UN#11-183

Enclosure 1
Response to
Maryland State Highway Administration Comments on
Traffic Impact Study, 2011

RESPONSE TO MARCH 17, 2011 SHA COMMENTS ON TRAFFIC IMPACT STUDY DATED FEBRUARY 2, 2011

June 17, 2011

Based upon the SHA review comments provided on March 17, 2011 of the Traffic Study related to the proposed expansion at the Calvert Cliffs site in Lusby, MD prepared by KLD in cooperation with URS for UniStar, and follow up discussions with SHA, the comments are addressed below one by one, following each section of the review comments.

1) Figure 9 Illustrates a left turn lane from Calvert Cliffs Parkway to southbound MD 2-4. The left turn movement is to be eliminated while temporary access is in operation. In addition, the proposed traffic control at the intersection of MD 2-4 with Calvert Cliffs Parkway must be clarified.

   Response: Figure 9 has been revised accordingly. During construction, the signal at the MD 2-4/Calvert Cliffs Parkway intersection will continue to operate, but the WB phase will be eliminated. The text and figures have been revised to explicitly indicate this.

2) Impacts to operations caused by the diverted left turn traffic from Calvert Cliffs Parkway must be considered at the adjacent crossover.

   Response: The diverted left turn traffic from CC1&2 will be directed to the temporary CC3 access intersection, internal to the site. The Synchro and critical lane analysis for Calvert Cliffs Parkway and the Synchro analysis for the temporary CC3 access intersection have been updated to reflect this change in the routing.

3) The lane configuration along MD 2-4 at the proposed temporary site access is not consistent throughout the analysis.

   Response: The final configuration on northbound MD 2-4 at the proposed temporary site access is 2 thru and 1 right turn lane. Figures 9 and 10 have been revised accordingly.

4) The proposed temporary site access intersection should be included in Table 11 and H-1.

   Response: This has been done. Note that these tables present CLVs. It was agreed with the SHA that the analysis of the temporary site access intersection would be based on Synchro and therefore Synchro results are presented in the tables where applicable. This point is clarified whenever Synchro results are shown in the summary tables.

5) The Critical Lane analyses for MD 2-4 Split intersection are not correct for the existing, background and build no mitigation options in the evening peak hour.

Response: We believe that these analyses (shown on pages C-4, G-18 and H-5) are correct. We have added a note to each of these sheets, indicating that the NB right turn movement is assumed to be accommodated by right-turn-on-red while the WB left turn phase movement receives a green signal.

6) A plan must be developed for maintaining the access to CC3 from Nursery Road during construction of the new temporary access once the new connection is open to traffic. In addition, the proposed construction schedule does not appear to include any buffer in the schedule to cover unforeseen construction difficulties or increased traffic flow. Additional time must be added to the schedule to ensure construction of the new temporary access is complete, well before the Nursery Road access reaches unacceptable operations.

   Response: The access to CC3 from Nursery Road will be closed after the temporary site access intersection is complete. The text in Chapter 6.4 has been modified to demonstrate that a 6 month buffer has been provided in the schedule before the Nursery Road access reaches unacceptable operations. Currently this cut-off date for the opening of temporary access road is estimated as March 2015. Using a 24 month period for design, permitting, and construction the latest start date is March 2013. Adding the 6 month buffer, the report presents the "Design start date" of September 2012.

7) The queue analysis for the gate was not available and must be provided for review. Previous reviews have indicated gate queues could be problematic.

   Response: Appendix G presents the gate queue analysis. The ftp site noted on page G-13 has been re-opened to allow SHA to download the SimTraffic files at this time. Please contact URS immediately if you are unable to access the files. The configuration of 4 lanes was identified as being sufficient.

8) The calculations to project traffic to the "current year" (2010) should be provided.

   Response: This has been done.

9) Queue analyses for the offsite intersections must be provided based on the SHA's 95% Probability methodology. If deficient queue storage is identified, UniStar will be responsible for providing additional storage capacity.

   Response: Queue analyses based on the SHA 95% Probability had been provided and were imbedded in the CLV worksheets. They are now summarized into a tabular form based on the SHA provided sample. The design configuration proposed for the turn bays at the study intersections are such that they accommodate the queue estimates based on the SHA method.

10) It is important to include a constructability review of proposed mitigation measures. It appears that some of the proposed concepts have major right-of-way and utility impacts; however, no attempt was made to mitigate impacts.

Response: The proposed concepts were developed with the following goals in mind:

- provide the required traffic movements and queue lengths outlined in the Traffic Study;
- meet SHA and AASHTO criteria;
- minimize impacts to right-of-way, utilities, and environmental and cultural features; and
- minimize construction costs.

In developing the proposed concepts we evaluated constructibility and balancing the goals outlined above. For example, the Concept Plan for the MD 2/4 Split Intersection was designed to avoid impacts to the All Saints Church property (which includes a cemetery near the right-of-way line) while minimizing impacts to forested area and right-of-way on the other side of MD 2, which may require a geo-reinforced steep slope or a retaining wall. The widening along MD 4 is based upon the assumption that the bifurcated median should remain as-is due to geometric constraints, drainage, and safety. This assumption is an example of an issue that will be addressed later in the detailed engineering phase.

We believe the Traffic Study now represents the final list of intersections agreed to by both parties requiring mitigation and includes a general description of the necessary mitigation. The MOA could capture more specific mitigation details under scope and schedule sections.

11) The existing third lane along southbound MD 2-4 at MD 231 becomes a lane drop at the next intersection 1500ft to the south (Old Field Lane/Sherry Lane). The concept plans must clearly indicate how two lanes would be dropped within 1500 ft., or if one of the lanes would be extended beyond the adjacent intersection.

Response: The proposed configuration extends the third lane beyond the adjacent intersection for Option 1 only. The drawings related to the intersection of MD2-4 at MD 231 (Option 1) have been modified to include the adjacent intersection of MD 2-4/Old Field Lane/Sherry Lane. The revised figures depicting the proposed design are included in the updated Traffic Study.

RESPONSE TO JUNE 1, 2011 SHA COMMENTS ON UNISTAR'S COMMENT RESPONSES DATED APRIL 13, 2011

SHA Comment:

The letter indicates that SHA's comments related to clarifying lane assignments and traffic control between the various analyses, providing queue tables, providing a time buffer between the maintaining the existing site access and opening the new access to CC3 and clarifying the Critical Lane Analyses will be addressed in the revised report.

UniStar Response:

Yes, the updated traffic study addresses these comments.

SHA Comment:

The SHA is still concerned about the constructability of the proposed mitigation measures at the MD2/MD4 and MD2-4/MD231 intersections. Included with the revised study should be addition details regarding the impacted right-of-way and forested areas noted as constraints in the MD2/MD4 design. In addition, the concepts provided in the Draft Response Letter for the MD2-4/MD231 intersection still illustrate proposed widening over rows of parked vehicles indicating potential major right-of-way impacts. Major design issues such as right-of-way impacts must be addressed now, rather than during the detailed engineering phase of the design.

UniStar Response:

In response to this comment and discussions with the SHA, we have evaluated several alternatives for the MD 2/4 Split improvements and we have determined that the proposed lane configurations for Concepts 1 or 2 are the best options for mitigating the traffic impacts. A description of the other alternatives that were evaluated and the associated analysis is included in the updated traffic study. Additional information regarding the impacted right-of-way and forested areas have also been included in the updated traffic study. The report addresses the estimated forest impact and right-of-way areas and a proposed refinement in the design to minimize impacts to a gas station. An exhibit showing the vehicle turning templates for the triple left (Concept 2) has also been added to the traffic study.

We have updated the concepts and analysis for the MD2-4/MD231 intersection based upon comments provided by the SHA in the June 3, 2011 meeting. Based upon this update, we are now presenting 3 options for improvements to the MD2-4/MD231 intersection. With the addition of a separate right turn lane from southbound MD 2/4 to MD 231, the proposed widening of MD 2-4 as shown in Option 1 has severe impacts to the car dealership property at the northwest quadrant of the intersection. Options 2 and 3 would avoid the car dealer property impact and would require outside widening and minor right-of-way impacts on the east leg of MD 231 only. Additional information regarding the right-of-way and site impacts on the properties at the northeast corner of the MD 231 intersection has been added to the traffic study, including an exhibit showing the relatively minor property impacts at the northeast corner. An exhibit showing the vehicle turning templates for the triple left (Options 1 or 2) has also been added to the traffic study.

Enclosure 2
Traffic Impact Study at the
Calvert Cliffs Nuclear Power Plant
Draft Final Report, Revision 4
June 16, 2011
(Hard copy + CD)

KLD ENGINEERING, P.C.

Traffic Impact Study at the

Calvert Cliffs Nuclear Power Plant

Draft Final Report

Prepared for
Unistar Nuclear Energy, LLC
750 East Pratt Street
Baltimore, MD 21202

Prepared by
KLD Engineering, P.C.
43 Corporate Drive
Hauppauge, NY 11788

June 16, 2011

TR-427
Rev.4

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The addition of a third unit at the Calvert Cliffs Nuclear Power Plant has been in planning for some time, and the Combined License Application (COLA) and the associated Emergency Plan documents have been filed with the Nuclear Regulatory Commission (NRC). The Maryland PSC (Public Services Commission) has issued the CPCN (certificate of public convenience and necessity) related to this proposed unit. This traffic impact study (TIS) defines the traffic impacts associated with the construction of the new unit. An MOA (memorandum of agreement) or equivalent document between UniStar and Maryland State Highway Administration (SHA) will be drafted for planning, engineering and construction of roadway improvements to mitigate the traffic impacts as defined in this TIS. A supplemental TIS will be submitted at a later date addressing the post-construction conditions that occur during the future operation of the new unit.

This report is a revised version of the submittal in February earlier this year that addresses all the SHA comments specifically related to constructability of the proposed mitigation at MD 2/MD 4 diverge, and MD 2/MD 231 intersection. This report incorporates input from the multiple working sessions and written correspondence that occurred in the intervening time between this submission and the previous formal review.

In the February submittal, the center piece of the proposed mitigation was a temporary at-grade intersection on MD 2/MD 4 between Calvert Cliffs Parkway and White sands Drive. This location would provide direct access to the construction site. This is based on the concept plan provided by SHA in December 2010 and is henceforth referred to as CC3 Access Road & MD 2/MD 4.

KLD has had the advantage of the involvement of the local office of URS in the process, leading to a sequence of discussions and working sessions with SHA that have led to a set of understandings that define the scope and study methodology, and are the basis of the present submittal:

1) The intersections at MD 231 & MD 2/MD 4 and at the MD 2/MD 4 diverge are to be added to the study area, but no others (a full set of intersections to be studied is shown in Table ES-1);
2) The trip distribution north and south of the construction site was agreed upon with SHA, and is used herein;
3) The construction traffic shall enter via a new but temporary signalized intersection (CC3 Access Road & MD 2/MD 4) located between Calvert Cliffs Parkway and White Sands Drive, using a triple southbound left turn with geometrics as defined herein;
4) The westbound left turn from Calvert Cliffs Parkway onto MD2/MD 4 will be closed to traffic while the temporary intersection at CC3 Access Road is in operation;
5) The intersection of Nursery Road & MD 2/MD 4 is to remain unsignalized, but will be the initial access point for the construction traffic until the new

intersection is constructed; The access to CC3 from Nursery Road will be closed after the construction of the temporary site access intersection is complete.

6) A Synchro/SimTraffic analysis of the CC3 Access Road & MD 2/MD 4 intersection is an SHA-approved methodology for the purposes of this study, with all other intersections being analyzed by the CLV and SHA queuing methods;
7) The traffic volumes used in the analysis are to be based upon the construction traffic loaded upon the background peak hour traffic, rather than a new peak hour created by the construction and related traffic;
8) A growth rate of 2.0% is used for all background traffic, and counts are brought forward to a common 2010 base year for the base condition;
9) The average vehicle occupancy of 1.30 used in prior submittals is continued;
10) The on-site security gate shall be located at a sufficient distance into the property and/or provided with sufficient gates that the traffic does not queue back to MD 2/MD 4.

Other details addressed in those meetings (e.g. truck percentages) are included in the text of this report.

Table ES-1: Intersections in the Study Area

1	MD 2/MD 4 Diverge
2	MD 231 & MD 2/MD 4
3	Calvert Beach Road/Ball Road & MD 2/MD 4
4	Calvert Cliffs Parkway & MD 2/MD 4
5	CC3 Access Road & MD 2/MD 4
6	White Sands Drive & MD 2/MD 4
7	Nursery Road & MD 2/MD 4
8	Pardoe Road/HG Trueman Road & MD 2/MD 4
9	Cove Point Road & MD 2/MD 4

For the purpose of the impact analysis, the maximum potential impact occurs in 2016, which is the year in which the construction traffic first reaches its peak level. That peak is 3,950 workers, spread over three shifts. The maximum construction workforce was estimated (with 60% on the primary shift) as used in earlier documents and in the COLA. The construction workforce is expected to work primarily in a single shift through the first 20 months of the construction schedule (some backshift during excavation), and in three shifts for the rest of the construction schedule. The shift timings and splits are different for Monday-Thursday and for Friday. The Friday shift plan has shorter durations for each shift, but the splits are the same. The Mon-Thu shift plan was selected since it represented the period of maximum impact during the average weekday.

The Monday-Thursday shift plan is as follows:

Shift	Start Time	End Time	% Workforce	Comment
1	7:00am	5:30pm	60%	Main Shift
2	6:30pm	5:00am	35%	Gap of 1 hour between Shifts 1 & 2
3	9:30pm	8:00am	5%	Shift 3 starts 3 hours after Shift 2 starts, and ends 1 hour after Shift 1 begins

This schedule was designed based upon the on-site construction, including space available for parking and lay-down. Arrivals are uniformly distributed across the hour preceding shift start time. Departures from the parking lots at the end of the shift are spread somewhat on-site by the metering effect of the recommended traffic signal at CC3 Access Road & MD 2/MD 4.

The background traffic is taken to grow at 2% annually, based upon SHA direction.

Based upon advice from a Engineering/Procurement/Construction (EPC) vendors (Bechtel and AREVA) with experience on large construction projects, and consistent with other such traffic impact submittals, an average vehicle occupancy (AVO) of 1.3 is used.

In response to discussions with SHA and given their comments on the demographics of the area, it is taken that 80% of the construction workers will arrive on site from the north and 20% will arrive from the south, all using MD 2/MD 4 for their approach. The temporary intersection at CC3 Access Road & MD 2/MD 4 is designed to accommodate all site traffic.

Construction-related trucks were also included. Despite the very large number of estimated truck movements (67,879 in total), the impact on hourly flow is relatively low (typically 1-2 trucks per hour) due to the duration of the construction period. Wide loads are avoided, due to planned movements of larger elements by barge. A batch concrete plant is also planned on site. For design purposes, a WB-50 truck is considered.

Impact

The analysis showed significant impacts during the peak periods. Details are provided in the report.

Mitigation: Considerations and Alternatives

A number of alternatives were considered:

- One early mitigation plan focused on routing traffic through an upgraded and signalized intersection at Nursery Road & MD 2/MD 4. This has been eliminated, because it would require a multi-phase "split phase" operation and widening of Nursery Road from 2 lanes to 4 lanes, which could raise serious community concern, even if the right of way existed or could be acquired;

- The use of two intersections for access to the site (White Sands Drive & MD 2/MD 4, plus Nursery Road & MD 2/MD 4, both signalized) was eliminated, due to a strong preference by SHA to minimize the number of signalized intersections.

- The use of White Sands Drive as the site access intersection was eliminated due to SHA concerns of safety and efficiency;

Other alternatives were eliminated because added traffic on other roads (e.g. Saw Mill Road) would probably raise community concern, or eliminated because the separation of the two workforces could not be implemented.

Recommended Mitigation Plan

The recommended mitigation plan has as its centerpiece a temporary at-grade intersection along MD 2/MD 4 between Calvert Cliffs Parkway and White Sands Drive. The key word is "temporary": a permanent new intersection had been proposed earlier in this process, at this location. SHA had indicated that the process for a break-in access control could prove lengthy and costly, with the approval uncertain for a longer review process. Considering alternatives since that time, SHA has indicated that a temporary measure for the duration of the construction is a different matter.

A triple left turn will be used for the southbound traffic originating from the north on MD 2/MD 4 to enter the site. The intersection was designed to accommodate a WB-50 vehicle, with 10% trucks included in the turning traffic (the contractor can control the delivery times, so this is primarily included as a factor of safety). A companion CD contains the Synchro files related to the analysis of this intersection.

After the construction of the new unit is complete, this intersection will be closed. The access/egress to the site will be defined in the Supplemental TIS.

In addition to the temporary at-grade intersection at CC3 Access Road & MD 2/MD 4, there are four other intersections along MD 2/MD 4 where improvements are proposed as part of the mitigation plan. These four MD 2/MD 4 intersections include: Calvert Cliffs Parkway, Calvert Beach/ Ball Road, MD 231 and the MD 2/MD 4 Diverge.

The Design Concepts for these intersection improvements are included in this report. These proposed design concepts were developed using the following goals:

- provide the required traffic movements and queue lengths outlined in this TIS
- meet SHA and AASHTO criteria;
- minimize impacts to right-of-way, utilities, and environmental and cultural features; and
- minimize construction costs.

In developing the proposed concepts constructability and balancing the goals outlined above were taken into consideration.

Required Lead Times & Mitigation Actions

Once a mitigation plan is agreed upon, the detailed engineering, permitting, and actual construction has to be done. This can take 18 or more months; 30 months is used for scheduling purposes.

The temporary signalized intersection at CC3 Access Road & MD 2/MD 4 has to be in place before the pre-construction traffic (site clearing, etc) exceeds the southbound turning capacity at the unsignalized intersection of Nursery Road & MD 2/MD 4.

When a CLV of 1450 vph (LOS D/E breakpoint) or lower can be achieved by mitigation at other intersections, the mitigation must be in place before this level is reached, in accord with SHA guidelines. However, given that the act of doing the construction will reduce capacity, a trigger level of CLV = 1300 vph (LOS C/D breakpoint) is used.

At the diverge of MD 2/MD 4, the mitigation recommended addresses the situation that this intersection will not operate in accord with this desired CLV, even without the added construction traffic. As part of the final agreement between SHA and UniStar, the equitable sharing of costs for the improvements will have to be addressed.

At the intersection of MD 231 & MD 2/MD 4, where construction was recently done, additional mitigation is recommended.

Future Build Conditions

In the "Future Build", 363 additional employees are required on site when the new unit is operational. They will actually phase in during the construction, and are taken into account in the construction profile. Given that the temporary access via CC3 Access Road & MD 2/MD 4 will be discontinued after the construction, a Supplemental TIS will be prepared for the post-construction phase at a later date. The scenarios in that Supplemental TIS will likely recommend use of White Sands Drive and/or Nursery Rd or Calvert Cliffs Parkway for the new unit operations employees.

Summary

The current best estimates of the construction workforce profile and related issues (shift times, distribution by shift) based upon UniStar planning to date has been incorporated into this document.

There is significant impact during an extended period within the construction phase. This report details both the impact and the proposed mitigation. Various alternatives have been considered and discussed with SHA. Those discussions and overall operational issues with the various other alternatives led to the conclusion that at this point, the most practical and effective mitigation approach is the plan recommended herein.

1. INTRODUCTION

1.1. Project Objective

UniStar Nuclear Energy, LLC, through its subsidiary, Calvert Cliffs 3 Nuclear Project, LLC (collectively, UniStar), plans to expand the existing power generation site in Lusby which is located in Calvert County, Maryland. Calvert Cliffs Nuclear Power Plant (CCNPP) has two units currently operational and UniStar has proposed to construct one more unit at the existing site.

The Combined License Application (COLA) and the associated Emergency Plan documents have been filed with the Nuclear Regulatory Commission (NRC) [1]. The Maryland PSC (Public Services Commission) has issued the CPCN (certificate of public convenience and necessity) related to this proposed unit. This traffic impact study (TIS) defines the traffic impacts associated with the construction and operation of the new unit and the related mitigation. An MOA (memorandum of agreement) or equivalent document between UniStar and Maryland State Highway Administration (SHA) will be drafted for planning, engineering and construction of roadway improvements to mitigate the traffic impacts as defined in this TIS.

This report is a revised version of the submittal in February earlier this year that addresses all the SHA comments (included with responses as part of the appendices) specifically related to constructability of the proposed mitigation at MD 2/MD 4 diverge, and MD 2/MD 231 intersection. This report incorporates input from the multiple working sessions and written correspondence that occurred in the intervening time between this submission and the previous formal review.

In the February submittal, the center piece of the proposed mitigation was a temporary at-grade intersection on MD 2/MD 4 between Calvert Cliffs Parkway and White sands Drive. This location would provide direct access to the construction site. This is based on the concept plan provided by SHA in December 2010 and is henceforth referred to as CC3 Access Road & MD 2/MD 4. The TIS study area is shown in Figure 1.

Figure 2 presents a typical TIS includes analysis of the following traffic conditions:

- Existing
- Future No-Build (background),
- Future Build (build-out)

Given the nature and size of the construction effort related to building a nuclear reactor, this TIS analysis is focused on traffic conditions during construction. This is also shown in Figure 2. It is the condition during the peak construction months/years that dominates the situation, and requires the most attention in terms of impact and mitigation. Supplemental TIS will be submitted at a later date addressing the post-construction conditions that occur during the future operation of the new unit.

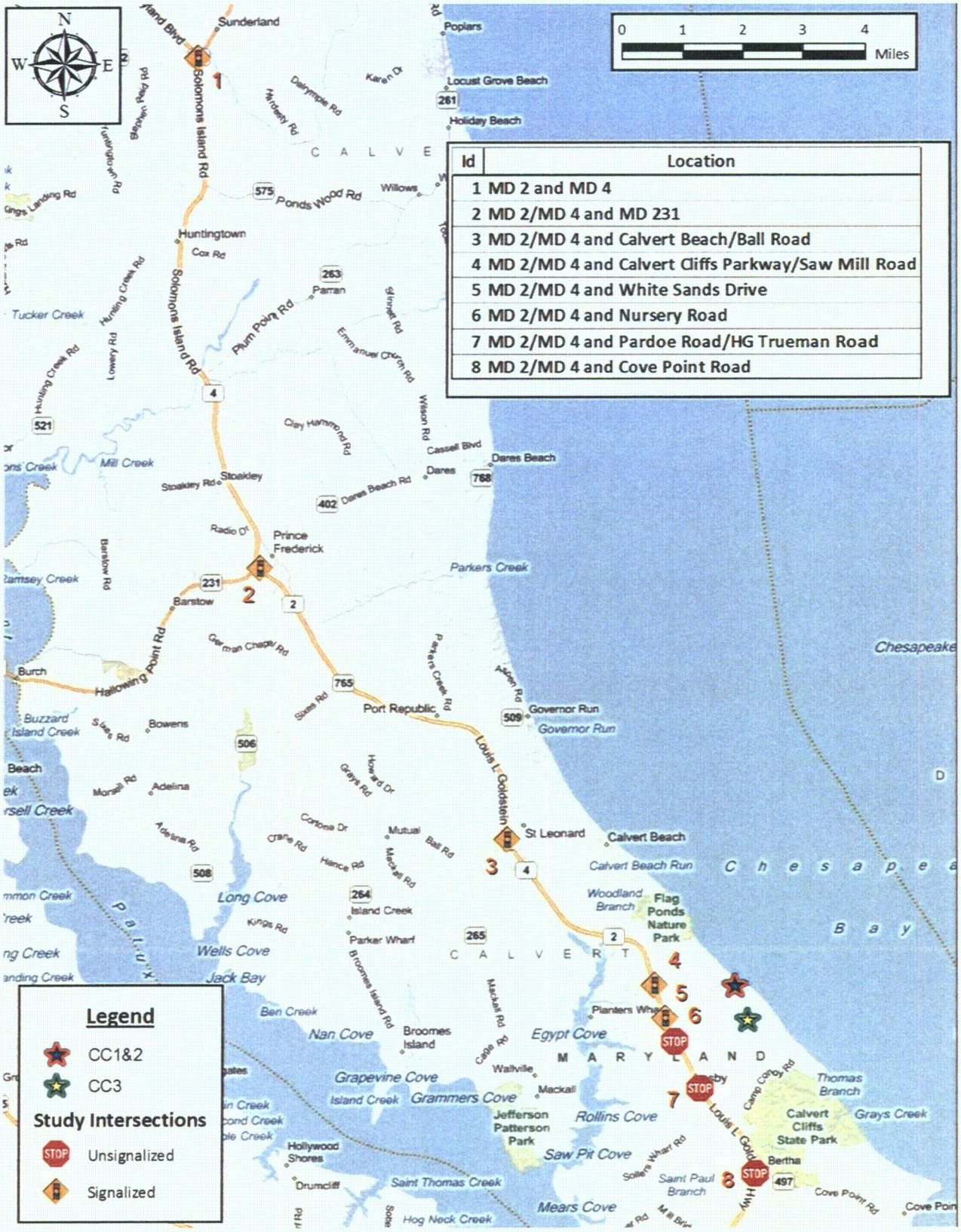


Figure 1 – CCNPP Site and Traffic Impact Study Area

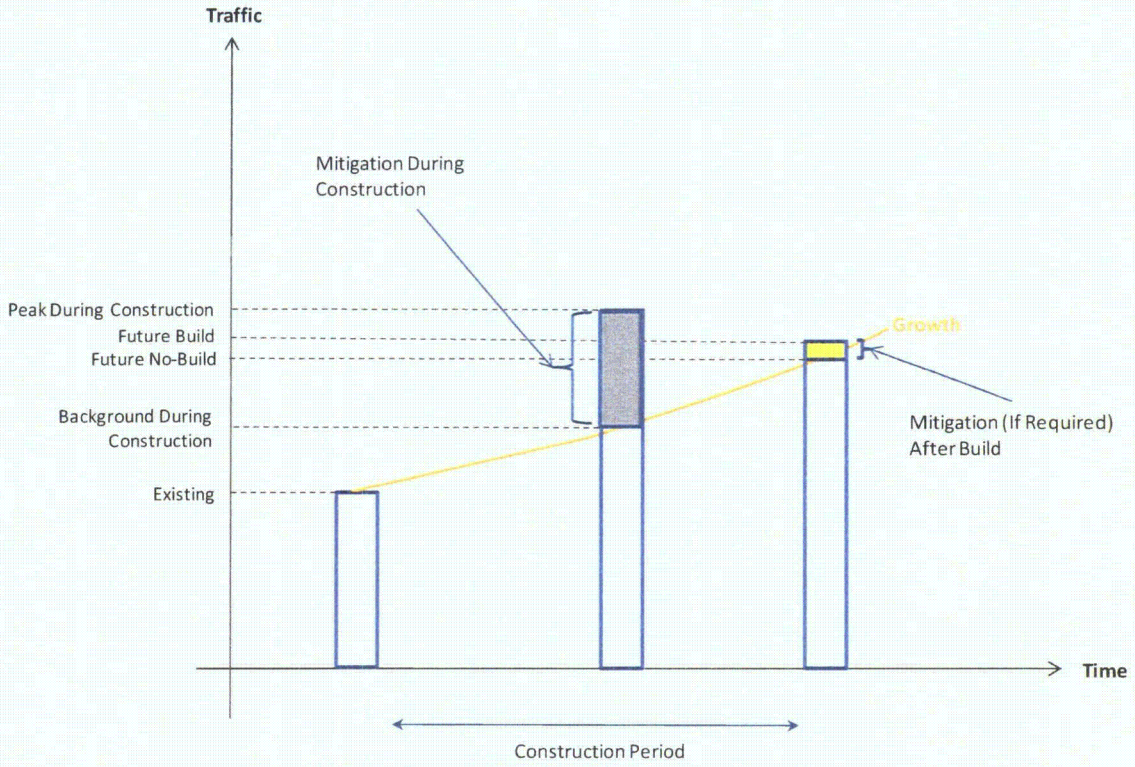


Figure 2 – Traffic Impact Analysis: Approach

1.2. Study Area

CCNPP is accessed via the intersection of Calvert Cliffs Parkway & MD 2/MD 4, the latter being the major thoroughfare in Calvert County. The proposed site is expected to be accessed via the temporary signalized intersection of CC3 Access Road & MD 2/MD 4, during construction. The Supplemental TIS will likely recommend use of White Sands Drive and/or Nursery Rd or Calvert Cliffs Parkway as the site access for the new unit employees, during operations.

