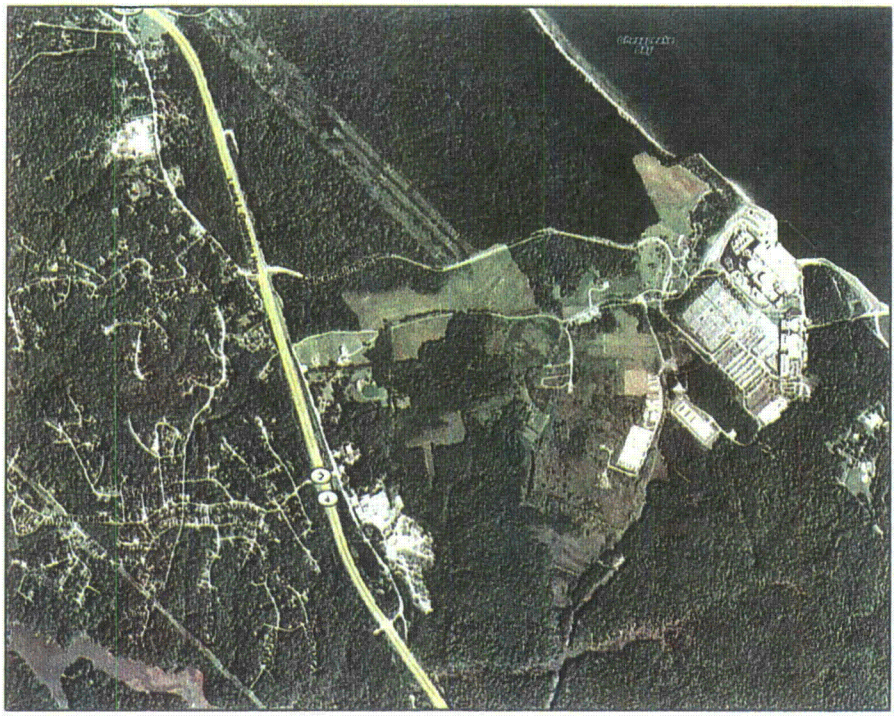
Traffic Impact Study at the

Calvert Cliffs Nuclear Power Plant

Draft Final Report



Prepared for
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February 2, 2011
TR-427

Rev. 3

KLD ENGINEERING, P.C.

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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.

Over the past 14 months several alternative design concepts for providing access from MD 2/MD 4 to the CC3 construction site have been evaluated and submitted to the SHA for review. As a result of this review, the SHA indicated as acceptable a concept for a temporary at-grade intersection on MD 2/MD 4 between Calvert Cliffs Parkway and White sands Drive. This location will provide direct access to the construction site. The SHA provided a concept plan for this option to UniStar on December 3, 2010 and the concept plan was discussed in a meeting between UniStar and the SHA on December 8, 2010. This concept plan is the basis for the temporary intersection contained in this report, 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;

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 2/4 Split. The Design Concepts for these intersection improvements are included in this report.

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, alternative paths for some of this traffic having been considered unlikely by SHA in prior discussions.

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.

An earlier report was submitted to SHA, dated November 4, 2009. That report proposed a new intersection, accessing the construction road to the site directly, with the new intersection located between Calvert Cliffs Parkway and White Sands Drive. In meetings and discussions with SHA, it became clear that the approval process needed for the permanent break in access control was likely to be extensive and potentially costly, with approval uncertain. In discussions with SHA soon after the cited report, attention focused on use of an existing access point, namely the intersection at White Sands Drive.

Also, further discussions with the SHA and others by teleconference led to an expressed desire to expand the study area further north, to include both the point at which MD 2/MD 4 diverge and the MD 231 at MD 2/MD 4 intersection.

The design configuration required to accommodate the expected demands during construction at White Sands Drive, were presented and discussed with SHA. This included a triple left turn under constrained geometric conditions. SHA expressed concerns over the ability of such a movement to operate safely, and over inefficiencies that might cause negative impacts on MD 2/MD 4.

As a result, the SHA indicated as acceptable a concept for a temporary at-grade intersection relocated to a point where the left turn does not need to turn north as part of the entry via White Sands to Nursery Rd to the construction site. The SHA provided a concept plan for this option to UniStar on December 3, 2010. This concept plan is the basis for the temporary intersection contained in this report, henceforth referred to as CC3 Access Road & MD 2/MD 4. The TIS study area is shown in Figure 1.

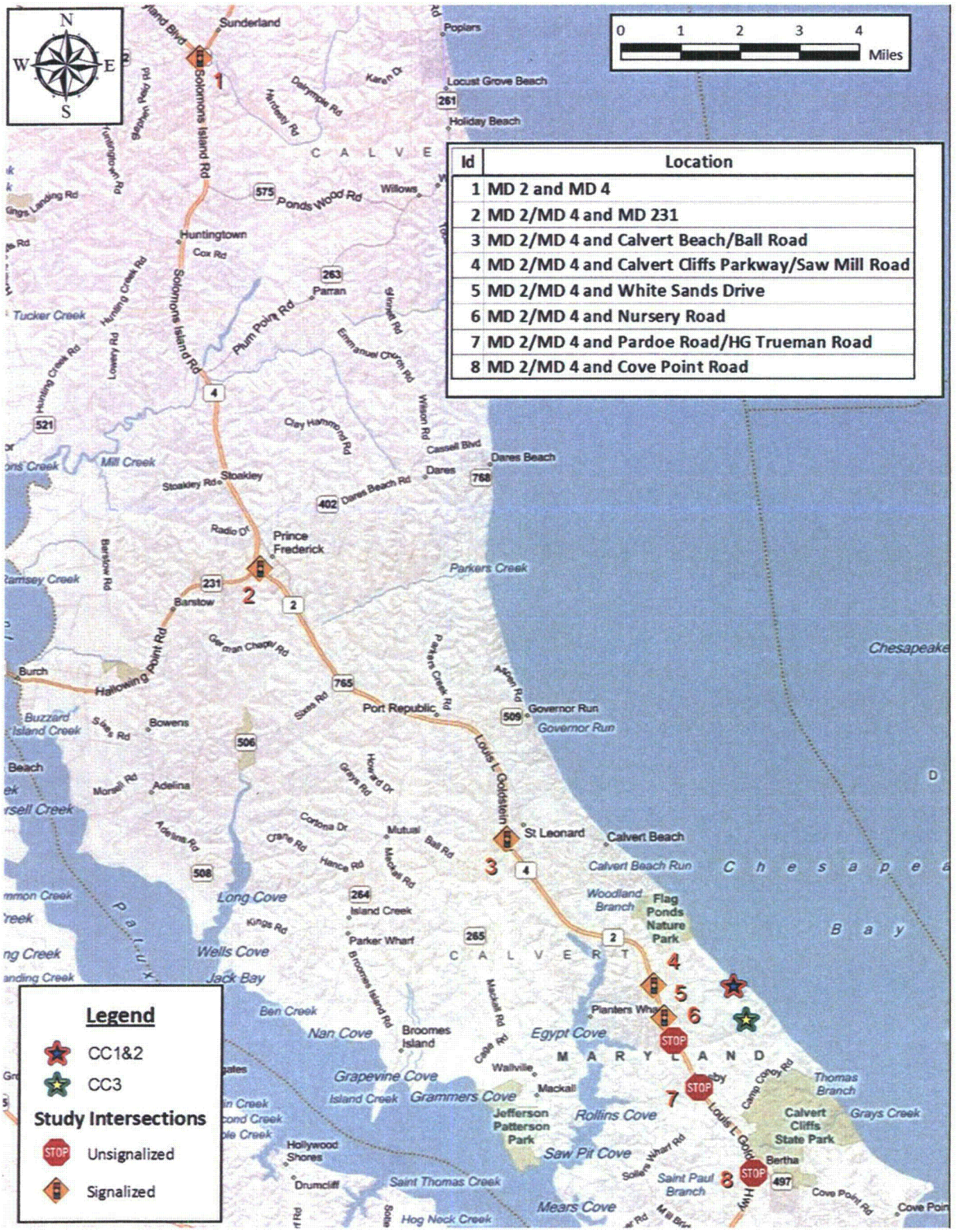


Figure 1 – CCNPP Site and Traffic Impact Study Area

As shown in Figure 2 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.

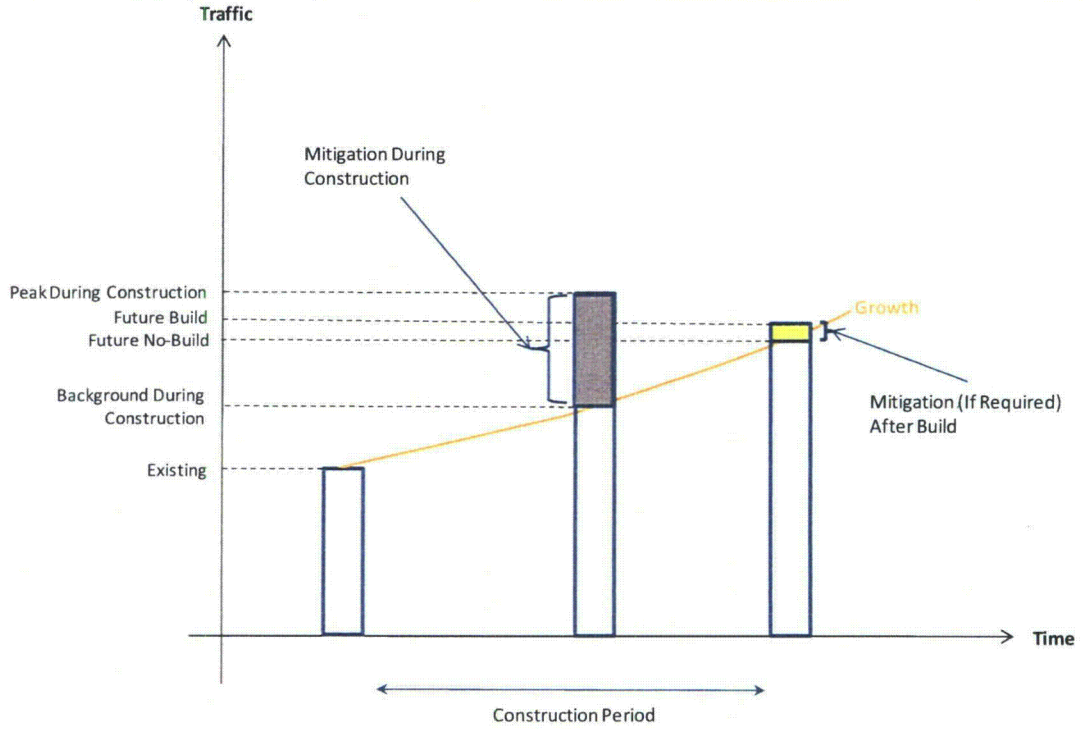


Figure 2 – Traffic Impact Analysis: Approach

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 impacts during the peak construction activity; Section 4 describes the related mitigation that is recommended. Section 5 contains the summary and Section 6 provides a list of references.

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.

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 DVD 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.

