

Section E
Major Spot Concepts

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E. Major Spot Concepts

PURPOSE

Two locations along the US 1 corridor were identified for major spot improvements. The purpose of this analysis is to provide a basis from which SHA and Howard County can begin planning in these locations. The two locations were identified based on operational and safety analysis, community and stakeholder input, and the potential to improve the locations through modified roadway geometry. These locations are:

- The US 1/MD 175 intersection
- US 1 in the vicinity of the MD 32 (Guilford Road to Corridor Road)

KEY FINDINGS

Multiple options were evaluated for the two identified spot-improvement locations at a conceptual level. Traffic operations, multimodal safety, and right-of-way impacts were the primary performance measures considered. Input from the community and stakeholder group was also considered.

US 1/MD 175 Intersection

Howard County and SHA should consider grade-separation alternatives including the following options prepared for this study:

- Eastbound left-turn flyover ramp;
- Northbound left-turn flyover ramp;
- Single-Point Diamond Interchange (SPDI); and
- Tight Diamond Interchange (similar impact area and operational characteristics as a SPDI).

SHA and Howard County should consider the following challenges and opportunities while evaluating the potential improvements:

- High demand for the northbound and eastbound left-turn movements and the possibility of creating alternative routes to serve these movements;
- Proximity of the I-95 on and off ramps to the US 1/MD 175 intersection and the weaving conflicts and driver navigation challenges that grade separation at US 1/MD 175 creates;
- Driver expectations on US 1 and MD 175 and the overriding design principle of creating a “self-enforcing” roadway that is consistent with the desired function of the facility and character of the area;



- Access impacts to the adjacent developments, the corresponding impacts to driver navigation, and potential need for additional signing or wayfinding guidance; and
- Impact that modifications to the roadway geometry and traffic operations at the US 1/MD 175 intersection could have on the safety and operations of I-95/MD 175 interchange.
- Plans for grade separated connections will need to consider the transition from a freeway to an urban arterial with busy intersecting streets and the presence of bicyclists and pedestrians.

These challenges and potential issues should be carefully considered in future studies that can invest the time and resources necessary to evaluate potential solutions for the US 1/MD 175 intersection in more detail. All alternatives must consider and accommodate non-auto modes. The US 1/MD 175 intersection is a critical node in the transportation network surrounding US 1 and serving I-95. The high traffic demand and changing function of US 1 creates a complex situation that warrants thoughtful evaluation.

US 1/MD 32 Interchange Area

Howard County and SHA should consider the following recommendations for the MD 32/US 1 interchange area:

1 - GUILFORD ROAD/US 1 INTERSECTION

- Realign the intersection to be approximately 90-degrees;
- Eliminate the driveway accesses between the intersection and the MD 32 on and off ramps; and
- Consolidate the driveway accesses on the north side of the intersection.



2 - MD 32/US 1 INTERCHANGE

- Modify loop ramp radii to create a slower speed environment;
- Increase distance between the on and off loop ramps;
- Add a lane on US 1 that continues onto the loop ramps that serve the US 1 southbound to MD 32 westbound movement and the US 1 northbound to MD 32 eastbound movement; and
- Modify the MD 32 westbound off ramp to decrease the exiting speeds and increase distance between the ramp and the Guilford Road/US 1 intersection.

3 - CORRIDOR ROAD/HOWARD STREET/US 1 INTERSECTION

- Consolidate the intersection to one conventional intersection.

Collectively these changes are designed to improve safety by increasing drivers' decision-making time, reducing the number of conflicts, and creating geometric characteristics more appropriate for an urban arterial roadway. Ideally, the MD 32/US 1 interchange would take a form more consistent with service interchanges found in urban areas such as a diamond, split diamond, single-point diamond, tight diamond, or partial cloverleaf interchange. SHA and Howard County may also wish to evaluate these forms in further detail. All alternatives for this location must consider and accommodate non-auto modes.