The study area of this TIS is presented in Figure 1. It includes the following intersections along MD 2/MD 4:

- MD 2 and MD 4 (Signalized Intersection)
- MD 231 (Signalized Intersection)
- Calvert Beach Road (Signalized Intersection)
- Calvert Cliffs Parkway (Signalized Intersection)
- White Sands Drive (Signalized Intersection)
- Nursery Road (Unsignalized Intersection)
- Pardoe Road (Unsignalized Intersection)
- Cove Point Road (Unsignalized Intersection)

These intersections are within twenty miles of the site access road in the north and four miles in the south direction. These locations were selected based on a series of discussions between UniStar, KLD, URS Corporation (URS), and SHA.

KLD has had the advantage of the involvement of the local office of URS in the process, leading to a sequence of discussions and working sessions with SHA that have led to a set of understandings that define the scope and study methodology, and are the basis of the present submittal:

1) The intersections at MD 231 & MD 2/MD 4 and at the MD 2/MD 4 diverge are to be added to the study area, but no others (a full set of intersections to be studied is shown in Table ES-1);
2) The trip distribution north and south of the construction site was agreed upon with SHA, and is used herein;
3) The construction traffic shall enter via a new but temporary signalized intersection (CC3 Access Road & MD 2/MD 4) located between Calvert Cliffs Parkway and White Sands Drive, using a triple southbound left turn with geometrics as defined herein;
4) The left turn coming from Calvert Cliffs Parkway onto MD 2/MD 4 will be prohibited while CC3 Access Road is in operation;
5) The intersection of Nursery Road & MD 2/MD 4 is to remain unsignalized, but will be the initial access point for the construction traffic until the new intersection is constructed
6) A Synchro/SimTraffic analysis of the CC3 Access Road & MD 2/MD 4 intersection is an SHA-approved methodology for the purposes of this study, with all other intersections being analyzed by the CLV and SHA queuing methods;
7) The traffic volumes used in the analysis are to be based upon the construction traffic loaded upon the background peak hour traffic, rather than a new peak hour created by the construction and related traffic;
8) A growth rate of 2.0% is used for all background traffic, and counts are brought forward to a common 2010 base year for the base condition;
9) The average vehicle occupancy of 1.30 used in prior submittals is continued;
10) The on-site security gate shall be located at a sufficient distance into the property and/or provided with sufficient gates that the traffic does not queue back to MD 2/MD 4.

Other details addressed in those meetings (e.g. truck percentages) are included in this report. The report is organized as follows: Section 2 discusses the existing conditions. Section 3 describes the trip generation; Section 4 presents the background conditions during construction; Section 5 presents the impacts during the peak construction activity; and Section 6 describes the related mitigation that is recommended. Section 7 contains the summary followed by a list of references in Section 8. Appendix A, B, and C are related to existing conditions. Appendix D provided information on the current employment at CCNPP. Appendix E and F present material shipments and census data related to construction. Appendix G and H are related to construction conditions. Appendix I presents responses to the latest set of SHA comments.

2. EXISTING CONDITIONS

2.1. Existing Lane Configuration

The roadway condition diagrams are included in Appendix A of this report. These condition diagrams define the posted speed limit, lane assignments and intersection traffic control. The existing traffic control plans for the study area were provided by SHA and were supplemented with information on SHA's website (http://www.marylandroads.com/SHAServices/SignalPlanLocator/Index.asp). These plans are also included in Appendix A.

2.2. Existing Traffic, Based Upon Counts

Traffic data was collected at some of the intersections and SHA data was available at other intersections. Data older than 2010, was projected to 2010 using an annual growth rate (2%) as defined by SHA. Table 1 presents the summary of data used in this TIS. Appendix B presents all field data.

Table 1 – Traffic Data (Turn Movement Counts)

ID	Intersection	Month/Year	Source
1	MD 2/MD 4 diverge	3/2010	SHA
2	MD 231 & MD 2/MD 4	3/2009	SHA
3	Calvert Beach/Ball Road & MD 2/MD 4	9/2006	Field Counts
4	Calvert Cliffs Parkway & MD 2/MD 4	10/2006	Field Counts
5	White Sands Drive & MD 2/MD 4	2/2010	SHA
6	Nursery Road & MD 2/MD 4	4/2008	Field Counts
7	Pardoe Road & MD 2/MD 4	4/2008	Field Counts
8	Cove Point Road & MD 2/MD 4	4/2008	Field Counts

The data referenced in Table 1 was used to determine the peak hour traffic volume during the periods of 6AM to 9AM and 4PM to 7PM. Traffic volumes were balanced for the section of MD 2/4 between Calvert Cliffs Parkway and Nursery Road. These calculations to generate the peak hour traffic volumes in 2010 are included in Appendix C.

2.3. Analysis of Existing CLV, Level of Service (LOS), and Capacity

The ability of a roadway network to accommodate projected traffic volumes generated by the proposed development during its construction and operation is assessed utilizing techniques to measure capacity and Level of Service (LOS). LOS is an ordinal scale that is defined from A to F with "A" being the best level of service. The different levels are defined in the latest edition of the Highway Capacity Manual (HCM 2000) [2], in terms of average delay for intersections and average travel speed for arterials. Typically, the LOS is determined for the Peak 1-hour within a given period as it represents "worst case" conditions.

Based on SHA guidelines [3]:

- All intersections will be analyzed using the SHA critical lane technique and factors. In certain circumstances other methodologies, including the Highway Capacity Manual (HCM), might be appropriate to identify operational problems;
- Any intersection with a CLV of 1450 vehicles/hour (vph) or less is considered acceptable, this corresponds to (Level of Service) LOS D;

Figure 3 presents the traffic volumes and turning movements at the study intersections during the AM and PM peak hours. Using these peak hour volumes, capacity analyses were performed. The calculations are presented in Appendix C and the summary results are presented in Table 2.

The existing conditions indicate all the intersections are operating acceptably (CLV less than 1450 vph). A companion CD to this report contains the related Synchro[1] files and clips of the SimTraffic animations [4] for the intersection of White Sands Drive & MD 2/MD 4.

Table 2 – Intersection LOS: Existing Conditions

Intersection	*CLV*		*LOS*	
	AM	*PM*	*AM*	*PM*
MD 2 /MD 4 diverge	1344	1176	D	C
MD 231 & MD 2/MD 4	865	1098	A	B
Calvert Beach/Ball Road & MD 2/MD 4	952	1148	A	B
Calvert Cliffs Parkway & MD 2/MD 4	837	710	A	A
White Sands Drive & MD 2/MD 4	708	1080	A	B
Nursery Road & MD 2/MD 4	715	949	A	A
Pardoe Road & MD 2/MD 4	881	961	A	A
Cove Point Road & MD 2/MD 4	746	1139	A	B

[1] Synchro/SimTraffic is a traffic analysis tool developed by Trafficware that is acceptable for traffic analysis by SHA.

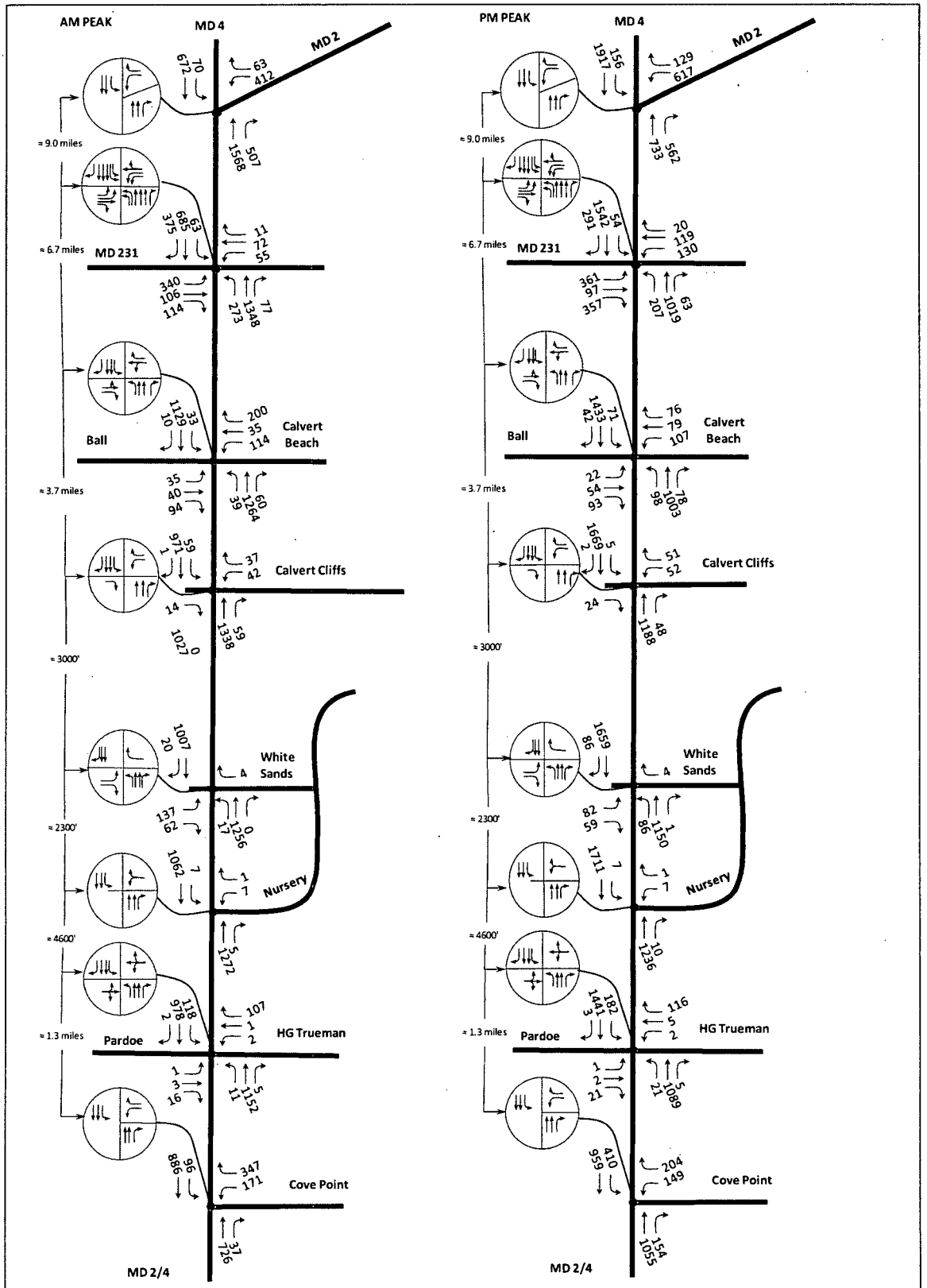


Figure 3 – Peak Hour Traffic Volumes – Existing Conditions

3. TRIP GENERATION

For the purpose of the impact analysis, the maximum potential impact occurs in 2016, which is the year in which the construction traffic first reaches its peak level. That peak is 3,950 workers, spread over three shifts. The maximum construction workforce was estimated (with 60% on the primary shift) as used in earlier documents and in the COLA.

During the first 20 months of the construction schedule, the workforce is expected to work primarily in a single shift (some backshift during excavation), and in three shifts for the rest of the construction schedule. The shift timings and splits are different for Monday-Thursday and for Friday. The Friday shift plan has shorter durations for each shift, but the splits are the same. The Mon-Thu shift plan was selected since it represented the period of maximum impact during the average weekday. The Mon-Thu shift plan is presented in Table 3. This schedule was designed based upon the on-site construction, including space available for parking and lay-down. Arrivals are uniformly distributed across the hour preceding a shift start time. Departures from the parking lots are distributed somewhat on-site by the metering effect of a recommended traffic signal

Table 3 – Shift Times for the Construction Period (Mon-Thu)

Shift	Start Time	End Time	% Workforce	Comment
1	7:00AM	5:30PM	60%	Main Shift
2	6:30PM	5:00AM	35%	Gap of 1 hour between Shifts 1&2
3	9:30PM	8:00AM	5%	Shift 3 starts 3hours after Shift 2 starts, and ends 1 hour after Shift 1 begins

Figure 4 shows the construction workforce profile by shift, expressed in terms of vehicles, over the multi-year construction period. The average vehicle occupancy used was 1.30, based upon the experience of Bechtel/AREVA with large construction projects and as discussed with SHA.

Because the workforce operates in a single shift for the first 20 months, at Month 21 there is a drop in the Shift 1 when the other shifts begin. Based upon these curves, there is an extended period during months 38 through 54 of the construction schedule when the workforce is at its maximum.

The additional traffic expected on site has three components:

- Operational Staff for the proposed unit (CC3)
- Heavy Vehicles to haul in materials
- Construction Staff for CC3

It is planned that the operations (CC3), construction staff and heavy vehicle shipments expected on site would access the site using the temporary intersection at CC3 Access Road and MD 2/MD 4 south of Calvert Cliffs Parkway as shown in Figure 5.

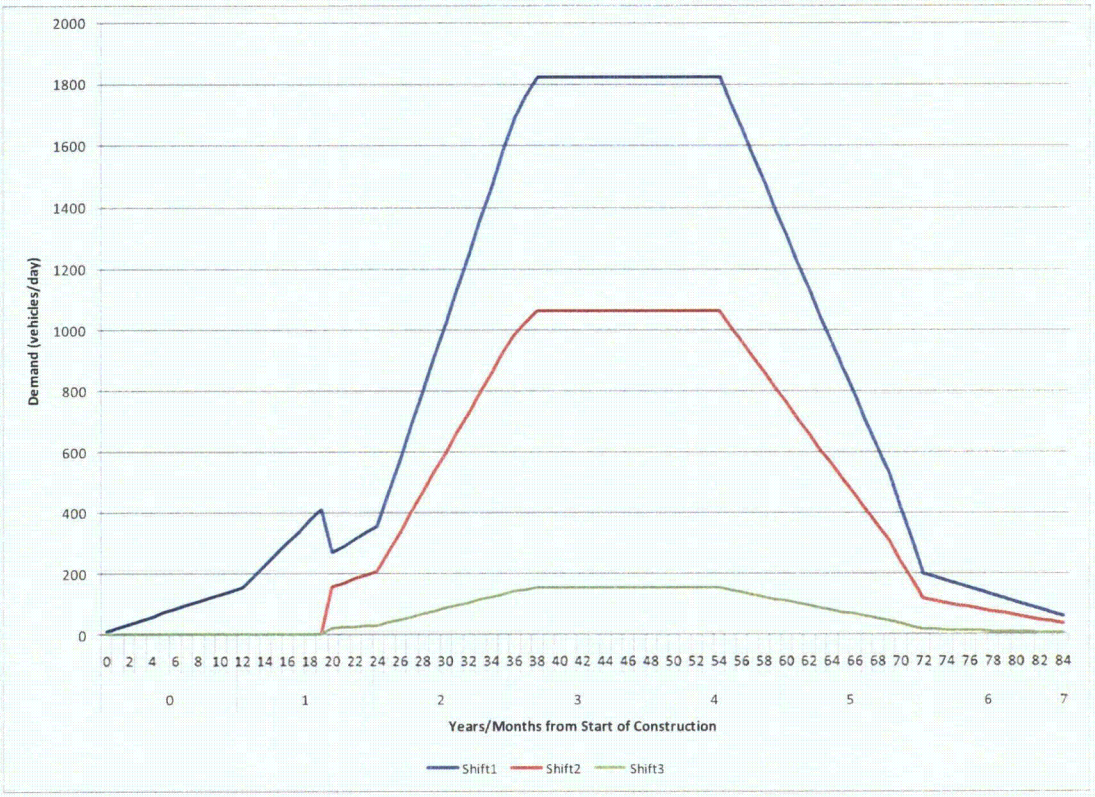


Figure 4 – Construction Profile, Expressed in Terms of Vehicles by Shift

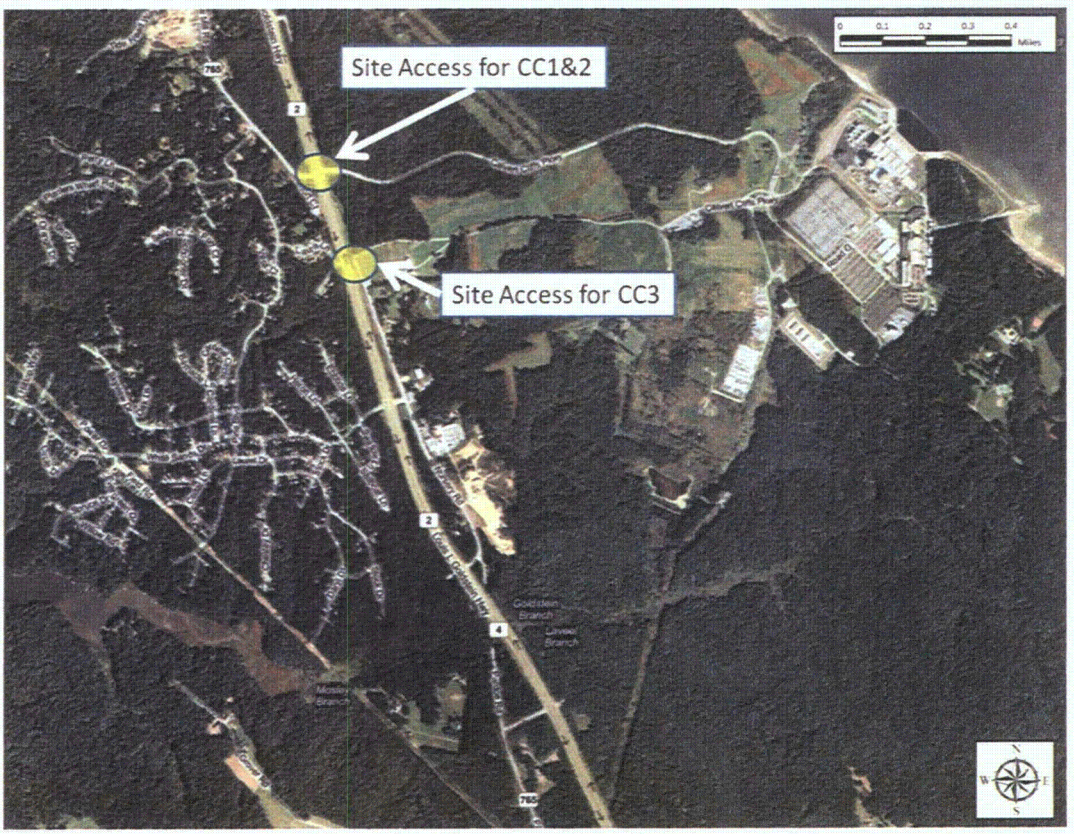


Figure 5 – Construction Site Access

This traffic will be impacted by the "bi-annual" outage at the existing units CC1&2, the duration of which is typically one month (February). The outage staffs for the existing units access their site using Calvert Cliffs Parkway.

3.1. Operational Staff for CC3

The new unit will require 363 additional personnel upon completion and it is estimated that less than 100 operations personnel will be on site in the first 26 months of construction. Using this information a conservative assumption is made that the number of operations personnel on site in months 1 through 26 is 100 and 363 in the remaining months. Assuming average vehicle occupancy of 1.0 for these employees, the number of daily trips expected to be generated are 200 (2*100) trips in months 1-26 and 726 (2*363) trips in the remaining months. These employees will be distributed over the day and directionally as discussed in the following section.

The staff size for the existing 2 units is 833 employees. The geographic distribution of the current staff by county is presented in Appendix D. This data indicates that approximately 50% of the traffic arrives from the south along MD 2/MD 4 and the remaining 50% arrive from the north along MD 2/MD 4. Figure 6 represents the arrival and departure distribution of the power plant employees across the workday along Calvert Cliffs Parkway (EB – East Bound – Into site, WB – West Bound – From Site). The vehicle trips related to the employees at CC1&2 are part of the background traffic counts.

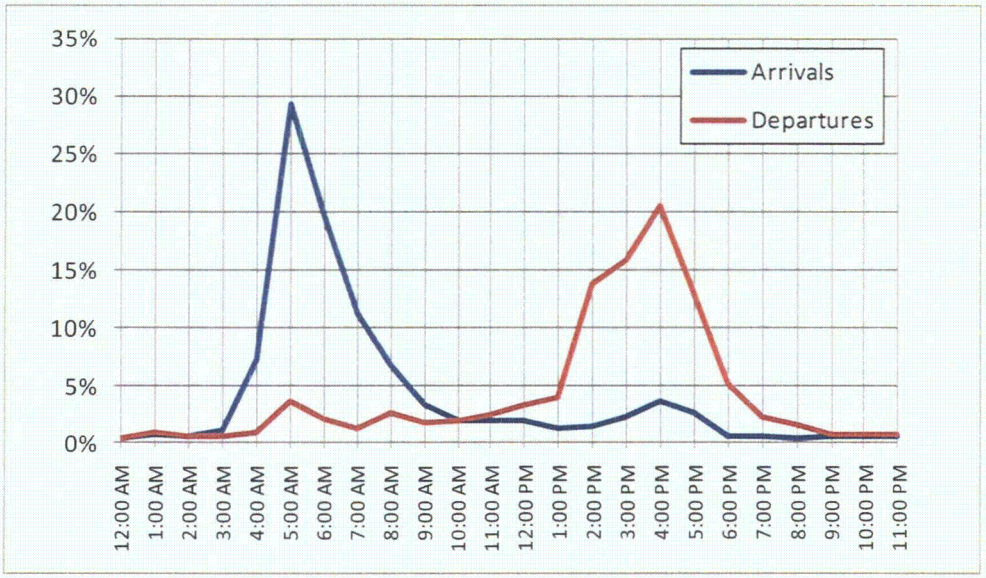


Figure 6 – Temporal Distribution of Power Plant Employees

3.2. Heavy Vehicles

It is expected that loads carrying heavy permanent plant equipment and commodities, including the Turbine Generator, Diesel Generators, Large Transformer, Nuclear Steam Supply, and the barge slip reconstruction material, will be brought to the site on barges.

The backfill and excavation will occur on site and most other plant material will arrive by road.

The breakdown of the materials arriving on site by road is presented in Appendix E. It is estimated that a total of 67,879 15-ton-shipments will arrive through the construction schedule.

