current traffic volume and roadway conditions, maintaining a consistent flow of traffic to optimize efficiency in operations.
- *Lane use restrictions* can help to minimize speed variance caused by entering or exiting traffic through interchange areas or by heavy vehicles through segments of significant grade, thus reducing delay and improving overall traffic flow.
- *Additional ramp lanes or lengthening of acceleration/deceleration lanes* (where possible) can improve ramp operations.

In conclusion, the HCS analysis of existing conditions indicated several problematic areas along the study corridor on both mainline Interstate 95 and adjacent interchange ramps. These problematic conditions, however, were not field observed to be as severe as indicated by the HCS output. Additionally, the analysis results can be viewed as accurate from a simulation standpoint, but may not necessarily reflect actual area driver perception or operating conditions indicative of *HCM* definitions. Regardless, the demand on the region's transportation network continues to grow. Future demands will continue to negatively impact operational performance along the I-95 study corridor, as evidenced by the 2015 and 2035 analyses. Other studies are currently being conducted to evaluate long-term investments (i.e., additional interchanges) to alleviate the impending operational issues. Other large-scale efforts (i.e., HOT Lanes) are in planning to help relieve the current and future demands along this and other corridors throughout the greater Washington, D.C. area. Although the HOT Lanes were included in the future conditions analysis of this study, the actual performance of the system and the resulting impacts on adjacent roadway facilities (including this study corridor) is highly speculative. To help alleviate current and short-term congestion issues along I-95, several suggestions for improvement have been identified. If any or all of these measures are viewed as viable options, a more in-depth evaluation of costs, benefits, and impacts should be pursued for consideration and inclusion in the FAMPO long-range corridor plan.