METHODOLOGY

Each location was evaluated using a basic traffic operations analysis, a detailed review of the issues and challenges, and a review of potential outcomes for various options. A summary review to qualify safety enhancements, traffic operations, right-of-way needs and driver expectancy was prepared for each option and location.

ANALYSIS

US 1/MD 175 Intersection

ISSUES

The high delay and excessive queuing that occurs during the commuter peak periods have made improving the US 1/MD 175 intersection a top priority for Howard County and SHA.

The intersection serves the high volume of truck traffic that travels between the I-95 ramps located 1,500 feet west of the intersection, and the industrial uses along US 1. This intersection also serves a high volume of commuter traffic. The northbound and eastbound left-turn movements are the critical movements (i.e. the highest demand) at the intersection.

CHALLENGES

There are a number of challenges that must be addressed to develop an effective solution and improve traffic operations at the US 1/MD 175 intersection:

- Signal timing modifications alone will not address the deficiencies; additional capacity improvements are needed;
- The close proximity of the I-95/MD 175 interchange limits the extent of improvements that can occur on MD 175 west of US 1;
- All four quadrants of the intersection are fully developed;
- Driveways are located on all intersection approaches; and
- The right-of-way and construction required to address the operational deficiencies will likely carry a high cost.



A frequent issue at the MD 175 intersection is truck stacking to turn left from northbound US 1 to go westbound on MD 175 to I-95. This is a key link for the many warehouse facilities located in the southeastern industrial quadrant.

Each challenge is explained in greater detail below.

SIGNAL TIMING AND PHASING

The northbound and eastbound left-turn movements conflict in signal phasing schemes—they compete for time within each cycle. The demand for both movements cannot be met by simply changing the signal splits or phasing. Geometric changes are needed to allow these movements to operate concurrently or additional capacity must be provided (i.e. additional lanes or grade separation) so that the demand can be served in less time.

PROXIMITY TO I-95

The US 1/MD 175 intersection is 850 feet east of the I-95 northbound off ramp and 1,500 feet east of the I-95 northbound on ramp. Any modifications to the geometry of the US 1/MD 175 intersection should consider and address how additional lanes and/or structures will affect access to the ramps that serve I-95. Particular consideration should be given to driver expectations, the distance and time that motorists need to make decisions and react, and to weaving conflicts that occur on MD 175 as drivers navigate between US 1 and I-95.

EXISTING DEVELOPMENT

There is currently development in all four quadrants of the intersection. An interim measure to allow a restricted left from the Maryland Food Center at Oceana Drive on to Westbound MD 175 was introduced during this study and approved by SHA's Office of Traffic Safety in August 2007. The operations improvement requires the installation of a fully operational traffic signal and is pending funding approval. Once installed, the MD 175/US 1 intersection can be monitored for reductions in the number of left-turning trucks from US 1 northbound.

Depending on the geometric improvements selected in the future, some of the developments in the vicinity of the MD 175 intersection will be physically impacted and others will undergo access changes. The selected alternative should balance traffic operations needs and property impacts. Some alternatives considered thus far impact only one or two quadrants. SHA and Howard County may benefit from considering which, if any, quadrants are likely to redevelop and how the abutting properties contribute to the character of US 1 in this area.

ACCESS

Access to the parcels and developments north, south, and east of the US 1/MD 175 intersection are likely to be impacted by any form of geometric improvement. There are currently numerous curb cuts within the vicinity of the intersection on the north, south, and east approaches. The frequent and relatively uncontrolled access introduces conflicts and friction on US 1, further impairs traffic operations near the intersection, and increases the potential for crashes. Any geometric changes to the intersection will require the existing accesses to be consolidated and may eliminate access or specific movements at existing accesses near the intersection.

RIGHT-OF-WAY AND CONSTRUCTION COSTS

To construct any geometric improvement, right-of-way will need to be acquired from some of the developments surrounding the intersection. The cost of the acquisition and construction will depend on the selected improvement.