Of these, 56,557 are expected to arrive throughout all the shifts, over the first 60 months 6 days a week (Monday-Saturday). The remaining shipments are expected to arrive over the first 60 months only during the day shift. Before actual construction, this may be reduced due to concrete materials arriving by barge.

The former set of 56,557 will be referred to as *Concrete Material Shipments* and the latter will be referred to as *Other Shipments*. Given the demographics of the area and discussions with UniStar, Bechtel and SHA, it is expected that 80% of these vehicles will arrive on site from the north and 20% will arrive from the south. It is assumed that each 15-ton shipment will arrive on separate trucks, leading to an average of 39 trucks and 8 trucks per day for the *Concrete Material Shipments* and *Other Shipments*, respectively.

Construction-related trucks were also included. Despite the very large number of estimated truck movements (67,879 in total), the impact on hourly flow is relatively low (typically 1-2 trucks per hour) due to the duration of the construction period. Wide loads are avoided, due to planned movements of larger elements by barge. A batch concrete plant is also planned on site. For design purposes, a WB-50 truck was considered.

3.3. Construction Staffing

The schedule of the construction staffing was presented in Figure 4, expressed in terms of vehicles. It is expected that the average vehicle occupancy for these workers will be 1.30, based upon expert guidance from Bechtel/AREVA from their experience in large construction projects and discussions with SHA. Based upon census data alone, for situations including smaller construction activities, the average vehicle occupancy would otherwise be 1.19; refer to Appendix F.

The workers are expected to start arriving an hour before the start of each shift, (uniformly over the hour). They are expected to leave over the hour after shift-end, departing from the parking lots. This traffic will be metered to some extent by signals, in terms of its load on MD 2/MD 4. (This metering effect was incorporated into the modeling and simulations).

The security gate for the new unit will be located such that queues awaiting entry do not affect MD 2/MD 4, in either the construction or future build conditions. A queuing analysis was conducted by URS to determine the location and layout of the security checkpoint. It is included in Appendix G.

Given the demographics of the area and discussions with UniStar, Bechtel, and SHA, it is taken that that 80% of these workers will arrive on site from the North and 20% will arrive from the south. The spatial distribution of the construction workers as applied in this analysis was provided by SHA and is included in Appendix G.

3.4. Outage Staff – Maintenance and Refueling

The existing two units currently operate on a 24-month outage schedule, with an outage at each unit lasting a month, and staggered by one year. Outages typically begin in February.

Each outage is expected to have an outage workforce of 750 personnel on site. These personnel work on the same shift schedule as the existing employees (2 shifts 6AM-6PM, 6PM-6AM) and will be distributed across the day and directionally assigned similar to the operational staff (Section 3.1).

Assuming average vehicle occupancy of 1.0 for these employees, 1500 (750*2) daily trips are expected to be generated each February. These trips are part of the existing traffic, but needs to be considered because it affects the traffic arriving at the proposed site.

3.5. Total Trip Generation

It is assumed that the construction-related trips will access the site through the new temporary intersection of CC3 Access Road and MD 2/MD 4.

There were two approaches to characterizing the total traffic load: (1) load the construction traffic onto the existing peak hours for the background traffic, (2) identify the "new" or "shifted" peak hour based upon the overall daily background traffic profile plus the four components described in Sections 3.1 to 3.4 inclusive. In terms of total traffic, analysis shows that both approaches result in comparable levels. Based upon discussions URS had with SHA, the first approach was used, given it is direct and consistent with general practice for project review.

Based on the traffic assignment cited in Section 3.3 (provided by SHA, following discussions) the additional trips during the AM and PM peak hour are shown in Figure 7.

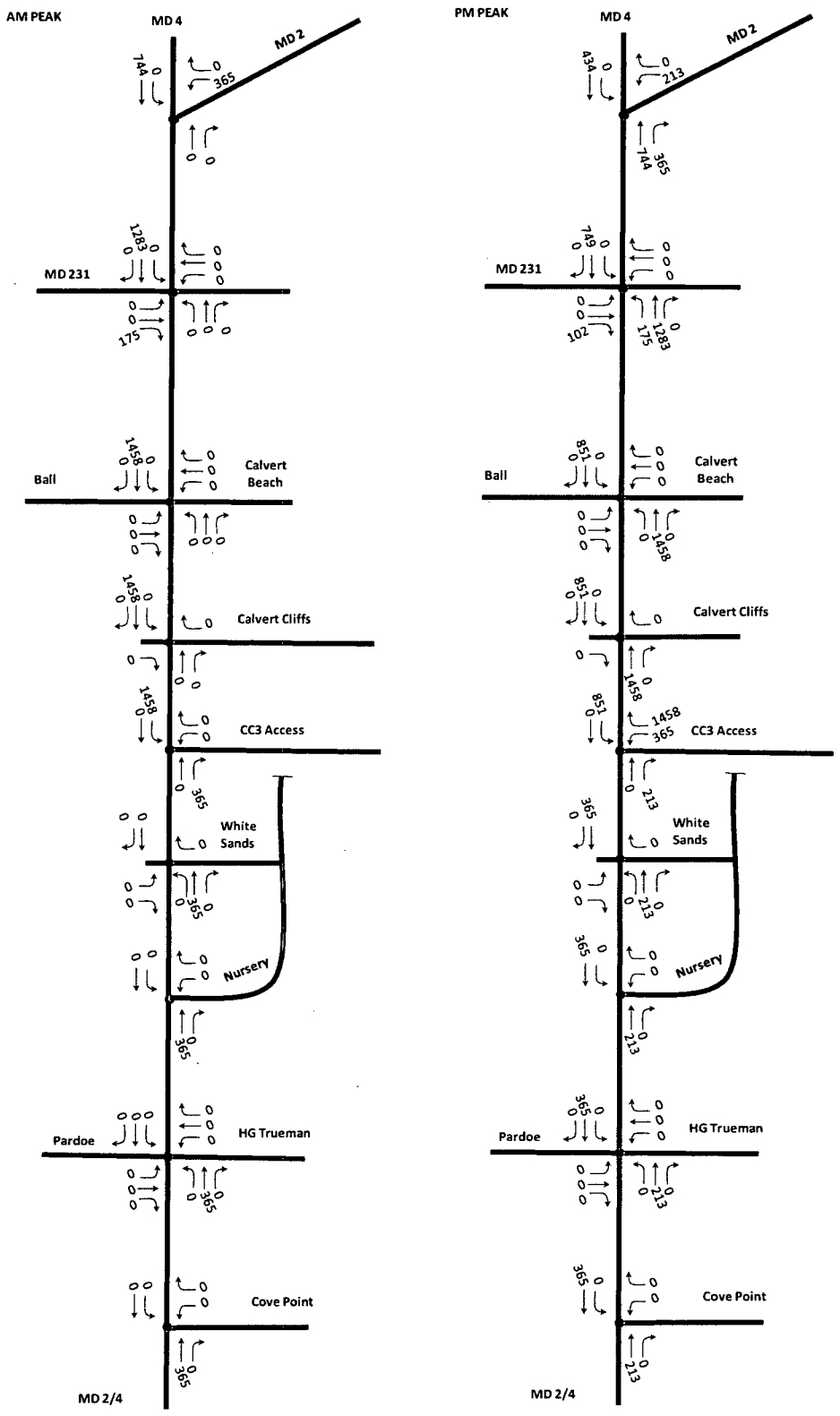


Figure 7 – Construction Site Trip Assignment

4. BACKGROUND CONDITIONS DURING CONSTRUCTION

4.1. Regional Growth and Other Developments

Based on the general background growth, SHA has specified an annual growth rate of 2.0%. This report uses this rate, compounded annually.

The Lusby Southern Connector [5] & [6], a project completed in Fall of 2008, south of the study area, has been opened. This includes a connector roadway running east-west between MD 2/MD 4, MD 765 and MD 760. This was considered for its effect on the future no-build, future build and traffic operations during construction. No major reassignment is anticipated, given the north-south arrival paths anticipated.

The baseline estimated volumes were projected forward from the year collected to 2016 by 2.0%, compounded annually.

4.2. Analysis of Background CLV, Level of Service (LOS), and Capacity

Figure 8 presents the traffic volumes and turning movements at the study intersections during the AM and PM peak hours. The CLV and LOS for each intersection in the AM and PM peak hours is shown below in Table 4. Appendix H presents the calculations for these values and the queues estimates based on SHA methodology.

Table 4 – Intersection LOS: Background Conditions During Construction

Intersection	*CLV*		*LOS*	
	AM	*PM*	*AM*	*PM*
MD 2 /MD 4 diverge	**1514**	1325	**E**	D
MD 231 & MD 2/MD 4	974	1236	A	C
Calvert Beach/Ball Road & MD 2/MD 4	1040	1248	B	C
Calvert Cliffs Parkway & MD 2/MD 4	930	796	A	A
White Sands Drive & MD 2/MD 4	782	1199	A	C
Nursery Road & MD 2/MD 4	808	1068	A	B
Pardoe Road & MD 2/MD 4	961	1061	A	B
Cove Point Road & MD 2/MD 4	800	1212	A	C

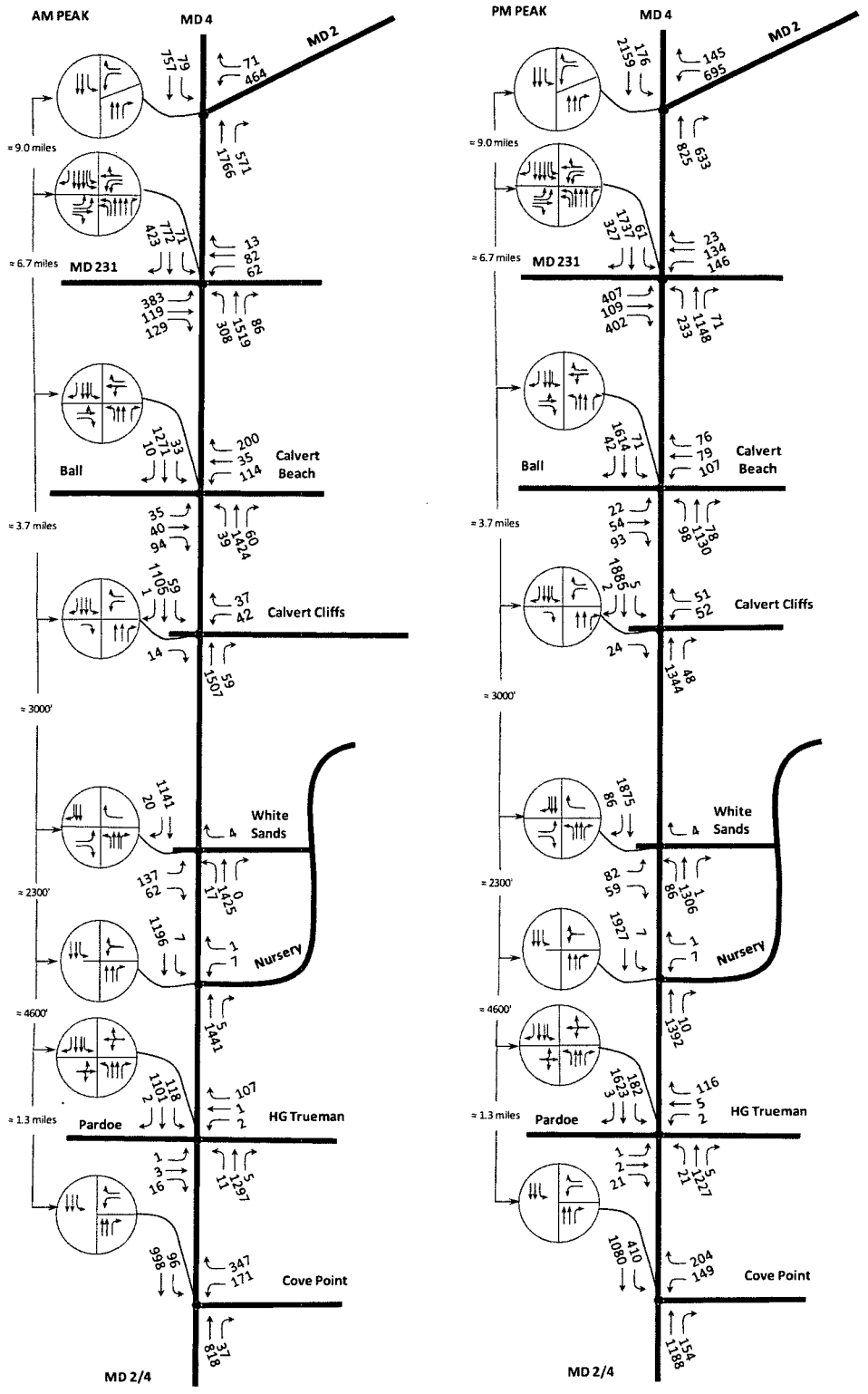


Figure 8 – Peak Hour Traffic Volumes For Background Conditions During Construction

5. PROJECTED CONDITIONS DURING CONSTRUCTION

5.1. Site Access Intersection – CC3 Access Road & MD 2/MD 4

The intersection of CC3 Access Road and MD 2/MD 4 needs to be designed to handle the traffic load entering and leaving the site as shown in Figure 9. Based on discussions with SHA by UniStar and URS, a triple-left turn concept was identified and presented in Figure 10. This intersection is expected to be able to handle all traffic to/from the site.

The triple left at this new intersection has the advantage that only one additional signalized intersection is needed, and that traffic is moved onto the construction site as directly as possible.

Based on SHA guidance, this intersection was analyzed using Synchro/SimTraffic. The analysis was focused on traffic operations of the left turn queue related to storage and spillback as well as operation experienced by the NB thru traffic. SHA required the NBT lanes operate at LOS D or better and that the SBL traffic not queue beyond their provided storage. The Synchro/SimTraffic files are provided in the companion CD.

A snapshot from the SimTraffic animation is provided in Figure 11 as an illustration to support the sufficiency of the left turn bay storage. Also, the results from the Synchro analysis show that NBT operates at LOS D (Avg delay 54.4 sec/veh) in AM and LOS D (Avg delay 52.5 sec/veh) in the PM. Thus, the operations at this intersection meet the SHA requirements. Appendix G has the supporting documentation. With this design in place, Table 4 presents the LOS and CLV at the other intersections in the study area. The queuing analysis using the SHA 95th percentile is also included in Appendix G.

Table 5 – Intersection LOS: Construction Peak (2016) Conditions

Intersection	*CLV*		*LOS*	
	AM	*PM*	*AM*	*PM*
MD 2/MD 4 diverge	**1879**	**1946**	**F**	**F**
MD 231 & MD 2/MD 4	1331	**1640**	D	**F**
Calvert Beach/Ball Road & MD 2/MD 4	**1764**	**1757**	**F**	**F**
Calvert Cliffs Parkway & MD 2/MD 4	888	**1592**	A	**E**
White Sands Drive & MD 2/MD 4	782	1400	A	D
Nursery Road & MD 2/MD 4	1008	1268	B	C
Pardoe Road & MD 2/MD 4	1162	1261	C	C
Cove Point Road & MD 2/MD 4	997	1329	A	D

Clearly mitigation is needed at the intersections to the north to handle the projected traffic during construction. The following section presents the discussion related to mitigation, including reference to 2016 conditions absent the construction traffic.

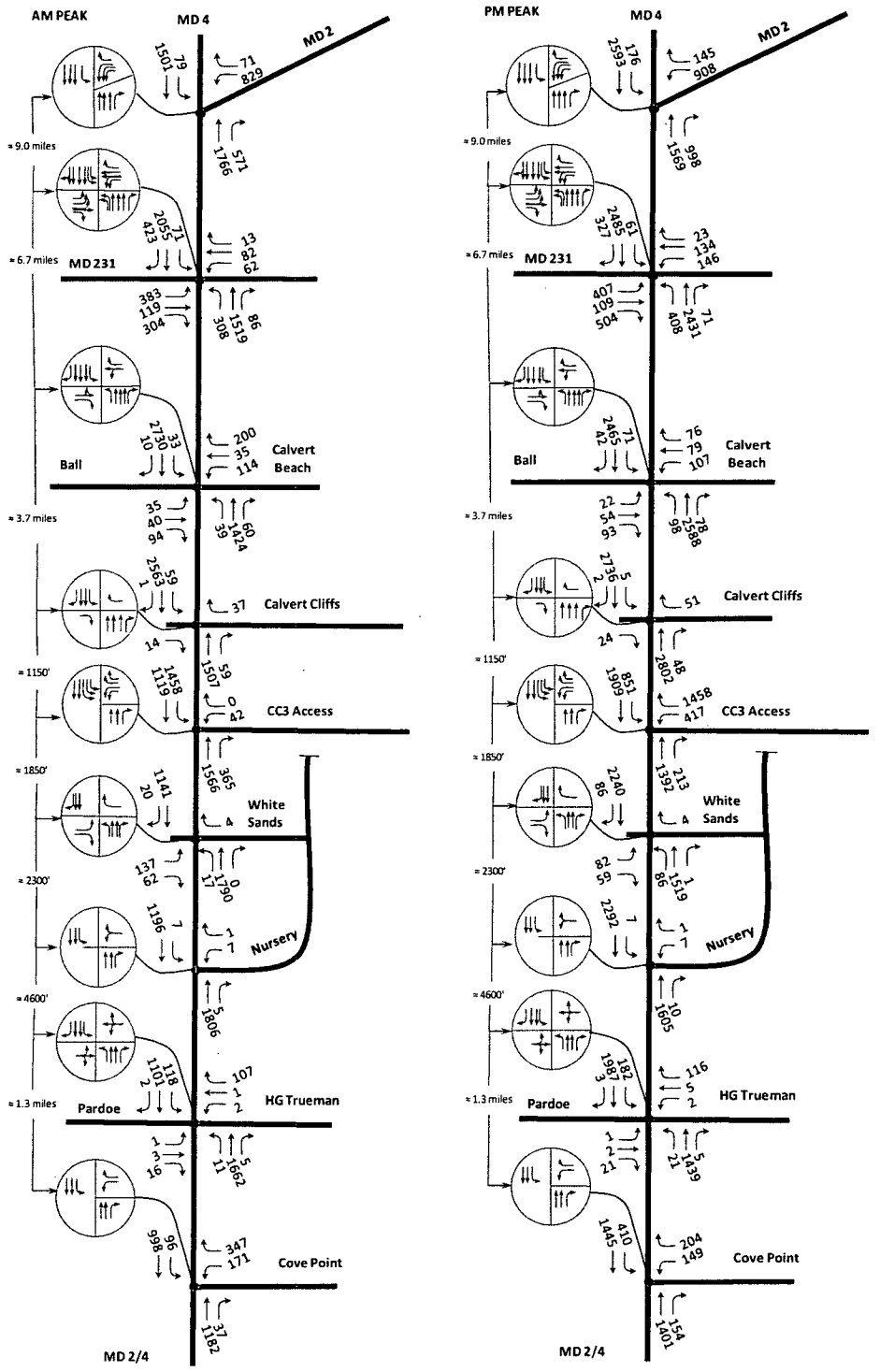


Figure 9 – Peak Hour Traffic Volumes During Construction

Figure 10 – CC3 Access Road & MD 2/MD 4 – Triple Left Turn

Figure 11 – Site Access Intersection – Triple Left Turn – Model Snapshot

6. MITIGATION MEASURES

The center piece of the mitigation is the new intersection at CC3 Access Road & MD 2/MD 4. But, without mitigation to the intersections to the north, the traffic headed towards the site cannot arrive at this intersection. Each individual intersection is discussed below.

The proposed concepts were developed with the following goals in mind:

- provide the required traffic movements and queue lengths outlined in this TIS;
- meet SHA and AASHTO criteria;
- minimize impacts to right-of-way, utilities, and environmental and cultural features; and
- minimize construction costs.

In developing the proposed concepts, constructability was evaluated while balancing the goals outlined above. This issue is discussed in more detail in the following section for

two of the intersections: MD 2/4 Diverge Intersection and the MD 2 / MD 4 at MD 231 Intersection.

6.1. Mitigation by Intersection

6.1.1.MD 2/MD 4 Diverge – Traffic Analysis

This intersection is currently a Maryland-T, where the southbound MD 2/MD 4 traffic does not stop. Under the existing conditions (2010), the intersection is operating at LOS D (CLV = 1344) during the AM peak period. With projected growth rate of 2%, by 2016 the CLV for the no-build exceeds 1450 and reaches LOS E. With the added construction traffic, the LOS is F.

Various mitigation concepts were considered for this intersection. The following two design concepts were considered based on SHA guidance:

- Relocating SB left turns from the MD 2 & MD 4 diverge to intersection of MD 2 & MD 262/Lower Marlboro Road.
- Allowing the SB through at the MD 2 & MD 4 diverge to remain a free movement by coordinating the signals at the diverge and at the intersection of MD 2 & Lower Marlboro such that the SB thru traffic is detained at the northerly intersection while the WB left turn phase is active at the diverge.

A detailed assessment of these options is included in Appendix H. Based on an assessment of the operating conditions, these concepts were not considered further because they resulted in either the addition of a new traffic signal, or reduced safety conditions as presented in Appendix H.

Two remaining mitigation options were considered for this intersection:

Concept 1, as shown on Figure 12, would achieve a LOS E under the 2016 Construction Condition. Concept 2, as shown on Figure 13 would achieve a LOS D under the 2016 Condition; however the impacts and costs are higher than Concept 1. While Concept 1 does not achieve SHA's goal of LOS D, we believe that it is a viable option because it matches the LOS experienced at this intersection for the AM peak in the background during construction conditions as shown in Table 6. A comparison of both these concepts for the "post construction" conditions when the new unit is operational will be part of the Supplemental TIS.

6.1.2.MD 2/MD 4 Diverge - Constructability and Geometric Analysis

The Concept Plans for the MD 2/4 Diverge Intersection show the existing and proposed right-of-way lines. The Concept Plans were designed to avoid impacts to the All Saints Church property (which includes a cemetery near the right-of-way line) while minimizing impacts to forested area and right-of-way on the other side of MD 2, which may require a geo-reinforced steep slope or a retaining wall. The widening along MD 4 is based upon

the assumption that the bifurcated median should remain as-is due to geometric constraints, drainage, and safety concerns. The proposed widening on MD 2/4 would be approximately 12 feet wide to accommodate the additional southbound thru lane and a 10 foot wide shoulder. The additional right-of-way area to accommodate this widening is currently estimated to be approximately 35,000 square feet on four parcels along southbound MD 2/4.

One property of concern is the gas station located on southbound MD 2/4 that is approximately 1000 feet south of the intersection. We could minimize the impact to this property if a narrower shoulder (4' to 6' wide) would be allowed for a 200 foot long section of roadway in front of the property, south of the first driveway. The shoulder on the approach to the first driveway into the gas station would be at least 10 feet wide and designed to accommodate a right turning vehicle into the gas station.

Concept 1 and 2 would impact some forested areas, which are shown on the aerial photo base map as the forested areas between the existing and proposed right-of-way lines. We currently estimate less than 0.4 acres of forest impact for Concept 1 and less than 1.0 acres of forest impact for Concept 2. During the final engineering phase, proposed reforestation to mitigate these impacts would be considered within the MD 2/4 corridor or other areas acceptable to the SHA and DNR.

