US 1 / MD 175 Improvement Study
Phase I Final Report

March 2010

Intersection of MD 175 and US 1

SHA
State Highway Administration
Maryland Department of Transportation

707 North Calvert Street
Baltimore, Maryland 21202

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1.0 INTRODUCTION

The Maryland State Highway Administration (SHA) has conducted a comprehensive assessment of the traffic operations and network performance along MD 175 from Snowden River Parkway to Pocomoke Avenue, just east of US 1, in Howard County, Maryland. The study area is shown in **Figure 1**. The purpose of this study is to assess existing and future No Build traffic operations through analysis of existing and future No Build traffic volumes with existing roadway, intersection, and interchange geometry, and existing traffic controls, as well as to assess existing crash experience and environmental features, and to develop preliminary concepts for operational improvements throughout the study area.

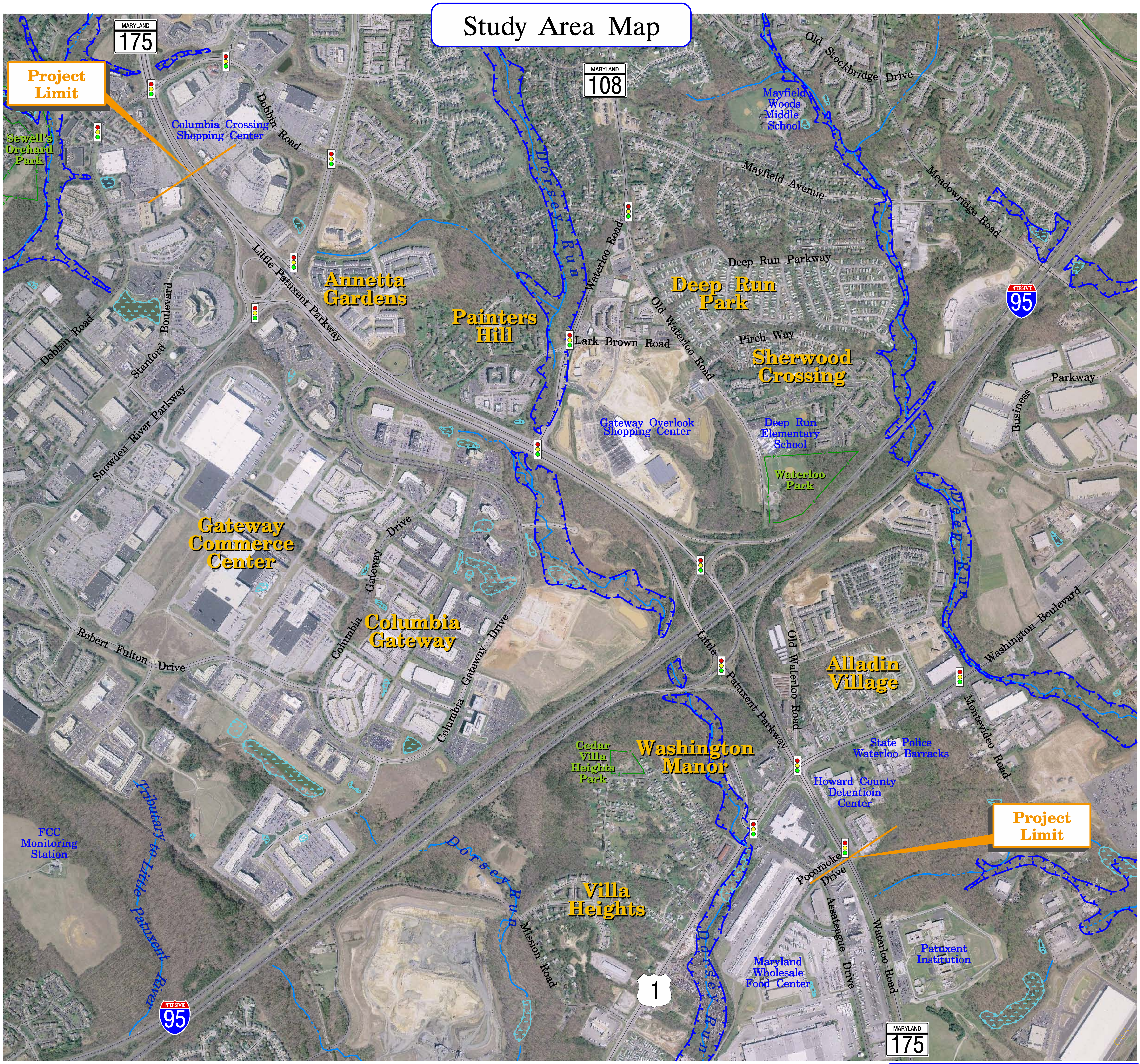
The study is being led by SHA's Office of Project Planning and Preliminary Engineering (OPPE), Regional Intermodal Planning Division (RIPD) and the study team is comprised of representatives from SHA District 7, SHA Travel Forecasting and Analysis Division (TFAD), SHA Office of Traffic and Safety, Traffic Development and Support Division (OOTS, TDSD), the Howard County Department of Public Works, and the Howard County Department of Planning and Zoning.

This study builds on previous analyses performed by SHA and Howard County, including the March 2007 *Columbia Gateway Corporate Park Short and Long-Term Traffic Assessment* and the November 2007 *MD 175 Gateway Park Access and Corridor Study*. The first study focused on assessing short-term (5-year) and long-term (30-year) development impacts within Gateway Park. The findings of the first study indicated a need for improved access in and out of Gateway Park due to potential long-term redevelopment and rezoning. The second study evaluated the MD 175 corridor between Snowden River Parkway and I-95 to identify impacts of a new access point for Gateway Park under existing conditions and short-term future conditions (year 2012). Traffic data collection, crash experience, queue analysis, and traffic simulation modeling were included in the second study.

The results of the second 2007 study did not conclusively prove the benefit of a single new access point to Gateway Park, but demonstrated congestion in the study area and the need for further study. Specifically, SHA requested the following be considered in any future studies of this corridor:

- A longer horizon year (2035)
- BRAC improvements and traffic patterns
- Pedestrian and bicycle needs
- Environmental constraints
- Impacts to I-95 mainline
- Improvement alternatives for each interchange and intersection, ranging from at-grade improvements and low-cost solutions to a full interchange reconstruction with multiple grade separations.

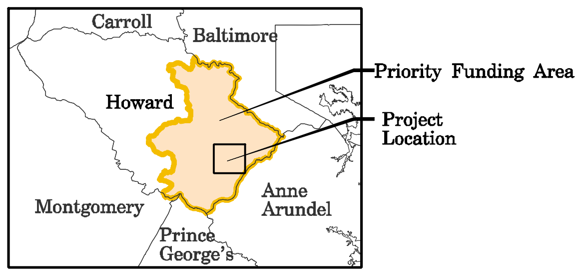
Study Area Map



Legend

- Parks
- Vegetated Wetlands
- Streams
- 100-YR Floodplain
- Existing Signal

Vicinity Map



Resource for aerial background:
MSHA Aerial photography program, October 2007

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SCALE IN FEET

DRAFT: WORK IN PROGRESS

SHA State Highway
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US 1 / MD 175 Improvement Study
Phase I
Howard County, MD

Figure 1 March 2010

As a result, this study was conducted to evaluate existing, 2015 No Build, and 2035 No Build conditions, including a 2035 scenario that takes into account the removal of covenants on land use zoning inside Gateway Park. This study has been divided into two phases. Phase I, which is documented in this report, includes the identification of operational issues expected for 2015 and 2035 under the No Build condition, collection of available environmental resource data, and the development of a number of concepts that could address the anticipated future operational issues. Phase II, which will be conducted upon the completion of Phase I, will include a more detailed investigation of the engineering feasibility, impacts, costs, and operational benefits of a set of improvements from the Phase I study.

2.0 EXISTING CONDITIONS

2.1 Study Area Network Roadways and Intersections

The study network includes six signalized intersections along MD 175 and US 1 and 11 interchange ramp connections to MD 175, as follows:

- MD 175 at Snowden River Parkway (interchange – two ramp connections, to the east of Snowden River Parkway)
- MD 175 at Columbia Gateway Drive (interchange – three ramp connections)
- MD 175 at MD 108 (signalized intersection)
- MD 175 at I-95 (interchange – six ramp connections and two signalized intersections)
- MD 175 at US 1 (signalized intersection)
- MD 175 at Pocomoke Avenue (signalized intersection)
- US 1 at Assateague Drive/Crestmount Road (signalized intersection)

The following is a brief description of each roadway in the study area:

1. MD 175 (Rouse Parkway/Waterloo Road). West of US 1, MD 175 is a two-way divided urban freeway expressway, with partial access control, and a 50 mph posted speed, that ranges from two to four through lanes in each direction with auxiliary lanes at ramp junctions and intersections. East of US 1, MD 175 is a two-way divided state secondary urban minor arterial, with no access controls, and a 40 mph posted speed, that ranges from one to three lanes in each direction with auxiliary lanes at intersections. Land uses along MD 175 within the limits of the study area include commercial, office, and light industrial types.

2. Snowden River Parkway (CO 1140). Snowden River Parkway is a county-maintained, two-way divided urban minor arterial roadway with partial control of access and a posted speed of 45 mph that provides three through lanes in each direction in the immediate vicinity of MD 175. Adjacent land uses are residential and commercial.

3. Columbia Gateway Drive. In the vicinity of the study area, Columbia Gateway Drive is a two-way divided roadway with partial control of access and a posted speed of 30 mph

that provides three lanes in each direction. Columbia Gateway Drive provides access to Gateway Park, which is characterized by primarily office land uses.

4. MD 108 (Waterloo Road). In the vicinity of the study area, MD 108 is a two-way undivided urban minor arterial with no access controls, and with a posted speed limit of 45 mph, that provides one through lane in each direction. MD 108 widens significantly to provide one right turn lane, 3 left turn lanes, and three receiving lanes just north of MD 175. The adjacent land use along MD 108 is primarily commercial.

5. Interstate 95 (I-95). In the vicinity of the study area, I-95 is a two-way divided urban interstate with full access control and a posted speed limit of 65 mph that provides four through lanes in each direction with auxiliary lanes at interchanges. The interchange of MD 175 and I-95 provides directional ramps for the four "right turn" movements, loop ramps in the northwest and southeast quadrants to carry "left turn" traffic from MD 175 to I-95, and at-grade intersections to allow I-95 "left turn" traffic onto MD 175. The posted speed limits along the directional ramps vary between 40 mph and 55 mph and the posted speed limit along the loop ramps is 30 mph.

6. US 1 (Washington Boulevard). In the vicinity of the study area, US 1 is a two-way undivided urban other principal arterial with no access controls, and a 45 mph posted speed, that provides two through lanes in each direction with auxiliary lanes at intersections. The adjacent land use along US 1 within the study area is commercial.

7. Pocomoke Avenue (CO 1419). Pocomoke Avenue is a county-maintained, two-way undivided local roadway with no access controls that provides one lane in each direction north of MD 175, and two departure lanes and three approach lanes south of MD 175. There is no posted speed limit along Pocomoke Avenue. North of MD 175 Pocomoke Avenue provides access to the Howard County Detention Center. South of MD 175 Pocomoke Avenue provides access to the Maryland Food Center Authority, which is primarily a commercial and heavy truck oriented warehousing land use.

8. Assateague Drive (CO 1090). Assateague Drive is a county-maintained two-way undivided local roadway with no access controls and a posted speed of 30 mph that provides two through lanes in each direction. Assateague Drive provides access to the Maryland Food Center Authority, which is primarily a commercial and heavy truck oriented warehousing land use.

9. Crestmount Road (MD 958P). Crestmount Road is a two-way, two-lane undivided local roadway with no access controls. There is no posted speed limit signing along Crestmount Road. The adjacent land use is primarily commercial.

2.2 Background Data

2.2.1 Data Collection

SHA and Howard County officials provided pertinent operational traffic control data such as signal plans and phasing and timing data as well as historic crash data for the study area. The study team also obtained historic traffic count data from SHA files, including 13-hour turning movement and 48-hour machine classification counts, which was used to assess traffic characteristics and to determine peak-hour factors, conflicting pedestrian/bicyclist movements, and percent heavy vehicles. Using aerial photographs and a comprehensive field inventory, the study team identified key roadway network characteristics such as roadway geometry, lane configurations, posted speeds, and traffic controls. The study team performed a travel time study and field observations of traffic operations were made throughout the study corridor during the AM and PM peak hours to document maximum vehicular queues, driver behavior, and heavy truck operations. County and SHA officials provided historical crash data and traffic signal plans and timing.

2.2.2 Field Observations and Queuing Measurements

Traffic engineers conducted field observations of traffic operations throughout the study area during the AM and PM peak hours of Tuesday, September 1, 2009 and Thursday, September 3, 2009 to document maximum vehicular queues, driver behavior, and heavy truck operations. A summary of the maximum queues observed at study intersections is presented in **Table 1**. Key observations made during the field visits are described below.

1. AM Peak Hour Observations.

    - Significant truck traffic volume in and around the roadways and access points to the Maryland Food Center: MD 175 @ US 1, MD 175 @ Pocomoke Avenue, and US 1 at Assateague Drive
    - The WB MD 175 outer through lane queues beyond the right-turn storage, blocking the right turns at the MD 175 / MD 108 intersection
    - Trucks from Assateague Drive turn right onto US 1 and then left onto MD 175 to gain access to I-95 (rather than using the MD 175 / Pocomoke Avenue intersection to exit the Maryland Food Center)
    - At the intersection of MD 175 and US 1, the left turn queue exceeds the NB US 1 left turn storage length
    - At the intersection of MD 175 and US 1, some vehicles wait through more than one signal cycle before being able to clear the intersection
    - At the intersection of MD 175 and MD 108, only the rightmost two through lanes in the westbound direction incur maximum usage
    - At the intersection of MD 175 and MD 108, some vehicles on WB MD 175 wait through more than one signal cycle before being able to clear the intersection

2. PM Peak Hour Observations.

- No vehicles wait through more than one signal cycle before being able to clear the intersection for any intersection within the study area
- Queues on US 1 approaching MD 175 extend back to Assateague Drive
- At the intersection of MD 175 and MD 108, only the rightmost two through lanes in the eastbound direction incur maximum usage, with underutilization of the other lanes
- The WB MD 175 right lane approaching MD 108 experiences significant queues
- EB MD 175 at the ramp to NB I-95 experiences occasional queues
- Vehicles entering WB MD 175 from NB I-95 (a left merge) jockey toward the right-most lane to turn right onto MD 108
- Vehicles entering EB MD 175 from Columbia Gateway Drive queue at the intersection of MD 175 and MD 108
- Of the three SB left turn lanes from MD 108 onto EB MD 175, the two lanes toward the right carry the majority of the traffic volume
- Occasional queues (lasting up to 20 minutes) on EB MD 175 at the NB I-95 ramp, and at the Columbia Gateway Drive ramp.

Table 1. Maximum Queues Observed at Study Intersections: AM(PM)

AM (PM) PEAK HOUR MAXIMUM QUEUES (veh)[1]											
NB Approach[3]			SB Approach			EB Approach			WB Approach		
Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right
MD 175 at MD 108[2]											
—	—	—	10(11)	—	0(1)	4(12)	15(29)	—	—	26(23)	15(19)
MD 175 at US 1											
8(12)	7(12)	0(1)	8(7)	12(12)	4(4)	9(11)	14(16)	0(1)	5(4)	8(7)	1(2)
US 1 at Assateague Drive/Crestmount Road											
0(0)	11(12)	—	6(6)	10(7)	—	—	0(1)	—	1(4)	2(2)	—
MD 175 at Pocomoke Avenue											
5(4)	—	1(1)	—	—	—	1(2)	5(2)	0(0)	2(1)	4(5)	—

Notes:

(1) For multi-lane movements, reported number of vehicles is the maximum observed in one lane.

(2) WB through vehicles primarily use the rightmost two through lanes; the other through lanes were underutilized.

(3) MD 175, Assateague Drive, and Crestmount Road are assumed to operate in an east-west direction. US 1, MD 108, and Pocomoke Avenue are assumed to operate in a north-south direction.

2.2.3 Travel Time Data

The study team performed a travel time study on Tuesday, September 1, 2009, and Wednesday, September 2, 2009 to establish baseline data necessary to properly calibrate the Synchro and Corsim models developed for the MD 175 study corridor. The travel time study was conducted using the multi-run, "floating car" methodology in accordance with standard industry methods and practice (*ITE Manual of Transportation Engineering Studies*). The study team performed five runs in each direction along MD 175 between Snowden River Parkway and Pocomoke Avenue during the AM and PM commuter peak hours.

2.2.4 Pedestrian, Bicycle, and Transit Facilities

Within the limits of the study area, sidewalk is provided at the intersection of MD 175 and US 1, along US 1 from south of MD 175 to Assateague Drive, and on the south side of MD 175 from east of US 1 to Pocomoke Avenue. Marked crosswalks, pedestrian signals, and ADA ramps are provided at the intersection of MD 175 at US 1 for pedestrians desiring to cross either leg of MD 175 and the south leg of US 1. Audible pedestrian signals are not provided.

There are no marked on or off-road bicycle routes or facilities along any of the roadways within the limits of the study area.

The study area is served by the Howard County transit service. The Gold and Silver Bus Routes serve patrons along MD 175 and the Purple Bus Route serves those along US 1. A brief description of each route follows:

1. Gold Route. The Gold Route runs between the Maryland Food Center (to the east) and Columbia Mall (to the west). The route serves the Gateway Overlook Shopping Center off of MD 108, the Snowden River Park-and-Ride off of Snowden River Parkway, and the Maryland Food Center at Assateague Drive, all in the immediate vicinity of the study area. The Gold Route has a one-hour headway from 6:30 AM to 8:30 PM Monday through Friday and a two-hour headway from 8:30 AM to 8:30 PM on Saturdays.

2. Silver Route. The Silver Route runs between the BWI Light-Rail Station (to the north) and the Columbia Mall (to the west). The route serves the Maryland Food Center at Assateague Drive and the Snowden River Park-and-Ride, both in the immediate vicinity of the study area. The Silver Route has a one-hour headway from 6:00 AM to 10:00 PM Monday through Friday, a one-hour headway from 7:00 AM to 10:00 PM on Saturdays, and a two-hour headway from 10:00 AM to 6:00 PM on Sundays.

3. Purple Route. The Purple route runs between the Laurel Mall (to the south) and the Elkridge Corners Shopping Center (to the north). The route serves patrons to/from the Maryland Food Center at Assateague Drive. The route has a one-hour headway from 6:00 AM to 9:00 PM Monday through Friday and a two-hour headway from 9:00 AM to 9:00 PM on Saturdays.