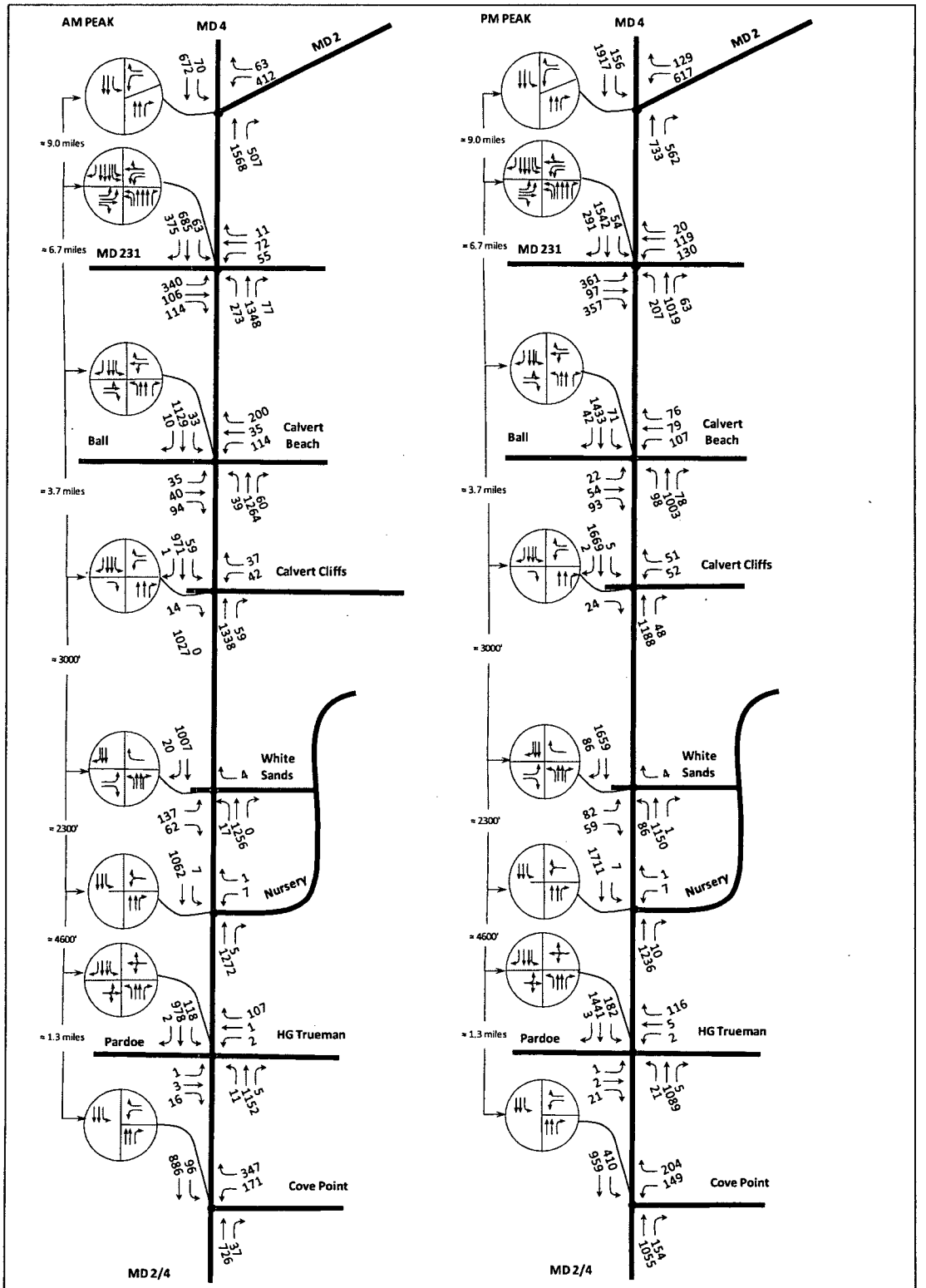


Figure 3 – Peak Hour Traffic Volumes – Existing Conditions

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.

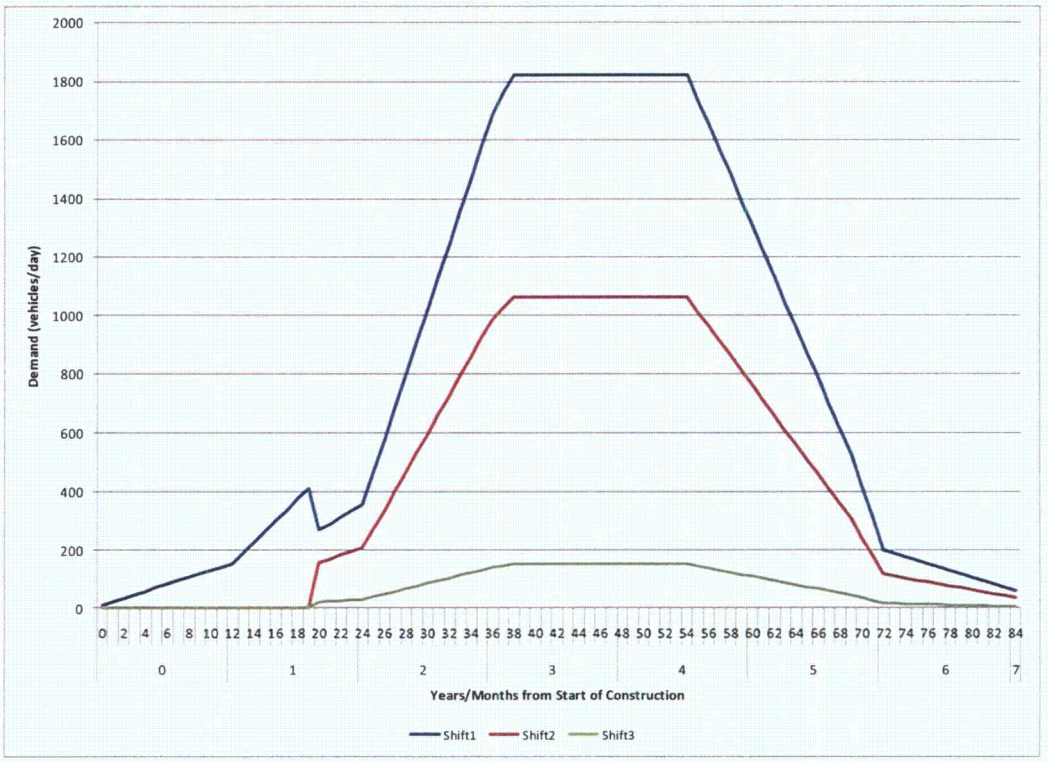


Figure 4 – Construction Profile, Expressed in Terms of Vehicles by Shift

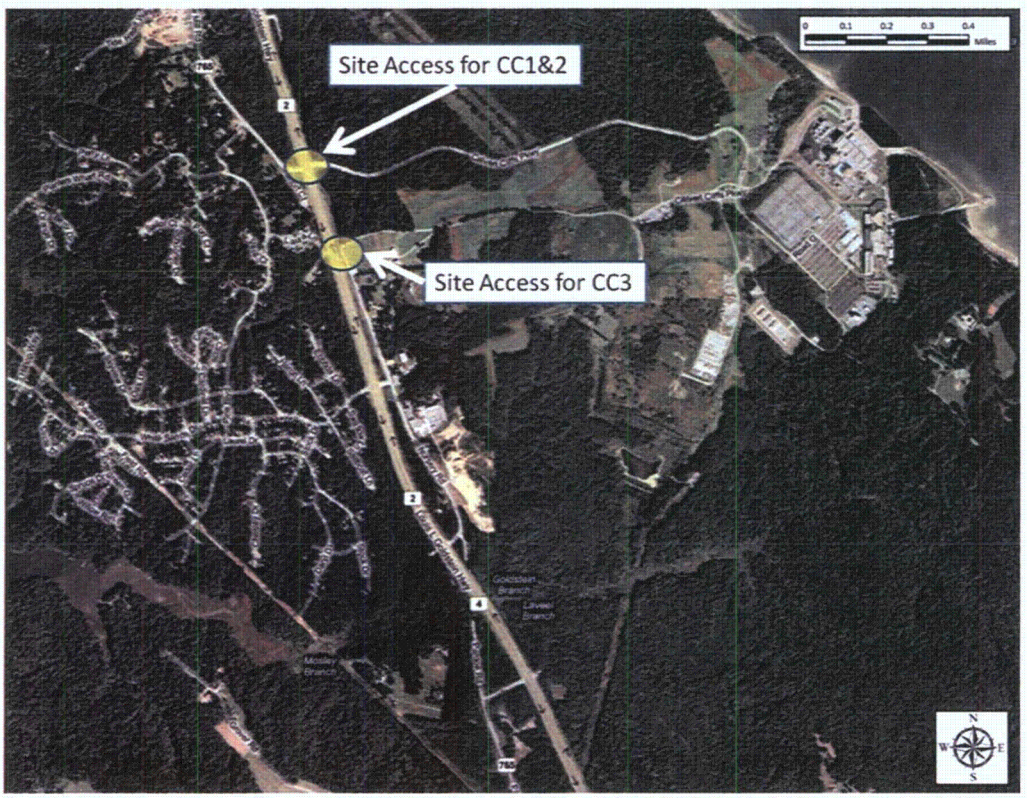


Figure 5 – Construction Site Access

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.

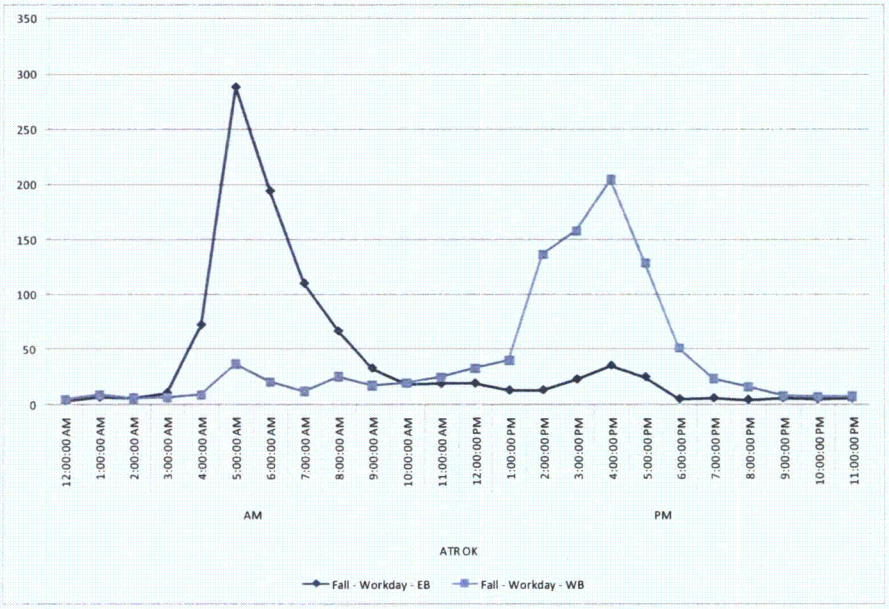


Figure 6 – Temporal Distribution of Power Plant Employees

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.

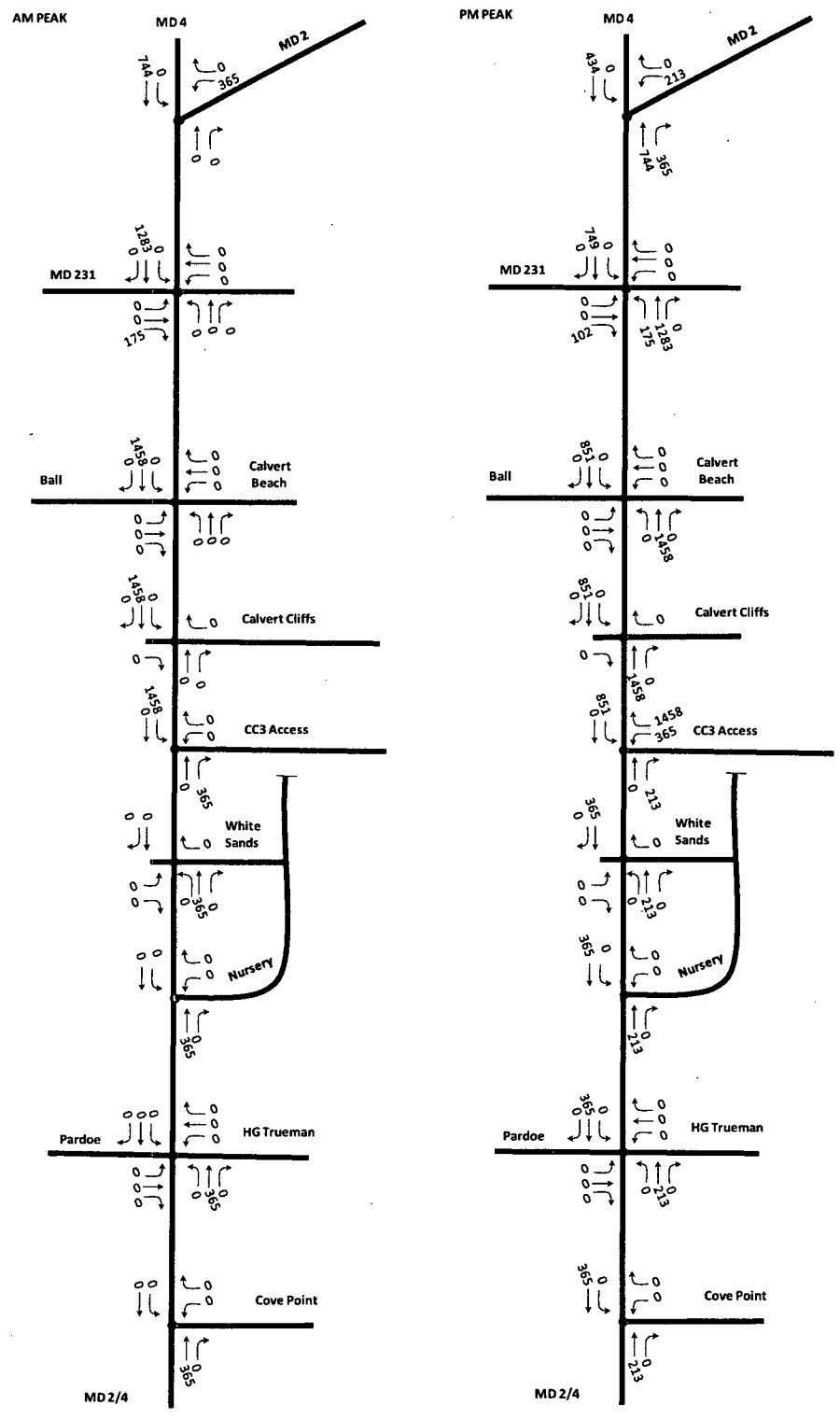


Figure 7 – Construction Site Trip Assignment

4. BACKGROUND CONDITONS 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

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	925	795	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