IMPROVEMENT CONCEPTS

To effectively improve traffic operations at the US 1/MD 175 intersection, the improvement concepts need to address the high-volume northbound and eastbound left-turn movements.

As part of this study 17 preliminary concepts were initially developed and evaluated for the US 1/MD 175 intersection. Each option was evaluated in terms of safety (including ability to meet driver expectations), traffic operations, right-of-way impact, and impact on the existing and desired character of US 1. The concepts range from a no-build scenario to grade-separated options. The traffic volumes projected for the year 2030 were used to

evaluate the traffic operations for each concept. The 2030 traffic volumes were provided by SHA and account for regional growth in the area.

Attachment E-1 provides a summary of the safety, traffic operations, and right-of-way impacts along with the general assessment for all 17 concepts evaluated for the US 1/MD 175 intersection.

From the 17 options considered, three were chosen for further analysis based on the operations, safety, and right-of-way considerations. Single-line sketches were developed for the three chosen concepts to highlight and uncover specific design considerations and concerns. The single-line sketches illustrate the modifications to the geometry and the approximate right-of-way impact. The three options are:

- Eastbound left-turn flyover ramp
- Northbound left-turn flyover ramp
- Single-Point Diamond Interchange (also representative of the relative right-of-way impact a Tight Diamond Interchange could have)

Table 11 provides a summary of the safety, operations, right-of-way, and driver-expectancy considerations of these alternatives.

Table 11 MD 175 Improvement Alternatives Summary

	Safety Perspective	Future Traffic Operations (HCM)	ROW Impact	Driver Expectancy
Northbound Left Turn Flyover Ramp	Removes a critical movement from the intersection. Creates weaving maneuver for traffic destined to the on ramp	v/c = 1.0 LOS = D (assumes six lanes on US 1)	Impacts to Southeast, Southwest, and Northwest quadrants	This would be the first flyover ramp located on US 1. Signing for downstream movements would be needed in advance of the intersection.
Eastbound Left Turn Flyover Ramp	Removes a critical movement from the intersection. Creates a weaving maneuver for traffic traveling from the I-95 northbound off-ramp.	v/c = 0.90 LOS = D (assumes six lanes on US 1)	Impacts to Northeast, Southwest, and Northwest quadrants	Reasonably consistent with driver expectancy because drivers have just traveled through an interchange. Signing for downstream movements would be needed in advance of the intersection.
Single Point Urban Interchange (MD 175 over US 1 changes grade)	Eliminates MD 175 through traffic conflicts. Creates weaving interaction on MD 175 west of US 1.	v/c = 0.96 LOS = D (assumes six lanes on US 1)	Impacts to access onto MD 175 east of the intersection. ROW impacts to all quadrants.	

All three options improve traffic operations by providing additional capacity for the eastbound left-turn and/or northbound left-turn movements. While all three have elements of grade separation, they have less impact than the larger interchange concepts, with limited impact to existing development and driveway access. The design of any change must consider driver expectations, avoid creating weaving conflicts on US 1 and on MD 175, and accommodate pedestrian and bicycle travel through the intersection.

The single-line sketches and approximate impact areas for these alternatives are shown in Figures 13 to 16.

Figure 13 MD 175 High Volume Movements

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Figure 14 MD 175 Improvement Concept (Eastbound Left Turn Flyover)

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Figure 15 MD 175 Improvement Concept (Northbound Left Turn Flyover)

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Figure 16 MD 175 Improvement Concept (Single Point Diamond Interchange)

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US 1/MD 32 Interchange Area

The US 1/MD 32 interchange area includes the portion of US 1 that extends from the north side of the US 1/Guilford Road intersection south through the US 1/Howard Street/Corridor Road intersection.

ISSUES

The US 1/MD 32 interchange area warrants a more detailed review due to the safety and traffic operations history at the US 1/Guilford and US 1/Howard Street/Corridor Road intersections, and because of the close proximity of the US 1/MD 32 interchange.