None of these routes have designated intermediate stops along either MD 175 or US 1 within the bounds of the study area.

2.3 Existing Traffic Volumes

The study team acquired existing AM and PM peak hour turning movement volume data and average daily traffic (ADT) data from the online SHA Traffic Monitoring System database and from data collected during previous studies conducted by SHA, Howard County, and Anne Arundel County. Once the available data was collected and cataloged, traffic engineers balanced traffic volumes between adjacent interchanges and intersections throughout the network (so that the traffic volume exiting one intersection would equal the traffic volume entering the next intersection). This data is summarized in **Figures 2**, **3**, and **4**.

2.4 Existing Conditions Traffic Operations Analyses

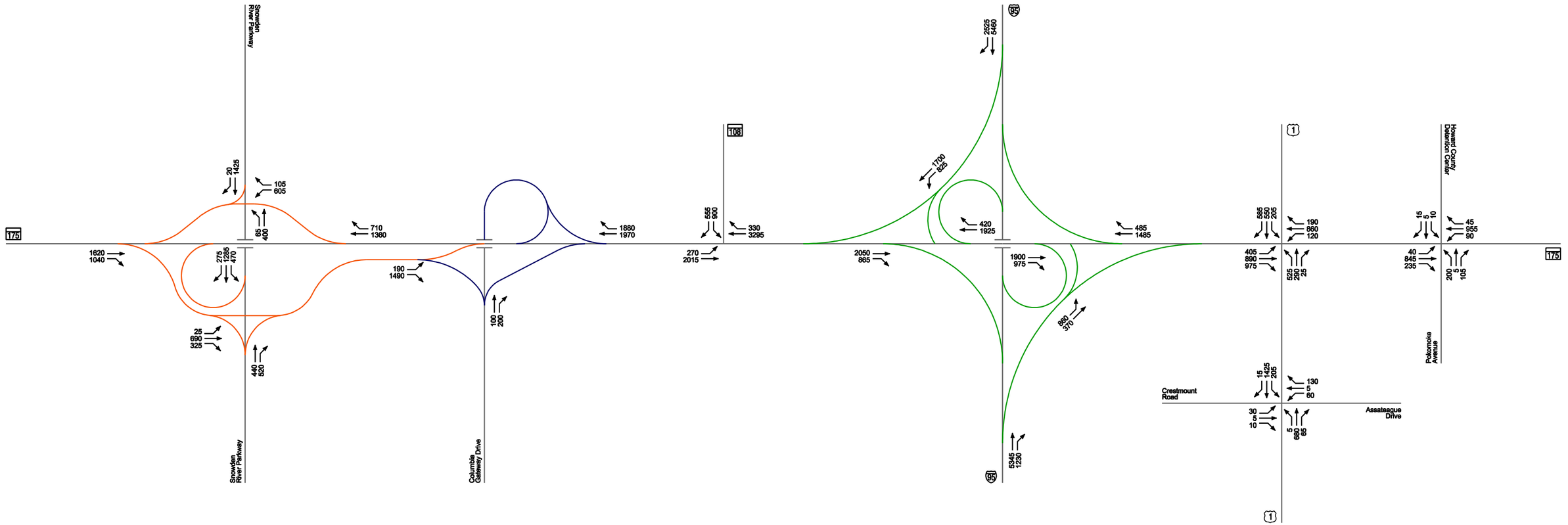
The HCM and CLA analyses presented in this section are static analyses, which were used to assess operations at each intersection or interchange feature independently and to assess the localized capacity constraints. However, these analyses do not consider the effects that queues or delays at one intersection or interchange feature may have on nearby intersections and interchange features within the study area. Therefore, the traffic operations and levels of service presented in this section may appear to be better than field observation of the study area intersections and interchanges would indicate.

2.4.1 Intersections

The study team performed intersection capacity analyses using both Highway Capacity Manual (HCM) and Critical Lane Analysis (CLA) methods for all study intersections. The measures of effectiveness (MOEs) that were evaluated include average control delay, level of service (LOS), volume-to-capacity (v/c) ratio, and critical lane volume (CLV). Both the CLA and HCM methodologies are used to assess LOS and v/c ratio, which are defined as follows:

1. Level of Service (LOS). A "qualitative measure describing operational conditions within a traffic stream." LOS ranges from A to F, where a LOS A represents optimal conditions and a LOS F represents saturated or failing conditions.

2. Volume-to-Capacity (v/c) Ratio. A parameter that describes the relationship between a roadway feature's capacity (the maximum amount of traffic that a roadway feature can process in a given time frame) and the amount of traffic (actual (service) or projected (demand)) using that roadway feature during that same time period. A v/c ratio of 1.0 indicates that the facility is operating at capacity, and a ratio greater than 1.0 indicates that the roadway facility is failing (i.e., the vehicular demand exceeds the facility's capacity).



Not To Scale

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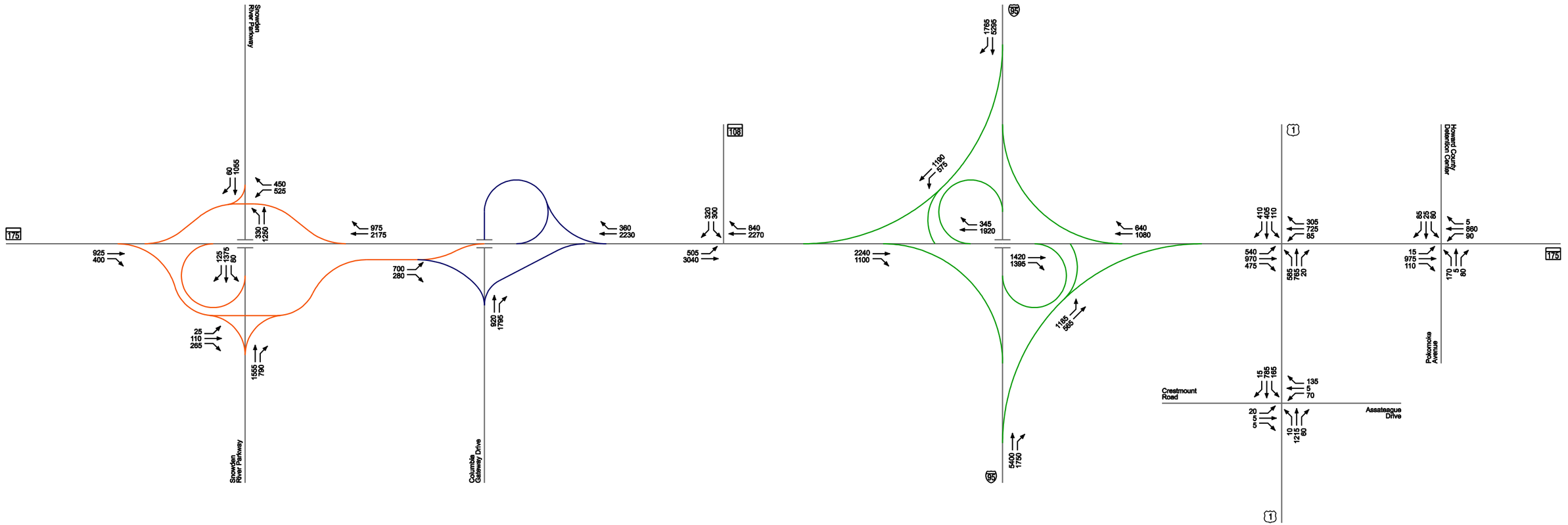
Howard County, Maryland

Existing Traffic Volumes
AM Peak Hour

Figure 2
March 2010



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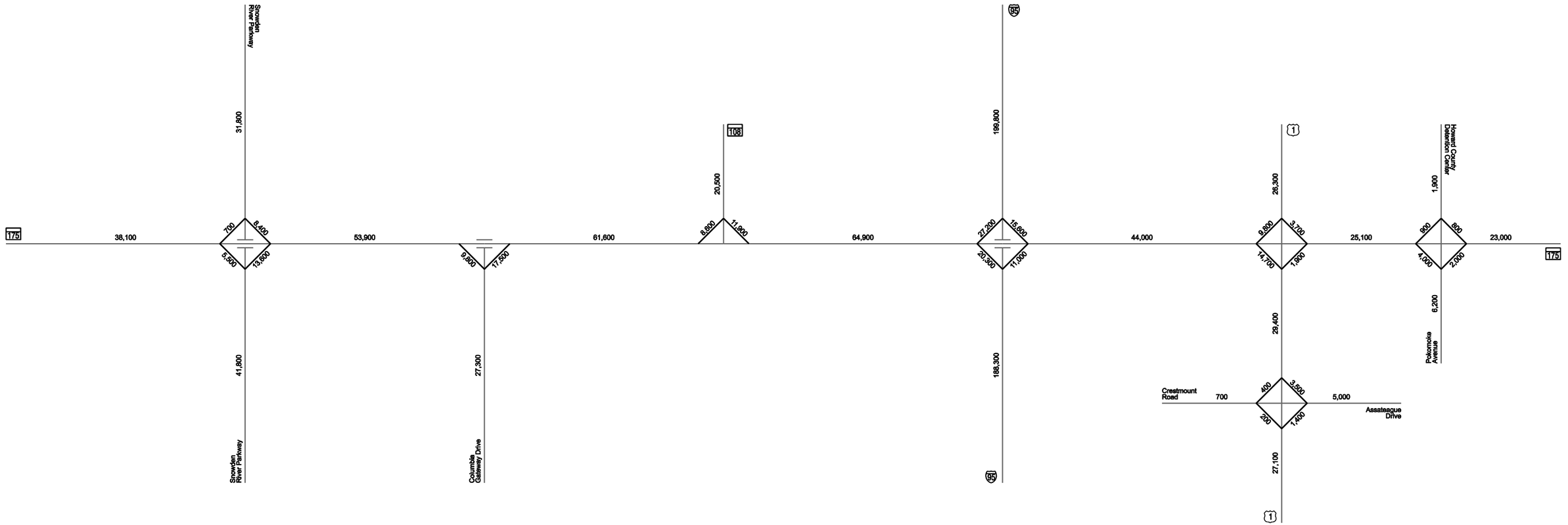
Howard County, Maryland

Existing Traffic Volumes
PM Peak Hour

Figure 3
March 2010



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Howard County, Maryland

Existing Traffic Volumes
Average Daily Traffic

Figure 4
March 2010

It should be noted that CLA does not typically include incorporation of heavy vehicle percentages. The CLA method is intended to be a quick assessment of overall conditions, and therefore does not typically include this kind of detail. However, for this study area, as discussed previously, there is a significant amount of truck traffic that moves in and out of the Maryland Food Center, which results in significant heavy vehicle percentages at the intersections of MD 175 and US 1, MD 175 and Pocomoke Avenue, and US 1 and Assateague Drive / Crestmount Road. Therefore, the study team determined that the heavy vehicle percentages for these intersections should be incorporated into the CLAs for those intersections to more accurately represent operational conditions at these locations.

The results of the HCM and CLA are summarized in **Table 2** and illustrated in **Figures 5 and 6**. See **Appendix B** and **Appendix D**, respectively, for the HCM and CLA worksheets. Study results indicate that five of the six study intersections operate at LOS D or better under existing conditions. The intersection of MD 175 and US 1 operates at LOS F during the AM peak hour and operates at LOS E during the PM peak hour.

Table 2. Existing Intersection LOS: AM(PM)

Intersection	Highway Capacity Manual Analysis			Critical Lane Volume Analysis		
	LOS	Delay (sec/veh)	v/c Ratio	CLV	LOS	v/c Ratio
MD 175 at MD 108	D (C)	48.7 (21.8)	0.92 (0.67)	1556 (1119)	E (B)	0.97 (0.70)
MD 175 WB at Ramp 5 from I-95 SB	C (C)	33.6 (22.6)	0.82 (0.73)	1224 (1084)	C (B)	0.76 (0.68)
MD 175 EB at Ramp 1 from I-95 NB	D (C)	37.2 (31.3)	0.83 (0.79)	1233 (1220)	C (C)	0.77 (0.76)
MD 175 at US 1	F (E)	118.2 (73.4)	1.34 (0.98)	1628 (1375)	F (D)	1.02 (0.86)
MD 175 at Pocomoke Avenue	B (C)	17.1 (32.5)	0.51 (0.85)	784 (1131)	A (B)	0.49 (0.71)
US 1 at Assateague Drive/Crestmount Road	B (C)	13.7 (21.5)	0.61 (0.63)	1077 (1125)	B (B)	0.67 (0.70)

2.4.2 Ramp Junctions and Weaving Segments

The study team performed capacity analyses for interchange features within the study area, including ramp junctions (i.e., merges and diverges) and weaving segments along MD 175. These analyses are described below.

1. Ramp Junctions. Level of service for ramp junctions is based on the density (passenger cars per lane per hour) and operating speed of the facility in relation to its ideal speed and flow rate. A point on a freeway that drops or adds a lane should not be evaluated as a ramp junction. Rather, these locations are evaluated via the constraining capacity of either the ramp roadway or the downstream or upstream freeway lane segment, as recommended by the *Highway Capacity Manual*.

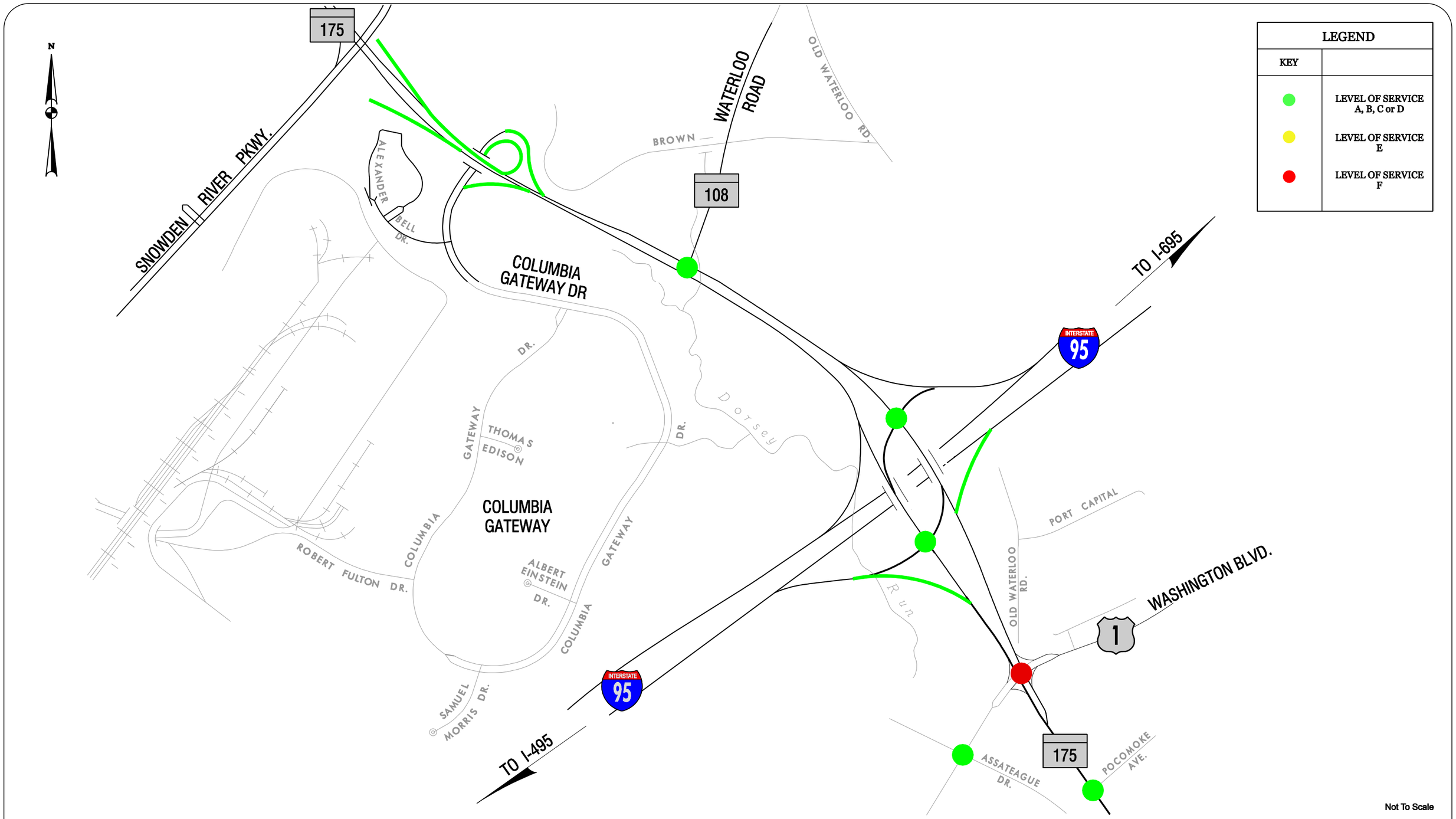
2. Weaving Segments. A weaving segment is defined as the crossing of two or more traffic streams traveling in the same direction along a length of highway without the aid of traffic control devices. Types of weaving maneuvers fall into the following three categories:
   a. Type A. All weaving vehicles must make one lane change.
   b. Type B. One weaving maneuver can be made without changing lanes, and the other weaving maneuver requires a single lane change.
   c. Type C. One weaving maneuver can be made without changing lanes, and the other weaving maneuver requires two lane changes.

The study team analyzed the capacity of ramp junctions and weaving segments along the MD 175 corridor using the latest version of Highway Capacity Software, which implements the procedures defined in the *Highway Capacity Manual 2000*. Note that only a Type A weave currently exists in the MD 175 study corridor – WB MD 175 between Columbia Gateway Drive and Snowden River Parkway. The results of the capacity analysis are summarized in **Table 3** and illustrated in **Figures 5 and 6.**. Detailed capacity analyses worksheets are provided in **Appendix C**.