Table 6 – Intersection LOS: MD 2 and MD 4: 2016 Conditions

Mitigation Detail	*CLV*				*LOS*			
	Background		*Construction*		*Background*		*Construction*	
	AM	*PM*	*AM*	*PM*	*AM*	*PM*	*AM*	*PM*
None	**1514**	1325	**1879**	**1946**	**E**	D	**F**	**F**
Concept 1: Remove Maryland-T, add 1 SBT and one WBL lane	1328	1280	**1547**	**1583**	D	C	**E**	**E**
Concept 2: Remove Maryland-T, add 1 SBT and 2 WBL lanes	1259	1176	1423	1447	C	C	D	D

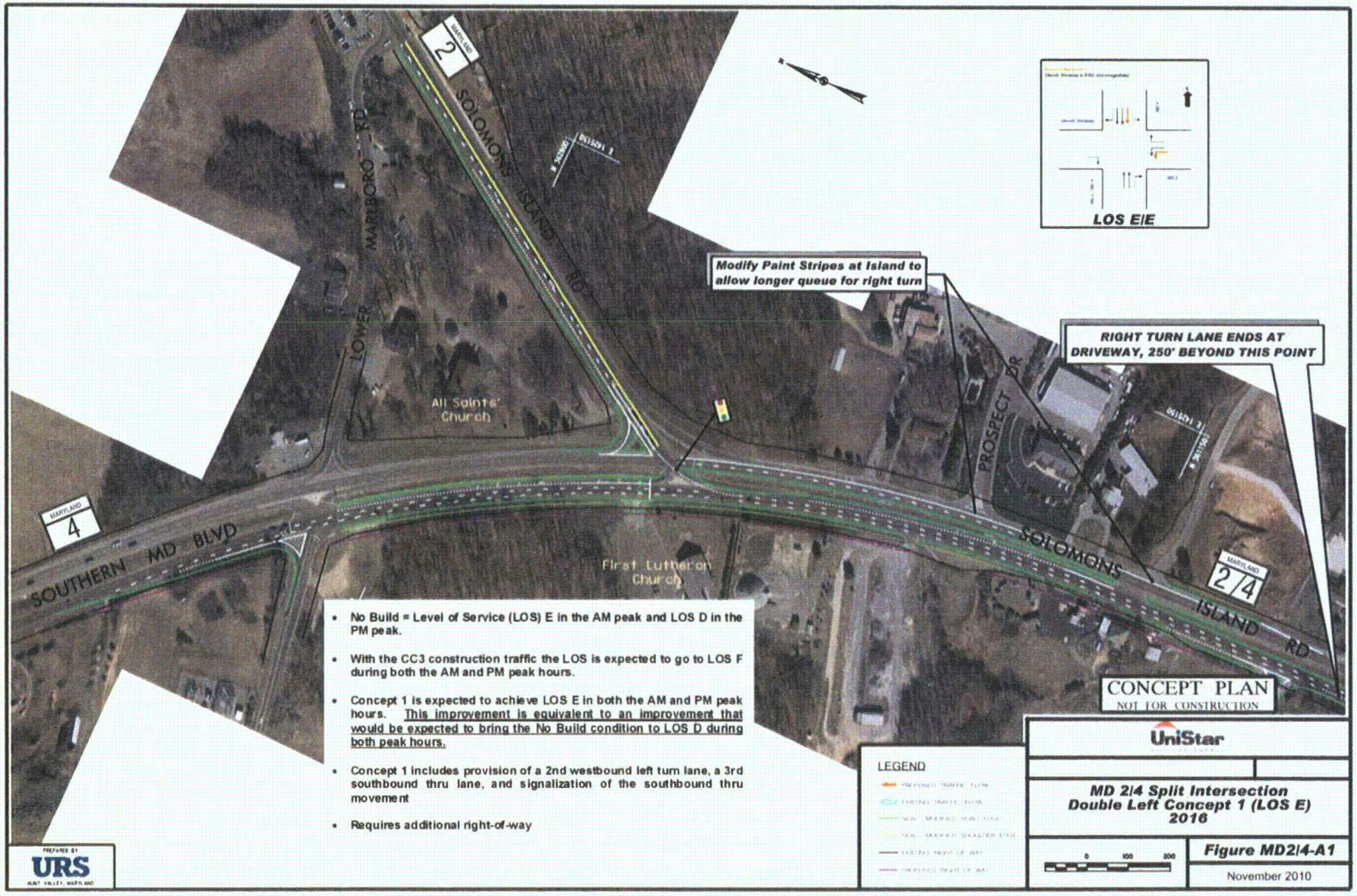


Figure 12 – MD2/MD4 Diverge – Mitigation Concept 1

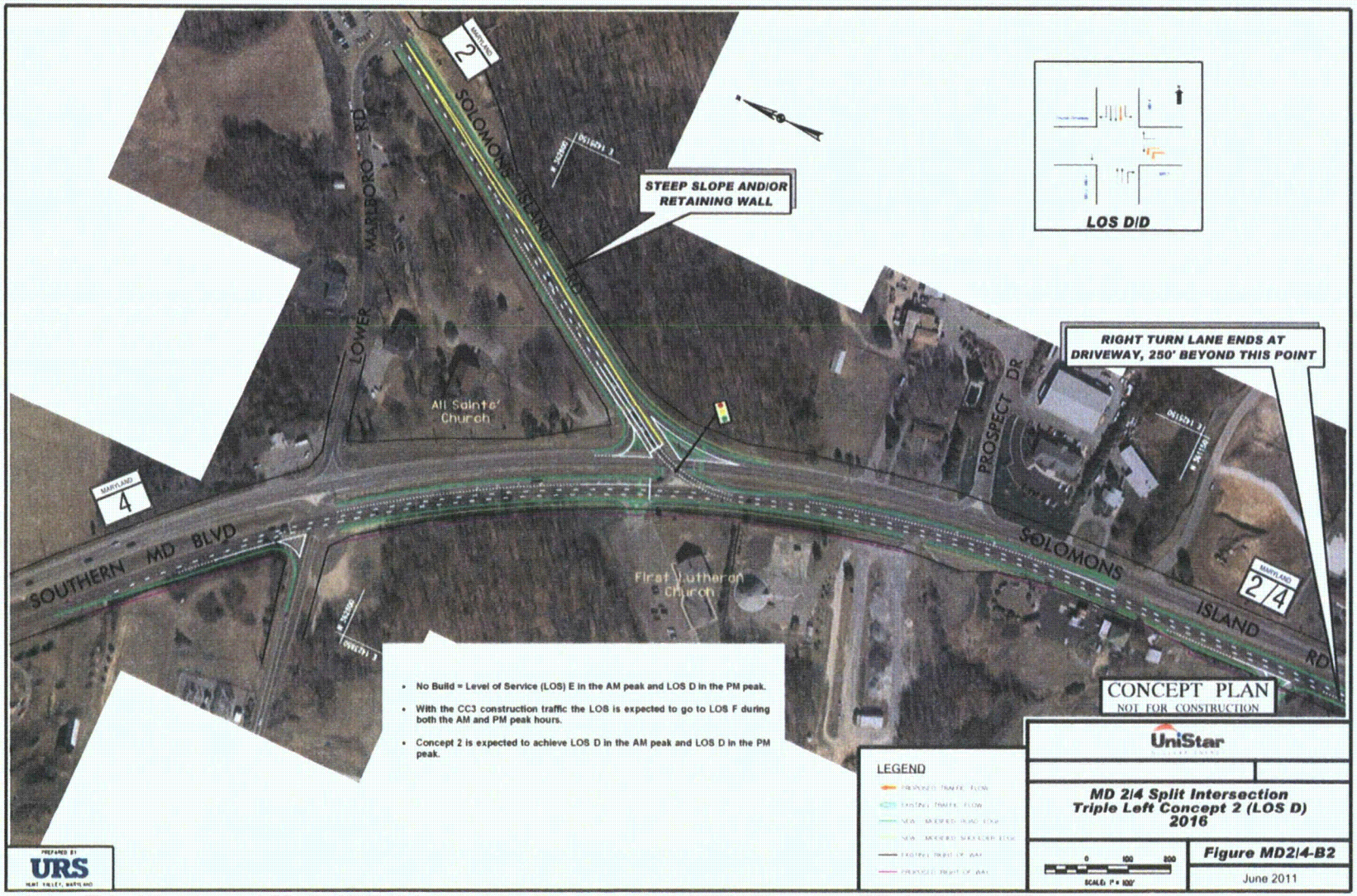


Figure 13 – MD 2 and MD 4 – Mitigation Concept 2

6.1.3.MD 2/MD 4 and MD 231-Traffic Analysis

This intersection has recently been upgraded by the SHA. With the increased traffic loads projected to use this intersection during construction, the CLV and LOS during the PM peak periods are above SHA guidelines, as seen in Table 5. Three mitigation options were developed for this intersection. The LOS and CLV for each option are shown in Table 7. The three options are defined below:

Option 1: Figure 14 presents Option 1 for this location. Option 1 would convert the existing southbound right turn lane to a thru lane. The receiving lane for this 4th southbound thru lane would be the existing receiving lane for the existing eastbound free right turn lane. Based upon SHA's comments, a separate right turn lane is proposed, which would require widening on the northwest quadrant. A separate receiver for the east free right movement is proposed to accommodate the free right movement. The existing eastbound thru lane is converted to a shared thru/left lane. Also, the 2nd westbound left turn lane would be converted into a thru/left turn lane and an exclusive right turn lane is to be added to this approach. Figure 15 shows how the added SB lane would continue through the adjacent intersection at Sherry Lane/Old Field Lane and also illustrates the transition back to 2 moving lanes beyond that point. The resulting LOS and CLV are shown in Table 7. With this mitigation in place, the intersection operates at a LOS D, however, the widening of MD 2/4 at the northwest quadrant of the MD 231 intersection would involve significant property impacts to the property owner at this location (currently a car dealership). Based upon this assessment, we investigated other alternatives. We determined that there were no other viable options that would achieve a comparable Level of Service to Option 1 however we identified two additional options that achieve LOS E, as described below.

Option 2: Figure 16 presents Option 2 for this location. This option is distinct from Option 1 in that it does not have an additional SB thru lane and the corresponding downstream lane drop. All other mitigation is similar to Option 1. This option achieves LOS C in the AM and LOS E in the PM period. Although this option does not meet the SHA requirement of LOS D in the PM, it is presented for special consideration since it would avoid the right of way impacts associated with Option 1 while still providing capacity improvements.

Option 3: Option 3, presented in Figure 17 below, is a second alternative which offers capacity improvements without widening the MD 2/MD 4 mainline. In this option, capacity is improved by adding a 2nd WB thru lane on the eastern leg of MD 231. Option 3 also achieves LOS C in the AM and LOS E in the PM period. Although this option does not meet the SHA requirement of LOS D in the PM, it is presented for special consideration since it would avoid the right of way impacts associated with expanding the MD 2/MD 4 mainline.

6.1.4.MD 2/MD 4 and MD 231 Constructability and Geometric Analysis

The Concept Plans for the MD 2/ MD 4 at MD 231 Intersection show the existing and proposed right-of-way lines. Option 1 would require widening MD 2/4, whereas Options 2 and 3 only involve widening the east leg of MD 231 (at the northeast quadrant). With Option 1, widening MD 2/4 at the northwest quadrant would require shifting the car dealer parking lot curb line approximately 14 feet towards the car dealer building. The remaining space between the proposed parking lot curb and the car dealer building would be approximately 22 feet wide, which would be required for circulation within the lot. This would result in a loss of approximately 12 parking/display spaces on the frontage of MD 2/4, currently used by the car dealer. Based upon this severe impact, we believe that an alternative to Option 1 would be preferable.

Options 2 or 3 require widening the east leg of MD 231 at the northeast quadrant. The outside widening and impacts are approximately the same for both Options 2 and 3. The proposed parking lot curb line for the two properties at this location would shift approximately 15 feet. On the convenience store property (currently a 7-11), the remaining driveway area between the new parking lot curb and the parking island would be over 30 feet wide, which is adequate for site circulation. On the adjacent parking lot, the corner of the lot can be restriped to maintain the existing number of parking spaces and adequate drive lanes. Additionally there is a decorative brick wall with a "Prince Frederick" sign at the northeast corner. This sign would be reconstructed at the same corner, approximately 15 feet behind its current location.

Options 1 and 2 require a triple left from eastbound MD 231 onto northbound MD 2/4. We have determined that the geometry of the intersection can accommodate one WB-50 and two passenger vehicles running concurrently. The truck turning templates for one version of this configuration is shown on Figure 18. Since Option 3 does not involve a triple left, we recommend Option 3 for the MD 231 intersection.

Table 7 – Intersection LOS: MD 2/MD 4 and MD 231: 2016 Conditions

Mitigation Detail	*CLV*				*LOS*			
	Background		*Construction*		*Background*		*Construction*	
	AM	*PM*	*AM*	*PM*	*AM*	*PM*	*AM*	*PM*
None	974	1236	1331	**1640**	A	C	D	**F**
Option 1: Restripe EB thru lane as left+thru, add receiver for EB right, add 1 SBT lane, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane	941	1019	1092	1367	A	B	B	D
Option 2: Restripe EB thru lane as left+thru, add receiver for EB right, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane	941	1193	1297	**1597**	A	C	C	**E**
Option 3: Add 1 WBT lane	932	1166	1288	**1571**	A	C	C	**E**

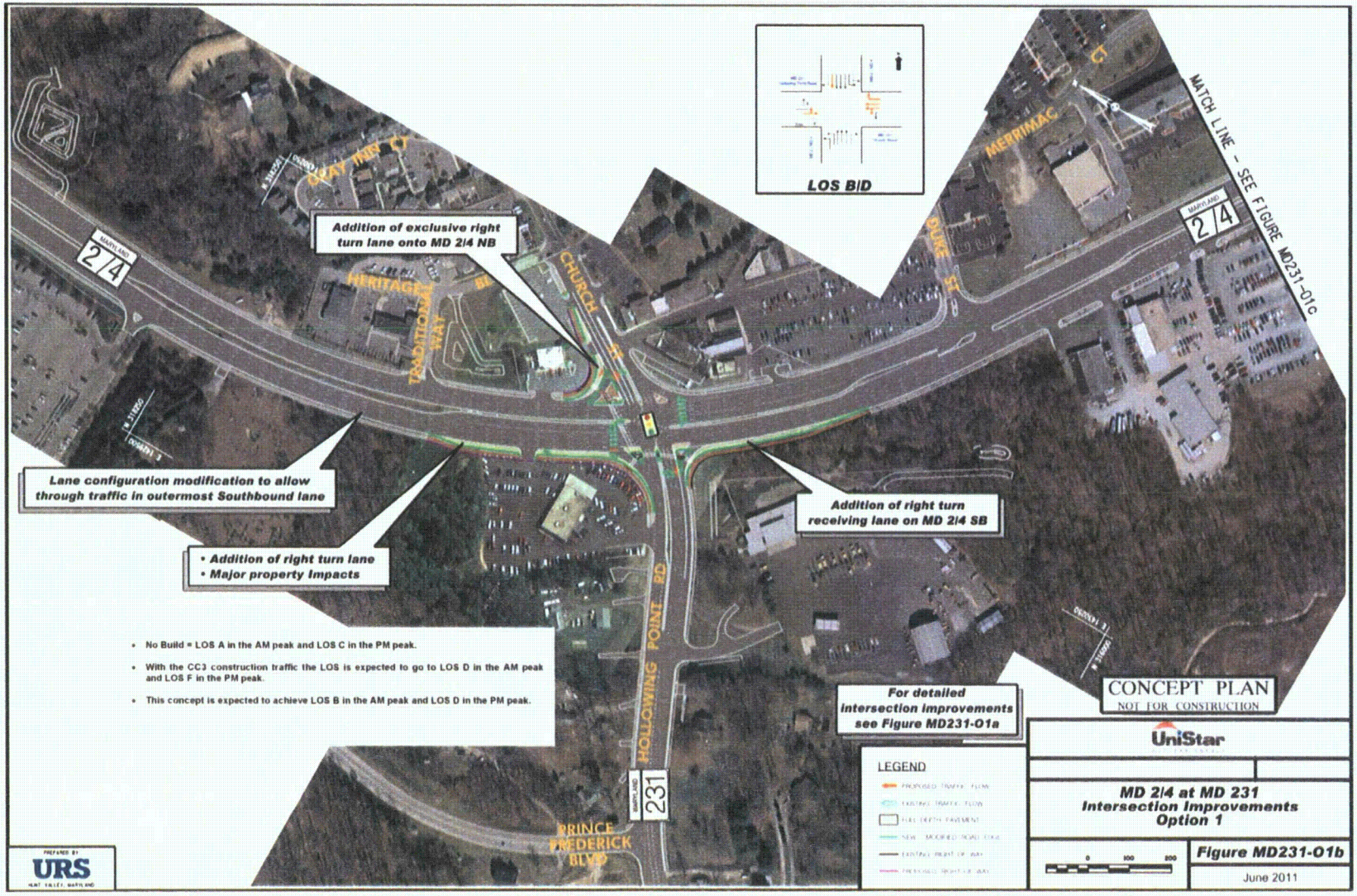


Figure 14 – MD 2/MD 4 and MD 231 – Mitigation Measures – 2016 Conditions – Option 1

Figure 15 - MD 2/MD 4 and Sherry Lane/Old Field Lane – Option 1

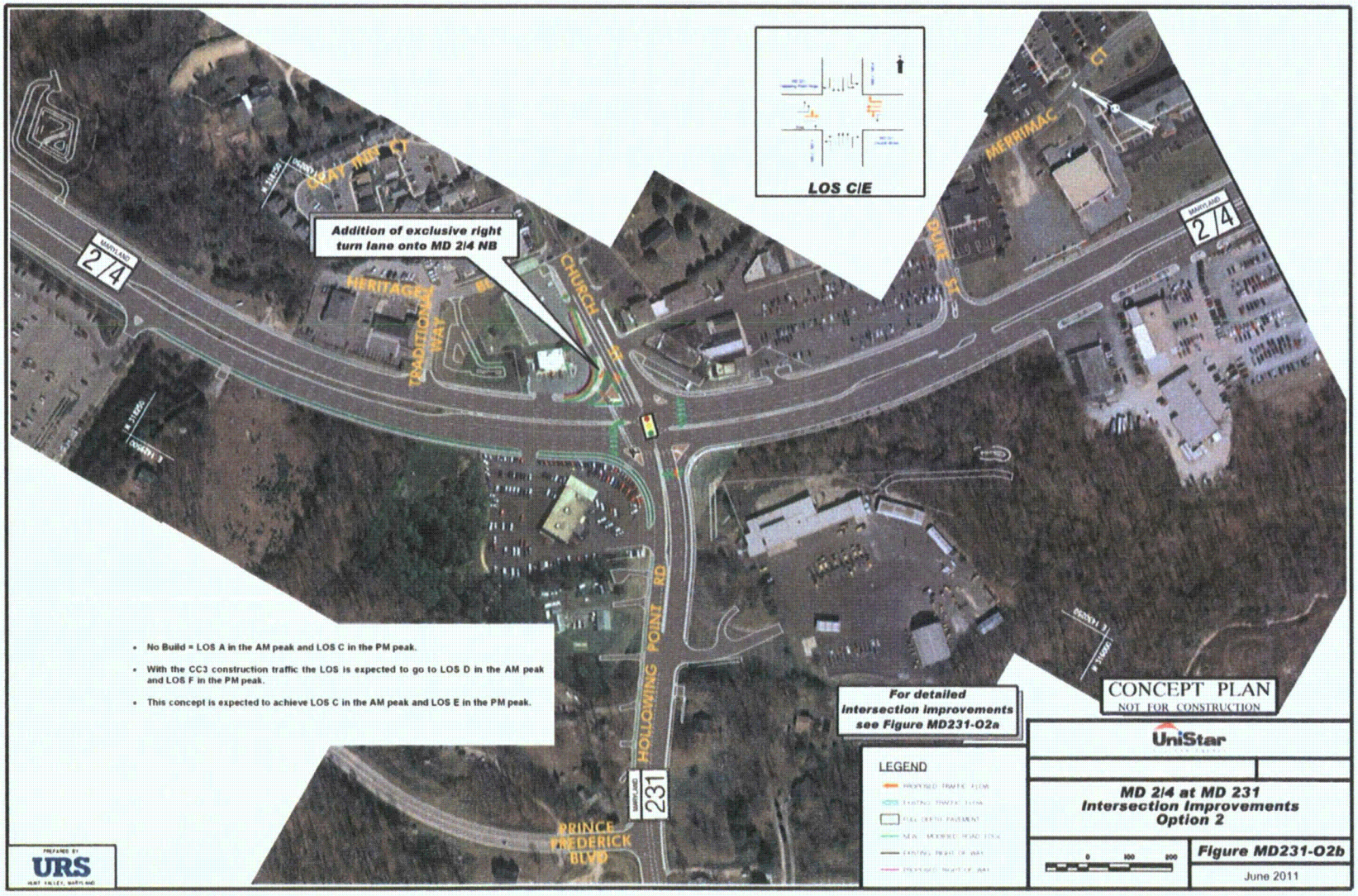


Figure 16 – MD 2/MD 4 and MD 231 – Mitigation Measures – 2016 Conditions – Option 2

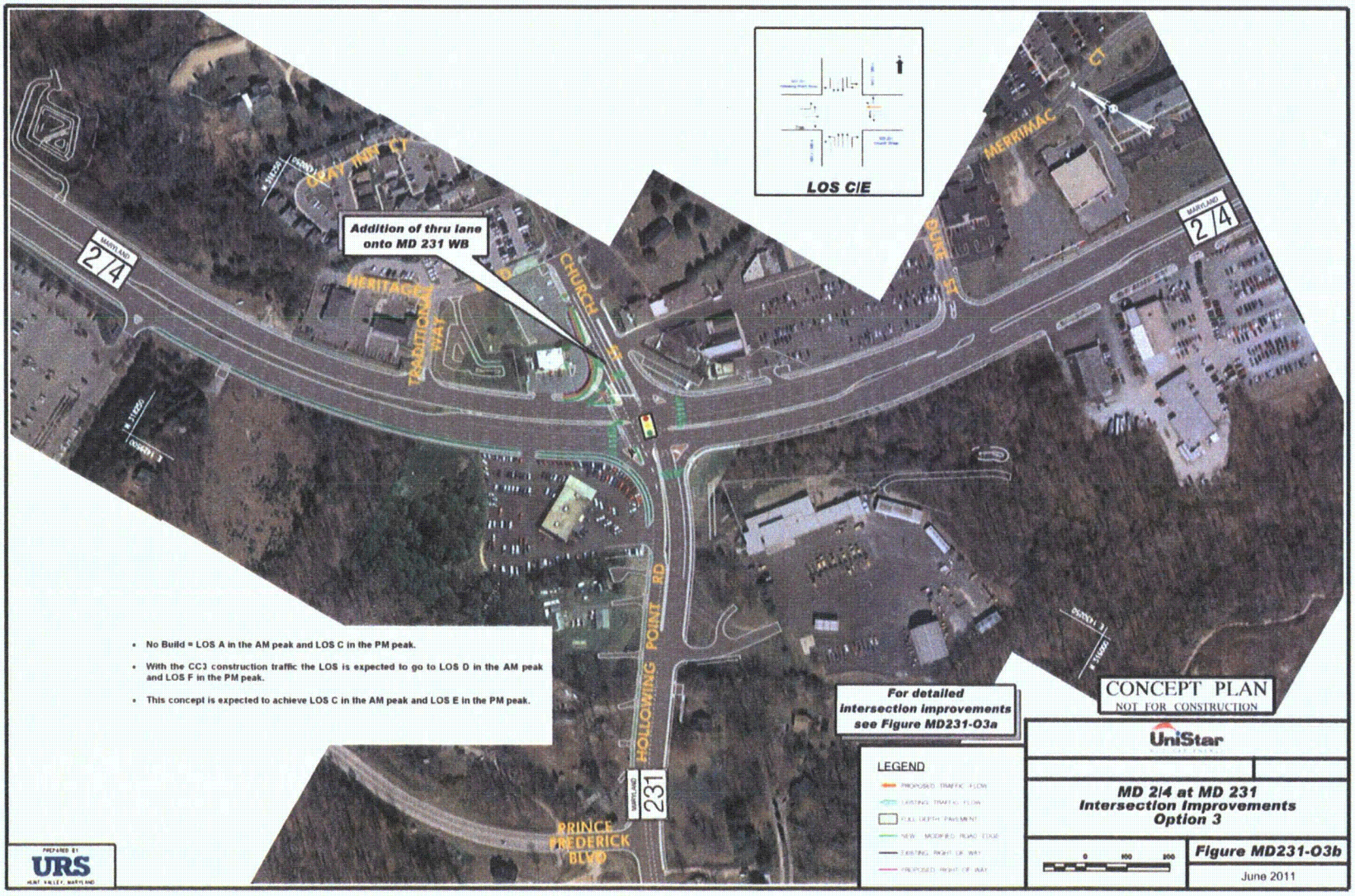


Figure 17 – MD 2/MD 4 and MD 231 – Mitigation Measures – 2016 Conditions – Option 3

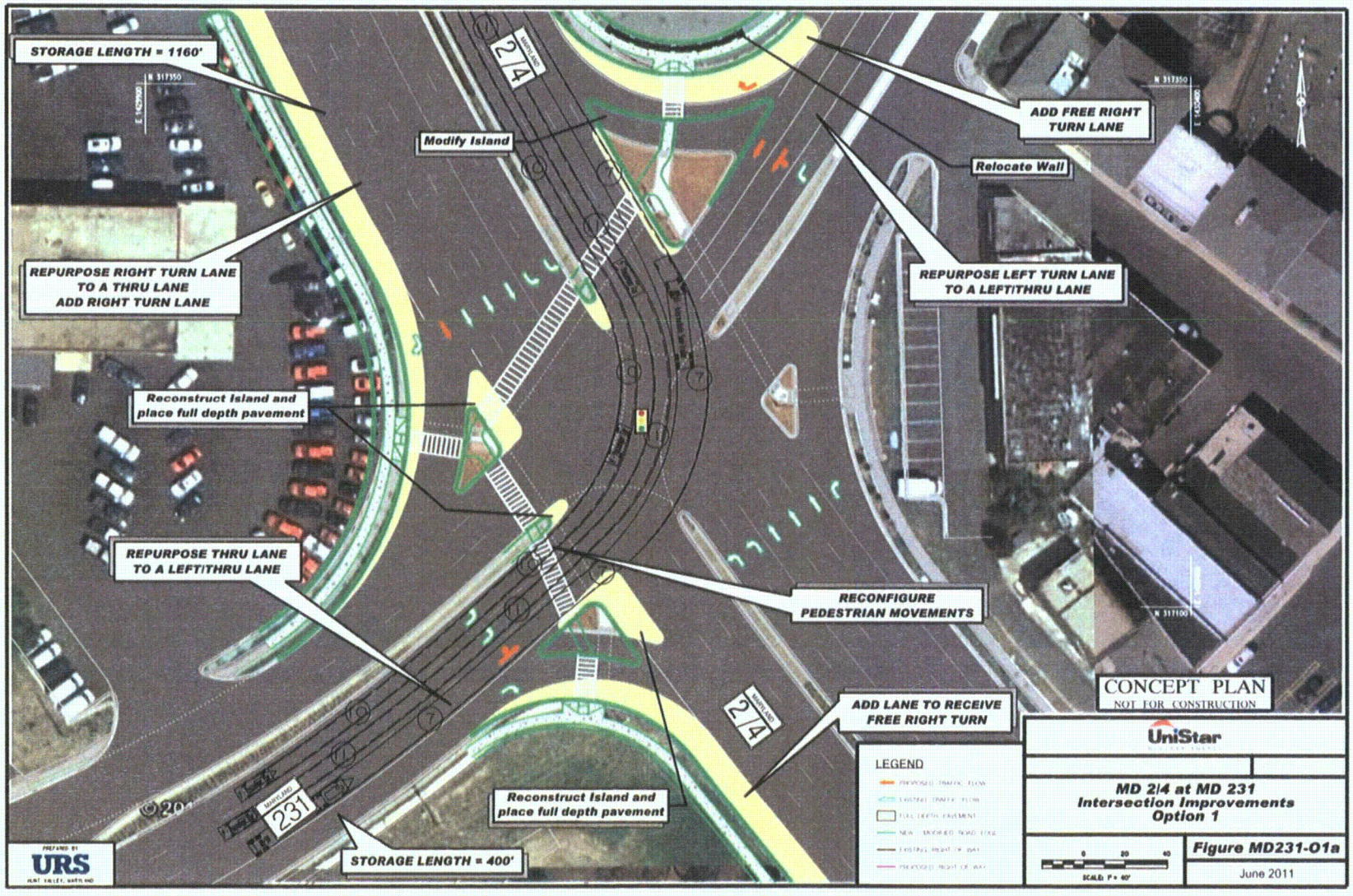


Figure 18 – MD 2/MD 4 and MD 231 – Mitigation Measures – 2016 Conditions – Option 1 – Truck Turning Template

6.1.5.MD 2/MD 4 and Calvert Beach/Ball Road

Similar to MD 2/MD 4, this intersection does not meet the operating requirements of LOS D, in both the AM and PM peak periods during construction, as shown in Table 5. Figure 19 presents a mitigation concept at this location. This involves adding a lane to MD 2/MD 4 to both directions. The resulting LOS and CLV are shown in Table 8. With this mitigation in place, the intersection operates acceptably.