SHA identified the US 1/Guilford Road and the US 1/Howard Street/Corridor Road intersections as Primary or Secondary Candidate Safety Improvement Intersections from 2001 to 2004. These intersections were also identified in this study as having higher-than-expected crash rates compared to the other signalized intersections along the US 1 corridor prior to safety improvements made to the intersection during an SHA roadway resurfacing in Spring 2007. The US 1/Howard Street/Corridor Street intersection was also identified as having a higher-than-expected proportion of rear-end crashes compared to similar intersections on the US 1 corridor. A complete description of the safety analysis is included in Attachment E-2.

Motorists at the US 1/Guilford intersection experience high delays during the morning and evening peak hours. These delays are expected to worsen as traffic volumes on US 1 grow in the future. Currently, the US 1/Guilford Road intersection operates at Level-of-Service (LOS) E with a volume-to-capacity ratio (v/c ratio) of 1.00 during the p.m. peak hour. If no changes are made to the intersection, it is expected to operate at LOS F with a v/c ratio of 1.75 in the year 2030.

Similarly, the US 1/Howard Street/Corridor Road intersection also has high delay in the morning and evening peak hours. Currently, the intersection operates at LOS D with a v/c ratio of 0.69. If no changes are made to the intersection, it is expected to operate at LOS F with a v/c ratio of 1.06 in the year 2030.

CHALLENGES

There are several geometric characteristics unique to the US 1/Guilford Road intersection and to the US 1/Howard Street/Corridor Road intersection that contribute to their safety and traffic operational difficulties.

The skew and geometry of the US 1/Guilford Road intersection requires that the intersection operate with split signal phasing for the east- and westbound approaches. The split-phase operation, percentage of heavy vehicles, volume of traffic, and the close proximity of the MD 32 westbound off ramp all contribute to the safety and traffic operations issues. Realignment Guilford Road to reduce the skew of the intersection will require right-of-way acquisition and will impact access to the current businesses located in the intersection quadrants.

The US 1/Howard Street/Corridor Road intersection shown on the next page has an unconventional geometric configuration. The intersection is controlled as one intersection but is physically split because of the approximately 150-foot-wide median. The

configuration results in inefficient operations and vehicles stacking in the intersection between phases.



The location and skew of Guilford Road crossing US 1 is recommended for a more detailed planning study to reorient the intersection for improved site distance, lower turning speeds, and improved non-motorized safety.

The MD 32/US 1 interchange introduces issues related to driver expectations, navigation and decision-making, and the desired function of US 1. The ramp loops create a weaving section on US 1 as it passes underneath MD 32. The interchange ramps are designed for a free-flow, controlled-access environment, which is inconsistent with the uncontrolled access and at-grade intersections on US 1. The high-speed geometry and free-flow characteristics of the westbound MD 32 off ramp bring traffic exiting MD 32 directly into the influence area of the Guilford Road/US 1 intersection. The overlap of the free-flow nature of the interchange and the increasingly urbanized character of US 1 increases conflict and decreases the amount of time that drivers have to make decisions and react to the surrounding roadway.

IMPROVEMENT RECCOMENDATIONS

Improvement concepts were developed that increase the decision-making time for drivers, reduce conflict points, and maintain or increase capacity at the intersections and interchange.

Attachment E-3 provides a summary of the safety, traffic operations, and right-of-way impacts along with the general assessment for the proposed modifications to the MD 32/US 1 interchange area. The modifications focus on geometric changes that can be made without completely rebuilding the existing interchange.



Drivers traveling north through the interchange zone of MD 32 are met with an abrupt change in scale and roadway character at Guilford Road.