Table 3. Existing Interchange Features Capacity and LOS

Ramp Junction / Weaving Segment	Type	LOS / Capacity Check AM (PM)
MD 175 at Snowden River Parkway		
EB MD 175 at Ramp from Snowden River Pkwy	Ramp Merge	B (B)
WB MD 175 at Ramp to Snowden River Pkwy	Ramp Diverge	B (E)
WB MD 175 between Col. Gateway Drive and Snowden River Pkwy	Type A Weave	B (D)
MD 175 at Columbia Gateway Drive		
WB MD 175 at Ramp to Columbia Gateway Dr	Ramp Diverge	D (B)
EB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	B (D)
WB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	C (D)
MD 175 at I-95		
EB MD 175 at Ramp 6 to I-95 SB [2100]*	Lane Drop	865 (1100)
EB MD 175 at Ramp 5 from SB I-95 [2100]*	Lane Add	825 (575)
EB MD 175 at Ramp 3 to NB I-95 [1900]*	Lane Drop	975 (1395)
EB MD 175 at Ramp 4 from I-95 NB	Ramp Merge	B (B)
WB MD 175 at Ramp 2 to NB I-95	Ramp Diverge	C (B)
WB MD 175 at Ramp 1 from NB I-95 [2100]*	Lane Add	860 (1185)
WB MD 175 at Ramp 7 to SB I-95 [1900]*	Lane Drop	420 (345)
WB MD 175 at Ramp 8 from I-95 SB [2100]*	Lane Add	1700 (1190)

*Highway Capacity Manual Exhibit 25-3 Capacity of Ramp Roadways, one-lane ramp roadway capacities, based on ramp free flow speeds.



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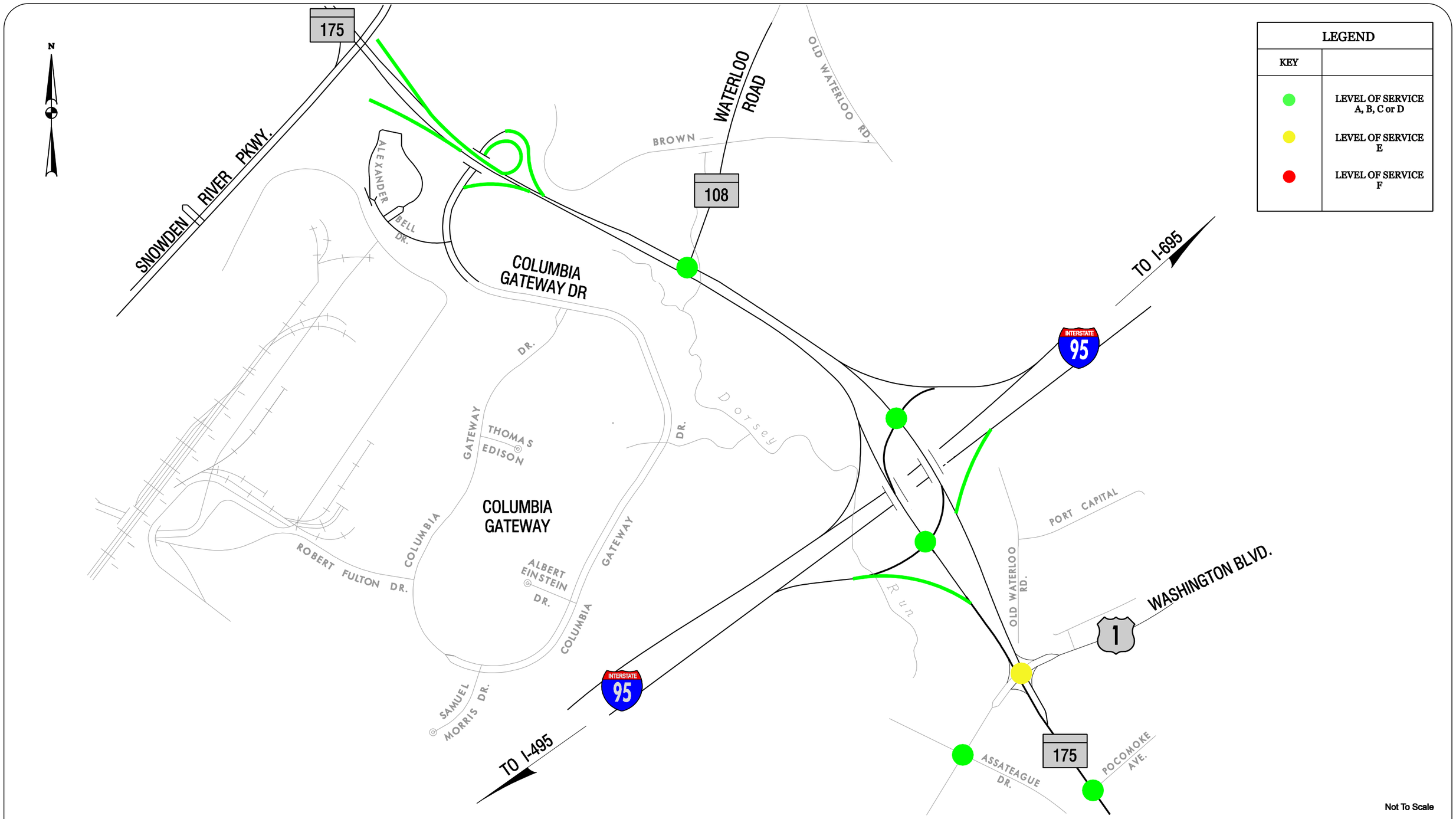
US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

Existing Level of Service
AM Peak Hour

Figure 5
March 2010



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US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

Existing Level of Service
PM Peak Hour

Figure 6
March 2010

Analyses of the interchange features show that all of the ramp junctions and weaving segments within the study area operate at a LOS D or better under Existing conditions, and that all of the ramp roadways operate under capacity during both the AM and PM peak hours, although the diverge ramp from WB MD 175 to Snowden River Parkway operates at a LOS E during the PM peak hour.

2.5 Simulation Model Development

Simulation models are useful tools for assessing future No Build traffic operations, and for assessment of improvement alternatives under future traffic conditions. While the static analysis tools do not take into account the interaction of traffic flows between intersections and interchanges within the study area, the simulation tool does, providing demonstration of the effect that queues and delays at one point in the study area may have on the rest of the system. Also, development and calibration of these tools under Existing conditions provides a useful resource for use in later stages of a study.

2.5.1 Simulation Model Validation and Calibration

Synchro is a software package that facilitates analysis of individual intersections and arterial networks. SimTraffic is the simulation modeling tool that accompanies Synchro. Corsim is another software package that facilitates analysis of roadway networks that include freeways and interchange ramps. These tools are used to perform analyses on roadway networks. The study team developed, validated, and calibrated Synchro/SimTraffic and Corsim models of the study area network for the AM and PM peak hour using the Existing traffic volumes, traffic signal data, travel time run data, and field observation data to provide a reasonable replication of real-world existing traffic operations.

Both the Synchro/SimTraffic and Corsim models, once calibrated for Existing conditions, were used in the assessment of future No Build conditions, to demonstrate system-wide delays as well as the impact that delays at one intersection may have on another intersection in the study area. The Synchro model was also used to perform the HCM static capacity analyses of signalized intersections.

2.5.2 Results of the Existing Conditions Simulations

The Existing conditions AM peak hour simulation model showed frequent queues along westbound MD 175 approaching the MD 175 / MD 108 intersection, occasional queues on the southbound I-95 ramp at its intersection with the westbound MD 175 lanes, and notable delays at both the MD 175 / US 1 and MD 175 / MD 108 intersections.

For the PM peak hour, the simulation showed queues on eastbound MD 175 from the diverge to northbound I-95 all the way to the MD 175 / MD 108 intersection, weaving conflicts along eastbound MD 175 between the on ramp from Columbia Gateway Drive and the MD 175 / MD 108 intersection, and extensive queues and delays at the MD 175 / US 1 intersection.

These results are consistent with the Existing conditions field observations.

2.6 Crash Analysis

The crash analysis is based on data provided by the SHA Office of Traffic and Safety (OOTS), Traffic Development and Support Division (TDSD). The data obtained from TDSD is provided in **Appendix A**.

The study team obtained data for the MD 175 corridor within the study area for January 1, 2006 through December 31, 2008, for MD 175 from east of Pocomoke Avenue (milepoint 1.15) to west of Snowden River Parkway (milepoint 3.45). A total of 211 police reported crashes occurred along this segment of MD 175 during the study period. The crash data for the MD 175 corridor is summarized in **Table 4**. This segment of MD 175 experienced a higher than average rear end crash rate, parked vehicle crash rate, and truck related crash rate during the analysis period.

The study team also obtained data for the US 1 corridor within the study area for January 1, 2006 through December 31, 2008, for US 1 from south of Assateague Drive (milepoint 5.29) to north of MD 175 (milepoint 5.70). This data includes a total of 56 police-reported crashes. This segment of US 1 experienced a higher than average property damage only crash rate and total crash rate during the analysis period, as well as a higher than average sideswipe crash rate, left turn crash rate, angle crash rate, and truck related crash rate.

Crash data for each intersection in the study area is described below. Locations marked with an asterisk (*) reference crashes reported between January 1, 2005 and December 31, 2007. All other locations' data is for January 1, 2006 through December 31, 2008. Based on the number and severity of crashes, MD 175 at MD 108 was identified as a 2008 Candidate Safety Improvement Intersection (CSII).

- MD 175 at Snowden River Parkway (Ramps 2 and 4) – nine crashes *
- MD 175 at MD 108 – 54 crashes
- MD 175 at I-95
    - All ramps – 43 crashes *
    - MD 175 at SB I-95 Off Ramp – data not yet available
    - MD 175 at NB I-95 Off Ramp – three crashes
- MD 175 at US 1 – 21 crashes
- MD 175 at Pocomoke Avenue – 11 crashes
- US 1 at Assateague Drive/Crestmount Road – 17 crashes

Table 4. Study Area Crash Summary

Time of Day	# of Crashes
12:00 AM to 6:00 AM	27
6:00 AM to 12:00 PM	51
12:00 PM to 6:00 PM	89
6:00 PM to 12:00 AM	44
Total	**211**
Vehicle Type	**# of Vehicles**
Heavy Trucks	9
Passenger Cars	226
Light Duty Trucks	54
Passenger Bus	2
School Bus	2
Other Types	128
Emergency Vehicle	2
Motor Cycle / Moped	5
Truck Trailer	19
Total	**447**
Reported Year	**# of Crashes**
2006	80
2007	68
2008	63
Total	**211**
Severity	**# of Crashes**
Fatal	3
Injury	75
Property Damage Only	133
Total	**211**
Illumination	**# of Crashes**
Daylight	110
Dark-Lights On	66
Dark-No Lights	15
Dawn/Dusk	15
Other	5
Total	**211**
Weather	**# of Crashes**
Clear/Cloudy	165
Foggy	2
Raining	38
Snow/Sleet	2
Other	4
Total	**211**

Crash Type	# of Crashes
Rear-End	114
Left-Turn	6
Angle	15
Sideswipe	20
Fixed Object	18
Opposite Direction	2
Pedestrian related	5
Parked Vehicle	6
Other/Unknown	25
Total	**211**
Probable Cause	**# of Crashes**
Followed too Closely	28
Failed to Give Full Attention	59
Failed to Obey Traffic Signal	7
Failed to Yield Right-of-Way	3
Improper Lane Change	11
Too Fast for Conditions	38
Other or Unknown	37
Failed to Obey Other Controls	6
Influence of Alcohol/Drugs	14
Improper Turn	4
Rain/Snow	4
Total	**211**
Direction of Movement	**# of Vehicles**
SB (L, T, R)	(6,29,0)
NB (L, T, R)	(4,22,0)
EB (L, T, R)	(6,211,0)
WB (L, T, R)	(5,90,1)
Total	**(21,352,1)**
Condition of Drivers	**# of Crashes**
Normal	159
Drinking/Drugs	23
Other	29
Total	**211**
Surface Conditions	**# of Crashes**
Wet	55
Dry	150
Ice/Snow	2
Other	4
Total	**211**

3.0 FUTURE NO BUILD CONDITIONS

3.1 2015 No Build Traffic Volumes

The study team developed 2015 AM and PM peak hour turning movement data and average daily traffic (ADT) data using an enhanced version of a travel demand forecasting model, then post-processed the data for use in this study. The travel demand forecasting model used for the 2015 forecasts was based on an enhanced version of the 2005 year model (Version 3.3.e) developed by the Baltimore Metropolitan Council (BMC) for a study of the roadway networks surrounding the Fort George G. Meade military installation, and Round 7a socioeconomic data. The enhanced model incorporated disaggregated traffic analysis zones (TAZs), or "TAZ splits," for portions of Anne Arundel County, Howard County, and the City of Laurel (in Prince George's County), as follows:

- The Anne Arundel County TAZ splits are those that had been built into the previous version of SAM 2, Anne Arundel County's Sub Area Model of West County, over a series of earlier studies.
- The Howard County TAZ splits are those that had been developed by Howard County in the vicinity of US 1, and provided to BMC for incorporation into this version of the model.
- The City of Laurel TAZ splits are the TAZs used for the City of Laurel TAZs in the current travel demand forecasting model maintained by the Metropolitan Washington Council of Governments (MWCOG).

In addition, the study team reviewed the travel demand forecasting model's roadway network for coding consistency, added network details to better represent traffic assignment patterns on major roadways in the study area, and added additional roadway links to the network in the study area. The study team then reviewed travel demand forecasting model outputs for consistency with recent traffic counts from throughout the study area, and calibrated the travel demand forecasting model to better represent existing conditions.

For the US 1/MD 175 Improvement Study, the study team enhanced the base model used in the previous Fort Meade Study, extending the region of focus for the calibration effort so that it would encompass the intersections and interchanges included in this study.

Once the 2005 base model was considered to be reasonably calibrated, the study team used 2015 socioeconomic data file along with the enhanced version of the 2015 BMC model networks to simulate the 2015 traffic conditions for the study area. All changes to the highway network and trip tables made during the model calibration process were carried forward to the 2015 model run.

Following completion of the model refinements, the study team post-processed outputs of the enhanced 2015 travel demand forecasting model using methods described in the National Cooperative Highway Research Program's Report Number 255 (NCHRP 255), and balanced

traffic volumes throughout the network in a manner similar to that performed for the Existing conditions. The resulting AM and PM peak hour turning movement volumes and ADTs are provided in **Figures 7**, **8**, and **9**, respectively.

3.2 2015 No Build Traffic Operations Analyses

As discussed for Existing conditions, the HCM and CLA analyses presented in this section are static analyses, which assess operations at each intersection or interchange feature independently to assess the localized capacity constraints. However, these analyses do not consider the effects that queues or delays at one intersection or interchange feature may have on nearby intersections and interchange features within the study area.

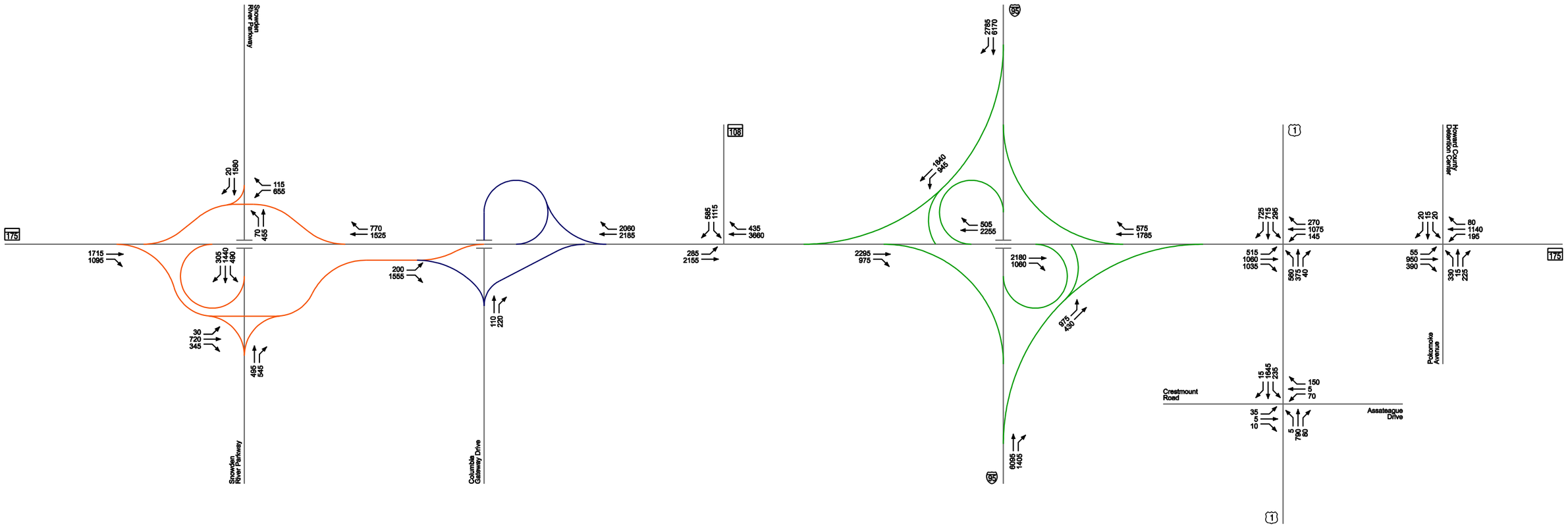
While the static analysis tools do not take into account the interaction of traffic flows between intersections and interchanges within the study area, the simulation tool does, providing demonstration of the effect that queues and delays at one point in the study area may have on the rest of the system. Results of the simulation models are included in this section as well, to demonstrate the effects that increased traffic volumes at each intersection and interchange have on the system as a whole.

3.2.1 Intersections

The results of the HCM and CLA capacity analyses for 2015 No Build conditions are summarized in **Table 5** and illustrated in **Figures 10 and 11**. The HCM and CLA worksheets are provided in **Appendix B** and **Appendix D**, respectively.