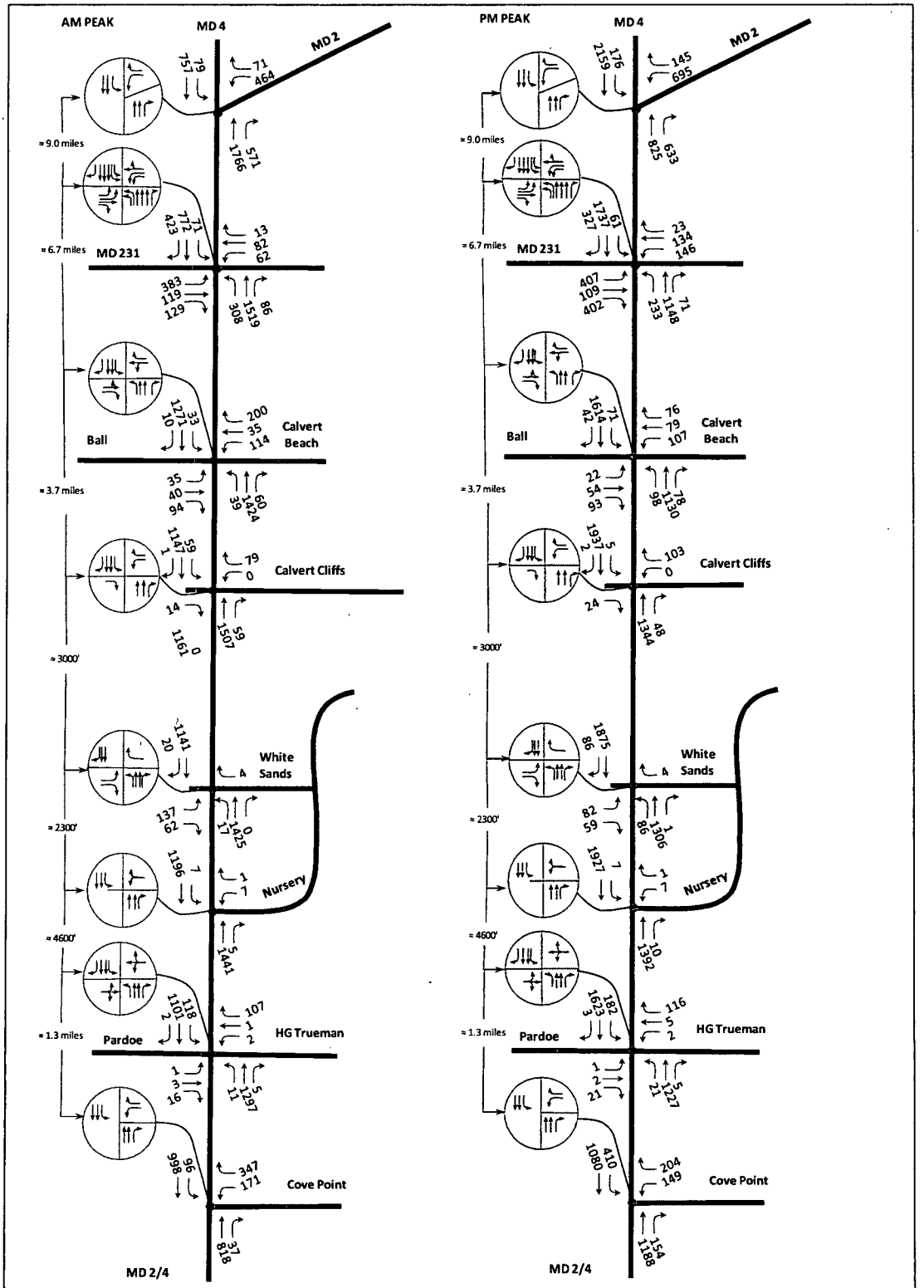


Figure 8 – Peak Hour Traffic Volumes For Background Conditions During Construction

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 42.4 sec/veh) in AM and LOS D (Avg delay 54.6 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	930	**1598**	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.

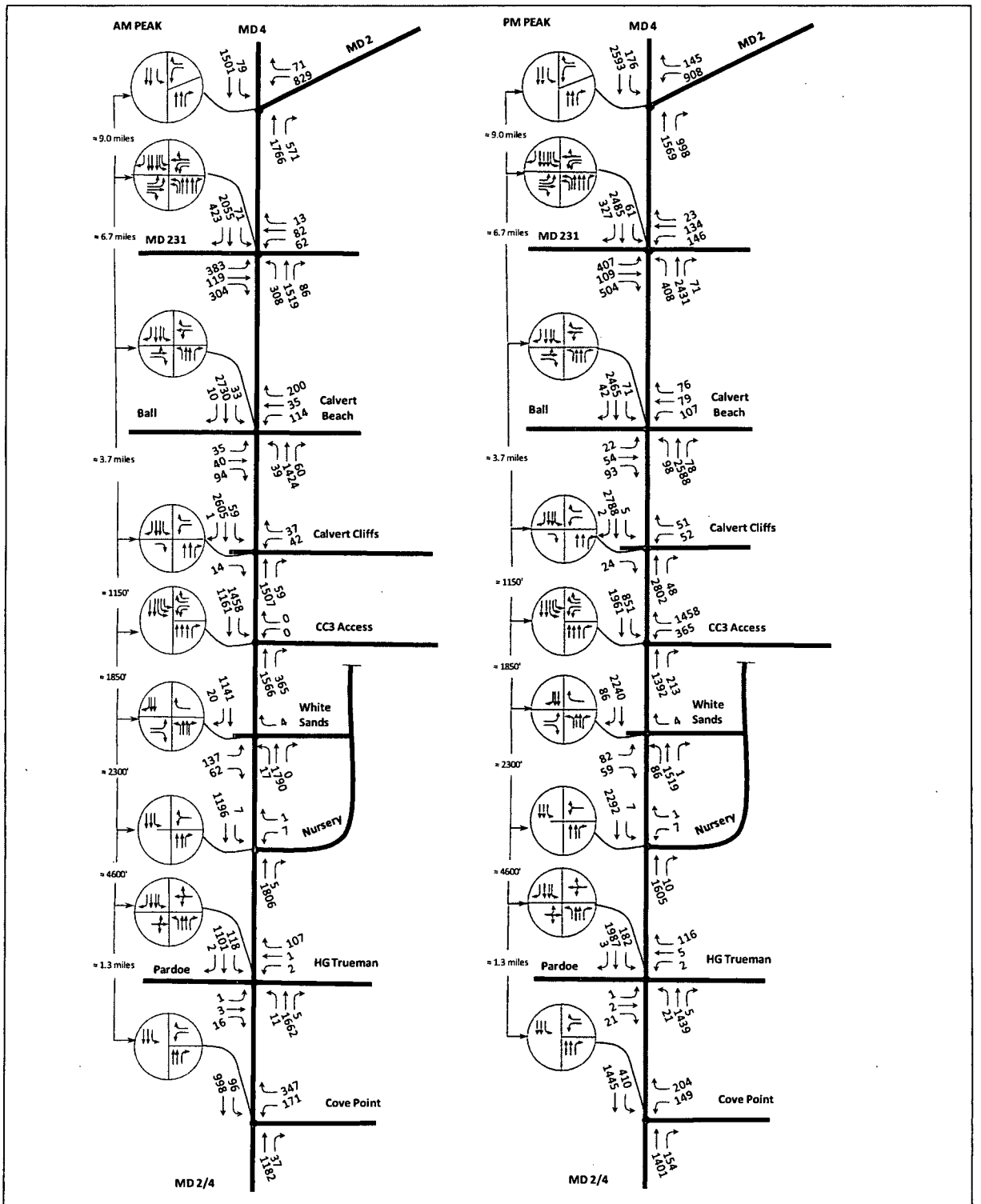


Figure 9 – Peak Hour Traffic Volumes During Construction

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.

6.1. Mitigation by Intersection

6.1.1.MD 2/MD 4 diverge

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.

Two 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 in the background during construction conditions as shown in Table 6. Concept 1 would also have less environmental and right-of-way impacts and a lower construction cost than Concept 2. A comparison of both these concepts for the "post construction" conditions when the new unit is operational will be part of the Supplemental TIS.

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 one SBT and one WBL lane	1328	1280	**1547**	**1583**	D	C	**E**	**E**
Concept 2: Remove Maryland-T, Add NBT, SBT and 2 WBL lanes	994	1176	1158	**1445**	A	C	C	**D**

6.1.2.MD 2/MD 4 and MD 231

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. Figure 14 presents a mitigation concept at this location. This concept would convert the existing southbound right turn lane to a thru/right turn lane. The receiving lane for this 4th southbound thru lane would be the existing receiving lane for the existing eastbound free right turn lane. 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. The resulting LOS and CLV are shown in Table 7. With this mitigation in place, the intersection operates acceptably.