Table 8 – Intersection LOS: MD 2/MD 4 and Calvert Beach Road: 2016 Conditions

Mitigation Detail	*CLV*				*LOS*			
	Background		*Construction*		*Background*		*Construction*	
	AM	*PM*	*AM*	*PM*	*AM*	*PM*	*AM*	*PM*
None	1040	1248	**1764**	**1757**	B	C	**F**	**F**
Add NBT and SBT	827	1006	1355	1368	A	B	D	D

6.1.6.MD 2/MD 4 and Calvert Cliffs Parkway

This is Maryland-T with no stopping for the southbound thru movement. During the PM peak period, with the increased traffic loads from construction traffic leaving the site, the NB movement needs additional capacity to meet the SHA requirement of LOS D as seen in Table 5. Hence it is proposed to add a lane on the northbound section of MD 2/MD 4 at this intersection. Space formerly occupied by the acceleration lane serving the WB left turn from Calvert Cliffs Parkway is reallocated as storage for the 3 southbound left turning bays required by the downstream CC3 Access Road intersection. Per discussions with SHA, due to the geometric constraints and concerns over the ability of WB left turning vehicles from Calvert Cliffs Parkway to merge, this movement is prohibited for the duration of the construction phase and the signal phase which services the WB movement will be removed from the timing plan. The diverted left turn traffic from CC1&2 will be directed to the temporary CC3 access intersection, internal to the site. Figure 20 presents a mitigation concept at Calvert Cliffs Parkway. The resulting LOS and CLV are shown in Table 9. With this mitigation in place, the intersection operates acceptably.

Table 9 – Intersection LOS: MD 2/MD 4 and Calvert Cliffs Parkway: 2016 Conditions

Mitigation Detail	*CLV*				*LOS*			
	Background		*Construction*		*Background*		*Construction*	
	AM	*PM*	*AM*	*PM*	*AM*	*PM*	*AM*	*PM*
None	930	796	888	**1592**	A	A	A	**E**
Add NBT, prohibit WBL turn	704	595	662	1172	A	A	A	C

The CLV calculations in Table 6 through Table 9 along with the drawings of the proposed mitigation at the other intersections are presented in Appendix H. All lane additions considered SHA 95th percentile queue analysis, and lane drops considered MUTCD requirements; no continuous lane additions are recommended for MD 2/MD 4. Existing bike/ped shoulders will be moved to the right, to retain these facilities.

6.2. Summary of Results after Recommended Mitigation

Table 10 provides a summary of the recommended mitigation.

Table 10 – Recommended Mitigation by Intersection

Intersection	*Mitigation Detail*
MD 2/MD 4 diverge	Concept 2: Remove Maryland-T, add 1 SBT and 2 WBL lanes
MD 231 & MD 2/MD 4	Option 3: Add 1 WBT lane
Calvert Beach/Ball Road & MD 2/MD 4	Add 1 SBT and 1 NBT lane
Calvert Cliffs Parkway & MD 2/MD 4	Add 1 NBT lane, prohibit WBL turn
White Sands Drive & MD 2/MD 4	None
Nursery Road & MD 2/MD 4	None
Pardoe Road & MD 2/MD 4	None
Cove Point Road & MD 2/MD 4	None

Table 11 provides a summary of the mitigation measures and comparison of the CLV between existing and construction peak conditions. The pink highlighted cells identify locations that have a CLV greater than 1450, all of which are addressed by the recommended mitigation (CLV levels also shown for the mitigation).

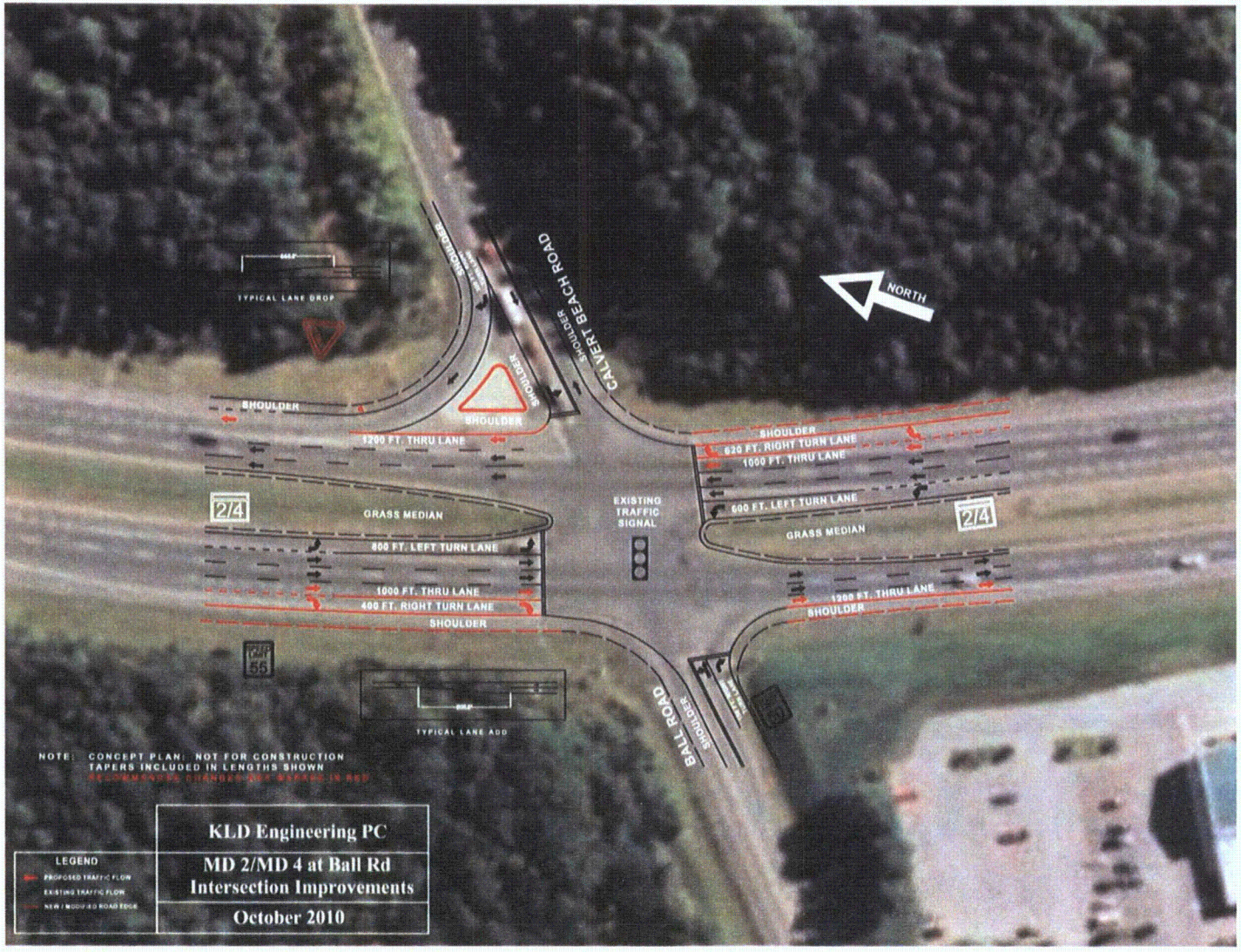


Figure 19 – MD 2/MD 4 and Calvert Beach Road– Mitigation Measures – 2016 Conditions

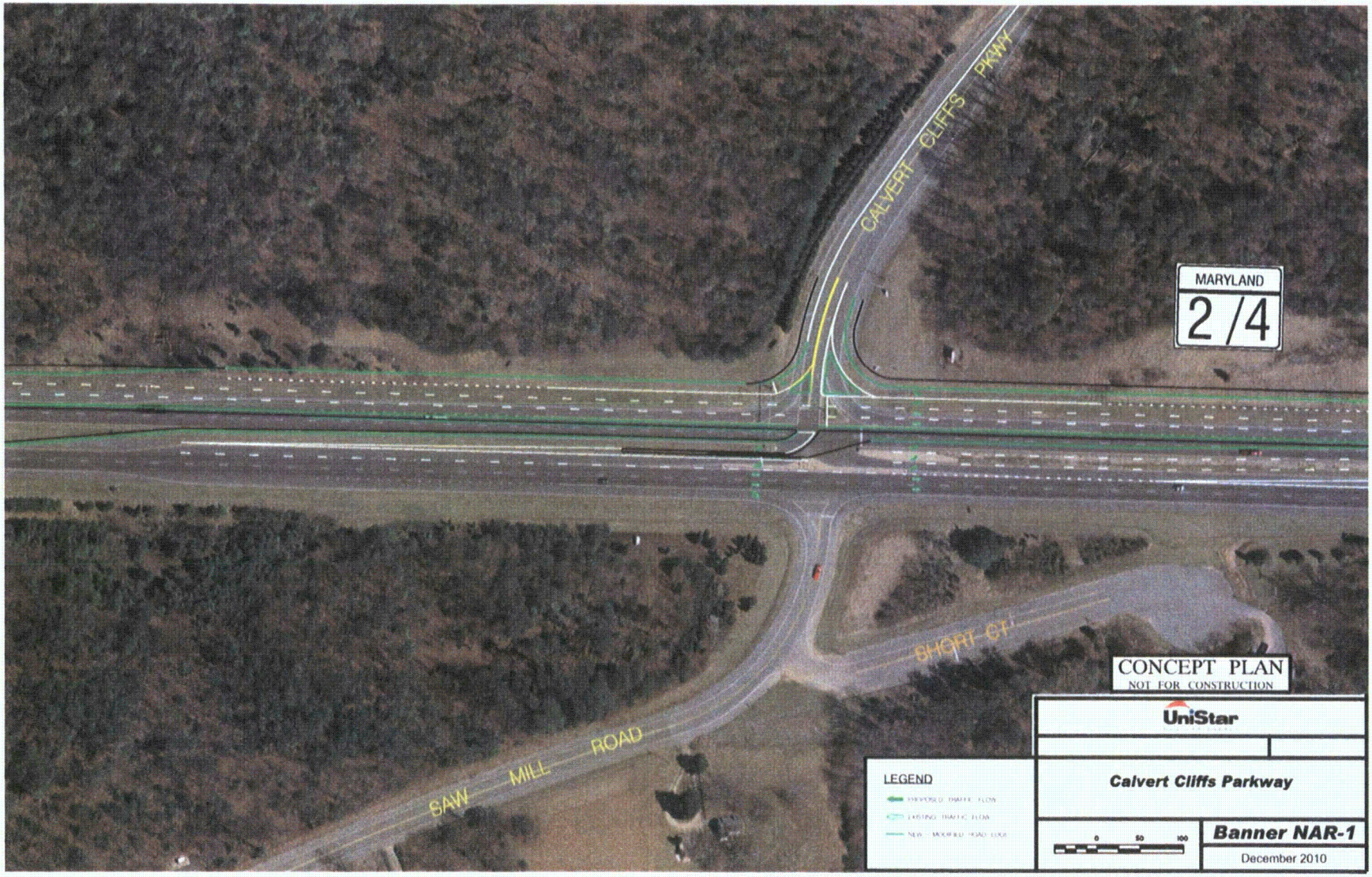


Figure 20 – MD 2/MD 4 and Calvert Cliffs Parkway– Mitigation Measures – 2016 Conditions

Table 11 – Summary of Conditions (CLV/Synchro HCM Delay)

Intersection	Mitigation Detail	2010		2016			
		Existing		No-Build		Construction	
		AM	PM	AM	PM	AM	PM
MD 2 and MD 4	None	1344	1176	1514	1325	1879	1946
	Concept 1: Remove Maryland-T, add 1 SBT and 1 WBL lane			1328	1280	1547	1583
	Concept 2: Remove Maryland-T, add 1 SBT and 2 WBL lanes			1259	1176	1423	1447
MD 2/MD 4 and MD 231	None	865	1098	974	1236	1331	1640
	Option 1: Restripe EB thru lane as left+thru, add receiver for EB right, add 1 SBT lane, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane			941	1019	1092	1367
	Option 2: Restripe EB thru lane as left+thru, add receiver for EB right, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane			941	1193	1297	1597
	Option 3: Add 1 WBT lane			932	1166	1288	1571
MD 2/MD 4 and Calvert Beach	None	952	1148	1040	1248	1764	1757
	Add one SBT and one NBT lane			827	1006	1355	1368
MD 2/MD 4 and Calvert Cliffs	None	837	710	930	796	888	1592
	Add one NBT lane, Prohibit WBL turn			704	595	662	1172
MD 2/MD 4 and CC3 Access Road*	Create temporary intersection					54.4	52.5
MD 2/MD 4 and White Sands Drive	None	708	1080	782	1199	782	1400
MD 2/MD 4 and Nursery Road	None	715	949	808	1068	1008	1268
MD 2/MD 4 and Pardoe Road	None	881	961	961	1061	1162	1261
MD 2/MD 4 and Cove Point Road	None	746	1139	800	1212	997	1329

Note: Highlighted cells correspond to locations that have a CLV greater than 1450

* Values reported for CC3 Access Road reflect Synchro HCM delay (sec/vehicle) for the NBT movement

6.3. Required Lead Times, to Implement Recommended Mitigation

Figure 21 shows a typical curve of the growth of the CLV over time, specifically at Calvert Beach/Ball Road & MD 2/MD 4.

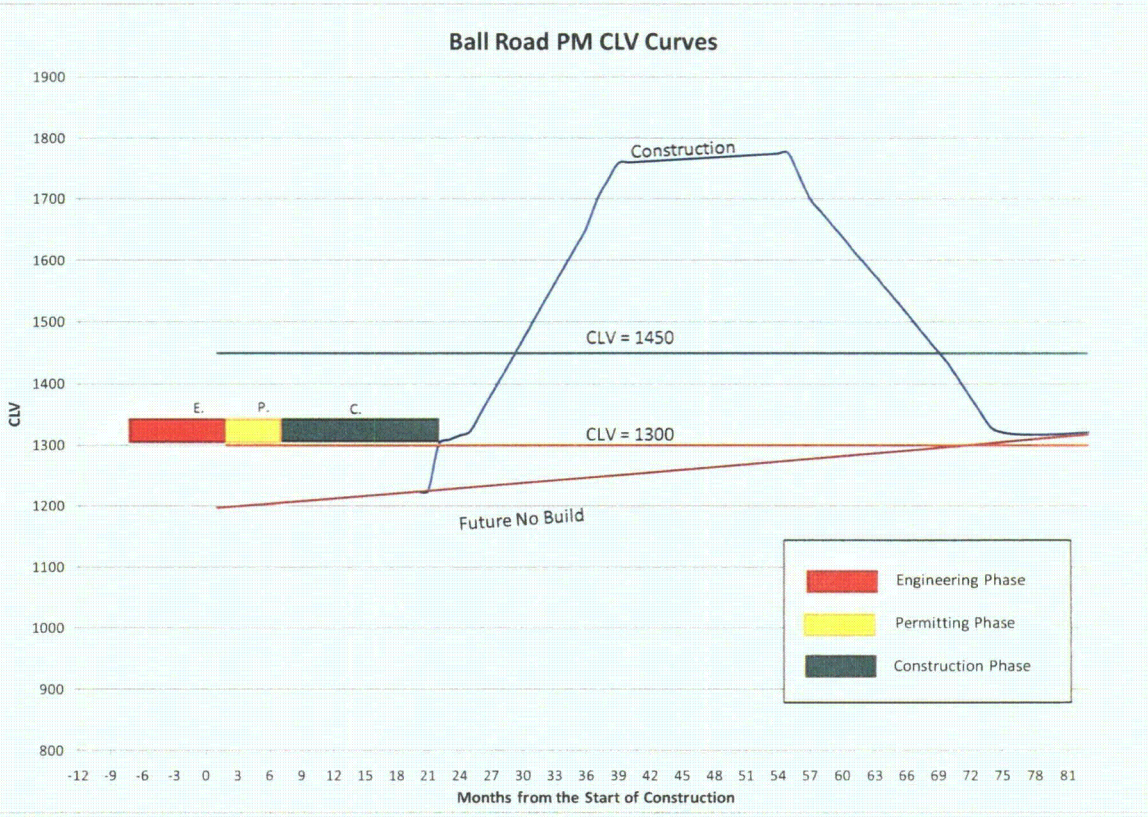


Figure 21 – Critical Lane Volumes at Ball Road/Calvert Beach Road & MD 2/MD 4, Without Mitigation, PM Peak Period

The traffic mitigation improvements must be done and in place before the CLV of 1450 vph is reached. Because of capacity-reducing effects of construction, a target was set that the traffic mitigation improvements had to be in place before a CLV of 1300 vph was reached.

Working backward from that date, one must consider

- the actual construction period
- any period lost to construction due to winter
- the permit process for the detailed engineering designs
- the detailed engineering design work itself
- additional buffer time to account for contingencies

For the present analysis, a period of 30 months (including a 6 month buffer) was used. The beginning of that period is the "last possible date" to start the process. It is shown in Figure 21 as the lead end of the engineering -permitting-construction (E-P-C) sequence.

This approach was used at all intersections, except CC3 Access Road & MD 2/MD 4, which is discussed in the next section.

6.4. CC3 Access Road & MD 2/MD 4

Until the CC3 Access Road intersection is built, the sole path into the site for pre-construction and early construction activity (e.g. site clearance) is the intersection of Nursery Rd & MD 2/MD 4.

Therefore, it is important that the work at CC3 Access Road & MD 2/MD 4 be completed before the left turn bay overflows and leads to increased delay for the vehicles entering/exiting the site, and spillback from the southbound left turn lane at that location.

Analyses have been done at this unsignalized intersection (as well as the others). As the pre-construction and then construction traffic grows over time, at some point the traffic arriving from the north leads to long queues and substantial delay in the SB left turn bay, spilling back with substantial delay and even spillback into the SB thru lanes.

Based upon queue analysis, the SB left turn bay 95th percentile queue exceeds the available storage of 500 feet by March 2015. Soon after, spillback from the southbound left turn lane is a distinct risk.

Based upon the potential for this spillback, it is necessary that the intersection of CC3 Access Road & MD 2/MD 4 be ready by March 2015, so that the arriving traffic is serviced there. Using the cited 30 month lead time, this means that the "latest start date" for the CC3 Access Road & MD 2/MD 4 is September of 2012 (If the construction at the new intersection can be done in a way that allows some usage for southbound left turns in the pre-construction and early construction phases, this date can be shifted later). Table 12 summarizes the "latest start dates" for the various mitigation activities.

Table 12 – Last Start Dates for E-P-C Sequence

Intersection	Latest Design Start Date	Notes
MD 2/MD 4 diverge	April 2012	The existing CLV exceeds 1300. Hence work is planned coincident with earliest work done (at Calvert Beach Road)
MD 2/MD 4 and MD 231	August 2012	
Calvert Beach Road & MD 2/MD 4	April 2012	
Calvert Cliffs Parkway & MD 2/MD 4	September 2012	Work planned coincident with CC3 Access Road due to proximity
CC3 Access Road & MD 2/MD 4	September 2012	See discussion in Section 6.4

6.5. Transportation Management Plan

The construction period represents an acute load on the road system. The present plans for the transportation management emphasize:

1) Spreading the demand over three shifts, for operational and traffic reasons;

2) Separating the plant operating personnel from the construction worker traffic flow, for operations and security reasons;

3) Setting a value for auto occupancy based upon Bechtel's experience (namely, 1.30 persons per vehicle) and the large scale of the project.

4) Assuring internal parking and circulation exists to service all construction worker vehicles, as well as materials deliveries;

5) Assuring entry point security operations that will avoid any possibility of queues affecting MD 2/MD 4;

6) Proposing specific traffic mitigation measures that will achieve the CLV levels and operations mandated by SHA;

7) Emphasis on mitigation measures that depend upon signalization, lane designations, or construction, rather than measures that require continual staffing over the life of the project.

7. SUMMARY

A summary of the analysis (LOS, CLV) and mitigation is shown in Table 11. Much effort has been spent on related project issues by UniStar and its team, specifically the current best estimate of the construction workforce profile and related issues (shift times, distribution by shift). That information has been incorporated into this document.

There is significant impact during an extended period within the construction period. The report details both the impact and the proposed mitigation.

In the "Future Build" 363 additional employees are required on site when the new unit is operational. They will actually phase in during the construction, and are taken into account in the construction profile. Given that the temporary access via CC3 Access Road & MD 2/MD 4 will be discontinued after the construction, a Supplemental TIS will be prepared for the post-construction phase at a later date. The scenarios in that Supplemental TIS will likely recommend use of White Sands Drive and/or Nursery Rd or Calvert Cliffs Parkway for the new unit operations employees.

8. REFERENCES

[1] http://www.nrc.gov/reactors/new-reactors/col/calvert-cliffs.html

[2] HCM 2000, Highway Capacity Manual, Transportation Research Board, Washington DC, July 2005

[3] STATE HIGHWAY ACCESS MANUAL - ENGINEERING ACCESS PERMITS DIVISION - January 2004 http://www.marylandroads.com/OHD/accesspermits.pdf as accessed August 31, 2009

[4] SYNCHRO Studio 7, User Manual, Trafficware Ltd., Sugarland, TX, June 2006

[5] Lusby Traffic Study Report, November 2005, STV / G&O Joint Venture

[6] http://www.marylandroads.com/OPPEN/Lusby_Transportation_Study.pdf As downloaded on October 9, 2009

[7] Maryland Manual On Uniform Traffic Control Devices - 2006 Edition (Rev-1, July 2009), Maryland State Highway Administration (MSHA), Baltimore, MD

[8] AASHTO Green Book – A Policy on Geometric Design of Highways and Streets, 5th Edition, American Association of State Highway and Transportation Officials, 2004.

Appendix A
Existing Conditions

Condition Diagrams and Signal Timing Plans

This appendix contains condition diagrams for all intersections and timing plans for signalized intersections shown in Figure A-1.