Table 5. 2015 No Build Intersection LOS: AM(PM)

Intersection	Highway Capacity Manual Analysis			Critical Lane Volume Analysis		
	LOS	Delay (sec/veh)	v/c Ratio	CLV	LOS	v/c Ratio
MD 175 at MD 108	E (C)	66.2 (26.1)	1.13 (0.76)	1771 (1252)	F (C)	1.11 (0.78)
MD 175 WB at Ramp 5 from I-95 SB	C (C)	30.2 (34.3)	0.95 (0.85)	1422 (1260)	D (C)	0.89 (0.79)
MD 175 EB at Ramp 1 from I-95 NB	D (D)	39.9 (40.3)	0.95 (0.90)	1408 (1378)	D (D)	0.88 (0.86)
MD 175 at US 1	F (F)	159.0 (88.3)	1.45 (1.05)	1829 (1698)	F (F)	1.14 (1.06)
MD 175 at Pocomoke Avenue	C (F)	26.1 (110.3)	0.75 (1.38)	1100 (1429)	B (D)	0.69 (0.89)
US 1 at Assateague Drive/Crestmount Road	B (C)	16.4 (24.5)	0.71 (0.77)	1242 (1326)	C (D)	0.78 (0.83)



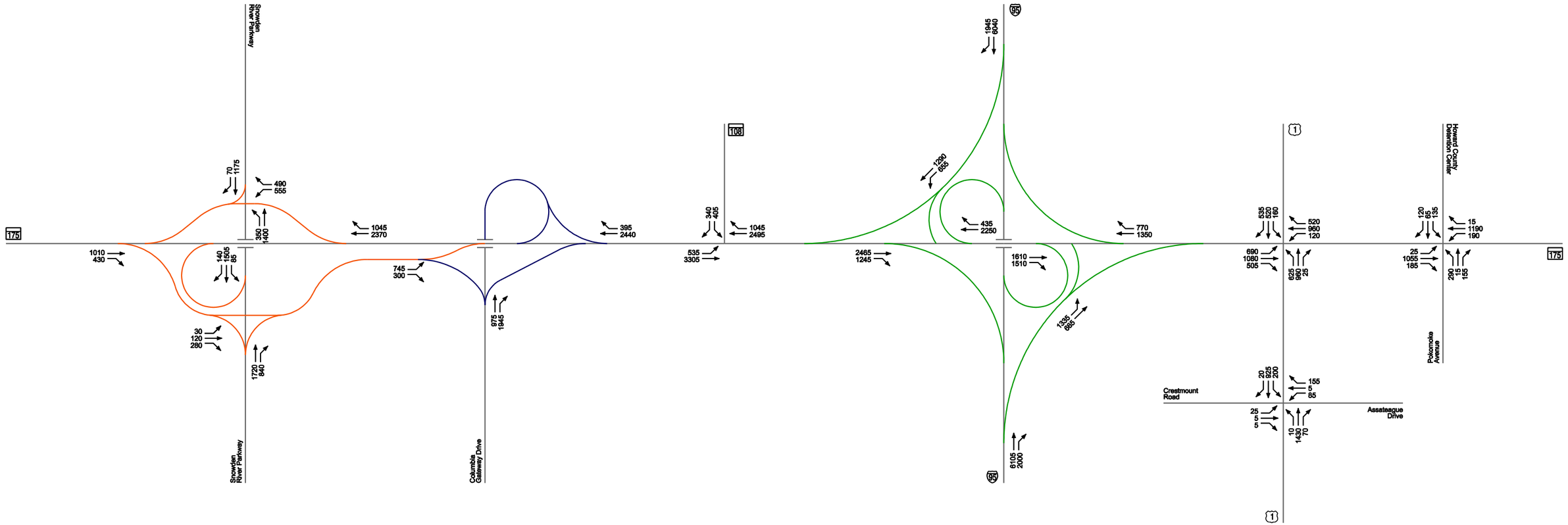
Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2015 Traffic Volumes
AM Peak Hour

Figure 7
March 2010



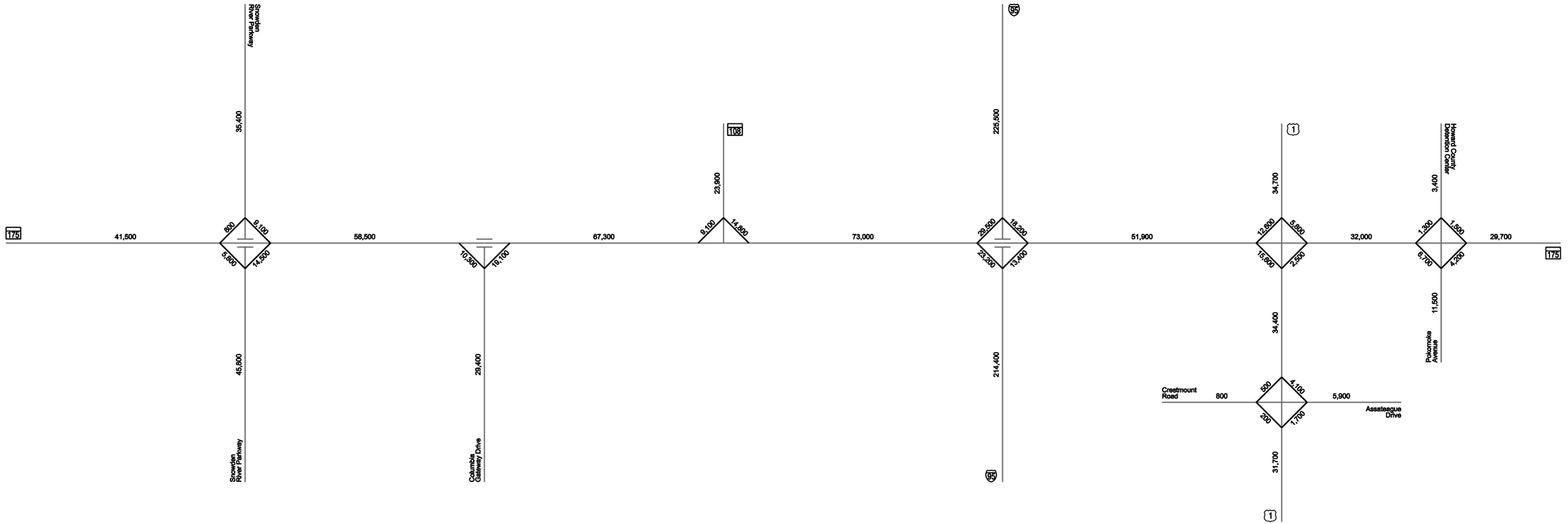
Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2015 Traffic Volumes
PM Peak Hour

Figure 8
March 2010



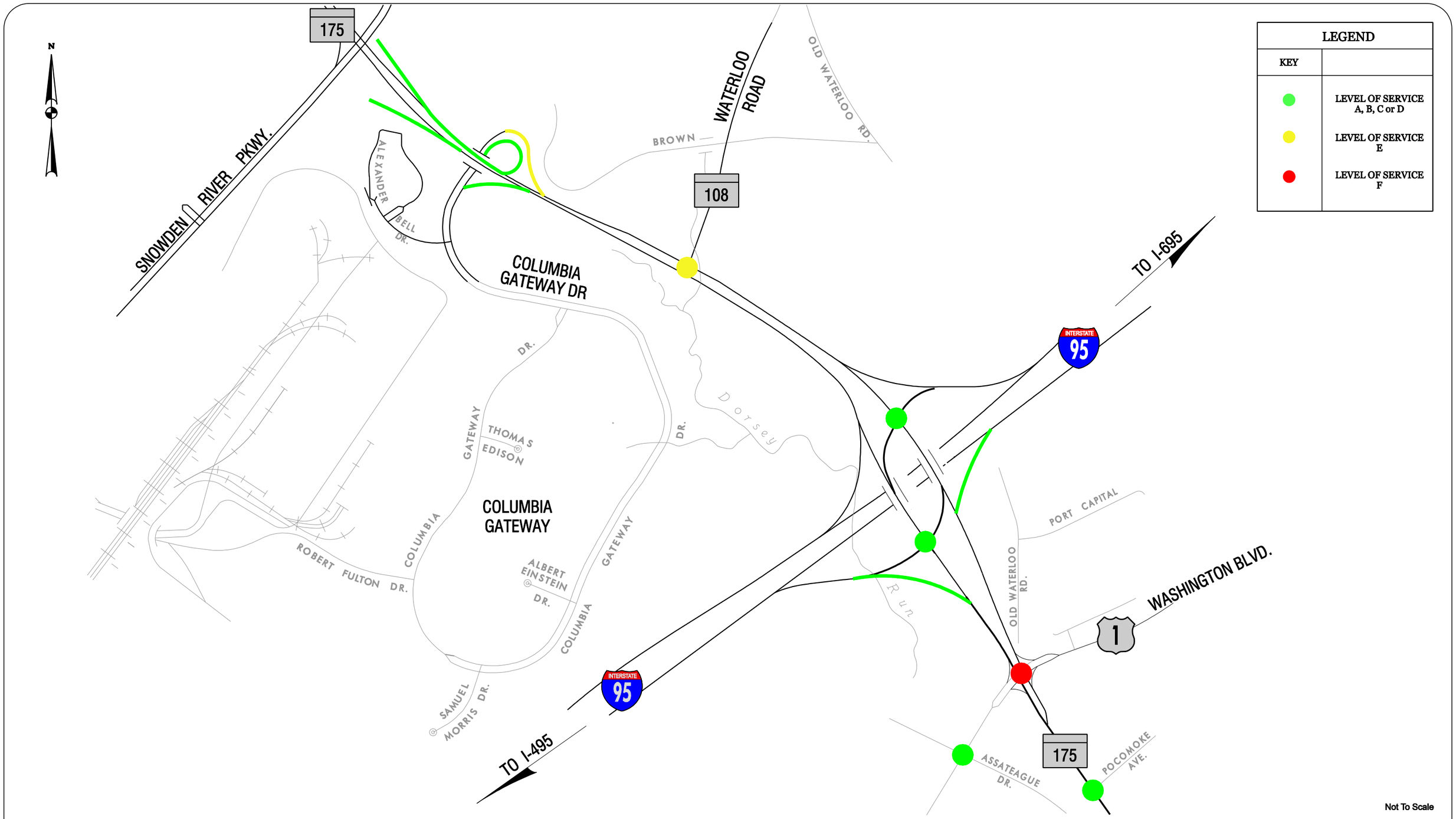
Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2015 Traffic Volumes
Average Daily Traffic

Figure 9
March 2010



Maryland State Highway Administration
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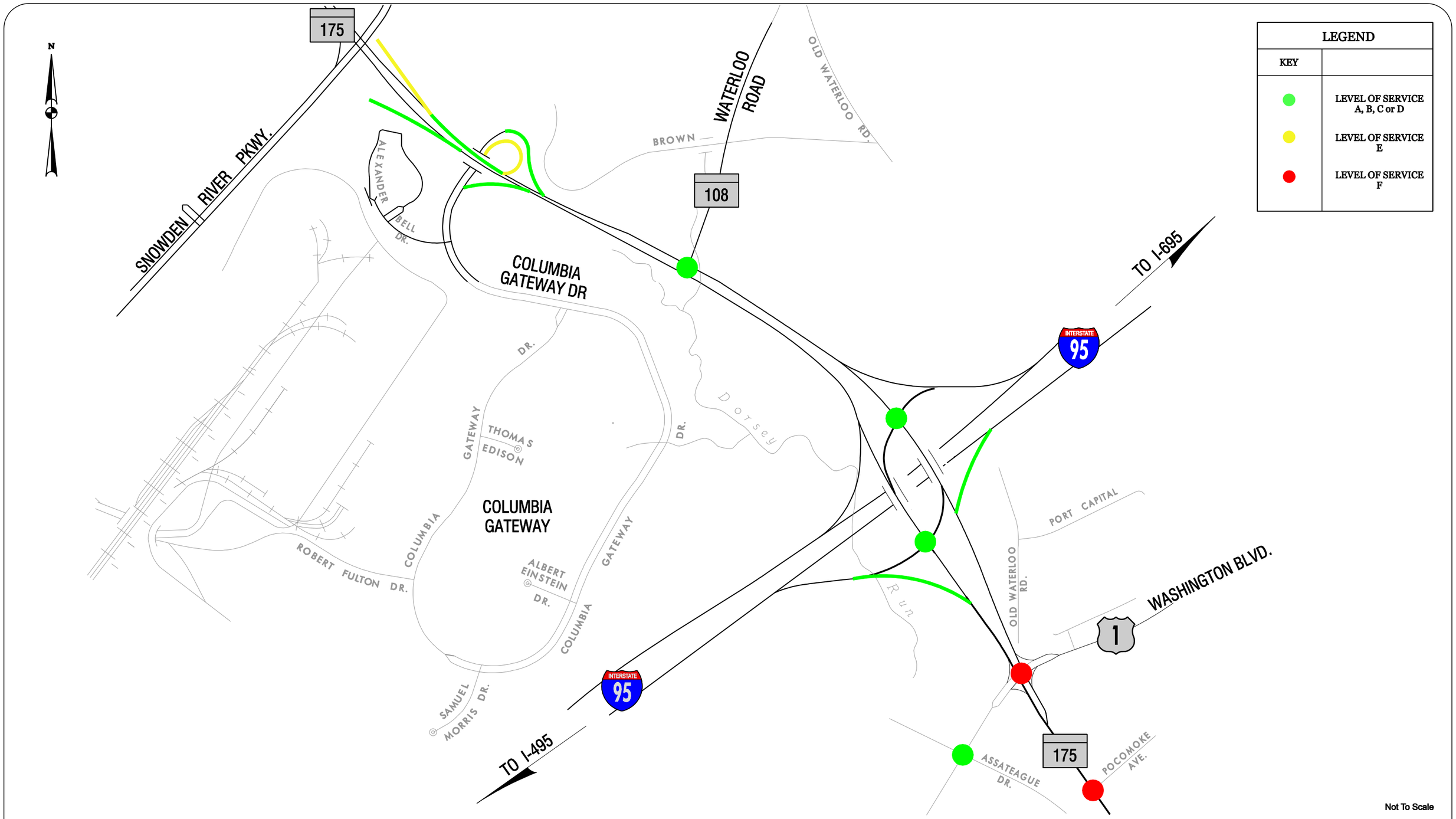
US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2015 Level of Service
AM Peak Hour

Figure 10
March 2010



Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2015 Level of Service
PM Peak Hour

Figure 11
March 2010

Results of the intersection analyses indicate that three of the six study intersections are expected to continue to operate at LOS D or better in 2015. The intersection of MD 175 and MD 108 is expected to operate at LOS E during the AM peak hour, and the intersection of MD 175 and Pocomoke Avenue is expected to operate at LOS F during the PM peak hour under 2015 No Build conditions. Additionally, the intersection of MD 175 and US 1 is expected to operate at LOS F during the AM and PM peak hours in 2015.

3.2.2 Ramp Junctions and Weaving Segments

The results of the capacity analysis for interchange features are summarized in **Table 6** and illustrated in **Figures 10 and 11**. Detailed capacity analyses worksheets are included in **Appendix C**. Results of the analyses indicate that all ramp junctions and weaving segments in the study area are expected to operate at LOS D or better, and the ramp roadways are forecast to operate below capacity during both the AM and PM peak hours. However, the merge ramp from Columbia Gateway Drive to WB MD 175 is projected to operate at LOS E during the PM peak hour, and the diverge ramp from WB MD 175 to Snowden River Parkway is projected to operate at LOS E during the PM peak hour.

Table 6. 2015 No Build Interchange Features Capacity and LOS

Ramp Junction / Weaving Segment	Type	LOS / Capacity Check AM (PM)
MD 175 at Snowden River Parkway		
EB MD 175 at Ramp from Snowden River Pkwy	Ramp Merge	B (B)
WB MD 175 at Ramp to Snowden River Pkwy	Ramp Diverge	C (E)
WB MD 175 between Col. Gateway Drive and Snowden River Pkwy	Type A Weave	B (D)
MD 175 at Columbia Gateway Drive		
WB MD 175 at Ramp to Columbia Gateway Dr	Ramp Diverge	E (C)
EB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	B (D)
WB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	C (E)
MD 175 at I-95		
EB MD 175 at Ramp 6 to I-95 SB [2100]*	Lane Drop	975 (1245)
EB MD 175 at Ramp 5 from SB I-95 [2100]*	Lane Add	945 (655)
EB MD 175 at Ramp 3 to NB I-95 [1900]*	Lane Drop	1060 (1510)
EB MD 175 at Ramp 4 from I-95 NB	Ramp Merge	C (C)
WB MD 175 at Ramp 2 to NB I-95	Ramp Diverge	C (C)
WB MD 175 at Ramp 1 from NB I-95 [2100]*	Lane Add	975 (1335)
WB MD 175 at Ramp 7 to SB I-95 [1900]*	Lane Drop	505 (435)
WB MD 175 at Ramp 8 from I-95 SB [2100]*	Lane Add	1840 (1290)

*Highway Capacity Manual Exhibit 25-3 Capacity of Ramp Roadways, one-lane ramp roadway capacities, based on ramp free flow speeds.

3.2.3 Results of the 2015 No Build Simulations

The 2015 No Build conditions AM peak hour simulation model showed frequent queues along westbound MD 175 that originated at the MD 175 / MD 108 intersection and occasionally extended back into the MD 175 / I-95 interchange, queues on the southbound I-95 ramp at its intersection with the westbound MD 175 lanes, and notable delays at the MD 175 / US 1 intersection, the MD 175 / MD 108 intersection, and both MD 175 / I-95 exit ramp intersections.

For the PM peak hour the simulation showed queues on eastbound MD 175 from the diverge to northbound I-95 all the way to the MD 175 / Columbia Gateway Drive interchange, delays for vehicles exiting Columbia Gateway Drive onto eastbound MD 175, and extensive queues and delays at the MD 175 / US 1 and the MD 175 / Pocomoke Avenue intersections.

These results are consistent with the Existing conditions simulation results, and demonstrate an overall degradation of traffic operations throughout the study area between 2009 and 2015.

3.3 2035 Programmed No Build Traffic Volumes

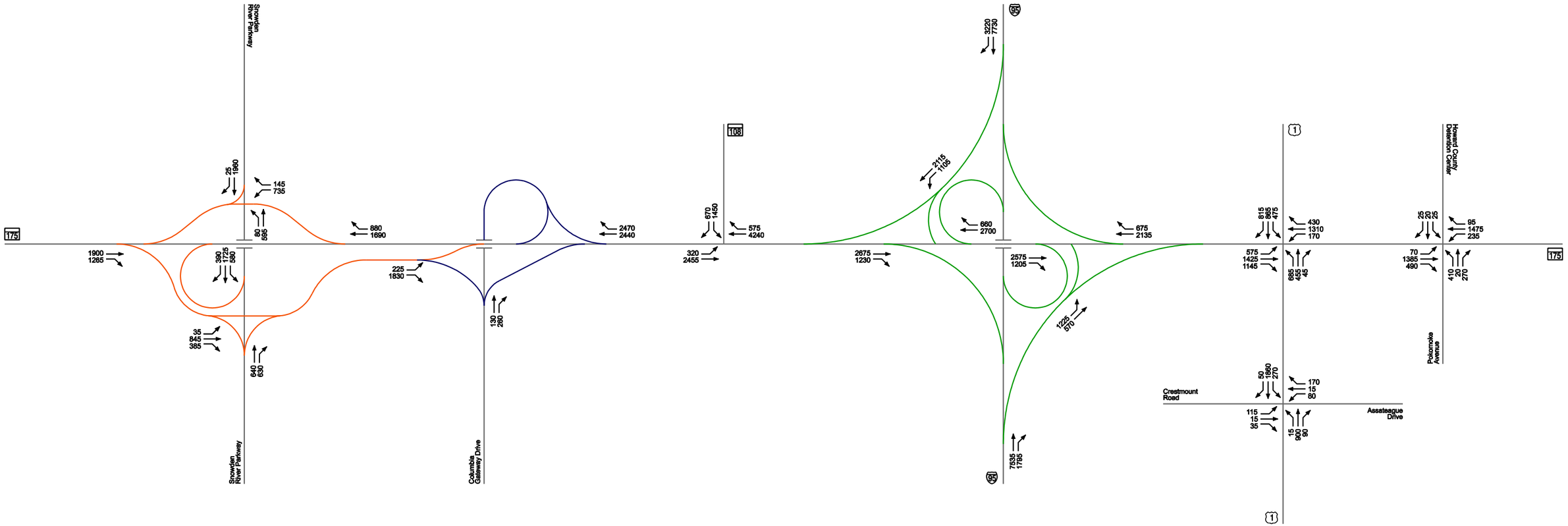
The enhanced network developed for the 2015 travel demand forecasting model has not yet been developed by BMC for the 2035 condition. Therefore, the study team used the base travel demand forecasting model developed by BMC for the 2035 horizon year. Comparisons in traffic flow between the 2015 and 2035 travel demand forecasting model outputs were used to incorporate the benefits of the 2015 forecasting model refinements into the 2035 condition.