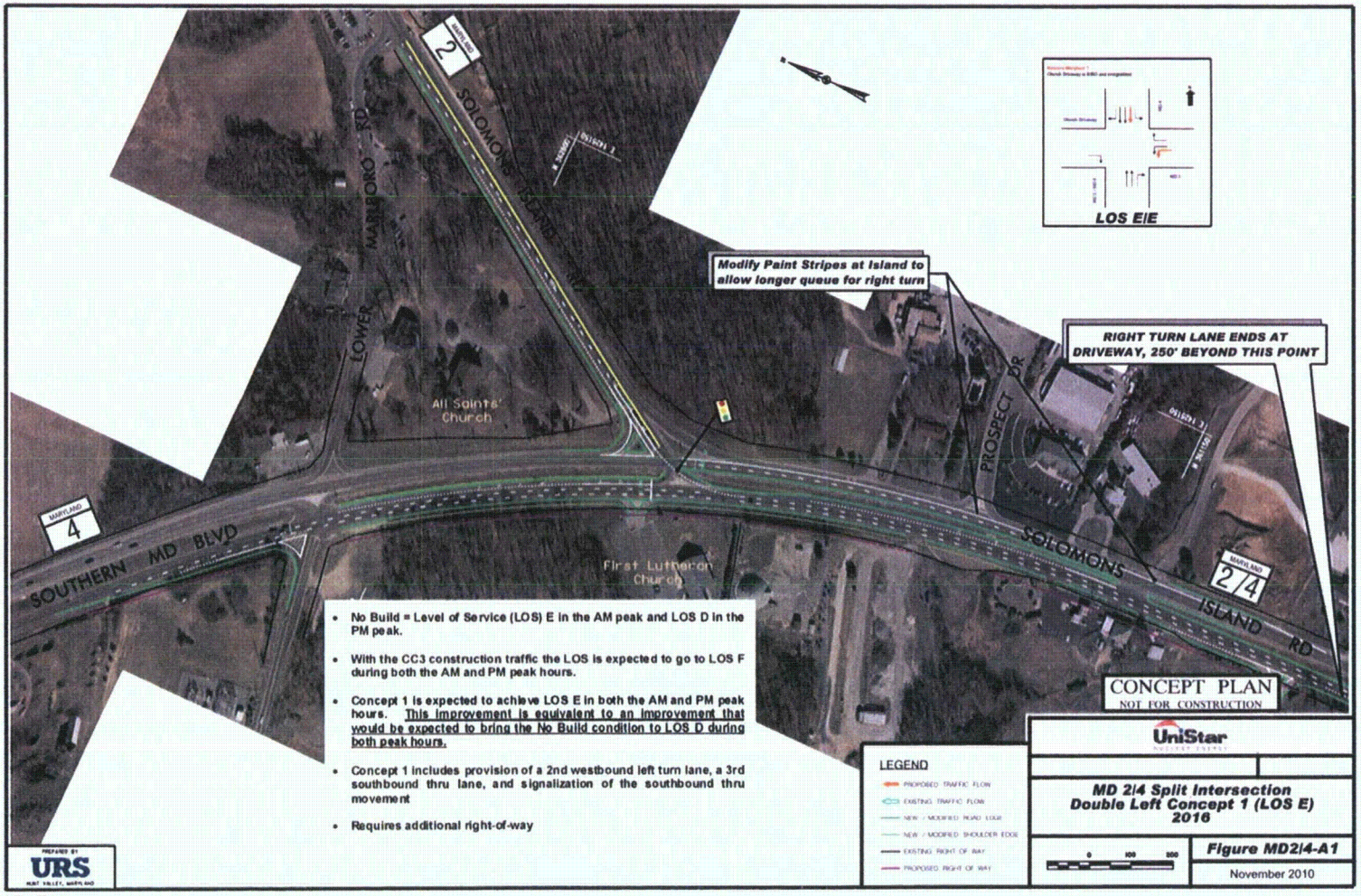


Figure 12 – MD2/MD4 Diverge – Mitigation Concept 1

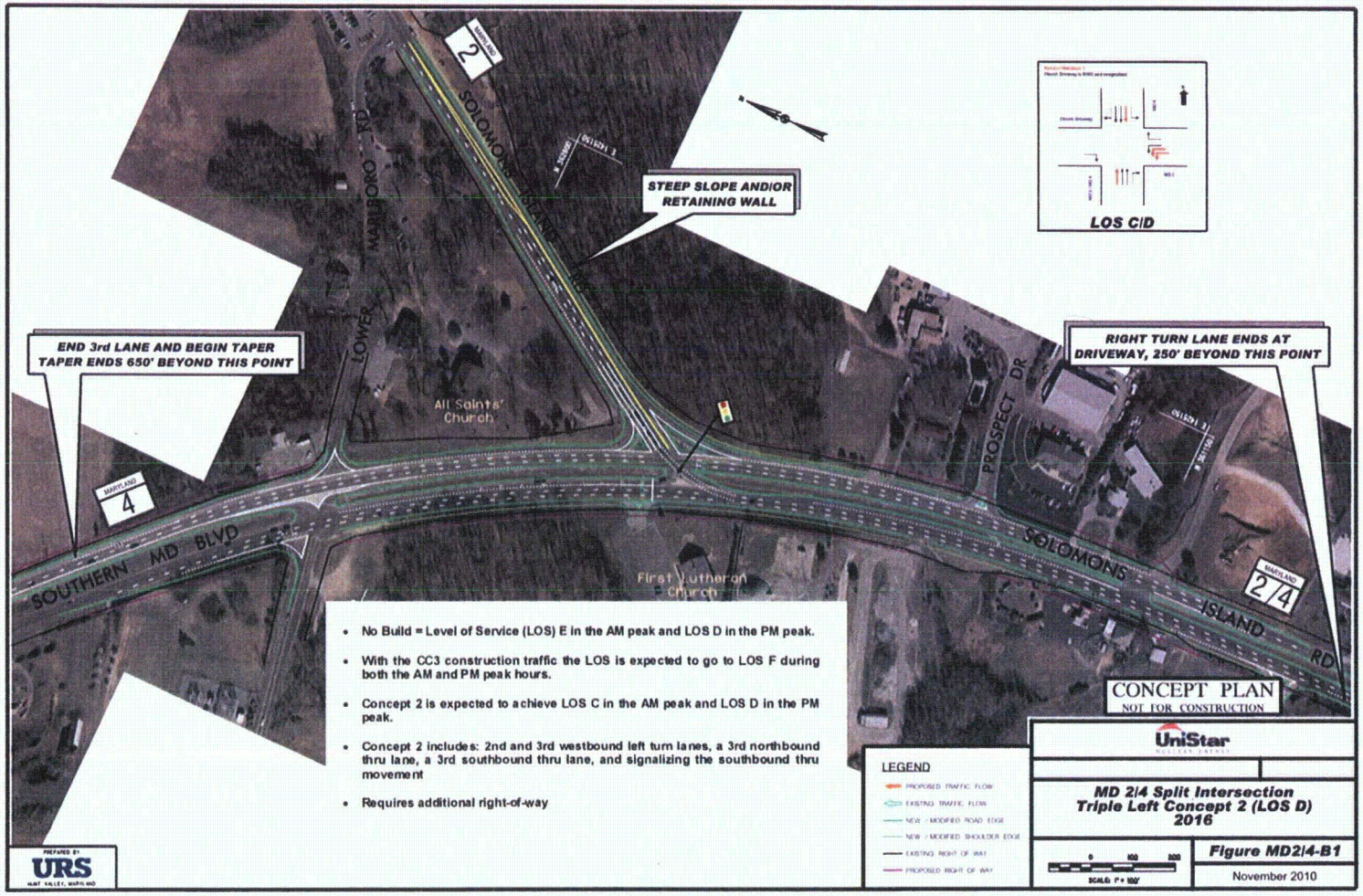


Figure 13 – MD 2 and MD 4 – Mitigation Concept 2

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**
Restripe EB thru lane as left+thru, add receiver for EB right, restripe SB as shared thru+right lanes, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane	941	1117	1219	1447	A	B	C	D

6.1.3.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 15 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

6.1.4.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. Figure 16 presents a mitigation concept at this location. 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	930	**1598**	A	A	A	**E**
Add NBT, prohibit WBL turn	662	543	662	1126	A	A	A	B

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 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	Remove Maryland-T, Add NBT, SBT and 2 WBL lanes
MD 231 & MD 2/MD 4	Restripe EB thru lane as left+thru, add receiver for EB right, restripe SB as shared thru+right lanes, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane
Calvert Beach/Ball Road & MD 2/MD 4	Add one SBT and one NBT lane
Calvert Cliffs Parkway & MD 2/MD 4	Add one 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).

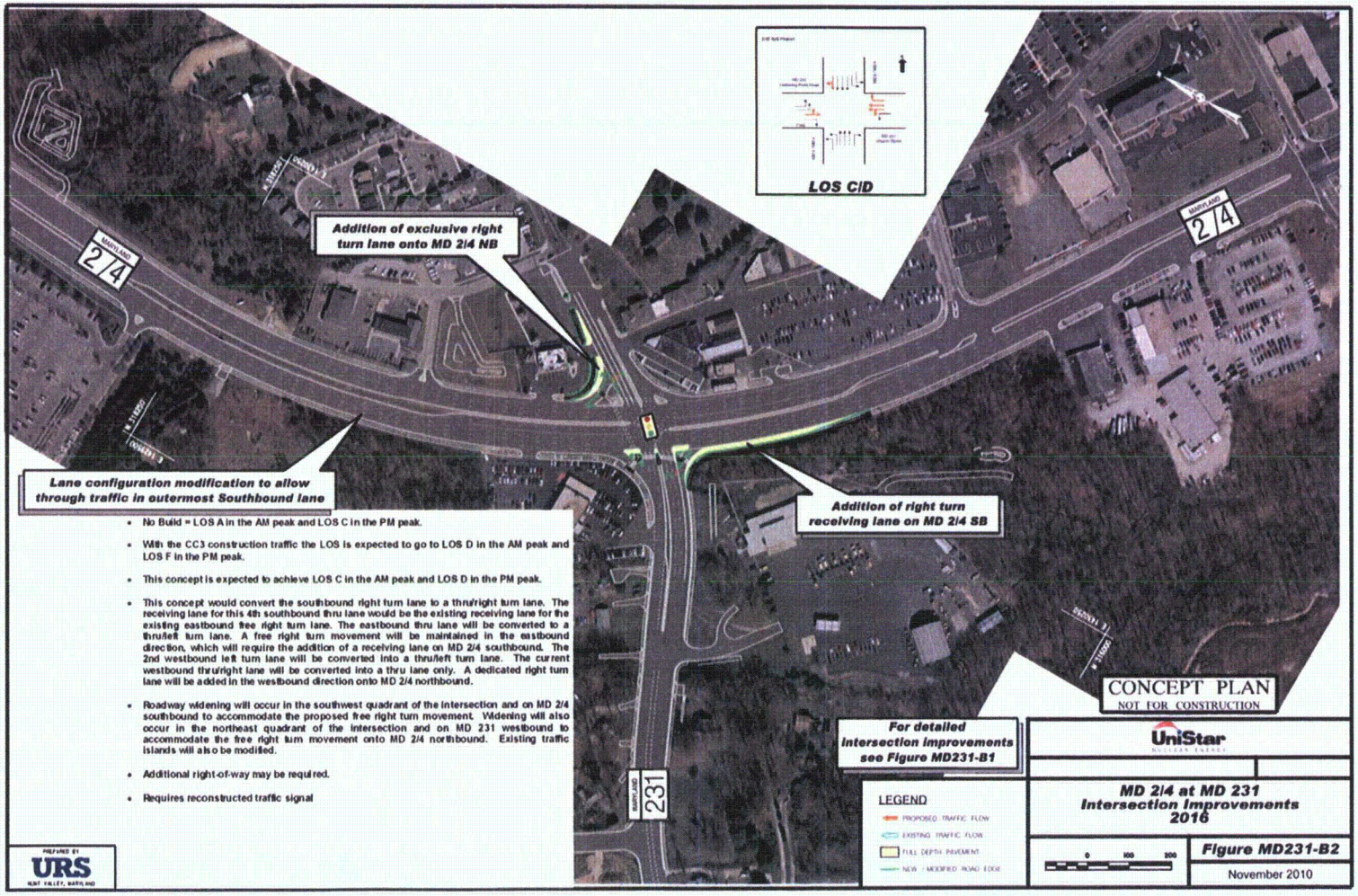


Figure 14 – MD 2/MD 4 and MD 231 – Mitigation Measures – 2016 Conditions

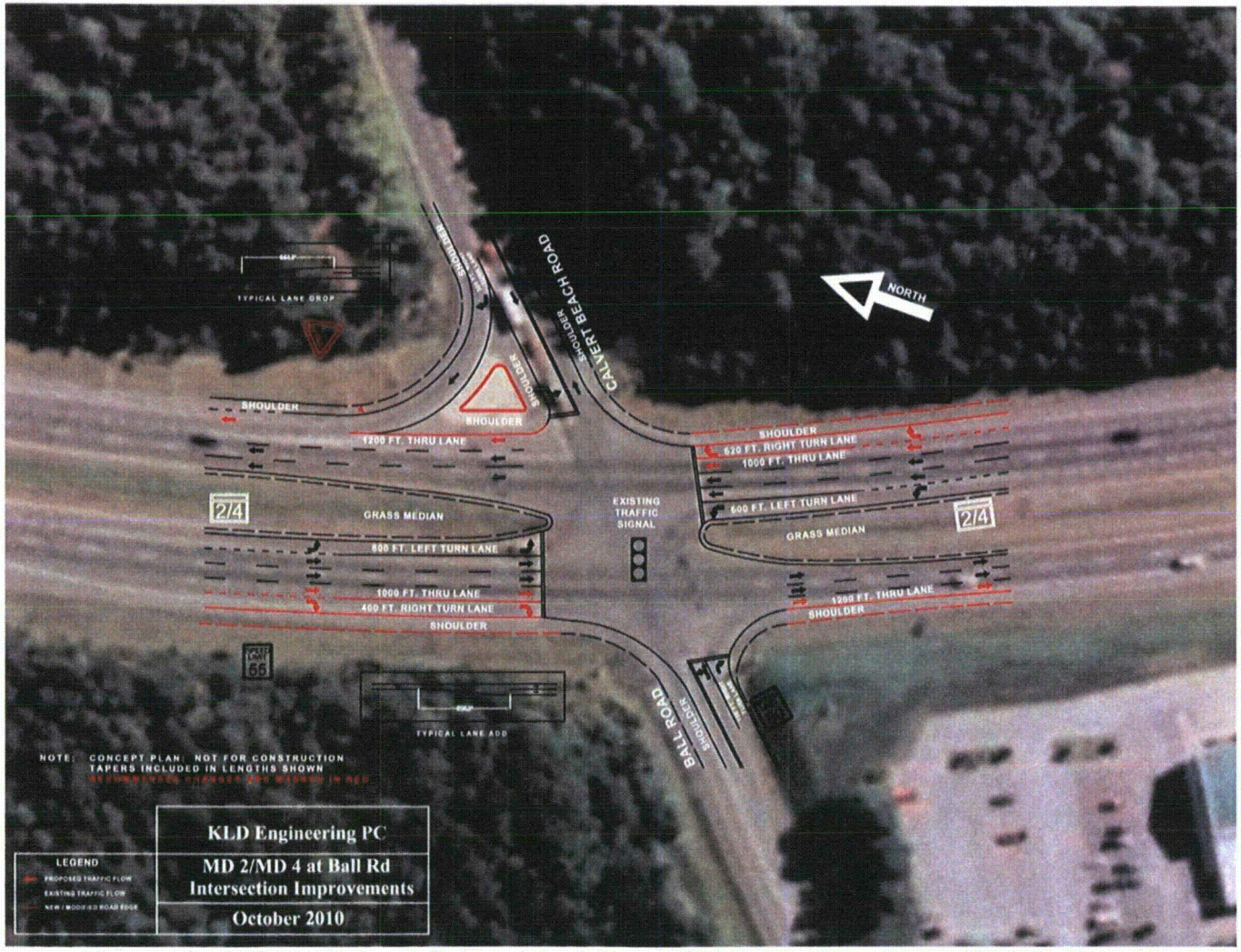


Figure 15 – MD 2/MD 4 and Calvert Beach Road– Mitigation Measures – 2016 Conditions