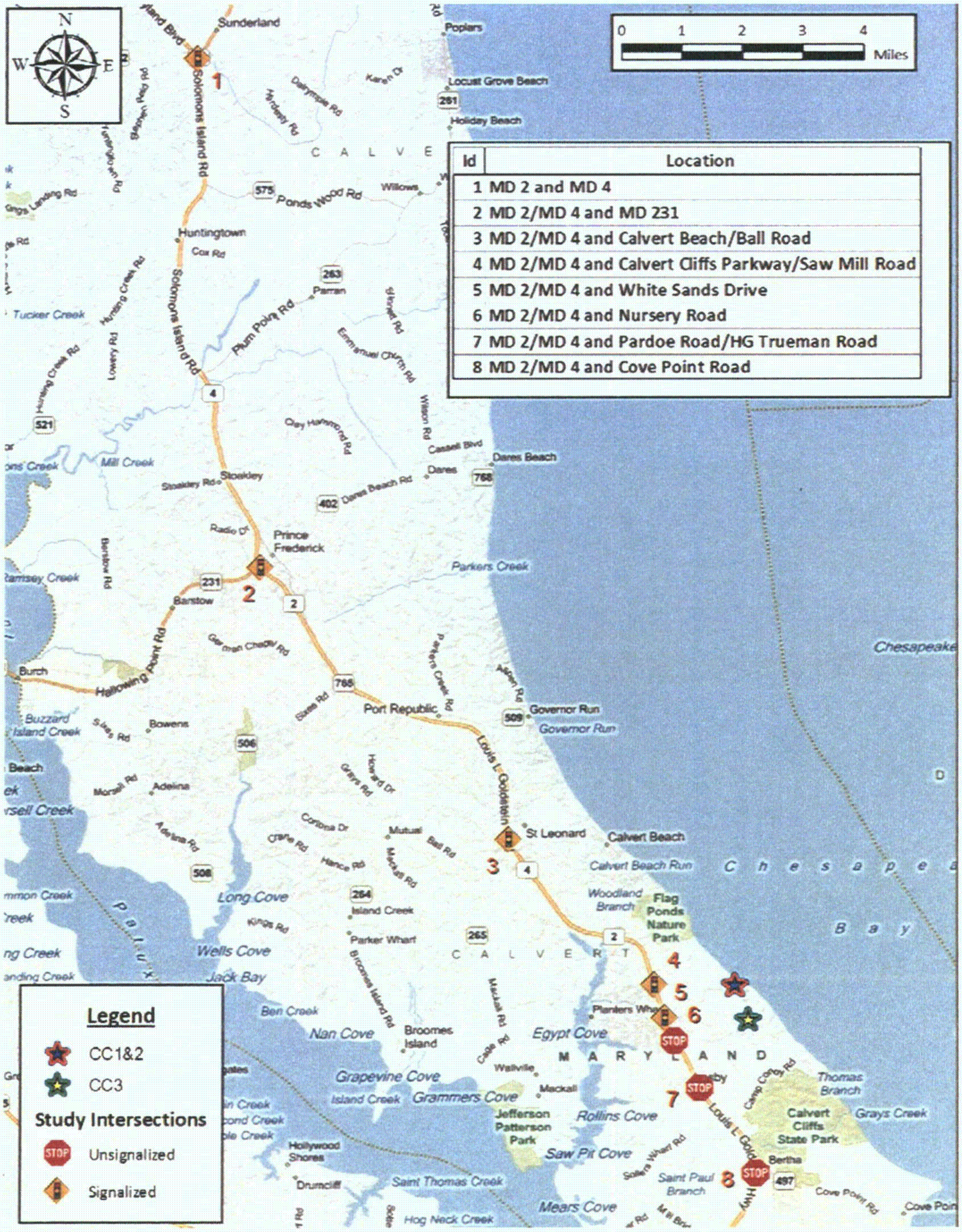
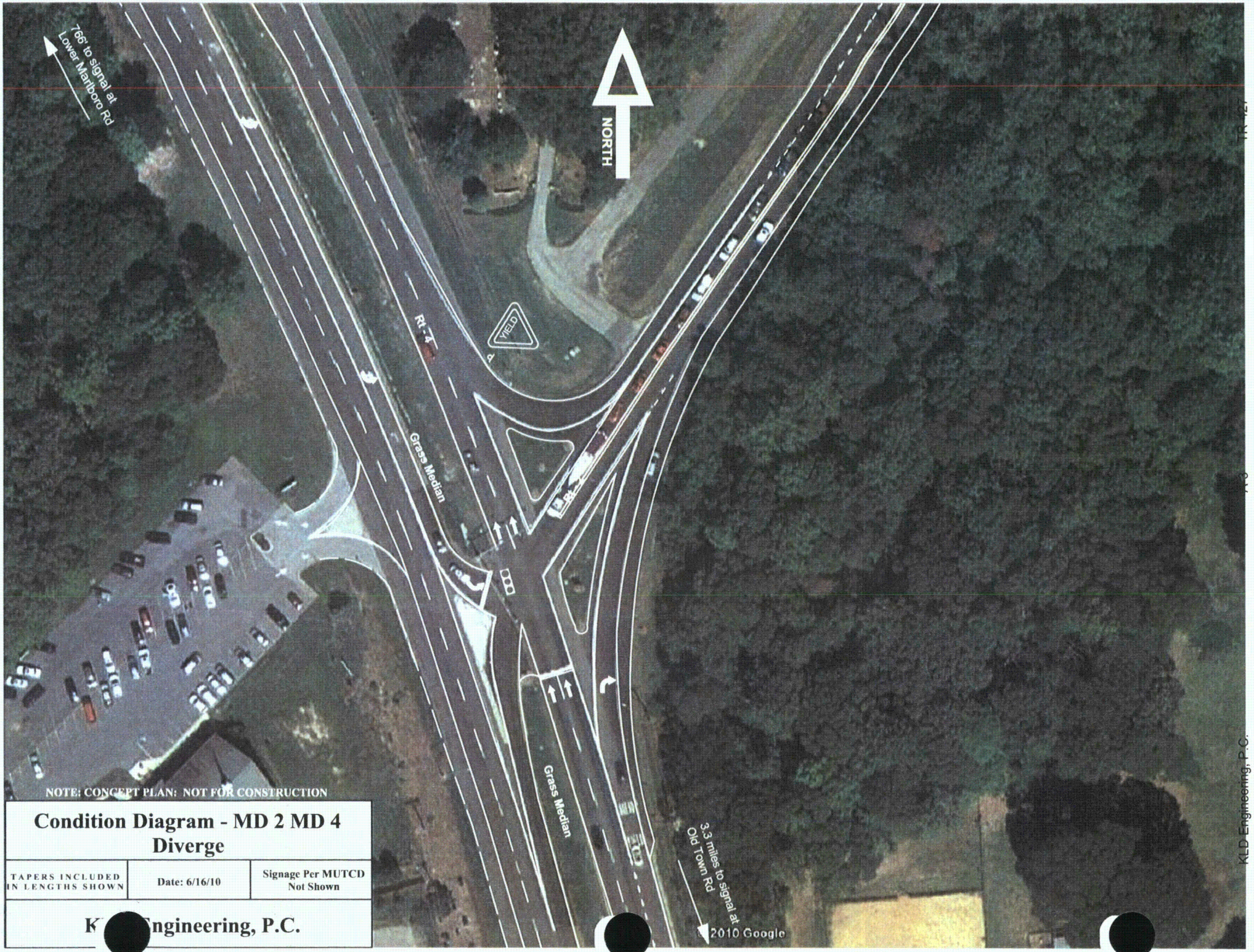


Figure A-1 – CCNPP Site and Traffic Impact Study Area



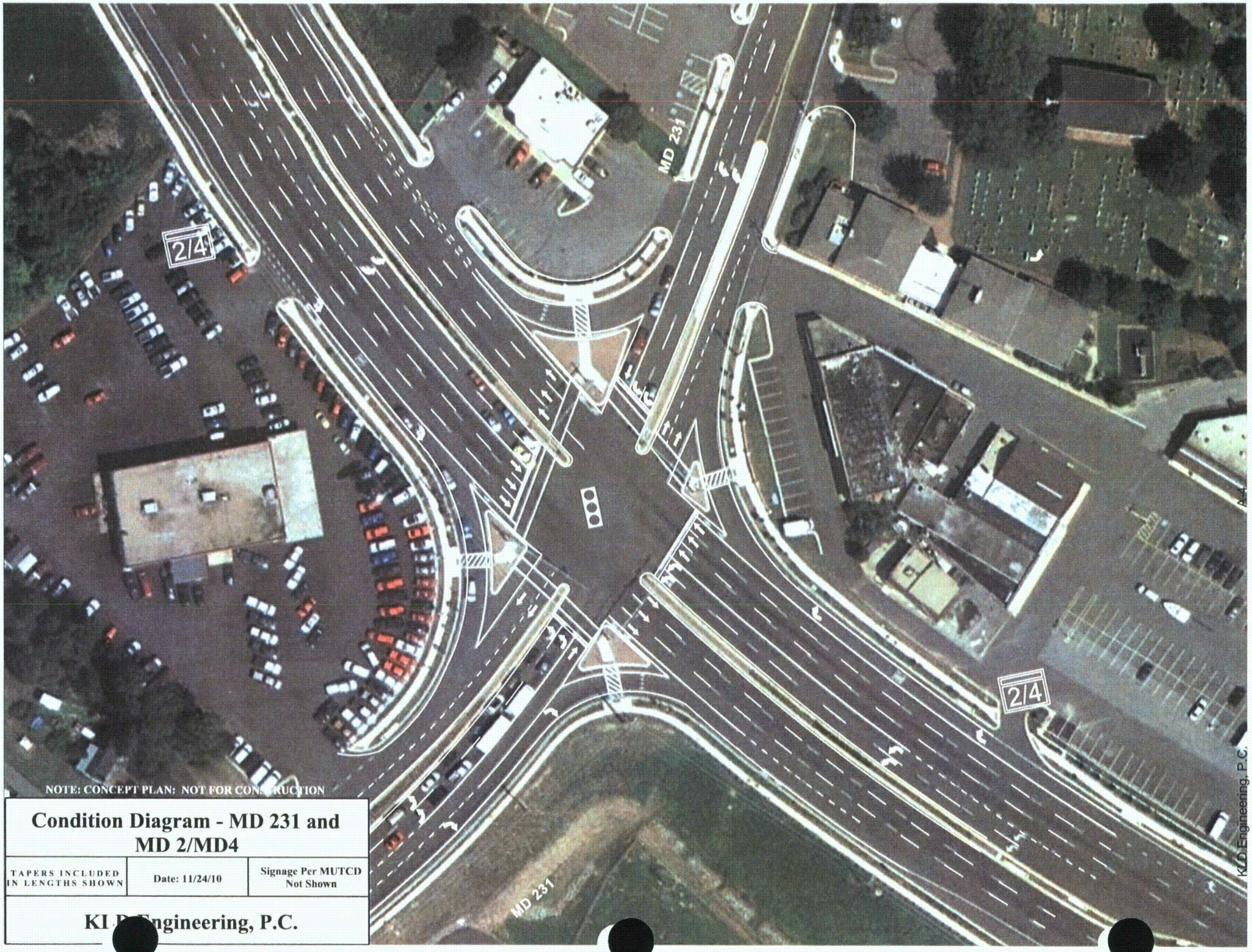
NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

Condition Diagram - MD 2 MD 4 Diverge

TAPERS INCLUDED IN LENGTHS SHOWN	Date: 6/16/10	Signage Per MUTCD Not Shown

K[redacted]Engineering, P.C.

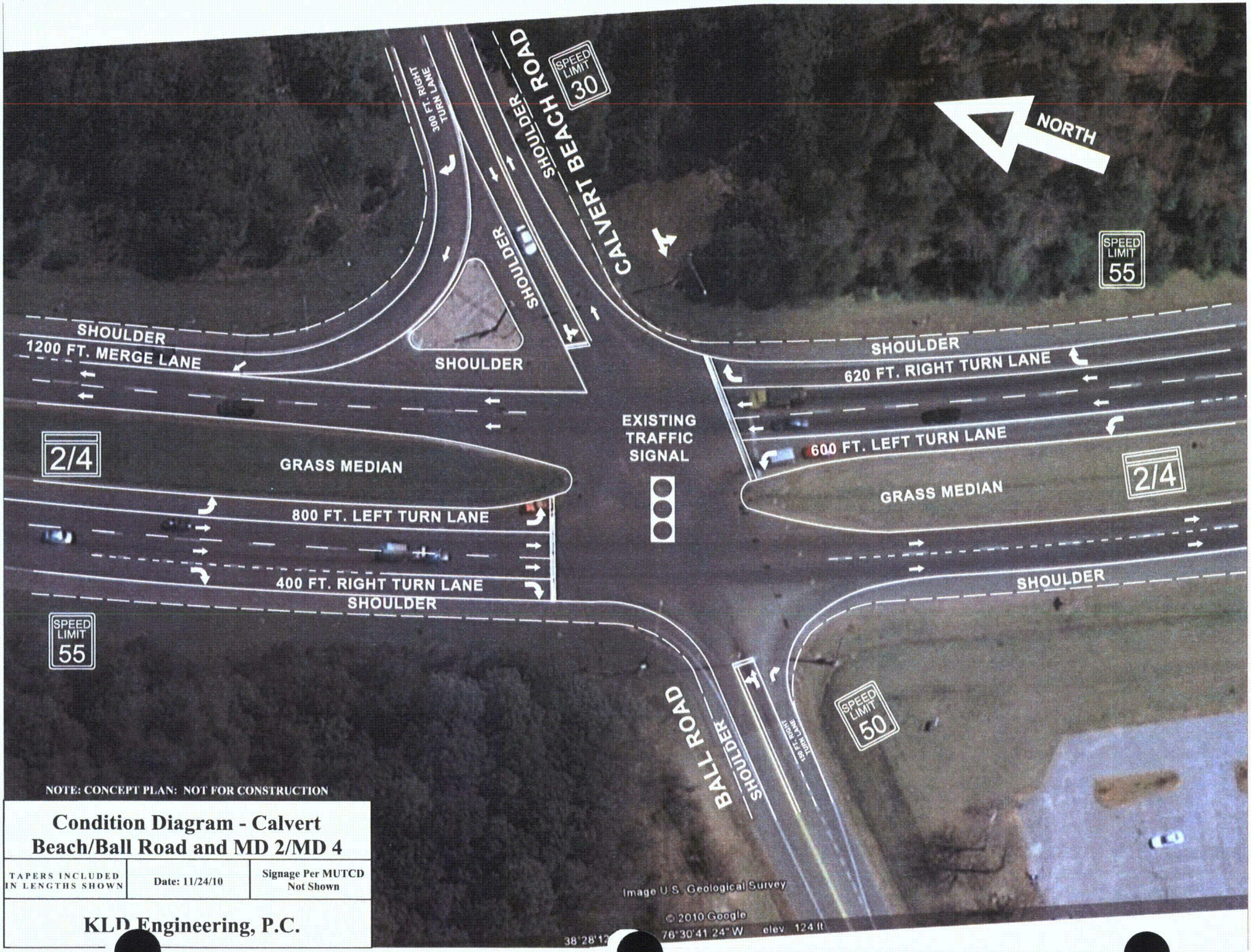
KLD Engineering, P.C.



Condition Diagram - MD 231 and MD 2/MD4

TAPERS INCLUDED IN LENGTHS SHOWN	Date: 11/24/10	Signage Per MUTCD Not Shown

KI D Engineering, P.C.



NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

Condition Diagram - Calvert Beach/Ball Road and MD 2/MD 4

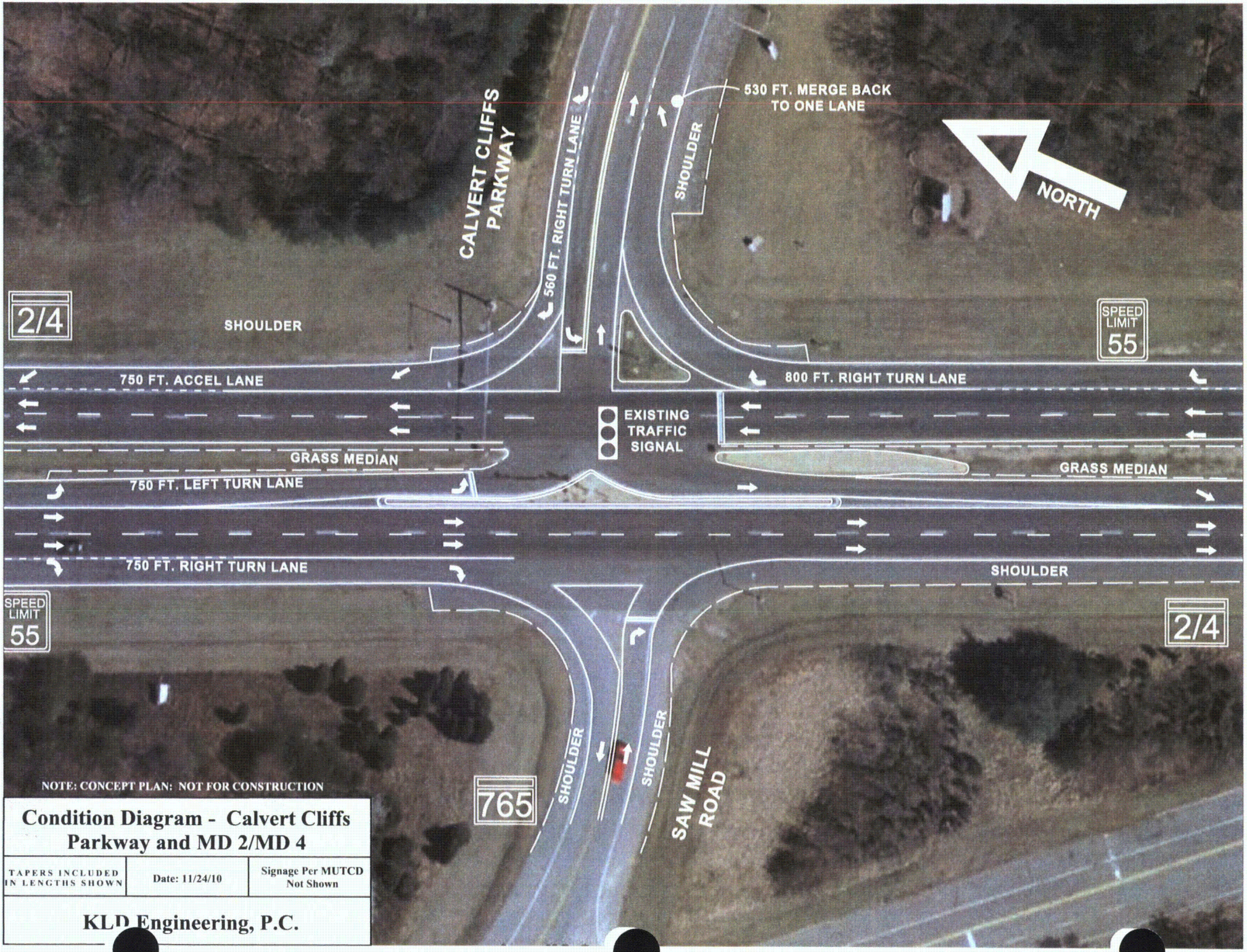
TAPERS INCLUDED IN LENGTHS SHOWN	Date: 11/24/10	Signage Per MUTCD Not Shown

KLD Engineering, P.C.

TR-427

A-5

KLD Engineering, P.C.



NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

Condition Diagram - Calvert Cliffs Parkway and MD 2/MD 4

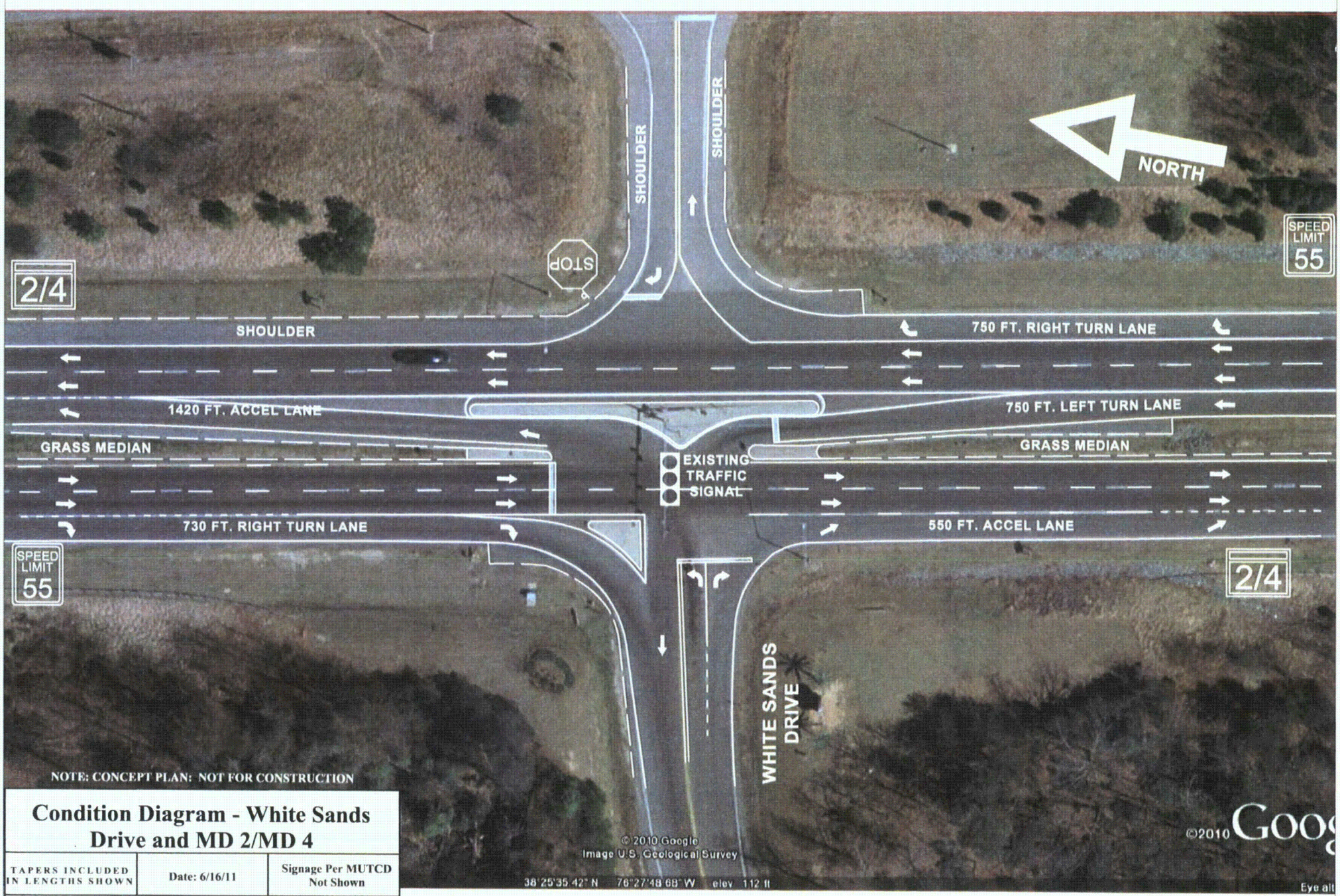
TAPERS INCLUDED IN LENGTHS SHOWN	Date: 11/24/10	Signage Per MUTCD Not Shown

KLD Engineering, P.C.

TR-427

A-6

KLD Engineering, P.C.



Condition Diagram - White Sands Drive and MD 2/MD 4

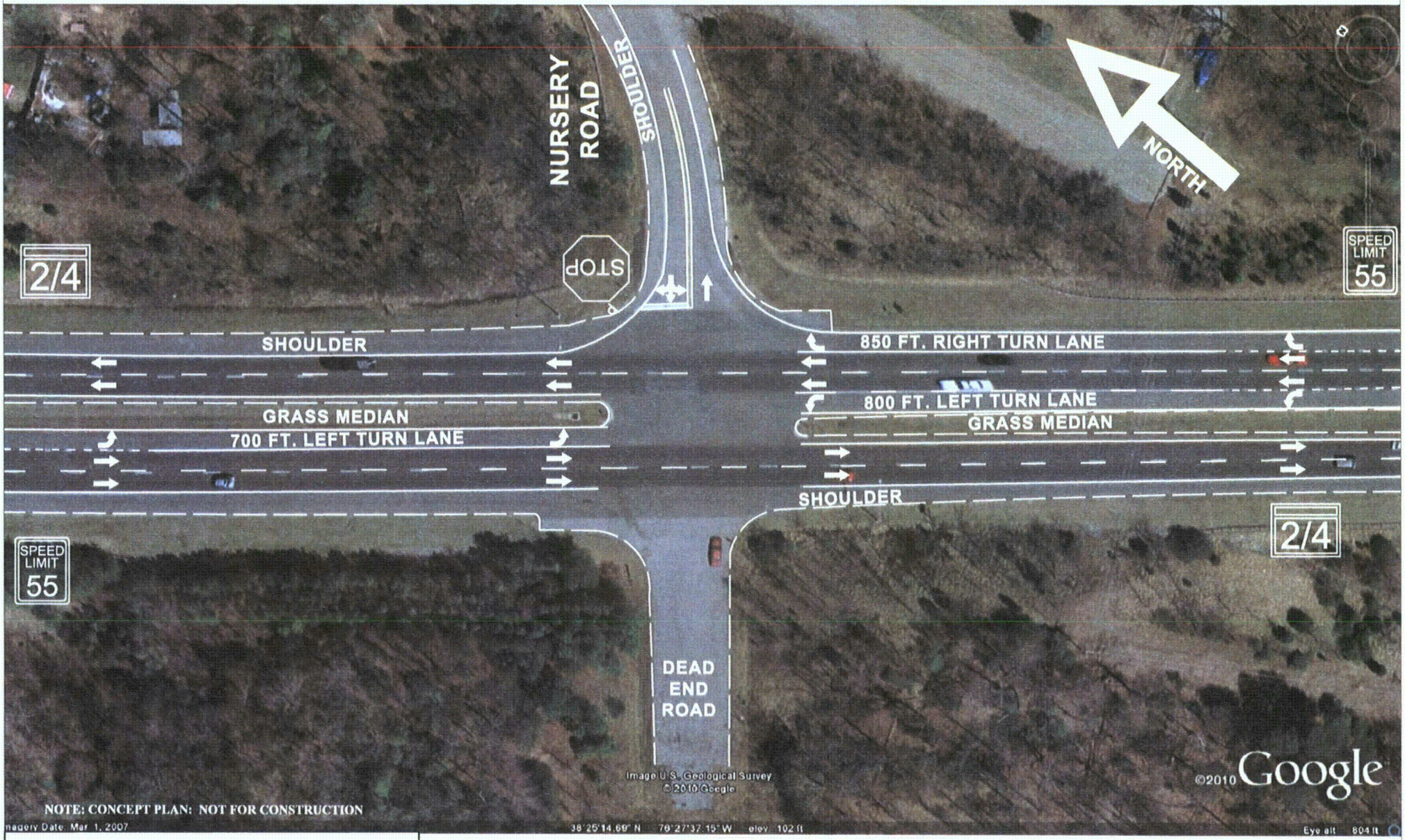
TAPERS INCLUDED IN LENGTHS SHOWN	Date: 6/16/11	Signage Per MUTCD Not Shown

KLD Engineering, P.C.