As was done for the 2015 condition, the study team post- processed the outputs of the 2035 travel demand forecasting model using methods described in NCHRP 255, and then balanced volumes throughout the network. The resulting AM and PM peak hour turning movement volumes and ADTs are provided in **Figures 12**, **13**, and **14**.

3.4 2035 Programmed No Build Traffic Operations Analyses

As discussed previously, the HCM and CLA analyses presented in this section are static analyses, which assess operations at each intersection or interchange feature independently to assess the localized capacity constraints. However, these analyses do not consider the effects that queues or delays at one intersection or interchange feature may have on nearby intersections and interchange features within the study area.

While the static analysis tools do not take into account the interaction of traffic flows between intersections and interchanges within the study area, the simulation tool does, providing demonstration of the effect that queues and delays at one point in the study area may have on the rest of the system. Results of the simulation models are included in this section as well, to demonstrate the effects that increased traffic volumes at each intersection and interchange have on the system as a whole.



Not To Scale

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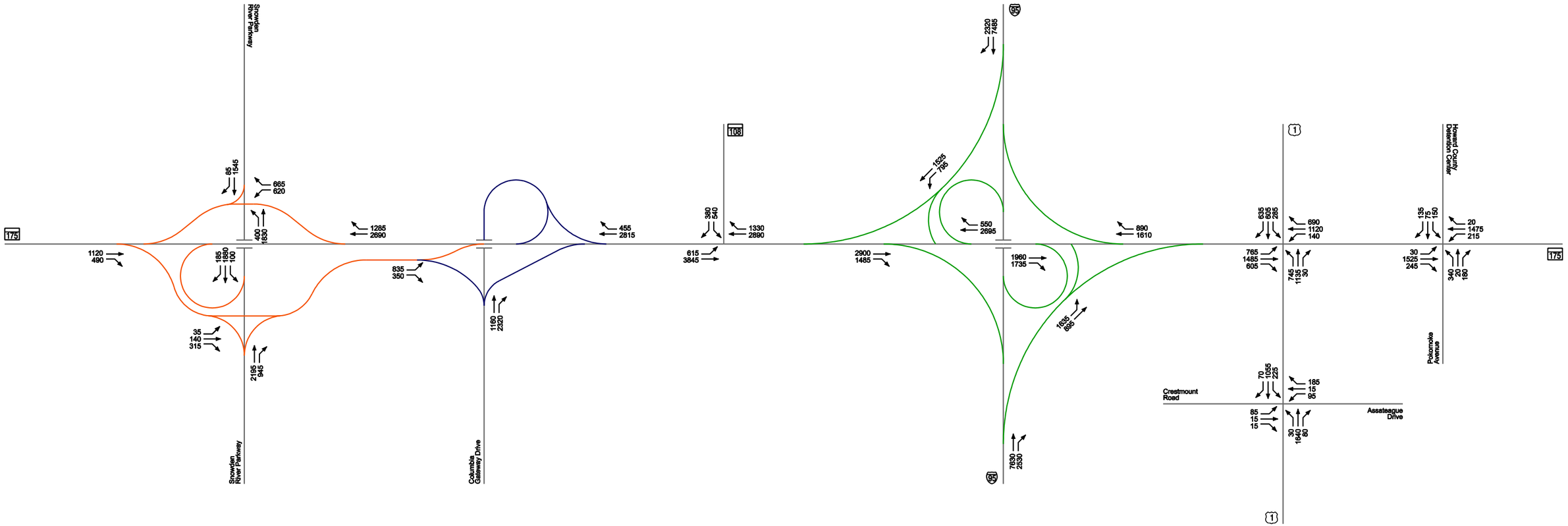
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Programmed Traffic Volumes
AM Peak Hour

Figure 12
March 2010



Not To Scale

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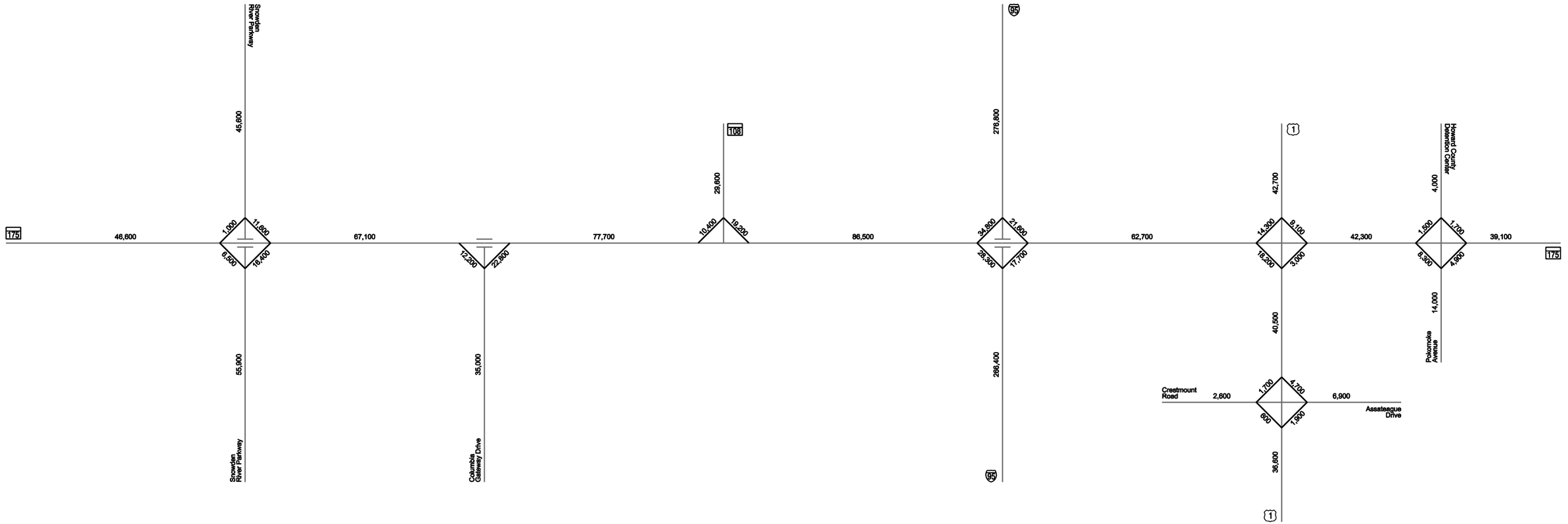
Howard County, Maryland

2035 Programmed Traffic Volumes
PM Peak Hour

Figure 13
March 2010



Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Programmed Traffic Volumes
Average Daily Traffic

Figure 14
March 2010

3.4.1 Intersections

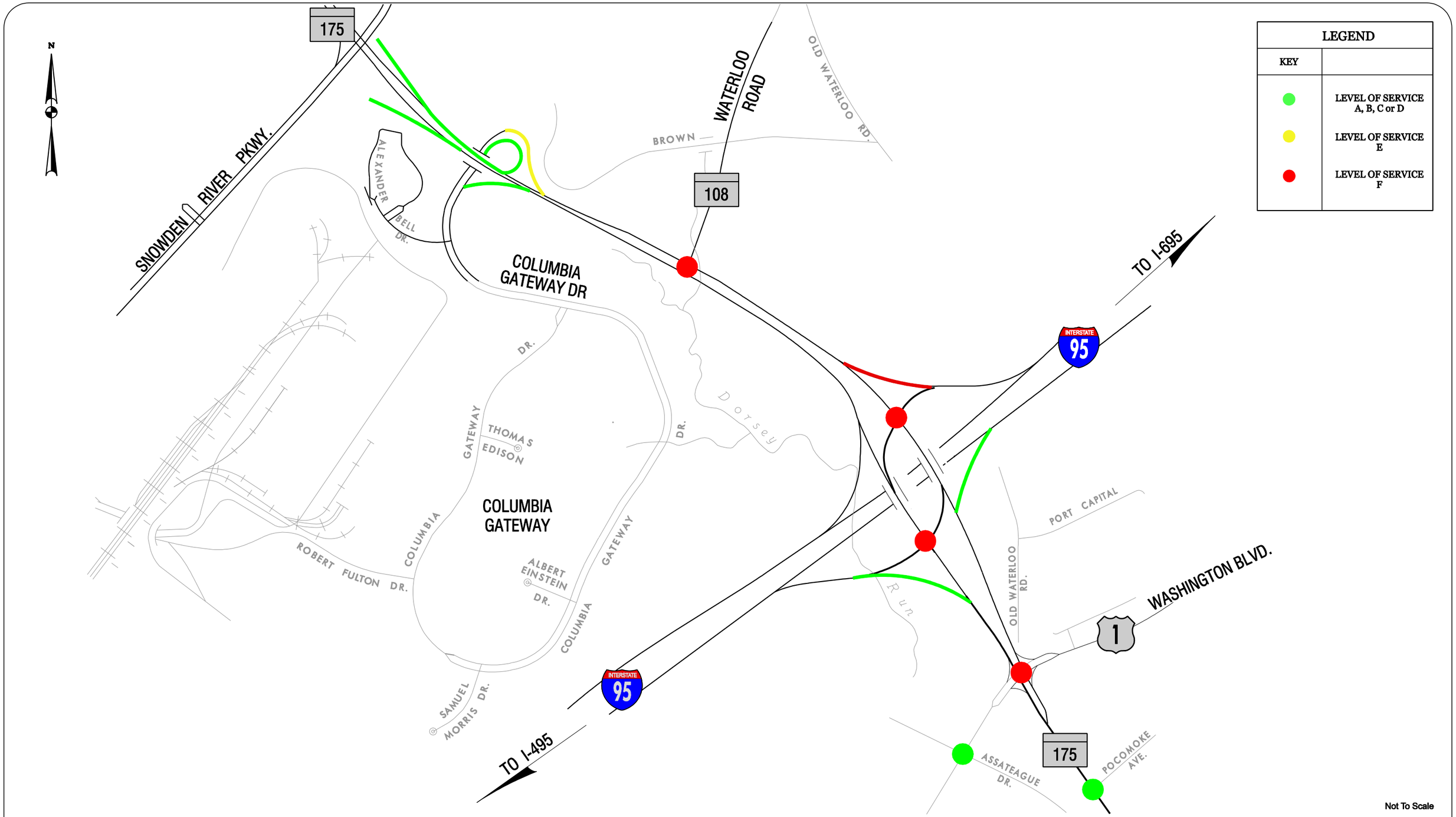
The results of the HCM and CLA capacity analyses are summarized in **Table 7** and illustrated in **Figures 15 and 16**. The HCM and CLA analysis worksheets are provided in **Appendix B** and **Appendix D**, respectively. Results of the analyses indicate that two of the study intersections (MD 175 EB at Ramp 1 from I-95 NB and MD 175 at US 1) are expected to operate at LOS F during both the AM and PM peak hours. Two of the study intersections (MD 175 at MD 108 and MD 175 WB at Ramp 5 from I-95 SB) are expected to operate at LOS F during the AM peak hour., the intersection of MD 175 WB at Ramp 5 from I-95 SB is expected to operate at a LOS E during the PM peak hour, and the intersection (MD 175 at Pocomoke Avenue) is projected to operate at LOS F during the PM peak hour. The remaining intersections are projected to continue to operate at a LOS D or better.

Table 7. 2035 Programmed No Build Intersection LOS: AM(PM)

Intersection	Highway Capacity Manual Analysis			Critical Lane Volume Analysis		
	LOS	Delay (sec/veh)	v/c Ratio	CLV	LOS	v/c Ratio
MD 175 at MD 108	F (C)	117.7 (30.3)	1.31 (0.88)	2117 (1479)	F (E)	1.32 (0.92)
MD 175 WB at Ramp 5 from I-95 SB	F (E)	85.3 (55.9)	1.13 (1.02)	1688 (1515)	F (E)	1.05 (0.95)
MD 175 EB at Ramp 1 from I-95 NB	F (F)	103.7 (87.2)	1.15 (1.10)	1704 (1683)	F (F)	1.06 (1.05)
MD 175 at US 1	F (F)	256.9 (163.8)	1.73 (1.29)	2136 (2107)	F (F)	1.34 (1.32)
MD 175 at Pocomoke Avenue	D (F)	47.0 (197.5)	1.08 (1.77)	1482 (1971)	E (F)	0.93 (1.23)
US 1 at Assateague Drive/Crestmount Road	D (D)	45.4 (51.1)	1.03 (1.01)	1518 (1589)	E (E)	0.95 (0.99)

3.4.2 Ramp Junctions and Weaving Segments

The results of the capacity analysis for the interchange features are summarized in **Table 8** and illustrated in **Figures 15 and 16**. Detailed capacity analyses worksheets are included in **Appendix C**. Results of the analyses show that two of the merge ramps (EB MD 175 at the ramp from Columbia Gateway Drive and WB MD 175 at the ramp from Columbia Gateway Drive), one of the diverge ramps (WB MD 175 at the ramp to Snowden River Parkway), and the weaving segment (WB MD 175 between Columbia Gateway Drive and Snowden River Parkway) are projected to operate at a LOS E during the PM peak hour. The diverge ramp from WB MD 175 to Columbia Gateway Drive is projected to operate at a LOS E during the AM peak hour. All other ramp junctions are projected to operate at a LOS D or better. One ramp roadway (WB MD 175 at Ramp 8 from I-95 SB – lane add) is projected to exceed the ramp roadway capacity during the AM peak hour. All other ramp roadways are projected to operate below capacity.



Not To Scale

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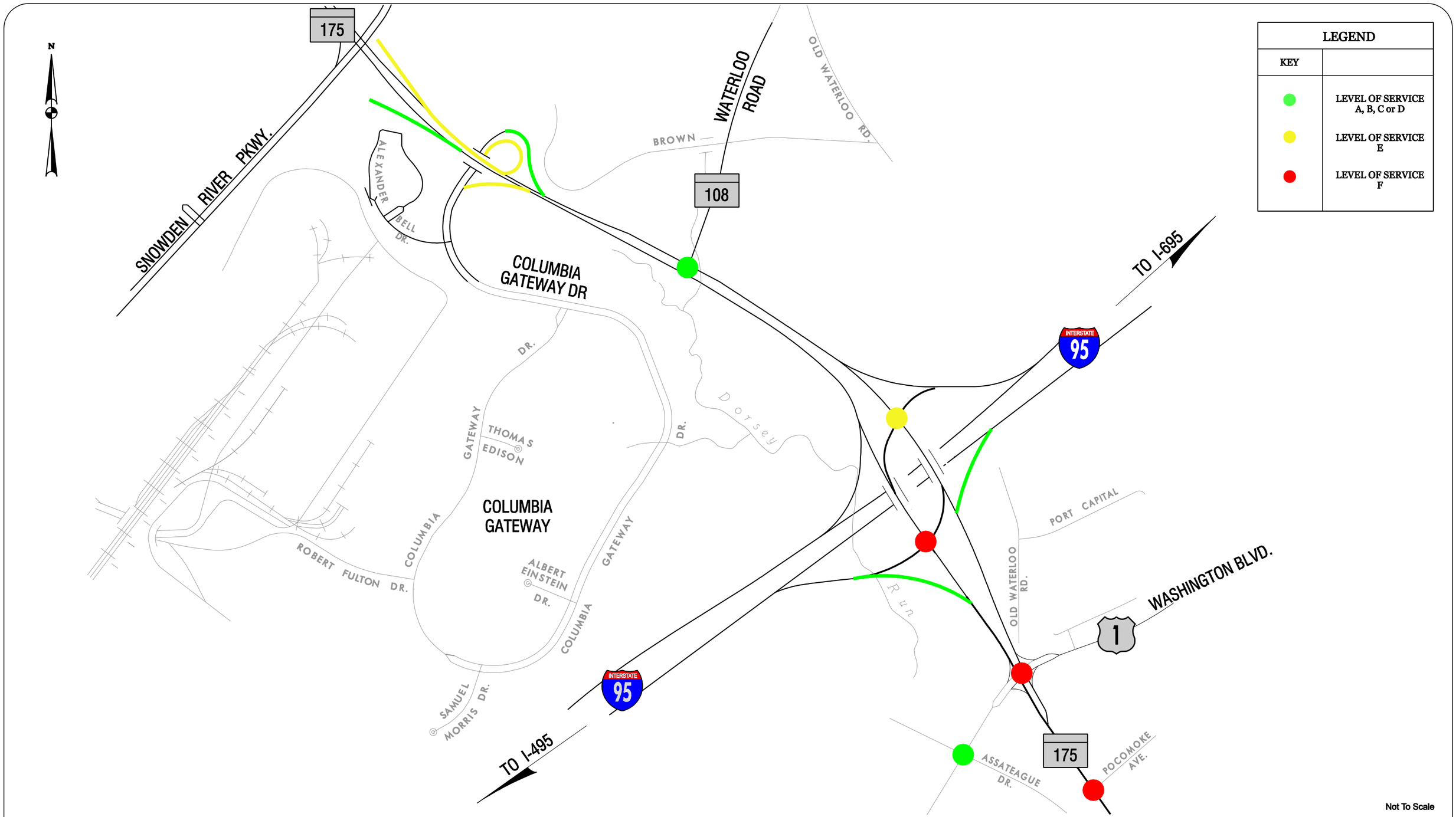
US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Programmed Level of Service
AM Peak Hour

Figure 15
March 2010



Maryland State Highway Administration
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US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Programmed Level of Service
PM Peak Hour

Figure 16
March 2010

Table 8. 2035 Programmed No Build Interchange Features Capacity and LOS

Ramp Junction / Weaving Segment	Type	LOS / Capacity Check AM (PM)
MD 175 at Snowden River Parkway		
EB MD 175 at Ramp from Snowden River Pkwy	Ramp Merge	B (B)
WB MD 175 at Ramp to Snowden River Pkwy	Ramp Diverge	C (E)
WB MD 175 between Col. Gateway Drive and Snowden River Pkwy	Type A Weave	C (E)
MD 175 at Columbia Gateway Drive		
WB MD 175 at Ramp to Columbia Gateway Dr	Ramp Diverge	E (C)
EB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	C (E)
WB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	D (E)
MD 175 at I-95		
EB MD 175 at Ramp 6 to I-95 SB [2100]*	Lane Drop	1230 (1485)
EB MD 175 at Ramp 5 from SB I-95 [2100]*	Lane Add	1105 (795)
EB MD 175 at Ramp 3 to NB I-95 [1900]*	Lane Drop	1205 (1735)
EB MD 175 at Ramp 4 from I-95 NB	Ramp Merge	C (C)
WB MD 175 at Ramp 2 to NB I-95	Ramp Diverge	C (C)
WB MD 175 at Ramp 1 from NB I-95 [2100]*	Lane Add	1225 (1635)
WB MD 175 at Ramp 7 to SB I-95 [1900]*	Lane Drop	660 (550)
WB MD 175 at Ramp 8 from I-95 SB [2100]*	Lane Add	2115 (1525)

*Highway Capacity Manual Exhibit 25-3 Capacity of Ramp Roadways, one-lane ramp roadway capacities, based on ramp free flow speeds.