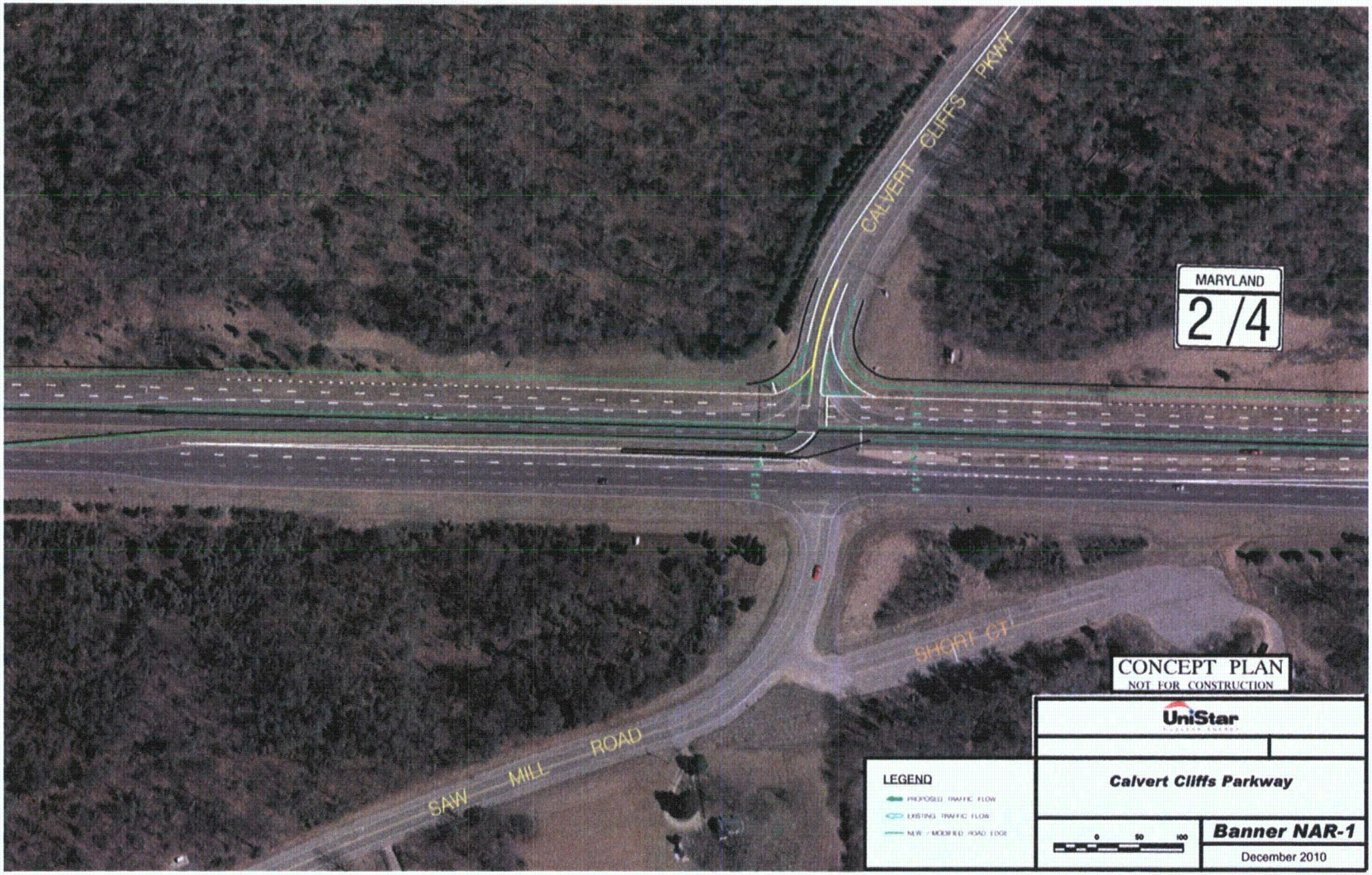


Figure 16 – MD 2/MD 4 and Calvert Cliffs Parkway– Mitigation Measures – 2016 Conditions

Table 11 – Summary of Conditions (CLV)

Intersection	*Mitigation Detail*	*2010*		*2016*			
		Existing		*Background*		*Construction*	
		AM	*PM*	*AM*	*PM*	*AM*	*PM*
MD 2 and MD 4	None	1344	1176	1514	1325	1879	1946
	Remove Maryland-T, Add SBT and WBL lane			1328	1280	1547	1583
	Remove Maryland-T, Add NBT, SBT and 2 WBL lanes			994	1176	1158	1445
MD 2/MD 4 and MD 231	None	865	1098	974	1236	1331	1640
	Restripe EB thru lane as left+thru, add receiver for EB right, restripe SB as shared thru+right lanes, restripe left lane on WB approach as shared thru+left, add an exclusive westbound right turn lane			941	1117	1219	1447
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 Parkway	None	837	710	930	796	930	1598
	Add one NBT lane, Prohibit WBL turn			662	543	662	1126
MD 2/MD 4 and White Sands	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

6.3. Required Lead Times, to Implement Recommended Mitigation

Figure 17 shows a typical curve of the growth of the CLV over time, specifically at Calvert Beach/Ball Road & MD 2/MD 4.

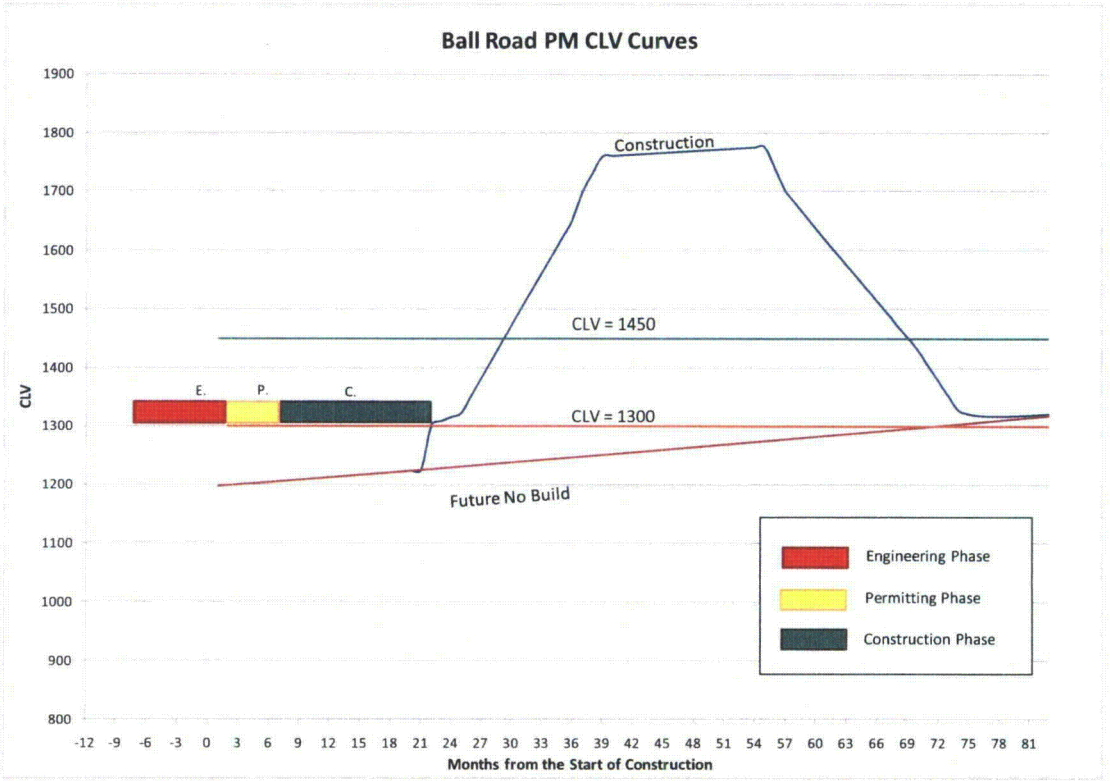


Figure 17 – Critical Lane Volumes at Ball Road/Calvert Beach Road & MD 2/MD 4, Without Mitigation, PM Peak Period

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

For the present analysis, a period of 30 months was used. The beginning of that period is the "last possible date" to start the process. It is shown in Figure 17 as the lead end of the engineering -permitting-construction (E-P-C) sequence.

This approach was used at all intersections, except CC 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 (including allowance for winter periods), 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.