TR-427

A-7

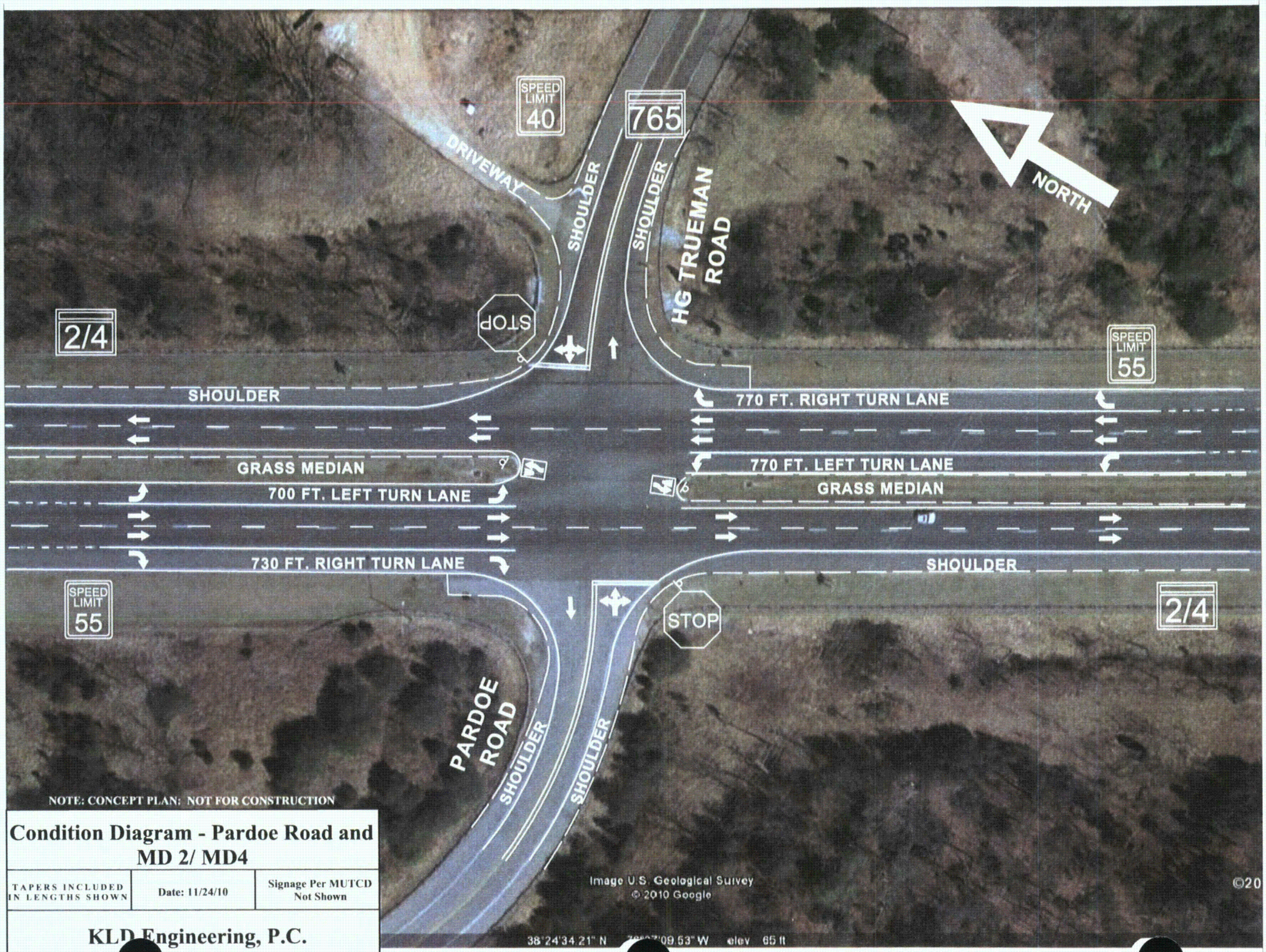
KLD Engineering, P.C.



Condition Diagram - Nursery Road and MD 2/MD 4

TAPERS INCLUDED IN LENGTHS SHOWN	Date: 11/24/10	Signage Per MUTCD Not Shown

KLD Engineering, P.C.



NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

Condition Diagram - Pardoe Road and MD 2/ MD4

TAPERS INCLUDED IN LENGTHS SHOWN	Date: 11/24/10	Signage Per MUTCD Not Shown

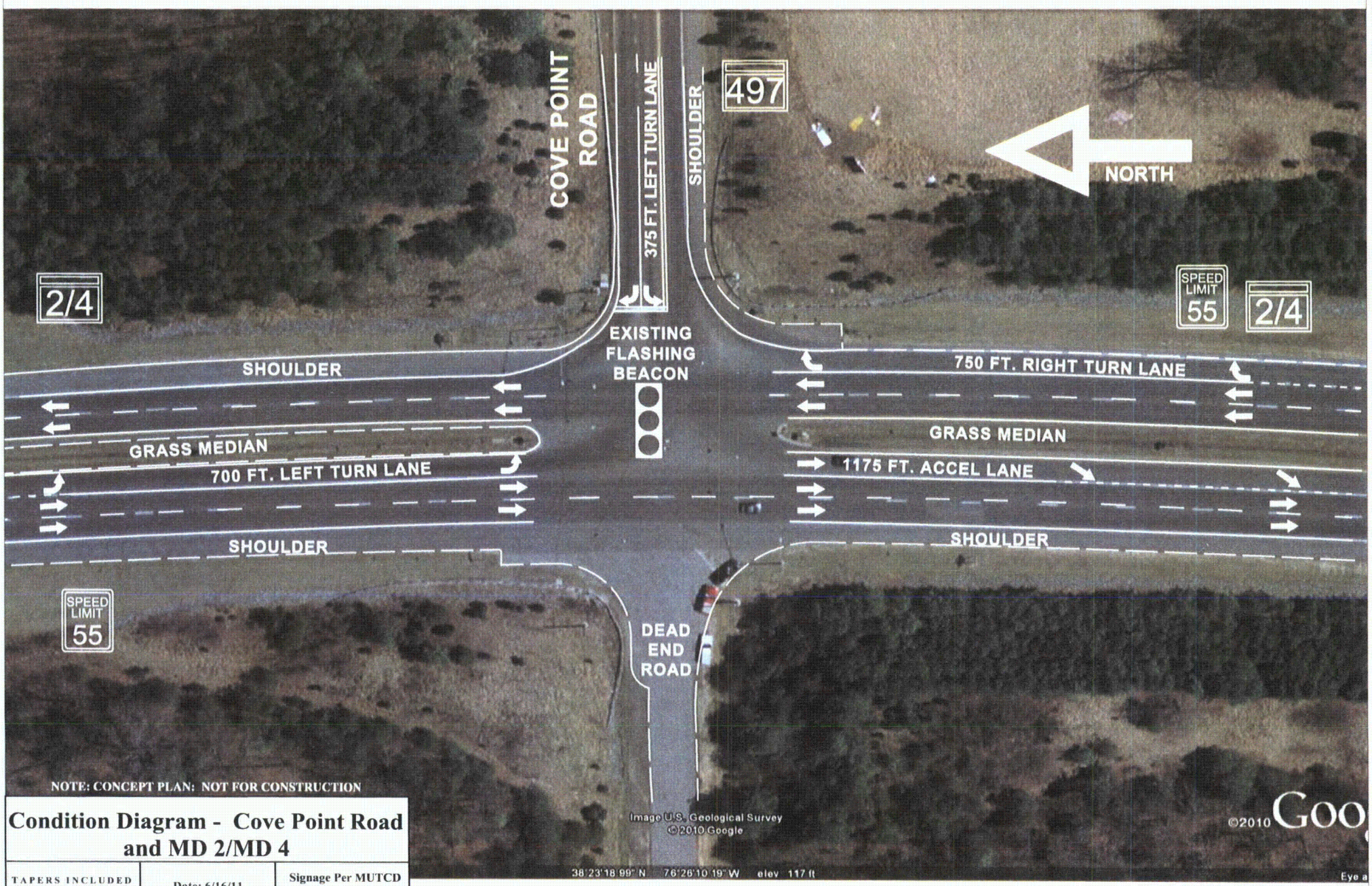
KLD Engineering, P.C.

TR-427

A-9

KLD Engineering, P.C.

©20



NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

Condition Diagram - Cove Point Road and MD 2/MD 4

TAPERS INCLUDED IN LENGTHS SHOWN	Date: 6/16/11	Signage Per MUTCD Not Shown

KLD Engineering, P.C.

RFI MW-004

STATE HIGHWAY ADMINISTRATION TIMING CHART WORKSHEET

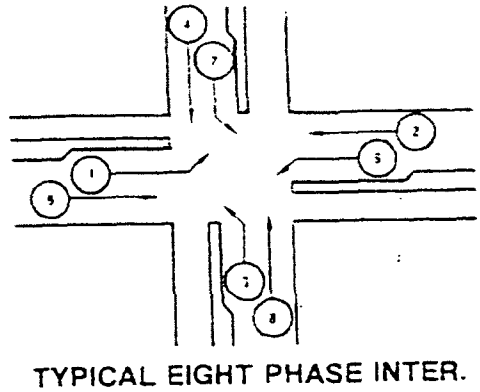
--LEGEND--

ALL VALUES IN SECONDS

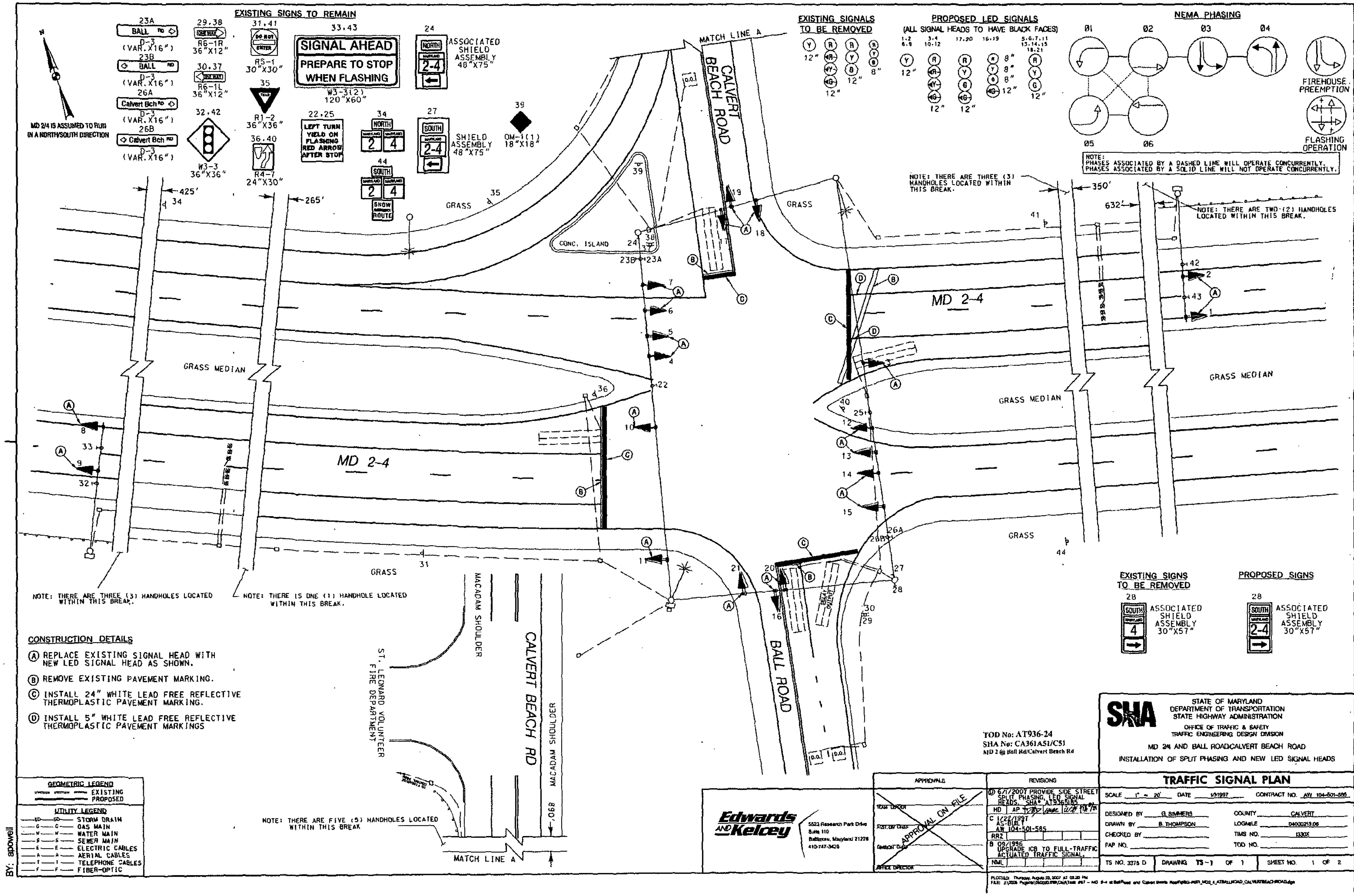
PHASE =	DIRECTION	N/B, S/B, E/B, W/B
	MOVEMENT	Left-turn, Thru, All
	MINIMUM GREEN	Guaranteed GREEN time
	VEHICLE EXTENSION	Supplemental GREEN time determined by traffic demand
	MAXIMUM I	Total GREEN time
	MAXIMUM II	A second total GREEN time used during peak traffic demand in Lieu of MAX I
	YELLOW	Signifying a change of right-of-way to stopping
	ALL RED	Indication of all STOP condition
	WALK	Allows pedestrians to enter intersection
	PEDESTRIAN CLEARANCE	: Allows pedestrians in walk movement to reach pedestrian refuge

NOTE: If there are any further questions, you may call the Office of Traffic and Safety at (410) 787-7625.

STATE HIGHWAY ADMINISTRATION
OFFICE OF TRAFFIC AND SAFETY
Effective - March 30, 1994

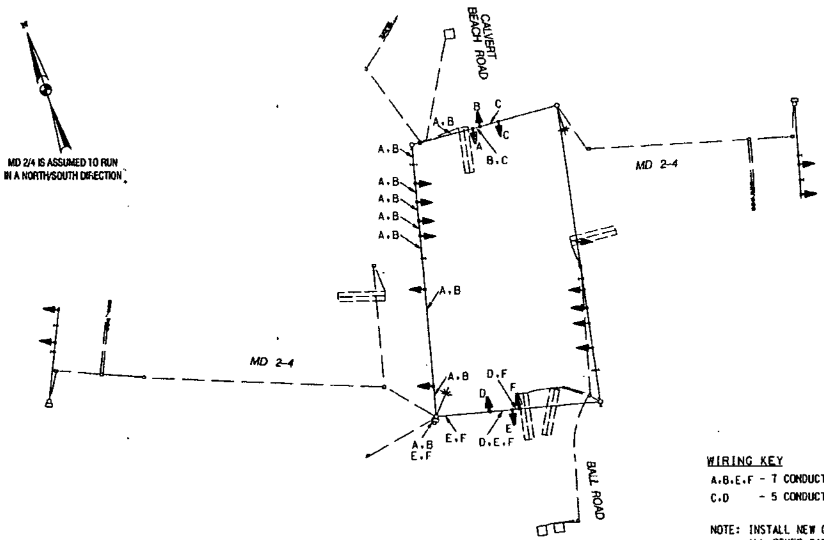


TYPICAL EIGHT PHASE INTER.
TR-427



EXISTING SIGNS TO REMAIN
23A BALL RD D-3 (VAR.X16")
23B BALL RD D-3 (VAR.X16")
26A Calvert Bch Rd D-3 (VAR.X16")
26B Calvert Bch Rd D-3 (VAR.X16")
29,38 ONE WAY R6-1R 36"X12"
30,37 ONE WAY R6-1L 36"X12"
31,41 DO NOT ENTER R5-1 30"X30"
35 YIELD R1-2 36"X36"
36,40 R4-7 24"X30"
32,42 W3-3 36"X36"
33,43 SIGNAL AHEAD PREPARE TO STOP WHEN FLASHING W3-3(2) 120"X60"
22,25 LEFT TURN YIELD ON FLASHING RED ARROW AFTER STOP
24 ASSOCIATED SHIELD ASSEMBLY 48"X75"
27 SHIELD ASSEMBLY 48"X75"
34 NORTH 2 4
44 SOUTH 2 4 SNOW ROUTE
39 OM-1(1) 18"X18"
MD 2/4 IS ASSUMED TO RUN IN A NORTH/SOUTH DIRECTION
EXISTING SIGNALS TO BE REMOVED
PROPOSED LED SIGNALS (ALL SIGNAL HEADS TO HAVE BLACK FACES)
NEMA PHASING
Ø1 Ø2 Ø3 Ø4 Ø5 Ø6
FIREHOUSE PREEMPTION
FLASHING OPERATION
NOTE: PHASES ASSOCIATED BY A DASHED LINE WILL OPERATE CONCURRENTLY. PHASES ASSOCIATED BY A SOLID LINE WILL NOT OPERATE CONCURRENTLY.
MATCH LINE A
CALVERT BEACH ROAD
CONC. ISLAND
GRASS
GRASS MEDIAN
MD 2-4
NOTE: THERE ARE THREE (3) HANDHOLES LOCATED WITHIN THIS BREAK.
NOTE: THERE ARE TWO (2) HANDHOLES LOCATED WITHIN THIS BREAK.
NOTE: THERE IS ONE (1) HANDHOLE LOCATED WITHIN THIS BREAK.
NOTE: THERE ARE FIVE (5) HANDHOLES LOCATED WITHIN THIS BREAK
MACADAM SHOULDER
CALVERT BEACH RD
ST. LEONARD VOLUNTEER FIRE DEPARTMENT
BALL ROAD
EXISTING SIGNS TO BE REMOVED
28 ASSOCIATED SHIELD ASSEMBLY 30"X57"
PROPOSED SIGNS
28 ASSOCIATED SHIELD ASSEMBLY 30"X57"
CONSTRUCTION DETAILS
(A) REPLACE EXISTING SIGNAL HEAD WITH NEW LED SIGNAL HEAD AS SHOWN.
(B) REMOVE EXISTING PAVEMENT MARKING.
(C) INSTALL 24" WHITE LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKING.
(D) INSTALL 5" WHITE LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS
GEOMETRIC LEGEND
EXISTING
PROPOSED
UTILITY LEGEND
STORM DRAIN
GAS MAIN
WATER MAIN
SEWER MAIN
ELECTRIC CABLES
AERIAL CABLES
TELEPHONE CABLES
FIBER-OPTIC
TOD No: AT936-24
SHA No: CA361A51/C51
MD 2 @ Ball Rd/Calvert Beach Rd
SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF TRAFFIC & SAFETY
TRAFFIC ENGINEERING DESIGN DIVISION
MD 2/4 AND BALL ROAD/CALVERT BEACH ROAD
INSTALLATION OF SPLIT PHASING AND NEW LED SIGNAL HEADS
TRAFFIC SIGNAL PLAN
SCALE 1" = 20'
DESIGNED BY G. SIMMERS
DRAWN BY B. THOMPSON
COUNTY CALVERT
TS NO. 3375 D
DRAWING TS-1 OF 1
SHEET NO. 1 OF 2
APPROVALS
APPROVAL ON FILE
REVISIONS
D 6/1/2007 PROVIDE SIDE STREET SPLIT PHASING, LED SIGNAL HEADS.
C 1/22/1997 AS-BUILT
B 09/1996 UPGRADE ICB TO FULL-TRAFFIC ACTUATED TRAFFIC SIGNAL
Edwards and Kelcey
5523 Research Park Drive Suite 110 Baltimore, Maryland 21228

WIRING DIAGRAM



WIRING KEY

A,B,E,F - 7 CONDUCTOR CABLE (NO. 14 AWG)
C,D - 5 CONDUCTOR CABLE (NO. 14 AWG)

NOTE: INSTALL NEW CABLES AS NOTED.
ALL OTHER CABLES ARE TO BE REUSED.

PHASING SEQUENCE CHART

	1 (Y)	2 (Y)	3 (R, ←R, ←Y, ←G)	4 (R, ←R, ←Y, ←G)	5 (R, Y, G)	6 (R, Y, G)	7 (R, Y, G)	8 (Y)	9 (Y)	10 (R, ←R, ←Y, ←G)	11 (R, Y, G)	12 (R, ←R, ←Y, ←G)	13 (R, Y, G)	14 (R, Y, G)	15 (R, Y, G)	16 (R, Y, G, ←G)	17 (R, Y, G, ←G)	18 (R, Y, G)	19 (R, Y, G, ←G)	20 (R, Y, G, ←G)	21 (R, Y, G)
PHASE 1 AND 5	FL/Y	FL/Y	←G–	←G–	R	R	R	FL/Y	FL/Y	←G–	R	←G–	R	R	R	R	R	R	R	R	R
CONTROLLER MAY SKIP TO PHASES 1 AND 6, PHASES 2 AND 5, OR PHASES 2 AND 6.																					
PHASE 1 AND 6	DARK	DARK	←G–	←G–	G	G	G	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	R	R	R	R	R	R
1 CHANGE	DARK	DARK	←Y–	←Y–	G	G	G	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	R	R	R	R	R	R
PHASE 2 AND 5	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	DARK	DARK	←G–	G	←G–	G	G	G	R	R	R	R	R	R
5 CHANGE	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	DARK	DARK	←Y–	G	←Y–	G	G	G	R	R	R	R	R	R
PHASE 2 AND 6	DARK	DARK	R/←R–	R/←R–	G	G	G	DARK	DARK	R/←R–	G	R/←R–	G	G	G	R	R	R	R	R	R
2 AND 6 CHANGE	FL/Y	FL/Y	R/←R–	R/←R–	Y	Y	Y	FL/Y	FL/Y	R/←R–	Y	R/←R–	Y	Y	Y	R	R	R	R	R	R
PHASE 3	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	R	R	R	G/←G–	G/←G–	G
3 CHANGE	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	R	R	R	Y	Y	Y
PHASE 4	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	G/←G–	G/←G–	G	R	R	R
4 CHANGE	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	Y	Y	Y	R	R	R
FLASHING OPERATION	DARK	DARK	FL/ R/←R–	FL/ R/←R–	FL/Y	FL/Y	FL/Y	DARK	DARK	FL/ R/←R–	FL/Y	FL/ R/←R–	FL/Y	FL/Y	FL/Y	FL/R	FL/R	FL/R	FL/R	FL/R	FL/R

FIREHOUSE PREEMPTION

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
FIREHOUSE PREEMPTION PHASE 3	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	R	R	R	G/←G–	G/←G–	G
PREEMPTION CLEARANCE	FL/Y	FL/Y	R/←R–	R/←R–	R	R	R	FL/Y	FL/Y	R/←R–	R	R/←R–	R	R	R	R	R	R	Y	Y	Y
NORMAL OPERATION PHASES 2 AND 6	DARK	DARK	R/←R–	R/←R–	G	G	G	DARK	DARK	R/←R–	G	R/←R–	G	G	G	R	R	R	R	R	R

PROJECT DESCRIPTION

1. GENERAL

THIS PROJECT INVOLVES PROVIDING SPLIT PHASING FOR THE EASTBOUND AND WESTBOUND APPROACHES, AND INSTALLATION OF LED SIGNAL HEADS AT THE INTERSECTION OF MD 2-4 AT CALVERT BEACH ROAD/BALL ROAD IN CALVERT COUNTY.

MD 2-4 IS ASSUMED TO RUN IN A NORTH-SOUTH DIRECTION.

2. OPERATION

THE INTERSECTION WILL RUN IN A NEMA SIX PHASE FULL TRAFFIC ACTUATED MODE.

THE EASTBOUND AND WESTBOUND PHASES WILL BE SPLIT.

THE INTERSECTION IS CURRENTLY PROVIDED WITH HAZARD IDENTIFICATION BEACONS AT THE NORTHBOUND AND SOUTHBOUND APPROACH ALONG MD 2-4.
FIREHOUSE PREEMPTION IS PROVIDED AT THE BALL ROAD APPROACH OF THE INTERSECTICN.

PROJECT CONTACTS

MR. GREG WELKER
DISTRICT ENGINEER
PHONE: 410-841-1001

MR. JOHN MAYS
DISTRICT UTILITY ENGINEER
PHONE: 410-841-1039

MS. KIMBERLY TRAN
ASSISTANT DISTRICT ENGINEER - TRAFFIC
PHONE: 410-841-1019

MR. EDWARD RODENHIZER
CHIEF,
SIGNAL OPERATIONS SECTION
PHONE: 410-787-7652

MR. ANDRE FUTREL
ASSISTANT DISTRICT ENGINEER - MAINTENANCE
PHONE: 410-841-1031

MR. ROBERT SNYDER
ASSISTANT DIVISION CHIEF,
TRAFFIC OPERATIONS
PHONE: 410-787-7631

EQUIPMENT LIST "A"

EQUIPMENT TO BE FURNISHED BY THE SHA.