3.4.3 Results of the 2035 Programmed No Build Simulations

The 2035 Programmed No Build conditions AM peak hour simulation model showed frequent queues along westbound MD 175 that originated at the MD 175 / MD 108 intersection and occasionally extended back into the MD 175 / I-95 interchange, extensive queues on the southbound I-95 ramp at its intersection with the westbound MD 175 lanes, and notable delays at the MD 175 / US 1 intersection, the MD 175 / MD 108 intersection, and both MD 175 / I-95 exit ramp intersections.

For the PM peak hour, the simulation showed queues on eastbound MD 175 from the diverge to northbound I-95 all the way to the MD 175 / Columbia Gateway Drive interchange, delays for vehicles exiting Columbia Gateway Drive onto eastbound MD 175, and extensive queues and delays at the MD 175 / US 1 and the MD 175 / Pocomoke Avenue intersections.

These results are consistent with the 2015 No Build conditions simulation results, and demonstrate an overall degradation of traffic operations throughout the study area between 2015 and 2035.

3.5 2035 Without Covenants No Build Traffic Volumes

Columbia Gateway is a significant generator of traffic along the MD 175 corridor, and is located directly adjacent to the MD 175 corridor within the study area. Currently, there are covenants in place that limit the amount of growth and development that can occur within Columbia Gateway. These covenants are a way of allowing local infrastructure to grow over time so that future growth at Columbia Gateway may be readily accommodated, rather than allow intense growth within this significant area before the necessary local roads, schools, and utilities are in place. The current Columbia Gateway covenants will expire in 2017.

For reference, the "2035 Forecasted Traffic Volumes – Programmed Condition" are based on the current land use development guidelines in place for Columbia Gateway. In other words, they assume that the covenants will still be in place in 2035.

At this time, the future of Columbia Gateway is unknown. New covenants may be developed to replace the expired covenants, or the covenants for this region may be removed entirely. Whatever the case, the build-out land use planned by the developer may vary. Therefore, the study team modeled a trial condition to assess the impacts of a relative "worst case scenario" that assumes the covenants will be entirely removed, and that significant development will occur after 2017. The land use input file for the 2035 travel demand forecasting model was updated to reflect the "without covenants at Columbia Gateway" condition, and the travel demand model was re-run. The "with" and "without covenants" at Columbia Gateway 2035 land use assumptions are provided below in **Tables 9**, **10**, and **11**.

Table 9. 2035 Columbia Gateway Developments

With Covenants (Programmed Condition)	Without Covenants
2,751,000 SF of Office Space	3,751,000 SF of Office Space
110,000 SF of Retail	610,000 SF of Retail
4,600 SF of High Turnover Restaurant	4,600 SF of High Turnover Restaurant
537 Households	5,537 Households

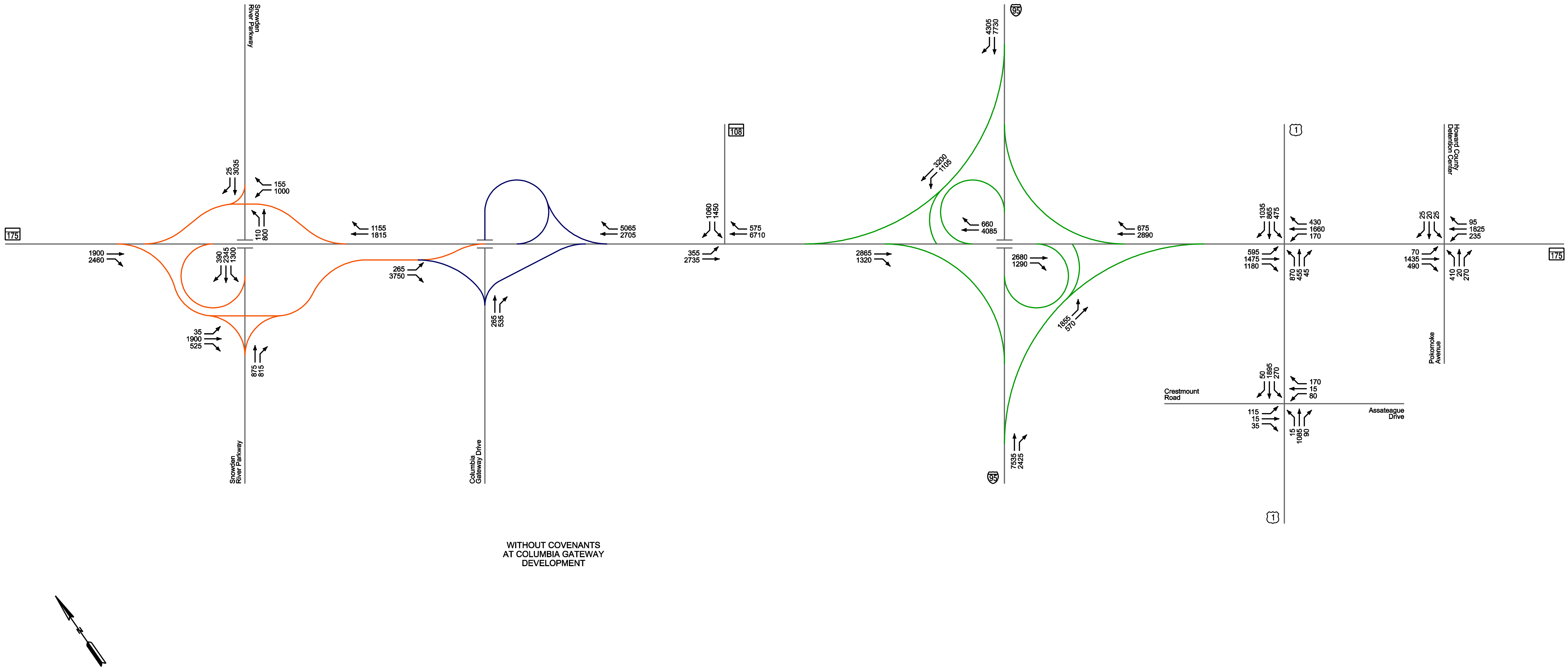
Table 10. 2035 Population and Household Assumptions for Columbia Gateway

Condition	Population	Households
With Covenants (Programmed Condition)	1,055	537
Without Covenants	10,888	5,537

Table 11. 2035 Employment Assumptions for Columbia Gateway

Condition	Retail	Office	Industrial	Other	Total
With Covenants (Programmed Condition)	2,187	13,201	1,719	3,769	20,876
Without Covenants	11,729	18,000	1,719	3,769	35,217

As for the 2035 Programmed condition, the outputs of the 2035 Without Covenants at Columbia Gateway travel demand forecasting model were post-processed using methods described in NCHRP 255, and then balanced throughout the network. The resulting AM and PM peak hour turning movement volumes and ADTs are provided in **Figures 17**, **18**, and **19**.



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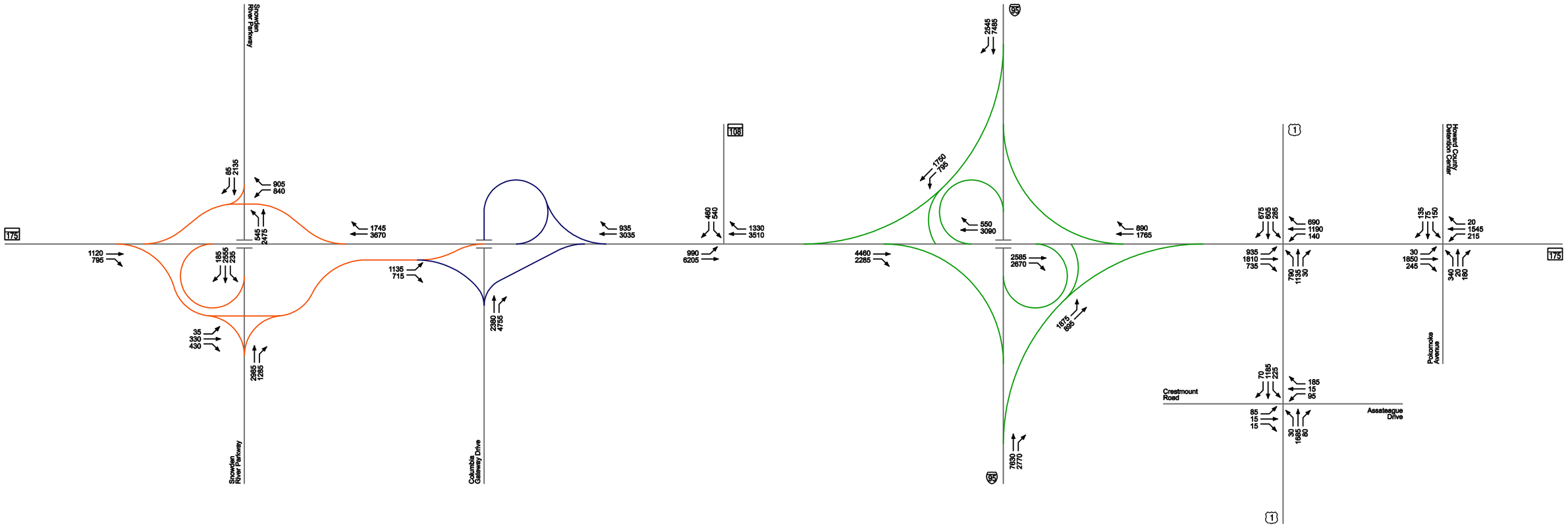
Howard County, Maryland

2035 Without Covenants Traffic Volumes
AM Peak Hour

Figure 17
March 2010



WITHOUT COVENANTS
AT COLUMBIA GATEWAY
DEVELOPMENT

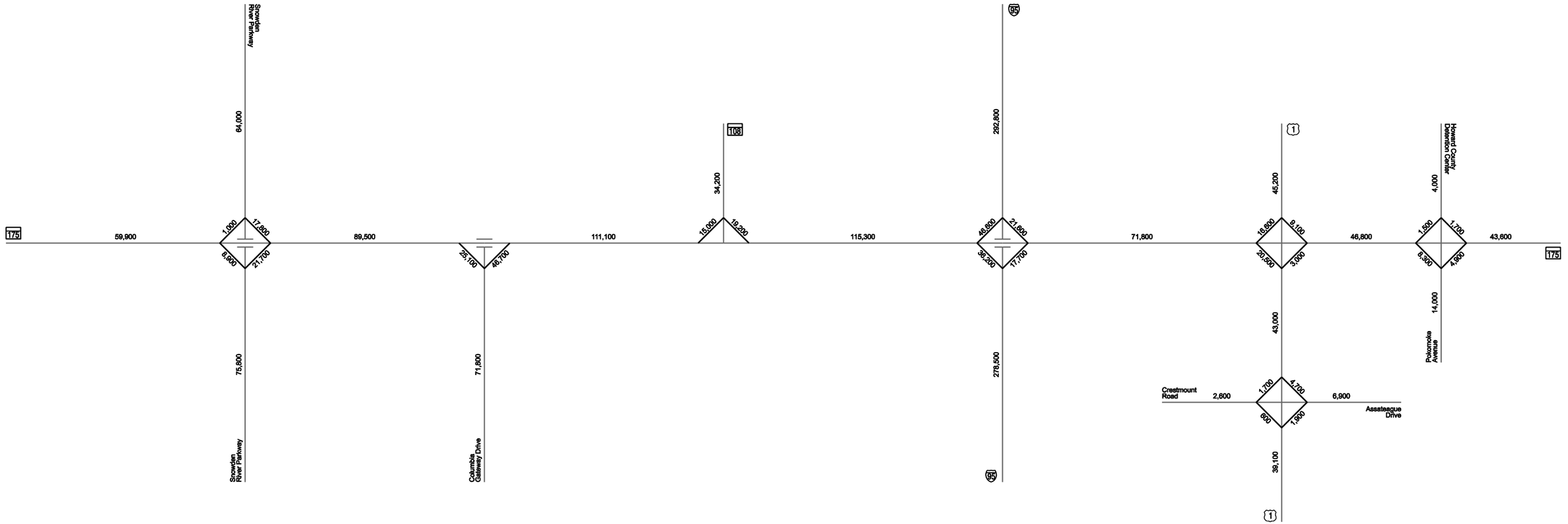
Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Without Covenants Traffic Volumes
PM Peak Hour

Figure 18
March 2010



WITHOUT COVENANTS
AT COLUMBIA GATEWAY
DEVELOPMENT

Not To Scale

Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Without Covenants Traffic Volumes
Average Daily Traffic

Figure 19
March 2010

3.6 2035 Without Covenants Traffic Operations Analyses

As discussed previously, the HCM and CLA analyses presented in this section are static analyses, which assess operations at each intersection or interchange feature independently to assess the localized capacity constraints. However, these analyses do not consider the effects that queues or delays at one intersection or interchange feature may have on nearby intersections and interchange features within the study area.

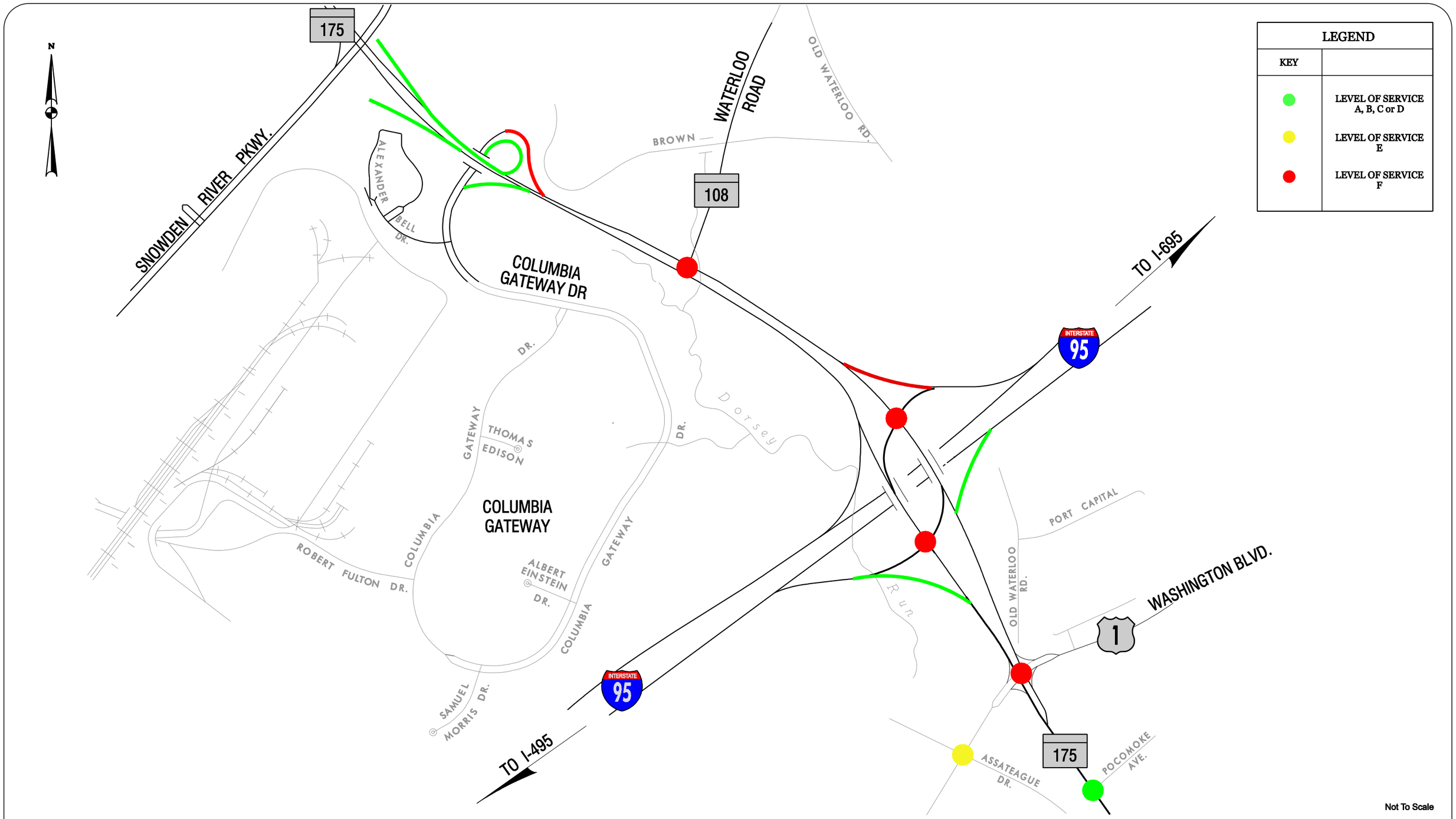
The study team performed analyses for the 2035 Without Covenants condition as a trial to demonstrate an approximation of the traffic operations issues that would be expected to arise if the covenants were removed from Columbia Gateway and that area was fully developed. It was determined that the HCM and CLA results would suffice for this effort, so no simulation model was developed for this condition.