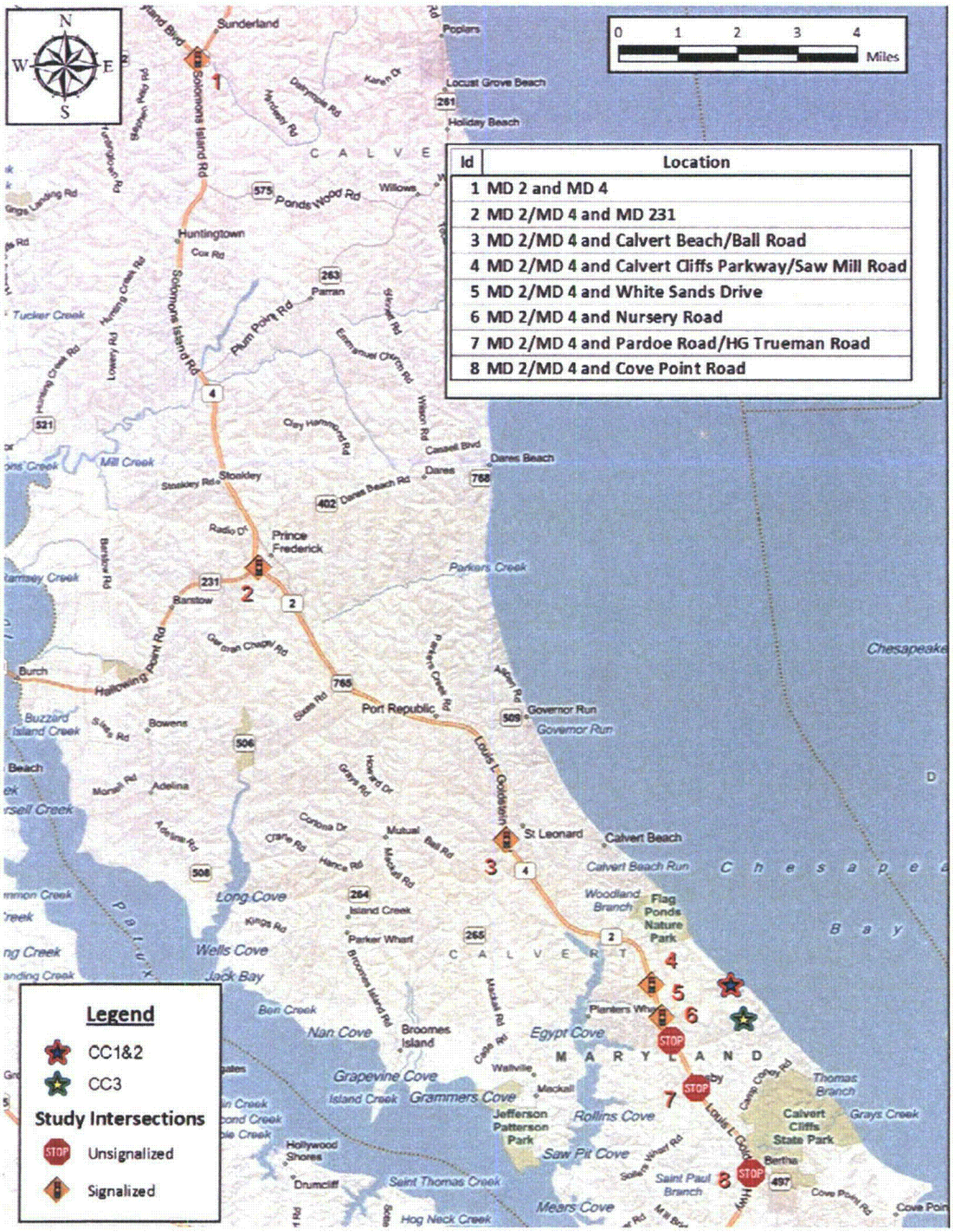
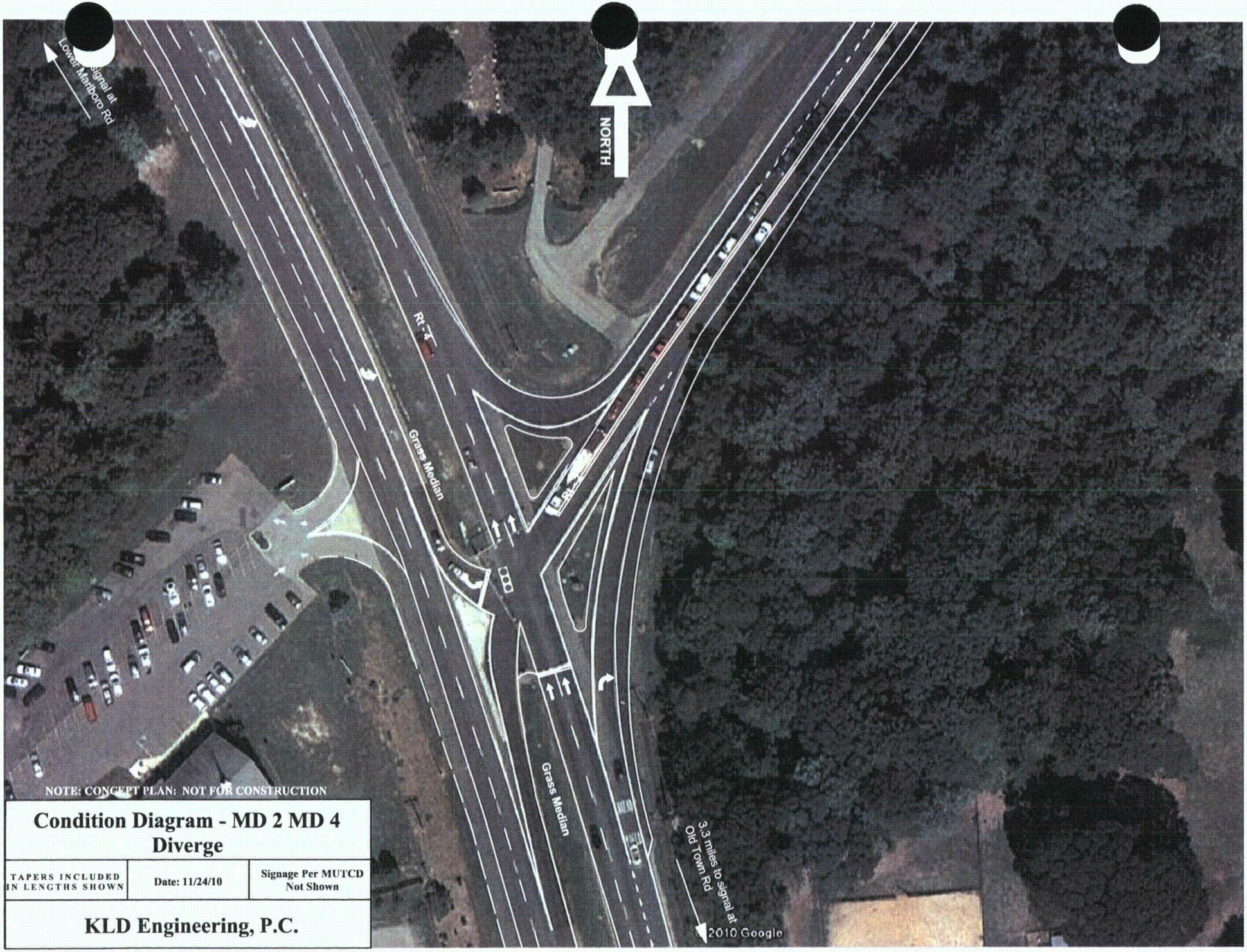
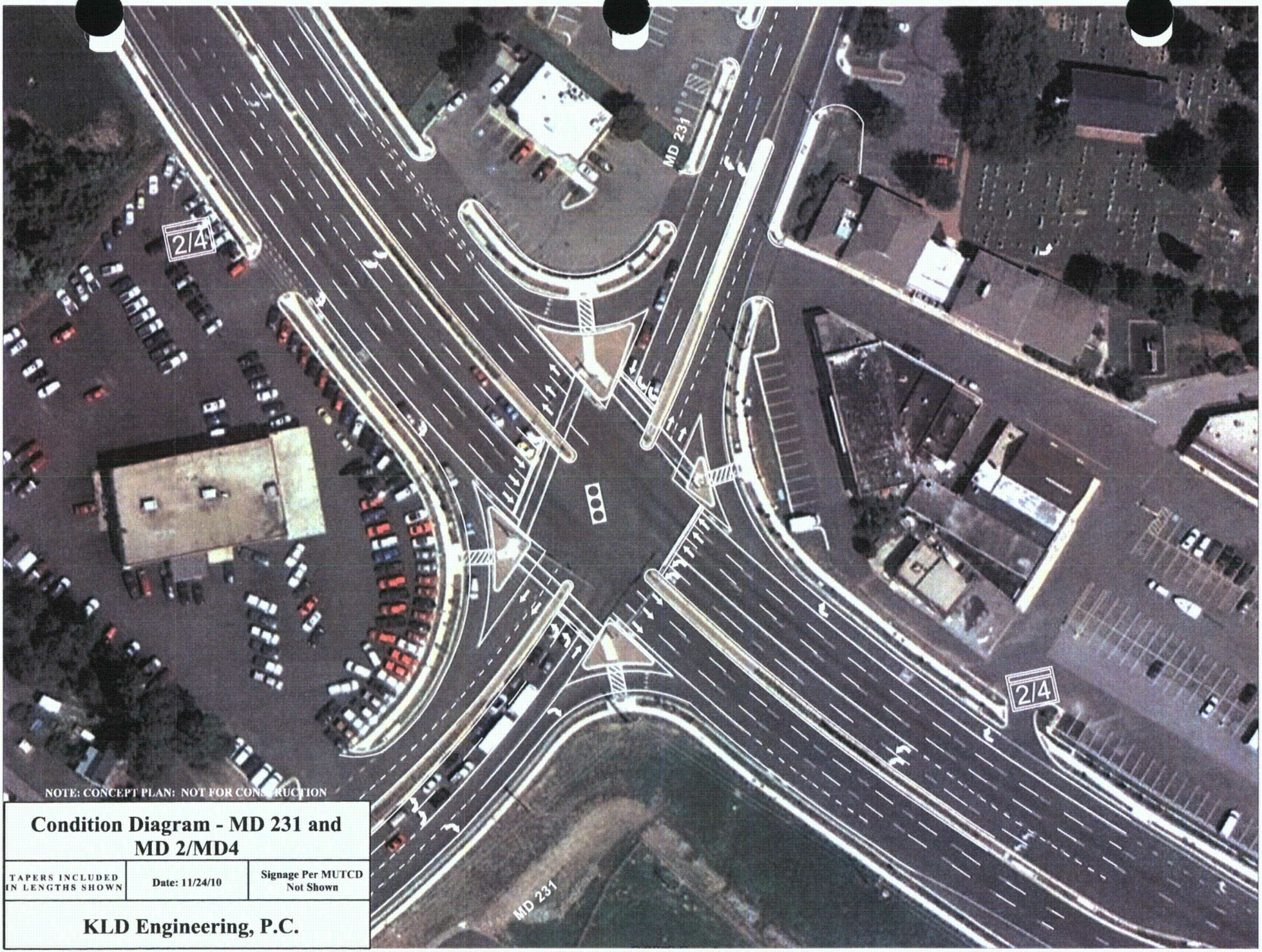


Figure A-1 – CCNPP Site and Traffic Impact Study Area

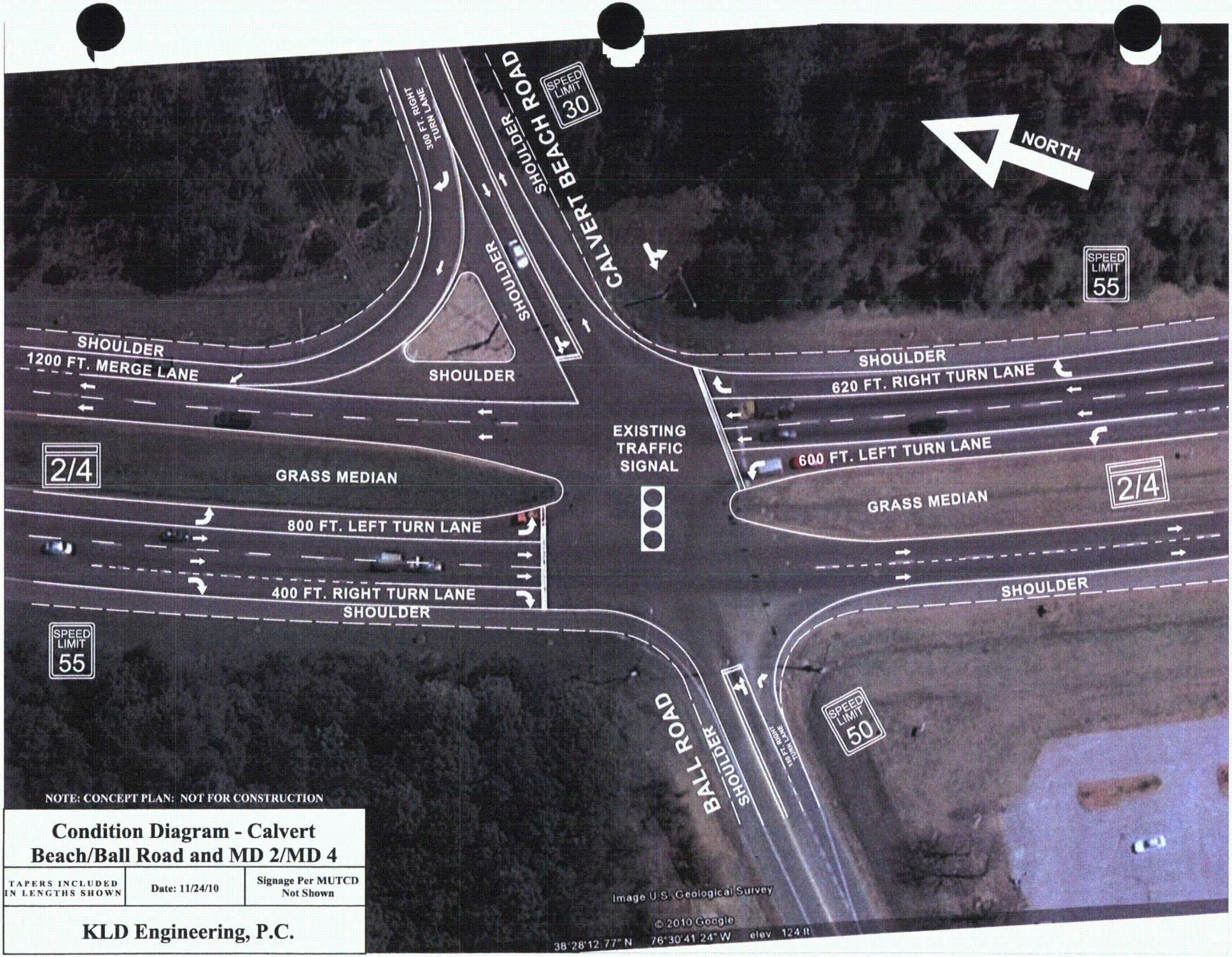


NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

Condition Diagram - MD 2 MD 4 Diverge		
TAPERS INCLUDED IN LENGTHS SHOWN	Date: 11/24/10	Signage Per MUTCD Not Shown
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
KLD Engineering, P.C.		