GUILFORD ROAD/US 1 INTERSECTION

The following set of actions is recommended as a concept to improve safety for all modes and traffic operations at the Guilford Road intersection:

- Realign the Guilford Road/US 1 intersection to an approximate 90-degree intersection;
- Eliminate the driveway accesses between the Guilford Road/US 1 intersection and the MD 32 on and off ramps; and
- Consolidate the driveway accesses adjacent to the Guilford Road/US 1 intersection to the north.

Realigning the Guilford Road/US 1 intersection would improve traffic operations by eliminating split signal phasing on the east/west approaches and increasing the distance from the MD 32 ramps. This would increase the decision making and reaction time available to drivers, reduce crossing distances for pedestrians and potentially offer more crossing time. Additionally, consolidating and eliminating driveway accesses near the intersection would decrease the number of conflicts points for all users.

MD 32/US 1 INTERCHANGE

The following series of improvements are recommended as a concept to improve safety and improve transitions to and from US1 to the MD 32 interchange ramps:

- Modify loop-ramp radii to create slower speed environment;
- Increase distance between the on and off loop ramps to provide drivers with more time to make decisions and change lanes;
- Add a lane on US 1 that continues onto the loop ramps to serve the US 1 southbound to MD 32 westbound movement and the US 1 northbound to MD 32 eastbound movement; and
- Modify the MD 32 westbound off ramp to reduce speeds and increase the distance between the end of the ramp and the Guilford Road/US 1 intersection.

The current design provides 575 feet between the entering and exiting loop ramp lanes, creates a weaving section on US 1. Adding a lane on US 1 that continues onto the MD 32 loop ramps will eliminate the need for motorists on US 1 traveling onto MD 32 to make a



The Corridor Road (to the south) and Howard Street (to the north) and ramp access area of US 1 that creates the MD 32 interchange introduces an interstate character to this section of US 1.

lane change. This would reduce conflicts and eliminate the required weaving movement. Modifying the MD 32 westbound off ramp would reduce the speed of the westbound exiting movement to a speed more consistent with an uncontrolled access facility with at-grade intersections. It would also increase the time that drivers have to decide which lane they need to choose.

CORRIDOR ROAD/HOWARD STREET/US 1 INTERSECTION

If consolidated into a single conventional intersection, the Corridor Road and Howard Street intersections would see improved driver expectancy and potentially improved traffic operations at the intersection. This improvement would decrease the size of the intersection and is expected to enhance traffic operations and safety.

Table 12 and Figure 17 summarize the improvement alternatives for the MD 32 area. Attachment E-3 provides additional information about improvement alternatives for the MD 32 area.

Table 12 MD 32 Area Improvement Recommendations Summary

	Safety	Future Traffic Operations	ROW Impacts
Guilford/US 1			
Realign Eastbound/Westbound approaches	Potential to reduce crashes by increasing distance and time for driver decisions and improving sight distance.	Improves efficiency by eliminating geometric offsets and split phasing for E/W movements.	Commercial property impacts
Consolidate Driveways near Intersection	Potential to reduce crashes by reducing conflicts between driveway traffic, intersection traffic and vehicles traveling to and from MD 32.	Improved operations. Operations analysis model unable to estimate LOS value for this improvement.	A local road needs to be constructed to give access to properties.
MD 32/US 1			
Reduce Loop Ramp Radii	Potential to reduce crashes by increasing distances between on and off ramps and increasing time for decision-making.	No impact	No impacts
Add Additional Lane on Loop	Potential to reduce crashes by reducing the weaving movement between the loop ramp and US 1.	Provides lane balance, eliminates need for mandatory lane changes from US 1.	
Modify MD 32 WB Off-Ramp	Potential to reduce crashes by increasing distance and time, and reducing speed for driver decisions.	Reduces turbulence by increasing the length of available weaving distance.	Relocate or modify existing storm water collection pond.
Howard/Corridor/US 1			
Consolidate into one physical intersection	Potential to reduce crashes by reducing exposure and increasing distance and time decision making.	Reduces loss time associated with current configuration.	Minimal Impacts

Figure 17 MD 32 Area Improvement Concepts



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