3.6.1 Intersections

The results of the HCM and CLV capacity analyses are summarized in **Table 12** and illustrated in **Figures 20 and 21**. The HCM and CLV analysis worksheets are provided in **Appendix B** and **Appendix D**, respectively. Results of the analyses show that four of the six study intersections are projected to operate at LOS F during both the AM and PM peak hours. The intersection of MD 175 at Pocomoke Avenue is expected to operate at LOS D during the AM peak hour, and the intersection of US 1 and Assateague Drive / Crestmount Road is expected to operate at LOS E during the AM peak hour and at LOS D during the PM peak hour.

Table 12. 2035 Without Covenants No Build Intersection LOS: AM(PM)

Intersection	Highway Capacity Manual Analysis			Critical Lane Volume Analysis		
	LOS	Delay (sec/veh)	v/c Ratio	CLV	LOS	v/c Ratio
MD 175 at MD 108	F (F)	323.6 (116.7)	2.06 (1.31)	2879 (2105)	F (F)	1.80 (1.32)
MD 175 WB at Ramp 5 from I-95 SB	F (F)	239.1 (96.7)	1.47 (1.12)	2242 (1673)	F (F)	1.40 (1.05)
MD 175 EB at Ramp 1 from I-95 NB	F (F)	220.6 (192.1)	1.42 (1.34)	2092 (2065)	F (F)	1.31 (1.29)
MD 175 at US 1	F (F)	316.1 (211.0)	1.96 (1.52)	2402 (2314)	F (F)	1.50 (1.45)
MD 175 at Pocomoke Avenue	D (F)	52.3 (237.1)	1.09 (1.92)	1512 (2178)	E (F)	0.94 (1.36)
US 1 at Assateague Drive/Crestmount Road	E (D)	56.7 (51.6)	1.04 (1.06)	1540 (1615)	E (F)	0.96 (1.01)



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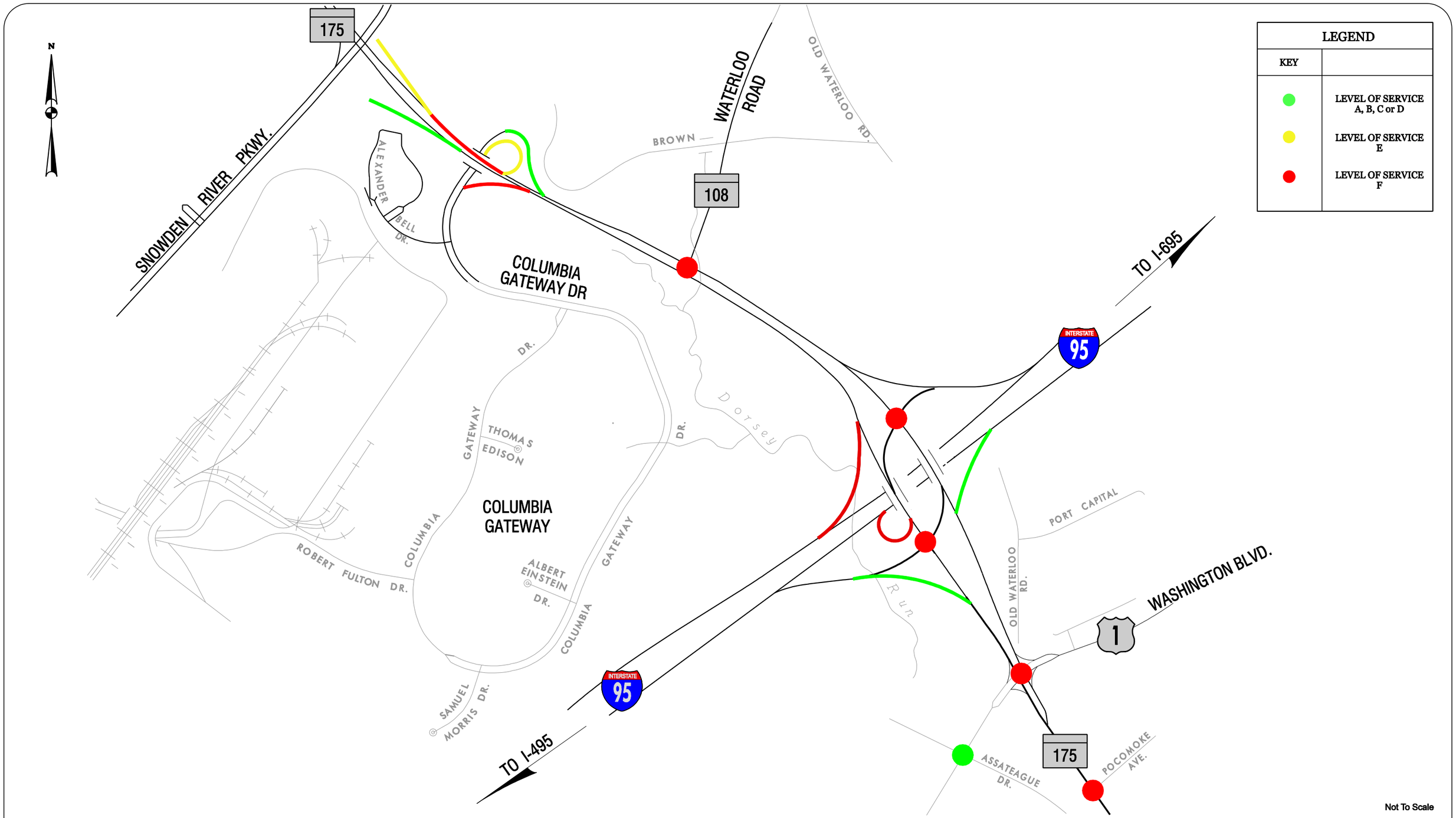
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Without Covenants Level of Service — Figure 20
AM Peak Hour — March 2010



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Maryland State Highway Administration
Travel Forecasting and Analysis Division

US 1 / MD 175 Improvement Study, Phase 1
Howard County, Maryland

2035 Without Covenants Level of Service
PM Peak Hour

Figure 21
March 2010

3.6.2 Ramp Junctions and Weaving Segments

The results of the interchange feature capacity analysis are summarized in **Table 13** and illustrated in **Figures 20 and 21**. Detailed capacity analyses worksheets are included in **Appendix C**. Results of the analyses show that one merge ramp (EB MD 175 at ramp from Columbia Gateway Drive) and the weaving segment are projected to operate at LOS F during the PM peak hour. One diverge ramp (WB MD 175 at ramp to Columbia Gateway Drive) is projected to operate at LOS F during the AM peak hour. One merge ramp (WB MD 175 at ramp from Columbia Gateway Drive) and one diverge ramp (WB MD 175 at ramp to Snowden River Parkway) are expected to operate at a LOS E during the PM peak hour. All other ramp junctions are expected to operate at a LOS D or better. Two ramp roadways (EB MD 175 at Ramp 6 to I-95 SB and EB MD 175 at Ramp 3 to NB I-95) are projected to exceed the ramp roadway capacity during the AM peak hour, and one ramp roadway (WB MD 175 at Ramp 8 from I-95 SB) is projected to exceed the ramp roadway capacity during the AM peak hour. All other ramp roadways are projected to operate under capacity.

Table 13. 2035 Without Covenants No Build Interchange Features Capacity and LOS

Ramp Junction / Weaving Segment	Type	LOS / Capacity Check AM (PM)
MD 175 at Snowden River Parkway		
EB MD 175 at Ramp from Snowden River Pkwy	Ramp Merge	B (C)
WB MD 175 at Ramp to Snowden River Pkwy	Ramp Diverge	D (E)
WB MD 175 between Col. Gateway Drive and Snowden River Pkwy	Type A Weave	C (F)
MD 175 at Columbia Gateway Drive		
WB MD 175 at Ramp to Columbia Gateway Dr	Ramp Diverge	F (D)
EB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	C (F)
WB MD 175 at Ramp from Columbia Gateway Dr	Ramp Merge	D (E)
MD 175 at I-95		
EB MD 175 at Ramp 6 to I-95 SB [2100]*	Lane Drop	1320 (2285)
EB MD 175 at Ramp 5 from SB I-95 [2100]*	Lane Add	1105 (795)
EB MD 175 at Ramp 3 to NB I-95 [1900]*	Lane Drop	1290 (2670)
EB MD 175 at Ramp 4 from I-95 NB	Ramp Merge	C (D)
WB MD 175 at Ramp 2 to NB I-95	Ramp Diverge	D (C)
WB MD 175 at Ramp 1 from NB I-95 [2100]*	Lane Add	1855 (1875)
WB MD 175 at Ramp 7 to SB I-95 [1900]*	Lane Drop	660 (550)
WB MD 175 at Ramp 8 from I-95 SB [2100]*	Lane Add	3200 (1750)

*Highway Capacity Manual Exhibit 25-3 Capacity of Ramp Roadways, one-lane ramp roadway capacities, based on ramp free flow speeds.

4.0 CONCEPT DEVELOPMENT

All traffic analyses and crash history information was shared with the study team to get feedback on the traffic operational issues identified in the study area. These issues include:

- The effect of queues from one location affecting operations at nearby intersections and interchanges as a result of the relatively small distances between the interchanges and intersections in the study area
- Weaving conflicts on MD 175 between I-95 and US 1 and Columbia Gateway Drive and MD 108
- Congestion on Columbia Gateway Drive to eastbound MD 175
- Heavy MD 175 through volumes at MD 108, along with heavy turn volumes from MD 108 to westbound MD 175
- Eastbound MD 175 to northbound I-95 queuing due to congestion on northbound I-95
- Queuing at the existing traffic signals located at the southbound I-95 to eastbound MD 175 and northbound I-95 to westbound MD 175 exit ramps
- Congestion and delays in all directions at the MD 175/US 1 intersection, resulting from heavy eastbound MD 175 to southbound US 1, southbound US 1 to westbound MD 175, and through volumes
- Reduction in the eastbound roadway capacity resulting from MD 175 dropping to one lane in each direction east of Pocomoke Avenue,

To address these issues, the study team developed preliminary improvement concepts for the study area based on existing, forecasted 2015, and forecasted 2035 traffic volumes and projected operations. At this stage, the study team did not perform detailed engineering and aerial photography was used as the basis for developing the improvements. Each of the improvements is presented as a stand-alone option, but combining improvements for each intersection would provide greater benefit. The study team identified improvements to address documented safety and capacity issues, but will also need to consider compatibility with potential developer improvements in the next phase of the study. A traffic analysis of the build conditions has not yet been conducted and the improvement concepts will be refined and evaluated further in the next phase of the study.

The study team developed both at-grade and grade-separated alternatives. Preliminary improvement concepts for the study area are shown in **Figure 22** at the end of this section. To improve pedestrian and bicycle access along/across MD 175, bicycle-compatible lanes and pedestrian access improvements will be incorporated with any designed roadway improvements. The issues identified in the traffic analyses and descriptions of the preliminary improvement concepts, as well as potential environmental impacts, are presented below.

4.1 MD 175 at Snowden River Parkway

HCM analyses of the features of the MD 175 / Snowden River Parkway interchange show that the westbound MD 175 diverge toward Snowden River Parkway currently operates at LOS E in the PM peak hour, and is expected to continue to operate at LOS E in the PM peak hour through 2035. The analyses further show that the weave on westbound MD 175 between Columbia Gateway Drive and Snowden River Parkway is expected to degrade to LOS E in the PM peak hour by 2035. All other movements analyzed are expected to operate at LOS D or better through 2035. These analyses assess isolated interchange features.

The simulation models of the study area network show that under Existing and Future No Build conditions, the intersection of MD 175 and MD 108 meters the westbound MD 175 traffic, forcing the westbound traffic to approach the MD 175 / Snowden River Parkway interchange at a reduced rate. Under this condition, the MD 175 / Snowden River Parkway interchange is able to operate at an acceptable level of service. Further, the MD 175 / Snowden River Parkway interchange has not experienced a higher than average crash history. Therefore, under these conditions, no improvements are recommended. However, if at some point in the future the metering of westbound MD 175 traffic at the MD 175 / MD 108 intersection is eliminated, improvements may be recommended for westbound MD 175 in the vicinity of Snowden River Parkway.

4.2 MD 175 at Columbia Gateway Drive

HCM analyses of the features of the MD 175 / Columbia Gateway Drive interchange show that the westbound MD 175 diverge toward Columbia Gateway Drive is expected to degrade to LOS E in the AM peak hour by 2015, and remain at LOS E through 2035. Also, the westbound MD 175 merge with traffic from Columbia Gateway Drive is expected to degrade to LOS E in the PM peak hour by 2015, and remain at LOS E through 2035. Finally, the eastbound MD 175 merge with traffic from Columbia Gateway Drive is expected to degrade to LOS E in the PM peak hour by 2035. All other movements analyzed are expected to operate at LOS D or better through 2035. These analyses assess isolated interchange features.

As discussed for the MD 175 / Snowden River Parkway interchange, the simulation models show that conditions at the MD 175 / MD 108 interchange effectively meter the westbound MD 175 traffic, therefore eliminating the need for operational improvements at the MD 175 / Columbia Gateway interchange as long as that metering effect is in place. However, the metering effect only applies to operations on westbound MD 175.

The simulation of 2035 conditions show that backups are expected to exist in the PM peak hour where the ramp from Columbia Gateway Drive merges onto eastbound MD 175. A potential improvement would be to add a second lane to the ramp from northbound Columbia Gateway Drive to eastbound MD 175. This improvement is shown as Concept 1A in **Figure 22**.

The 2035 PM peak hour simulation also shows that conflicts are expected to exist on eastbound MD 175 resulting from traffic entering from the Columbia Gateway Drive ramp and weaving across eastbound MD 175 to turn left onto northbound MD 108. To address this issue, traffic heading from Columbia Gateway Drive to northbound MD 108 could be directed to use a new ramp located between the eastbound and westbound MD 175 roadway that ties into the existing left-turn lane from eastbound MD 175 to northbound MD 108 (see Concept 1B in **Figure 22**).

4.3 MD 175 at MD 108

The intersection of MD 175 and MD 108 has the highest number of crashes in the study area and was identified as a Candidate Safety Improvement Intersection (CSII) in 2008 based on the number and severity of crashes. Over a three-year period, 54 accidents occurred, including one fatal crash and 19 injury crashes.

Critical lane analysis shows that the intersection of MD 175 and MD 108 currently operates at LOS E during the AM peak hour, and is expected to degrade to LOS F during the AM peak hour by 2015. By 2035 the intersection of MD 175 and MD 108 is expected to operate at LOS F during the AM peak hour (with a v/c ratio of 1.32) and LOS E during the PM peak hour.

During the AM peak hour the primary conflict is between the westbound MD 175 through movement, the southbound MD 108 left turn movement, and the eastbound MD 175 left turn movement, each of which require their own signal phase. As a result of heavy left turn volumes from southbound MD 108 to eastbound MD 175, westbound MD 175 through traffic queues and experiences delays. During the PM peak hour the conflict between the heavy eastbound MD 175 through movement and the southbound MD 108 left turn movement is compounded by queues extending back from the MD 175 / I-95 interchange. Congestion resulting from the northbound I-95 ramp results in queues that extend westward along eastbound MD 175 beyond the intersection of MD 175 and MD 108, and continue to the Columbia Gateway Drive ramps.

Two grade-separated options are proposed to address the conflicts created by the heavy left turn volumes from southbound MD 108 to eastbound MD 175. The first option is a grade-separation of the westbound MD 175 through traffic (see Concept 2A in **Figure 22**). Removal of this movement from the traffic signal would eliminate delays for the westbound MD 175 through traffic movement, as well as reduce the overall demand on the signal's timing, particularly in the AM peak hour when the westbound MD 175 through movement is the primary through movement.

The second improvement option is a grade-separation of the triple left turn from southbound MD 108 (see Concept 2B in **Figure 22**). Removal of this movement from the traffic signal would eliminate conflicts with both eastbound and westbound MD 175. The only remaining conflict for westbound MD 175 through traffic would be the eastbound MD 175 left turn movement, which experiences a relatively minor traffic volume.

The feasibility of these options based on distance requirements for grade-separation was briefly examined, assuming a 16.5-foot vertical clearance under all structures, and was found to be worthy of further study. Due to the complexity of grade-separating this intersection and the significant cost of construction, these potential alternatives are both considered to be long-range options.

At southbound MD 108, near the intersection with MD 175, the improvement options may impact the 100-year floodplain. Additionally, improvement options at this intersection must take weaving concerns into consideration. While the study team is aware of potential weaving concerns, further study (concept design and Corsim/Vissim modeling) is required to evaluate the improvement options.

4.4 MD 175 at I-95

The operational issues expected to occur at MD 175 at I-95, based upon both the HCM analyses and the simulation model results, are as follows:

- The exit ramps from southbound I-95 to eastbound MD 175 and from northbound I-95 to westbound MD 175 queue at the existing traffic signals along MD 175
- Eastbound MD 175 queues in the PM peak period due to vehicles attempting to access northbound I-95; northbound I-95 is congested and entering traffic is unable to flow freely
- Conflicts arise on eastbound MD 175 between I-95 and US 1 due to the short weaving section.

As noted previously, improvements to MD 175 at MD 108 would increase traffic flow along MD westbound MD 175, ultimately improving conditions on the exit ramps from southbound I-95 to westbound MD 175.

Due to the potential cost of construction, the at-grade alternatives are considered to be short/mid-range options and the grade-separated alternatives are considered to be long-range options.

The following are at-grade improvement options:

- To address the eastbound MD 175 to northbound I-95 queuing, add queue storage to accommodate the eastbound MD 175 to northbound I-95 traffic by widening the ramp to two lanes and lengthening the merge area (see Concept 3D in **Figure 22**). In the next phase of study, bridge pier locations and other existing geometric conditions must be examined to determine the feasibility of widening the ramp.
- To avoid conflicts on eastbound MD 175 between I-95 and US 1 due to the short weaving section, realign the northbound I-95 to eastbound MD 175 exit ramp to the existing signal in order to extend the weaving distance along eastbound MD 175 between I-95 and US 1 (see Concept 3E in **Figure 22**).