ITEM NO.	QUANTITY	DESCRIPTION
9571	12 SF	SHEET ALUMINUM POLE MOUNTED SIGN 1 EA - ASSOCIATED SHIELD ASSEMBLY (30" X 57") SOUTH, MD 2-4, RIGHT ARROW

EQUIPMENT LIST "B"

EQUIPMENT TO BE FURNISHED AND/OR INSTALLED BY THE CONTRACTOR.

ITEM NO.	QUANTITY	DESCRIPTION
1001	1 EA	MAINTENANCE OF TRAFFIC
5001	20 LF	5 INCH WHITE LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS
5004	184 LF	24 INCH WHITE LEAD FREE REFLECTIVE THERMOPLASTIC PAVEMENT MARKINGS
5005	188 LF	REMOVAL OF EXISTING PERMANENT PAVEMENT LINE MARKINGS
8001	57 EA	12 IN. SIGNAL HEAD SECTION - 15 EA RED BALL SIGNAL HEAD SECTION - 15 EA YELLOW BALL SIGNAL HEAD SECTION - 11 EA GREEN BALL SIGNAL HEAD SECTION - 4 EA RED ARROW SIGNAL HEAD SECTION (LEFT) - 4 EA YELLOW ARROW SIGNAL HEAD SECTION (LEFT) - 8 EA GREEN ARROW SIGNAL HEAD SECTION (LEFT)
8007	6 EA	8 IN. SIGNAL HEAD SECTION - 2 EA RED BALL SIGNAL HEAD SECTION - 2 EA YELLOW BALL SIGNAL HEAD SECTION - 2 EA GREEN BALL SIGNAL HEAD SECTION

EQUIPMENT LIST "B"

EQUIPMENT TO BE FURNISHED AND/OR INSTALLED BY THE CONTRACTOR.

ITEM NO.	QUANTITY	DESCRIPTION
8017	1 EA	REMOVE AND DISPOSE EQUIPMENT PER ASSIGNMENT
8046	12 LF	INSTALL OVERHEAD SIGN
8060	23 LF	ELECTRICAL CABLE - 5 CONDUCTOR (NO 14 AWG)
8061	444 LF	ELECTRICAL CABLE - 7 CONDUCTOR (NO 14 AWG)

TOD No: AT936-24
SHA No: CA361A51/C51
MD 2 @ Ball Rd/Calvert Beach Rd

SHA
STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF TRAFFIC & SAFETY
TRAFFIC ENGINEERING DESIGN DIVISION

MD2-4 AND BALL ROAD/CALVERT BEACH ROAD
INSTALLATION OF SPLIT PHASING AND NEW LED SIGNAL HEADS

GENERAL INFORMATION SHEET

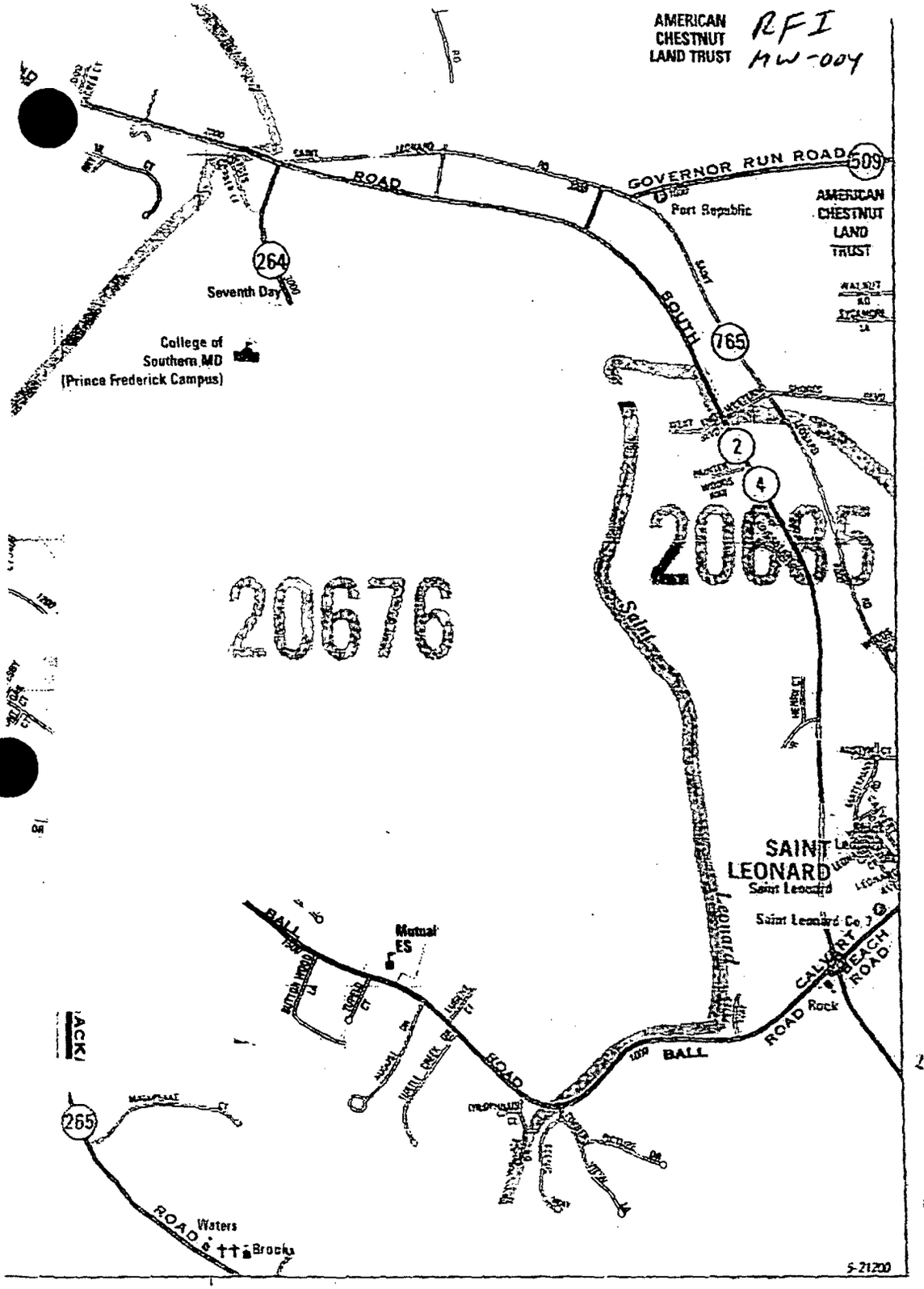
SCALE NOT TO SCALE DATE JUNE 2007 CONTRACT NO. AT9365185

Edwards and Kelcey
5523 Research Park Drive
Suite 110
Baltimore, Maryland 21228
410-747-3420

DESIGNED BY H. DONG
DRAWN BY A. POWELL
CHECKED BY
FAP NO
COUNTY CALVERT
LOGMILE 04000213.8
TIMS NO. 630X
TOD NO.

TS NO. 3376 D | DRAWING TS-1 OF 1 | SHEET NO. 2 OF 2

PLOTTED: Thursday, August 23, 2007 AT 03:30 PM
FILE: J:\2005 Projects\060020.010\Cad\Task #47 - MD 2-4 at Ball Road and Calvert Beach Road\603-N001_MD2_4_ATBALLROAD_CALVERTBEACHROAD.dgn


AMERICAN CHESTNUT LAND TRUST
RFI MW-004
GOVERNOR RUN ROAD
509
Port Republic
AMERICAN CHESTNUT LAND TRUST
264
Seventh Day
College of Southern MD (Prince Frederick Campus)
765
2
4
20665
20676
Joins Map
SAINT LEONARD
Saint Leonard
Saint Leonard Creek
Mutual ES
BALL ROAD
CALVERT BEACH ROAD
Rock
265
Waters
Brooks
MD GRID 230,000 FT
5-21200
Joins Map 15
930,000 FT
76°32'30"
© ALEXANDRIA DRAFTING CO.
MD GRID 940,000 FT
17

(1)

AL 10.25.04

(2)

SIGNAL NUMBER: 040000208.00 LOCATION: MD 2/4 @ CALVERT CLIFFS

COUNTY: CALVERT DEVELOPED BY: DATE INSTALLED

RDM INFORM	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8	PHASE 9	PHASE 10
ROAD NAME:	MD 2/4	MD 24	CALOOSA+ CLIFFS							
DIRECTION:	N/B	S/B	W/B							
MOVEMENT:	THRU	L.T.	ALL							
INTERVALS	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8	PHASE 9	PHASE 10
MIN GREEN	30	6	8							
BIKE GRN										
CS GREEN										
WALK										
PED CLEAR										
VEH EXT	6.0	3.0	4.0							
VEH EXT 2										
MAX EXT	30	15	15							
MAX 1	60	30	30							
MAX II	60	30	30							
MAX III	90	45	45							
DET MAX										
YELLOW	5.5	4.5	4.0							
RED CLEAR	1.5	1.5	1.5							
RED RVT										
ACT B4										
SEC/ACT										
MAX INI										
TIME B4	90+7=97	45+6=51	45+8=53							
CARS WT										
ITREDUC										

RFI MW 04

KLD Engineering, P.C.

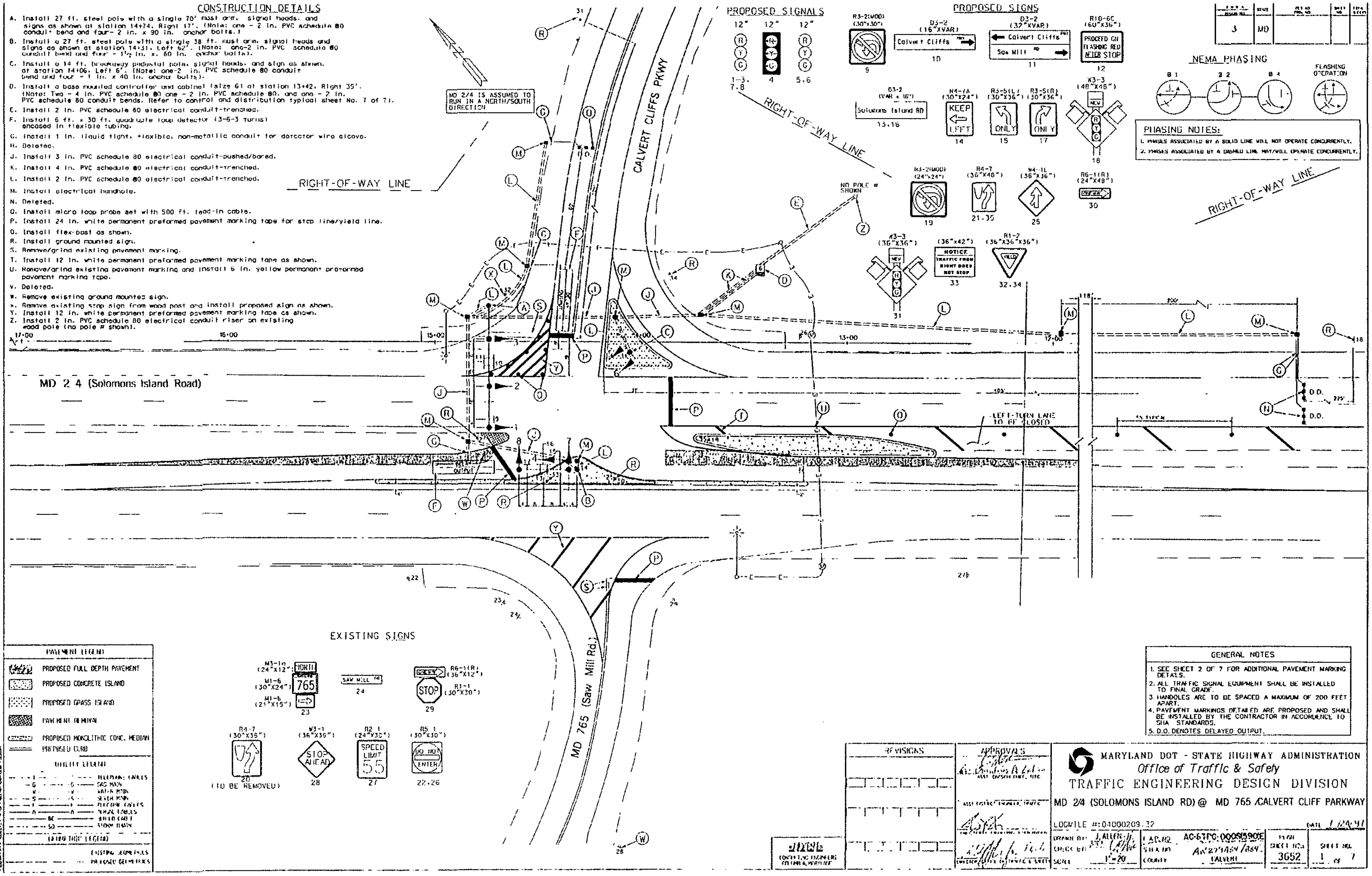
A-15

TR#427

CA 0002.08.00

RFI MW-004

(2)


CONSTRUCTION DETAILS
A. Install 27 ft. steel pole with a single 70' mast arm, signal heads, and signs as shown at station 14+74, Right 17'. (Note: one - 2 in. PVC schedule 80 conduit bend and four - 2 in. x 90 in. anchor bolts.)
B. Install a 27 ft. steel pole with a single 38 ft. mast arm, signal heads and signs as shown at station 14+31, Left 62'. (Note: one-2 in. PVC schedule 80 conduit bend and four - 1½ in. x 60 in. anchor bolts).
C. Install a 14 ft. breakaway pedestal pole, signal heads, and sign as shown. at station 14+06, Left 6'. (Note: one-2 in. PVC schedule 80 conduit bend and four - 1 in. x 40 in. anchor bolts).
D. Install a base mounted controller and cabinet (size 6) at station 13+42, Right 35'. (Note: Two - 4 in. PVC schedule 80 one - 2 in. PVC schedule 80, and one - 2 in. PVC schedule 80 conduit bends. Refer to control and distribution typical sheet No. 7 of 7).
E. Install 2 in. PVC schedule 80 electrical conduit-trenched.
F. Install 6 ft. x 30 ft. quadrupole loop detector (3-6-3 turns) encased in flexible tubing.
G. Install 1 in. liquid tight, flexible, non-metallic conduit for detector wire sleeve.
H. Deleted.
J. Install 3 in. PVC schedule 80 electrical conduit-pushed/bored.
K. Install 4 in. PVC schedule 80 electrical conduit-trenched.
L. Install 2 in. PVC schedule 80 electrical conduit-trenched.
M. Install electrical handhole.
N. Deleted.
O. Install micro loop probe set with 500 ft. lead-in cable.
P. Install 24 in. white permanent preformed pavement marking tape for stop line/yield line.
Q. Install flex-post as shown.
R. Install ground mounted sign.
S. Remove/grind existing pavement marking.
T. Install 12 in. white permanent preformed pavement marking tape as shown.
U. Remove/grind existing pavement marking and install 6 in. yellow permanent preformed pavement marking tape.
V. Deleted.
W. Remove existing ground mounted sign.
X. Remove existing stop sign from wood post and install proposed sign as shown.
Y. Install 12 in. white permanent preformed pavement marking tape as shown.
Z. Install 2 in. PVC schedule 80 electrical conduit riser on existing wood pole (no pole # shown).
MD 2/4 IS ASSUMED TO RUN IN A NORTH/SOUTH DIRECTION
RIGHT-OF-WAY LINE
CALVERT CLIFFS PKWY
MD 2 4 (Solomons Island Road)
MD 765 (Saw Mill Rd.)
PROPOSED SIGNALS
PROPOSED SIGNS
Calvert Cliffs
Saw Mill
Solomons Island RD
KEEP LEFT
ONLY
PROCEED ON FLASHING RED AFTER STOP
NOTICE TRAFFIC FROM RIGHT DOES NOT STOP
NO POLE # SHOWN
LEFT-TURN LANE TO BE CLOSED
NEMA PHASING
FLASHING OPERATION
PHASING NOTES:
1. PHASES ASSOCIATED BY A SOLID LINE WILL NOT OPERATE CONCURRENTLY.
2. PHASES ASSOCIATED BY A DASHED LINE MAY/WILL OPERATE CONCURRENTLY.
EXISTING SIGNS
NORTH
765
SAW MILL
STOP
STOP AHEAD
SPEED LIMIT 55
DO NOT ENTER
(TO BE REMOVED)
PAVEMENT LEGEND
PROPOSED FULL DEPTH PAVEMENT
PROPOSED CONCRETE ISLAND
PROPOSED GRASS ISLAND
PAVEMENT REMOVAL
PROPOSED MONOLITHIC CONC. MEDIAN
PROPOSED CURB
GENERAL NOTES
1. SEE SHEET 2 OF 7 FOR ADDITIONAL PAVEMENT MARKING DETAILS.
2. ALL TRAFFIC SIGNAL EQUIPMENT SHALL BE INSTALLED TO FINAL GRADE.
3. HANDOLES ARE TO BE SPACED A MAXIMUM OF 200 FEET APART.
4. PAVEMENT MARKINGS DETAILED ARE PROPOSED AND SHALL BE INSTALLED BY THE CONTRACTOR IN ACCORDENCE TO SHA STANDARDS.
5. D.O. DENOTES DELAYED OUTPUT.
REVISIONS
APPROVALS
MARYLAND DOT - STATE HIGHWAY ADMINISTRATION
Office of Traffic & Safety
TRAFFIC ENGINEERING DESIGN DIVISION
MD 2/4 (SOLOMONS ISLAND RD) @ MD 765 /CALVERT CLIFF PARKWAY
LOGMILE #:04000209.32
DATE 1/24/97
SCALE 1"=20'
COUNTY CALVERT
AC-STPC-000S(590)E
SHEET NO. 3652
SHEET NO. 1 of 7

(3) AM 10-25-06 JD

SIGNAL NUMBER: 040002 07.43 LOCATION: MD 214 @ WHITE SANDS

COUNTY: DEVELOPED BY: DATE INSTALLED

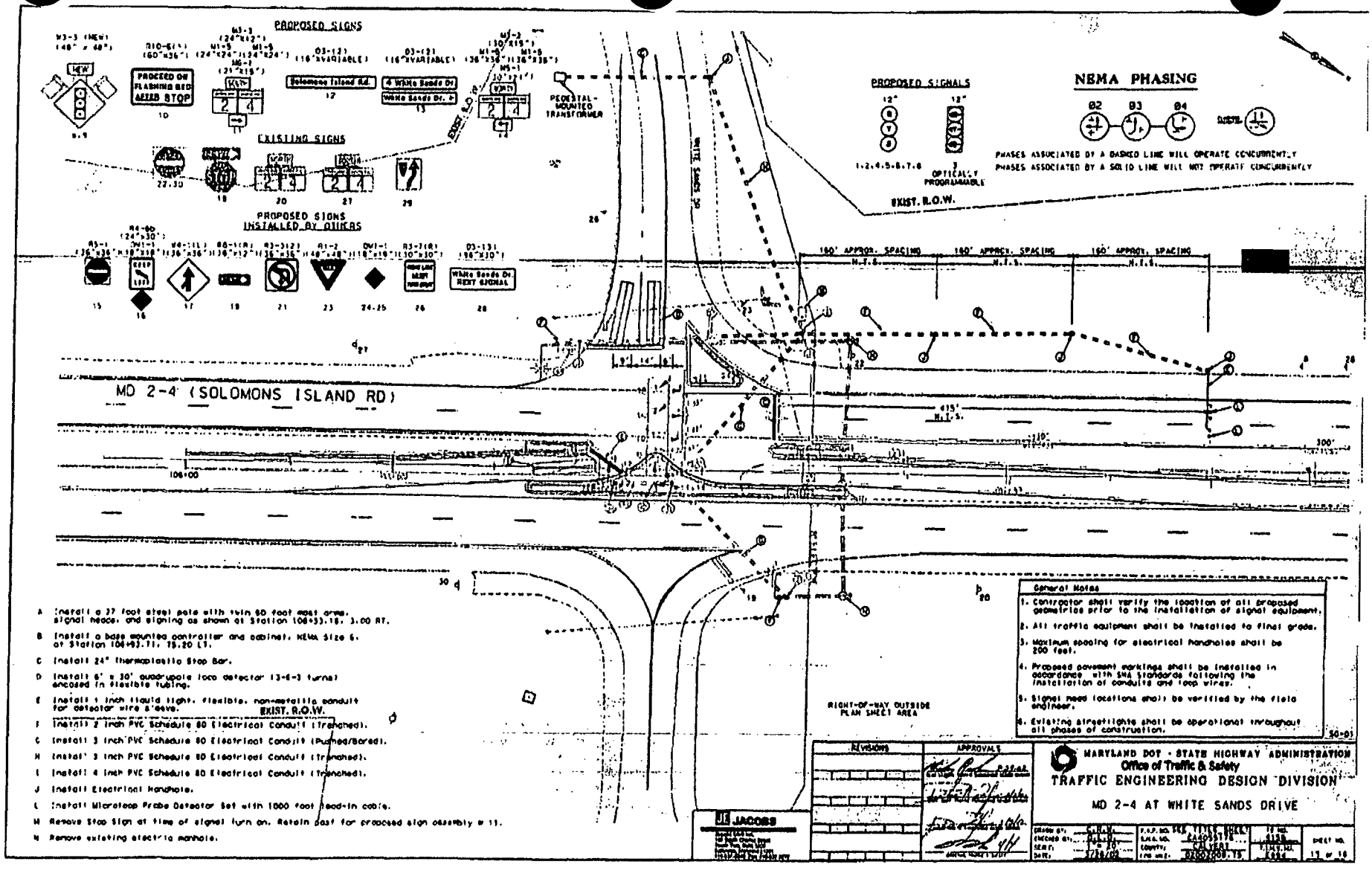
RDM INFORM	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8	PHASE 9	PHASE 10
ROAD NAME:		MD 214	MD 214	WHITE SANDS						
DIRECTION:		S/B	N/B	E/B						
MOVEMENT:		THRU	L.T.	ALL						
INTERVALS	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8	PHASE 9	PHASE 10
		25	5	5						
WALK		5								
PED CLEAR		7								
VEH EXT		6.0	3.0	3.0						
VEH EXT 2										
MAX EXT		15	10	10						
MAX 1		60	25	35						
MAX II		60	25	35						
MAX III		90	35	45						
DET MAX										
YELLOW		5.0	4.0	4.0						
RED CLEAR		2.0	1.0	1.0						
RED RVT										
ACT B4										
SEC/ACT										
MAX INI										
TIME B4										
CARS WT										
TREDIC										

MD 214 AM-PM

04-0-002 0143

RFI MW-004

(3)


PROPOSED SIGNS
EXISTING SIGNS
PROPOSED SIGNS INSTALLED BY OTHERS
PROPOSED SIGNALS
NEMA PHASING
PHASES ASSOCIATED BY A DASHED LINE WILL OPERATE CONCURRENTLY
PHASES ASSOCIATED BY A SOLID LINE WILL NOT OPERATE CONCURRENTLY
EXIST. R.O.W.
MD 2-4 (SOLOMONS ISLAND RD)
RIGHT-OF-WAY OUTSIDE PLAN SHEET AREA
A Install a 37 foot steel pole with twin 60 foot mast arms, signal heads and signing as shown at Station 106+33.18, 3.00 RT.
B Install a base mounted controller and cabinet, NEMA Size 6, at Station 106+93.71, 75.20 LT.
C Install 24" Thermoplastic Stop Bar.
D Install 6' x 30' quadrupole loop detector 13-6-3 turns) encased in flexible tubing.
E Install 1 inch liquid tight, flexible, non-metallic conduit for detector wire sleeve.
F Install 2 inch PVC Schedule 80 Electrical Conduit (Trenched).
G Install 3 inch PVC Schedule 80 Electrical Conduit (Pushed/Bored).
H Install 3 inch PVC Schedule 80 Electrical Conduit (Trenched).
I Install 4 inch PVC Schedule 80 Electrical Conduit (Trenched).
J Install Electrical Handhole.
L Install Microloop Probe Detector Set with 1000 foot lead-in cable.
M Remove Stop Sign at time of signal turn on. Retain post for proposed sign assembly # 11.
N Remove existing electric manhole.
General Notes
1. Contractor shall verify the location of all proposed geometries prior to the installation of signal equipment.
2. All traffic equipment shall be installed to final grade.
3. Maximum spacing for electrical handholes shall be 200 feet.
4. Proposed pavement markings shall be installed in accordance with SHA Standards following the installation of conduits and loop wires.
5. Signal head locations shall be verified by the field engineer.
6. Existing streetlights shall be operational throughout all phases of construction.
REVISIONS
APPROVALS
JACOBS
MARYLAND DOT - STATE HIGHWAY ADMINISTRATION
Office of Traffic & Safety
TRAFFIC ENGINEERING DESIGN DIVISION
MD 2-4 AT WHITE SANDS DRIVE