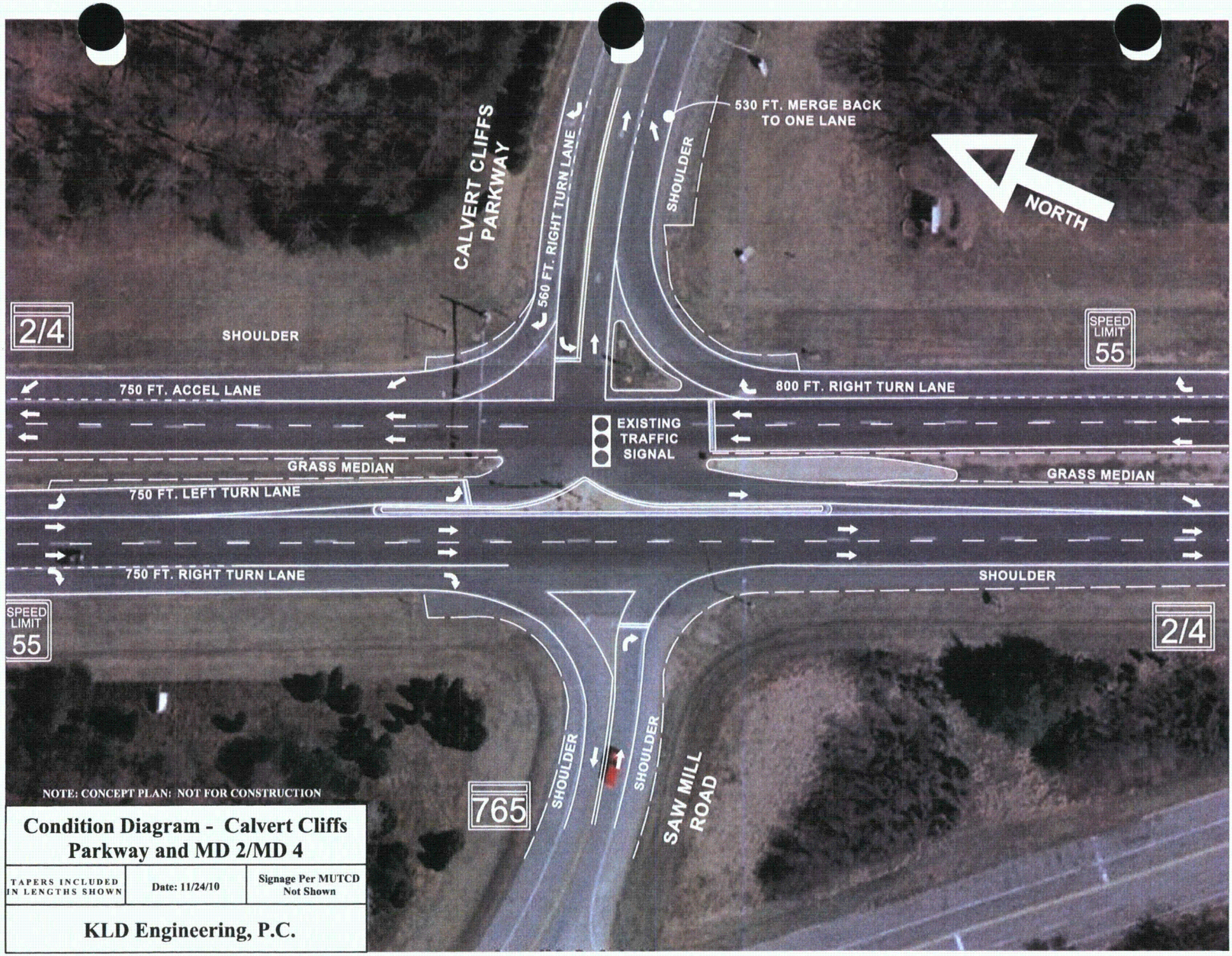


NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

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.

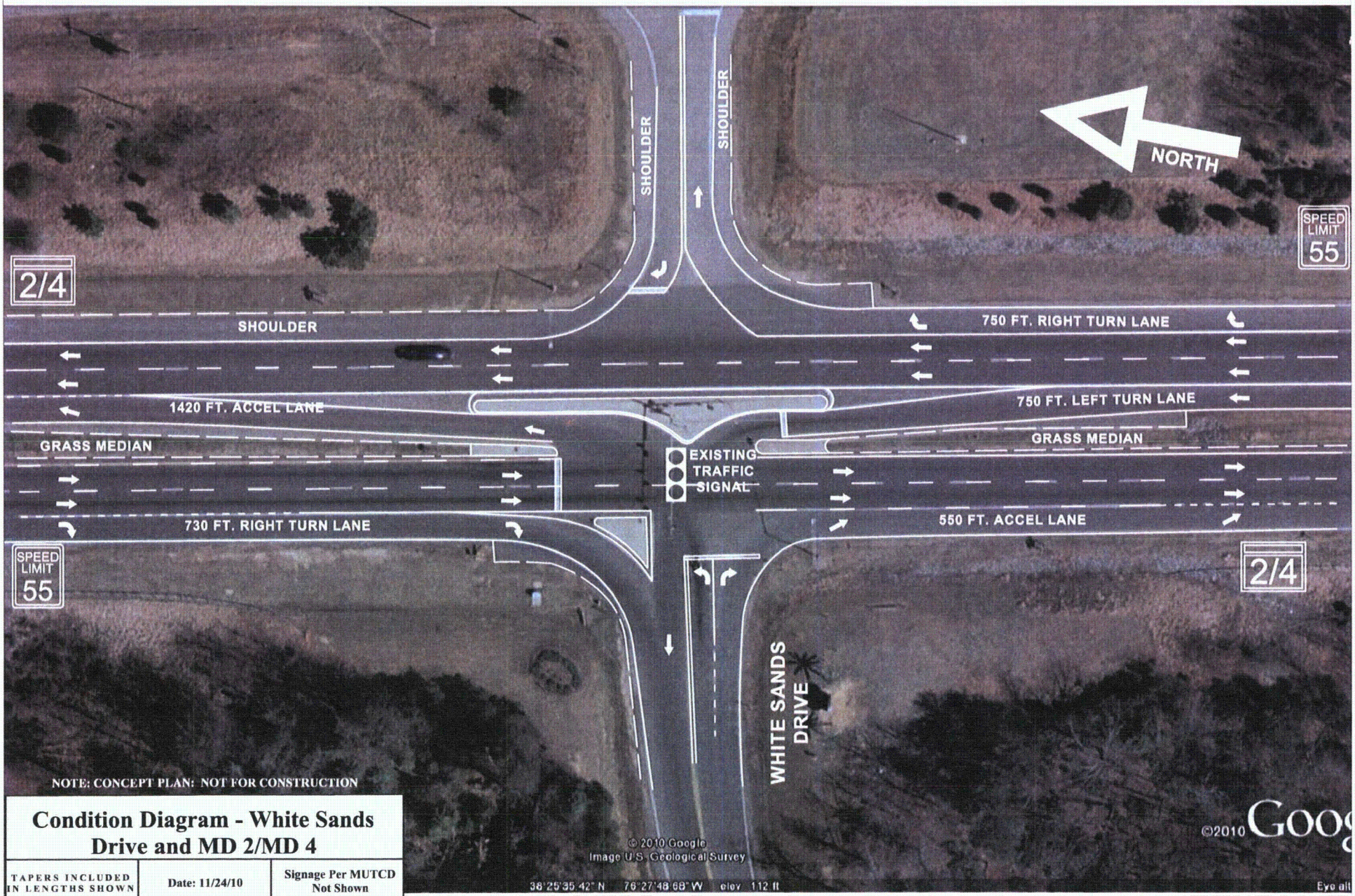


NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

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.