Preliminary geometric investigations found the following grade-separated improvement options to be feasible and worthy of additional study:

- To address the ramp queues at the existing traffic signals, remove the traffic signals and grade-separate the exit ramps (flyover or underpass) from southbound I-95 to eastbound MD 175 and from northbound I-95 to westbound MD 175; tie the new alignment in with the existing roadway before crossing I-95 to avoid impacts to the existing structure over I-95 (see Concept 3A in **Figure 22**)
- To address the ramp queues at the existing traffic signals, remove the traffic signals and realign MD 175 between the existing dualized eastbound and westbound lanes. Convert the existing MD 175 eastbound and westbound roadway to flyover ramps from southbound I-95 to eastbound MD 175 and from northbound I-95 to westbound MD 175 (see Concept 3B in **Figure 22**)
- To address the ramp queues at the existing signals and the eastbound MD 175 queues approaching the ramp to northbound I-95 due to vehicles unable to enter northbound I-95, realign MD 175 between the existing dualized eastbound and westbound lanes. Realign existing southbound I-95 to eastbound MD 175 and northbound I-95 to westbound MD 175 ramps to use the existing dualized eastbound and westbound lanes. Provide a connection with Columbia Gateway via John McAdams Drive and Benjamin Franklin Drive (see Concept 3C in **Figure 22**).

There would likely be stream, 100-year floodplain, and forest impacts associated with the improvement option that provides a connection between the interchange and Columbia Gateway via John Mcadams Drive and Benjamin Franklin Drive. Additionally, improvement options at this interchange must take weaving concerns into consideration. While the study team is aware of potential weaving concerns, further study (concept design and Corsim/Vissim modeling) is required to evaluate the improvement options.

4.5 MD 175 at US 1

Both the HCM and CLA results show that the intersection of MD 175 at US 1 operates at LOS F during the AM peak hour under Existing conditions, and at LOS D or E during the PM peak hour under Existing conditions. By 2015, the intersection of MD 175 and US 1 is expected to operate at LOS F during both the AM and PM peak hours, with conditions degrading further in 2035. With heavy through volumes as well as heavy turning volumes for most of the approaches, congestion and delay are present in all directions.

Due to the potential cost of construction, the at-grade alternatives are considered to be short/mid-range options, and the grade-separated alternative is considered to be a long-range option.

The following are at-grade improvement options:

- Extend Crestmount Road to intersect MD 175 between I-95 and US 1; the intersection would be a “Florida-T” intersection on MD 175 and westbound MD 175 would not be

signalized (see Concept 4B in **Figure 22**); the majority of the turning movements at the MD 175 / US 1 intersection would be relocated to Crestmount Road
- Add a second right turn lane, controlled by the traffic signal, for the eastbound MD 175 to southbound US 1 movement (see Concept 4C in **Figure 22**)
- Add a second right turn lane, controlled by the traffic signal, for the southbound US 1 to westbound MD 175 movement (see Concept 4D in **Figure 22**).

The grade-separated improvement option at this intersection would include converting the MD 175 / US 1 intersection to a Single Point Urban Interchange (SPUI). MD 175 through traffic would be grade separated to travel over US 1 and the intersection's turning movements (see Concept 4A in **Figure 22**). Based on a brief examination of existing grades, MD 175 was found to be a better candidate to cross over US 1 than vice versa, but all options will need to be closely examined during the next phase of the study. Care should be taken in coordinating the MD 175 / I-95 interchange ramps and the MD 175 / US 1 SPUI ramps in order to avoid potential weaving issues. Further study (concept design and Corsim/Vissim modeling) is required to evaluate the improvement options.

There are likely stream, 100-year floodplain, and forest impacts associated with the improvement option that provides an extension of Crestmount Road.

Through the course of this study, one potential alternative that was examined and dropped from consideration created a "Michigan U-turn" west of the MD 175 / US 1 intersection that was intended to redirect the westbound MD 175 left turn traffic destined for southbound US 1 traffic through the MD 175 / US 1 intersection before making a U-turn onto eastbound MD 175 and then a right turn onto southbound US 1 to continue on their original travel path.

The study team removed the "Michigan U-turn" option from consideration due to its proximity to the MD 175 / US 1 intersection and the condition that it be unsignalized. The eastbound MD 175 approach carries significant volume and the drivers making U-turns would need to not only merge with that traffic, but weave across several lanes in a very short, distance to turn right onto southbound US 1. During peak periods, eastbound MD 175 queues (including those turning right onto southbound US 1) would likely restrict this movement. Even if the U-turn were signalized, the eastbound MD 175 queues could still interfere with movement.

4.6 MD 175 at Pocomoke Avenue

The intersection of MD 175 and Pocomoke Avenue is expected to operate at LOS D or better through 2015. However, by 2035 this intersection is expected to operate at LOS D/E in the AM peak hour and LOS F in the PM peak hour. While turning movements in and out of the Howard County Detention Center are expected to be minor, turning movement volumes in and out of the Maryland Wholesale Food Center are expected to be relatively significant, and the through volumes along both eastbound and westbound MD 175 are expected to be heavy.

Two relatively minor at-grade improvement options could benefit this intersection. First, provision of separate right-turn/through and left-turn lanes on southbound Pocomoke Avenue to reduce the traffic signal phase time needed (see Concept 5A in **Figure 22**). Concurrently, there exists the potential to construct a connection between Pocomoke Avenue and Montevideo Road that runs parallel to US 1. This future connection could serve to redirect some traffic off of US 1.

The second at-grade improvement option, shown as Concept 5B on **Figure 22**, would be to redirect traffic entering/exiting the Maryland Wholesale Food Center to the signalized intersection of MD 175 and Oceano Avenue. This diversion could help alleviate delay and congestion at the intersections of MD 175 at Pocomoke Avenue and US 1 at Assateague Drive / Crestmount Road. In the next phase of study, redirection strategies such as conversion of the MD 175 / Pocomoke Avenue intersection to right-in/right-out operation can be examined.

4.7 MD 175 East of US 1

East of US 1, eastbound MD 175 narrows from three lanes in each direction to two lanes in each direction. Then, east of Pocomoke Avenue, eastbound MD 175 further narrows to provide only one travel lane in each direction. This reduction in lanes results in queues that may extend beyond US 1. The improvement proposed to alleviate this issue involves widening MD 175 to four lanes east of Pocomoke Avenue (two lanes in each direction). Dorsey Run Road could be considered a logical terminus, as the next signalized intersection past Oceano Avenue, but it is recommended that improvements further east be considered in future studies. This widening is shown as Concept 6A on **Figure 22.**

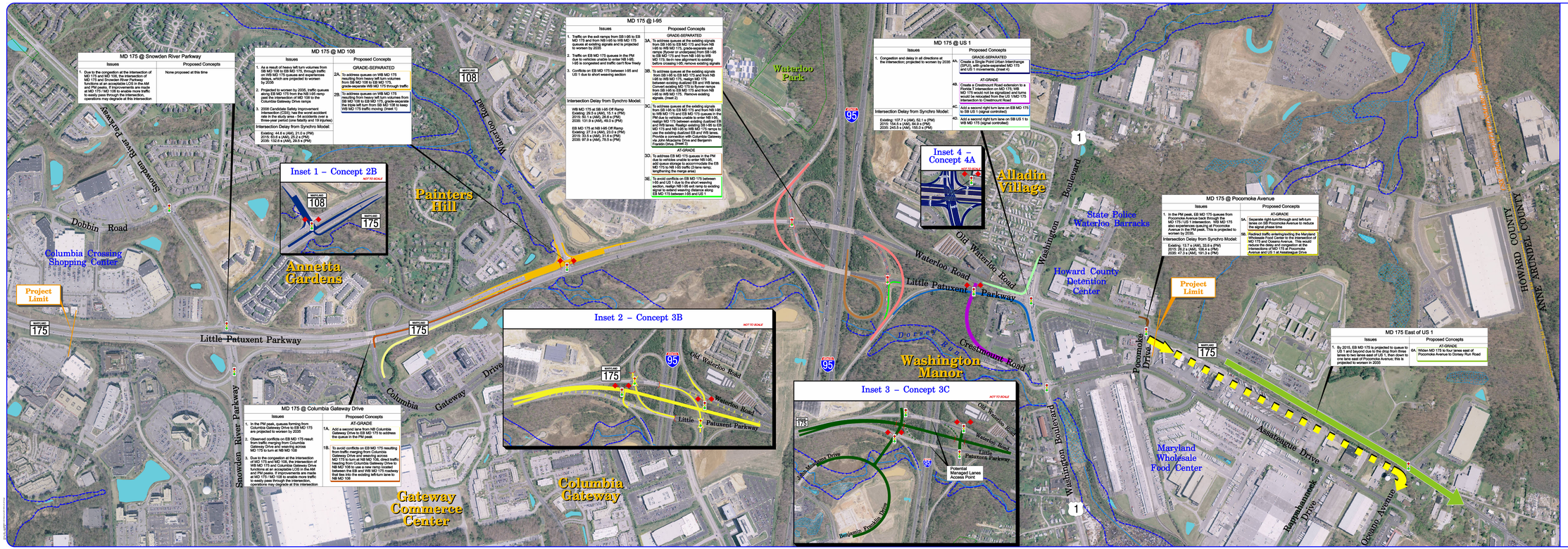
4.8 Columbia Gateway / I-95 Interchange

As a result of the congestion generated by traffic destined for Columbia Gateway at the MD 175 / MD 108 intersection and the MD 175 / Columbia Gateway Drive interchange, the study team considered a potential improvement option to add a new I-95 interchange between MD 32 and MD 175. The new interchange would connect with Columbia Gateway Drive and Mission Road and redirect Columbia Gateway traffic away from MD 175.

After examination, the proximity of the proposed interchange to the existing I-95 interchanges at MD 175 and MD 32 resulted in this improvement option being dropped from consideration. From an Interstate Access Point Approval (IAPA) standpoint, interchanges must be located a minimum of one mile apart (measured gore-to-gore). The proposed interchange would be less than one-half mile from the MD 175 interchange and only 0.9 miles from the MD 32 interchange.

4.9 MD 175 Bus Rapid Transit Alignment

Implementing a Bus Rapid Transit (BRT) line through the MD 175 corridor is potential long-range, multimodal strategy that could serve to increase transit ridership and reduce the number of vehicles on the road throughout the study area. A BRT facility was initially proposed and preliminarily discussed in the previous traffic studies performed by SHA and Howard County



SHA State Highway Administration
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MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

US 1/ MD 175 Improvement Study
Phase I
Howard County, MD

Preliminary Concepts

Figure 22

March 2010

DRAFT: WORK IN PROGRESS

(the March 2007 *Columbia Gateway Corporate Park Short and Long-Term Traffic Assessment* and the November 2007 *MD 175 Gateway Park Access and Corridor Study*) as one possible transit mode option for high-capacity east-west service and connection to the MARC line.

With the incorporation of a compatible cross section, a potential BRT line could be aligned as follows:

- From The Mall in Columbia station, travel east on MD 175 to a station at Columbia Gateway
- Continue east to the Maryland Wholesale Food Center station at the intersection of MD 175 and US 1
- Travel south on US 1 and then east on MD 32 to the Savage MARC Station
- Continue east on MD 32 to a Fort Meade Station
- Travel east/north on MD 32 to eastbound MD 175, with the final stop located at the Odenton MARC Station.

5.0 SUMMARY AND CONCLUSIONS

The SHA has completed the first phase of a comprehensive study to analyze the existing and future traffic operations along MD 175, from Snowden River Parkway to Pocomoke Avenue, and US 1 from MD 175 to Assateague Drive / Crestmount Road. This study area is located immediately adjacent to Columbia Gateway Park, a significant office employment area, the Maryland Food Center, an industrial land use that draws significant numbers of trucks to the area, and the US 1 Corridor, which is lined with commercial properties. Additionally, the Fort George G. Meade military installation and a number of developing business parks are located to the east of the study area. The MD 175 and US 1 corridors are important segments of a larger roadway network that carries traffic between residences and businesses throughout the Baltimore Washington Metropolitan Region.

Observation and analysis of Existing traffic operations throughout the study area reveals that the intersections and interchanges within the study area operate at a generally acceptable level of service throughout the day. However, the large numbers of vehicles processed through this region on a daily basis, combined with the relative density of the surrounding roadway network, result in queues at certain locations that may extend back toward adjacent intersections and create conflicts.

Specifically, during the AM peak hour, the density of traffic traveling westbound on MD 175 toward Columbia Gateway creates a lane volume distribution imbalance resulting in delays at the MD 175 / MD 108 intersection. Similarly, during the PM peak hour, traffic traveling eastbound on MD 175 intending to use the loop ramp at the I-95 interchange to access northbound I-95 queues due to congestion on northbound I-95 that constrains traffic flow on this ramp. The queues from this movement extend toward the west, again, creating conflict at the MD 175 / MD 108 intersection. Also in the PM peak hour the high density of traffic entering eastbound MD 175 from Snowden River Parkway and Columbia Gateway Drive, intending to merge left to

turn onto MD 108, experience conflicts with through traffic on eastbound MD 175 which is moving much faster than the merging traffic. The MD 175 / US 1 intersection experiences congestion during both the AM and PM peak hours due to the significant numbers of vehicles passing through this portion of the network such that all but a few of the twelve possible movements at the intersection experience significant volumes during each peak hour, including a higher than average truck volume due to the nearby Maryland Food Center.

Close examination of the analyses show that the study area experiences only a few notable points of congestion. However, due to the nature of the roadways and land uses within and adjacent to the study area the effects from these congested locations are not isolated. Queues from the congested locations extend through the study area to create conflicts and congestion even under Existing conditions. The analyses and simulations show that these conflicts are expected to increase in scale, with additional points of conflict developing over time, as regional and local development occurs, and as traffic volumes increase in accordance. Delays anticipated for each intersection within the study area are summarized in **Table 14** to demonstrate how those delays are expected to change over time.

Table 14. Intersection Delays Over Time: AM(PM)

Intersection	Delay (sec/veh)			
	Existing	2015 No Build	2035 No Build Programmed Conditions	2035 No Build Without Covenants
MD 175 at MD 108	48.7 (21.8)	66.2 (26.1)	117.7 (30.3)	323.6 (116.7)
MD 175 WB at Ramp 5 from I-95 SB	33.6 (22.6)	30.2 (34.3)	85.3 (55.9)	239.1 (96.7)
MD 175 EB at Ramp 1 from I-95 NB	37.2 (31.3)	39.9 (40.3)	103.7 (87.2)	220.6 (192.1)
MD 175 at US 1	118.2 (73.4)	159.0 (88.3)	256.9 (163.8)	316.1 (211.0)
MD 175 at Pocomoke Avenue	17.1 (32.5)	26.1 (110.3)	47.0 (197.5)	52.3 (237.1)
US 1 at Assateague Drive/Crestmount Road	13.7 (21.5)	16.4 (24.5)	45.4 (51.1)	56.7 (51.6)

To address the issues described above, the study team developed potential improvements to improve traffic operations within the study area, including both at-grade and grade-separated alternatives. While each of the improvements is presented as a stand-alone option, combining improvements for each intersection could provide greater benefit. Some improvement options that address the aforementioned issues are:

- Add a second lane to the northbound Columbia Gateway Drive ramp to eastbound MD 175

- Construct a new ramp between the eastbound and westbound MD 175 roadway that ties into the existing left-turn lane from eastbound MD 175 to northbound MD 108 to carry traffic from Columbia Gateway Drive to northbound MD 108
- Grade-separate westbound MD 175 through traffic at the MD 175 / MD 108 intersection
- Grade-separate the triple left turn from southbound MD 108 to eastbound MD 175
- Add queue storage to accommodate eastbound MD 175 to northbound I-95 traffic by widening the ramp to two lanes and lengthening the merge area
- Realign the northbound I-95 to eastbound MD 175 exit ramp to the existing signal to extend the weaving distance along eastbound MD 175 between I-95 and US 1
- Remove the traffic signals and grade-separate the exit ramps (flyover or underpass) from southbound I-95 to eastbound MD 175 and from northbound I-95 to westbound MD 175
- At the I-95 interchange, realign MD 175 into the space between the existing eastbound and westbound lanes and convert the existing MD 175 eastbound and westbound roadway to flyover ramps from southbound I-95 to eastbound MD 175 and from northbound I-95 to westbound MD 175
- At the I-95 interchange, realign MD 175 into the space between the existing eastbound and westbound lanes and realign the existing southbound I-95 to eastbound MD 175 ramp and the existing northbound I-95 to westbound MD 175 ramp to use the existing MD 175 eastbound and westbound lanes; provide a connection with Columbia Gateway via John Mcadams Drive and Benjamin Franklin Drive
- Extend Crestmount Road to intersect MD 175 between I-95 and US 1. The intersection would be a "Florida-T" intersection on MD 175 and westbound MD 175 would not be signalized. The majority of the turning movements at the MD 175 / US 1 intersection would be relocated to Crestmount Road.
- Add a second right turn lane, controlled by the traffic signal, for the eastbound MD 175 to southbound US 1 movement
- Add a second right turn lane, controlled by the traffic signal, for the southbound US 1 to westbound MD 175 movement
- Convert the MD 175 / US 1 intersection to a Single Point Urban Interchange (SPUI). MD 175 through traffic would be grade separated to travel over US 1 and the intersection's turning movements.
- Separate right-turn/through and left-turn lanes on southbound Pocomoke Avenue to MD 175 in order to reduce the traffic signal phase time needed
- Redirect traffic entering/exiting the Maryland Wholesale Food Center to the intersection of MD 175 and Oceano Avenue to alleviate delay and congestion at the intersections of MD 175 at Pocomoke Avenue and US 1 at Assateague Drive / Crestmount Road
- Widen MD 175 to four lanes east of Pocomoke Avenue
- Implement a Bus Rapid Transit (BRT) line through the MD 175 corridor.

6.0 NEXT STEPS

In Phase II of this study, SHA and its partners will further examine the feasibility and effectiveness of the improvement options that have been presented. Issues discussed by the study team regarding moving forward with Phase II include:

- Include the intersection of Columbia Gateway Drive and Eli Whitney Drive (in Columbia Gateway) in the study
- Perform traffic analysis on all proposed improvements in order to weigh benefits versus cost
- Exclude geometric analysis of Concept 4A (MD 175 at US 1 SPUI)
- Examine the internal Maryland Wholesale Food Center network and traffic movements resulting from the location of the fuel pumps near the intersection of Pocomoke Avenue and Assateague Drive
- Examine possible direct access to Dorsey Run Road from the Maryland Wholesale Food Center
- Examine secondary traffic impacts at MD 175/Snowden River Parkway if the MD 175/MD 108 intersection is improved
- Evaluate whether a second access point to Columbia Gateway is merited after other proposed improvements are implemented
- Develop measures of effectiveness for a combination of improvements
- Develop a forecast scenario where Columbia Gateway developer covenants will be removed and test the sensitivity of 2035 volumes on the build condition under the "without covenants" scenario.