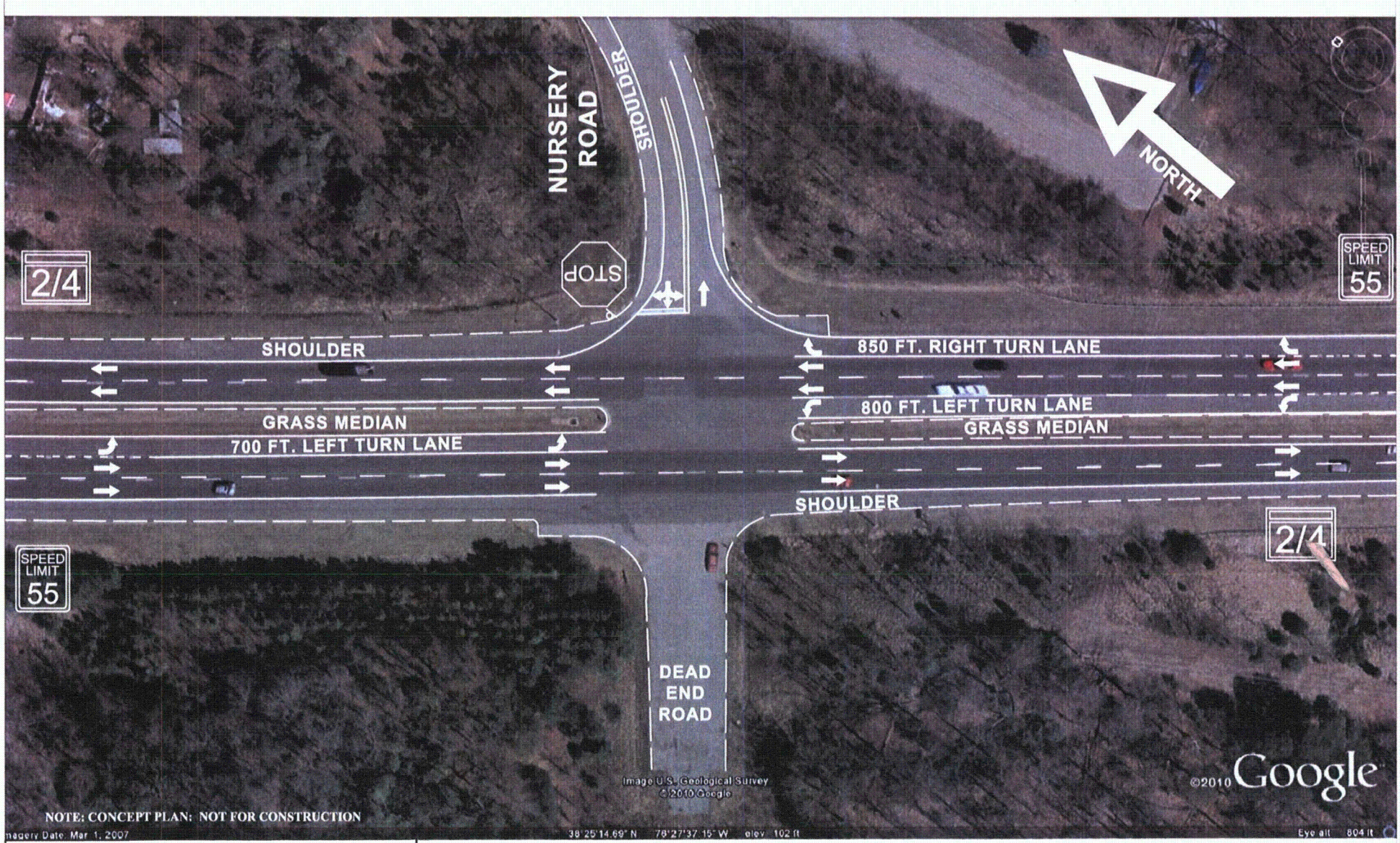


NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

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

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

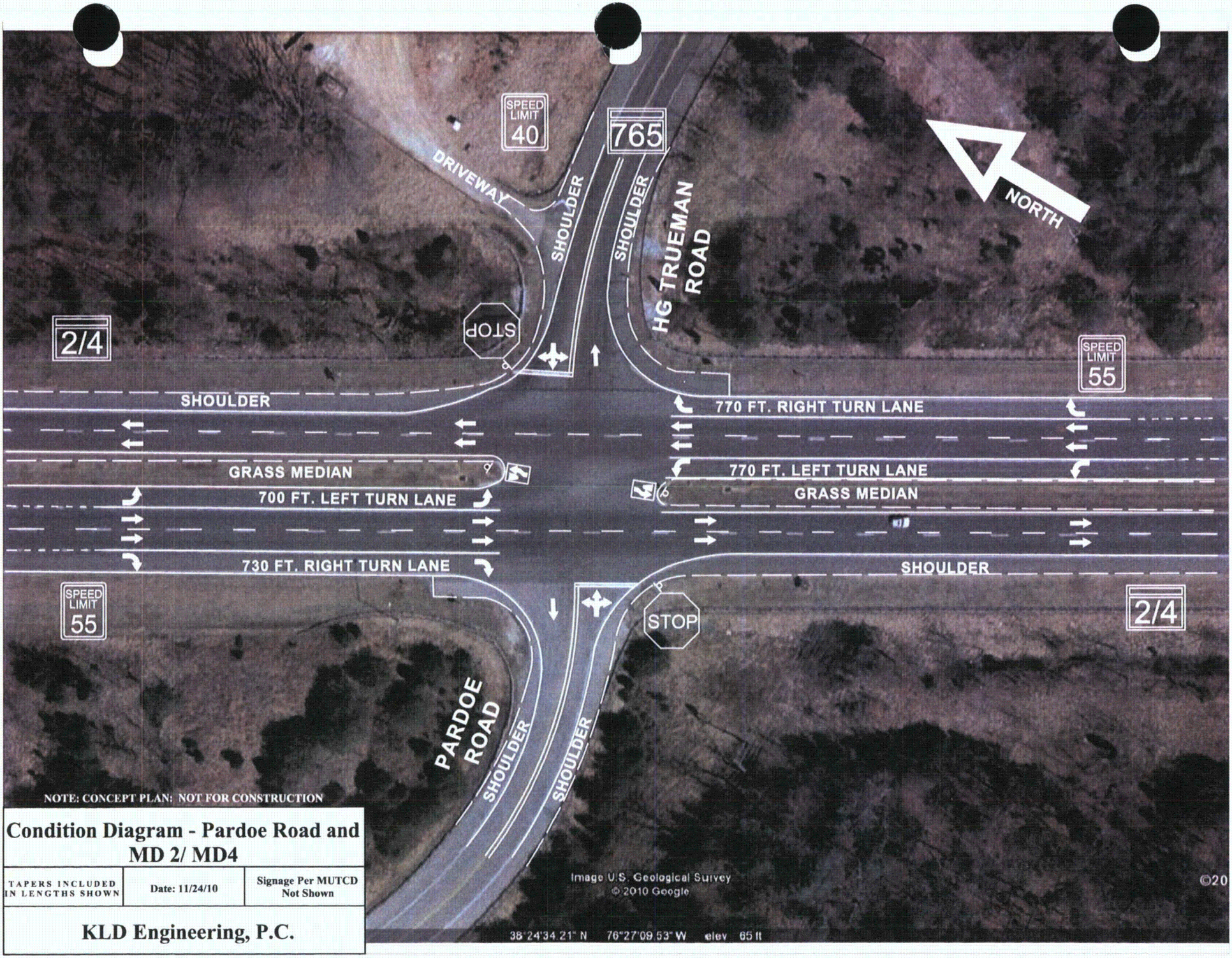
KLD Engineering, P.C.



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.

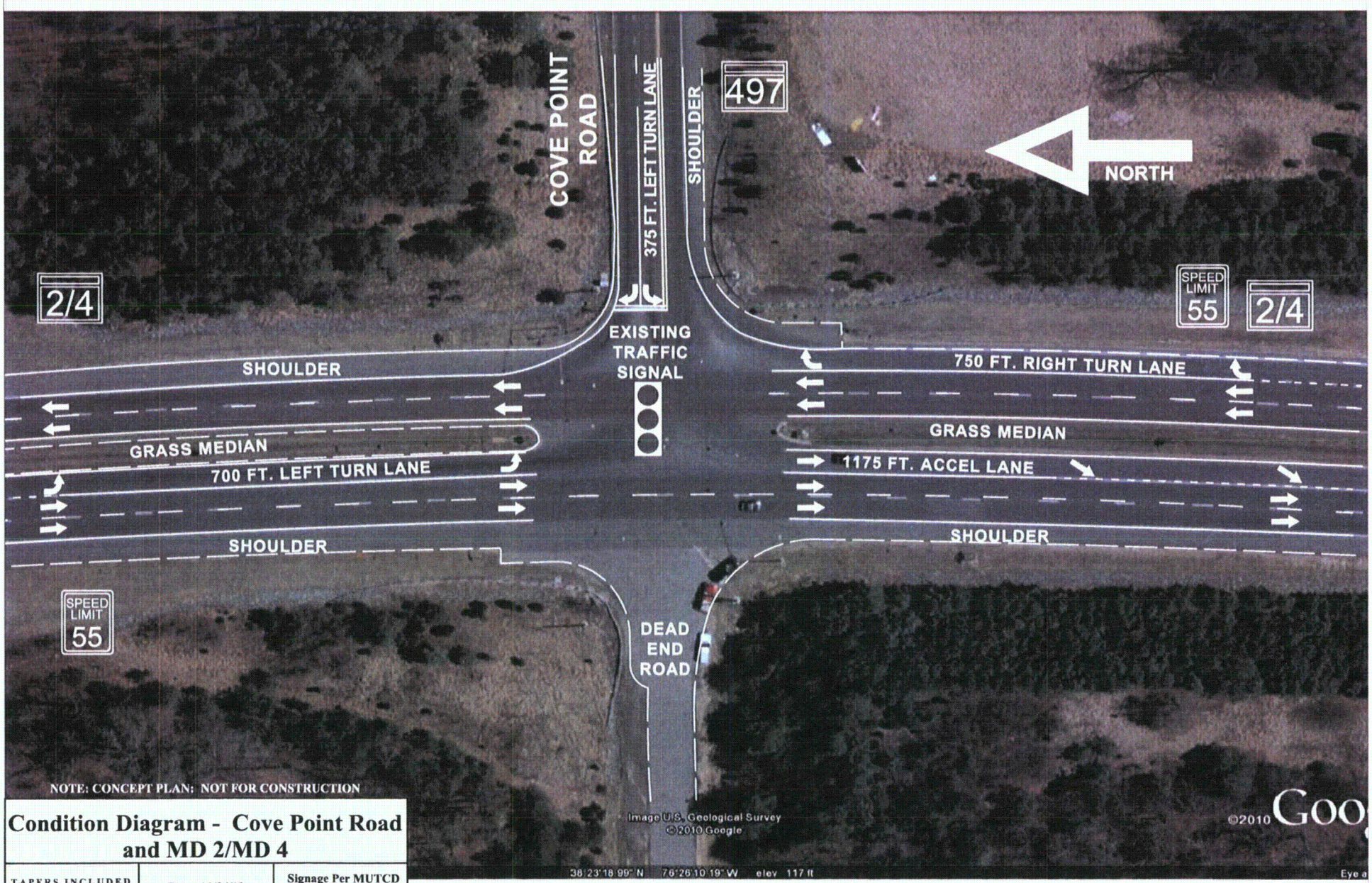


NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

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.



NOTE: CONCEPT PLAN: NOT FOR CONSTRUCTION

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

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

KLD Engineering, P.C.

RFI MW-004

STATE HIGHWAY ADMINISTRATION TIMING CHART WORKSHEET

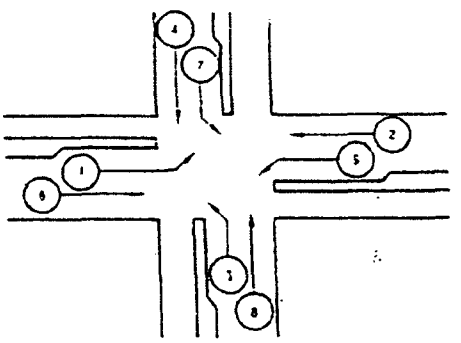
--LEGEND--

ALL VALUES IN SECONDS

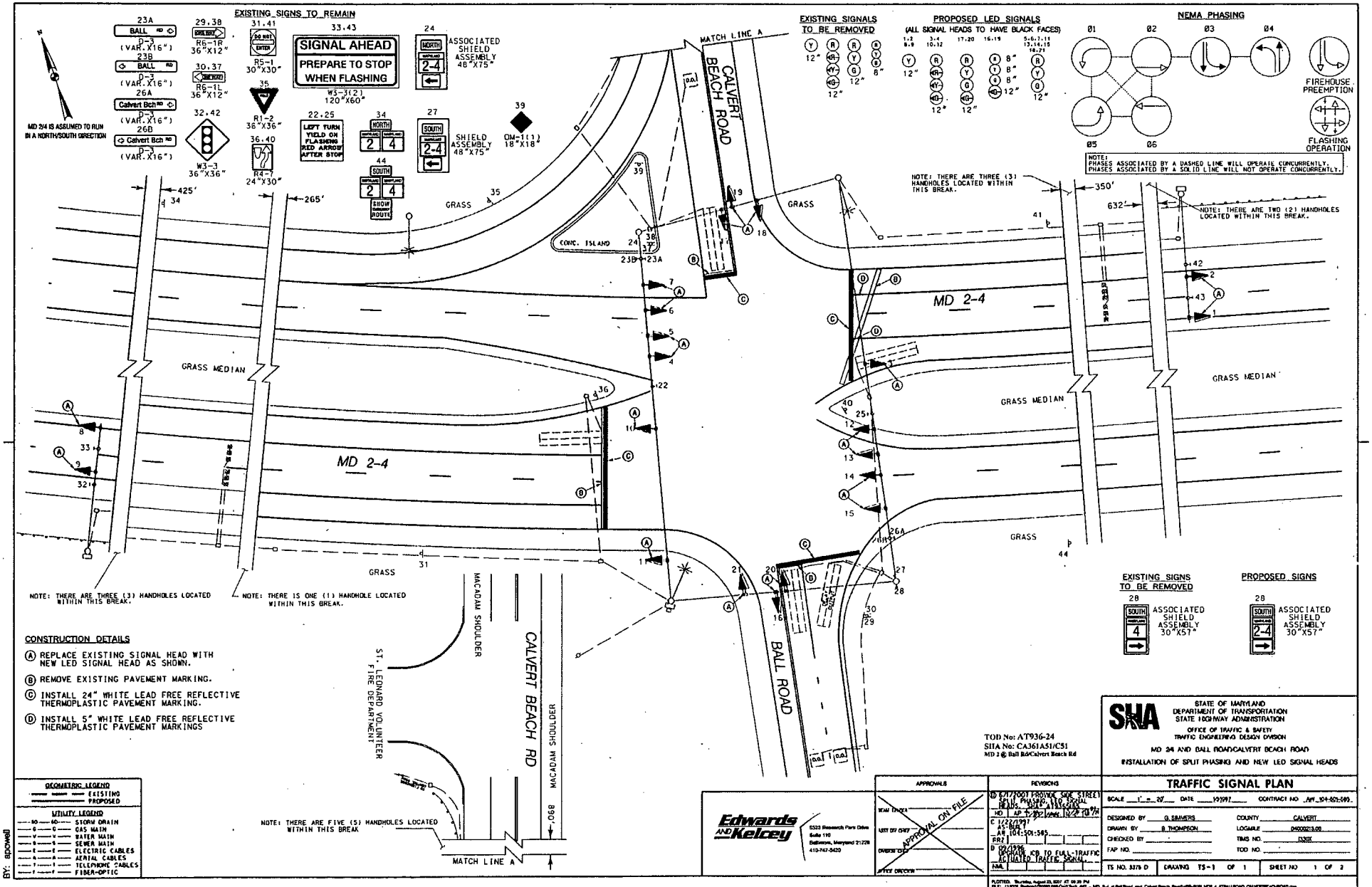
PHASE =	DIRECTION	N/B, S/B, E/B, W/B
	MOVEMENT	Left-turn, Thru, All
	MINIMUM GREEN	Guaranteed GREEN time
	VEHICLE EXTENSION	Supplemental GREEN time determined by traffic demand
	MAXIMUM I	Total GREEN time
	MAXIMUM II	A second total GREEN time used during peak traffic demand in Lieu of MAX I
	YELLOW	Signifying 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.



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

Edwards and Kelcey
5523 Research Park Drive
Suite 110
Baltimore, Maryland 21228
410-747-8420

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

MD 2A AND BALL ROAD/CALVERT BEACH ROAD
INSTALLATION OF SPLIT PHASING AND NEW LED SIGNAL HEADS

TRAFFIC SIGNAL PLAN

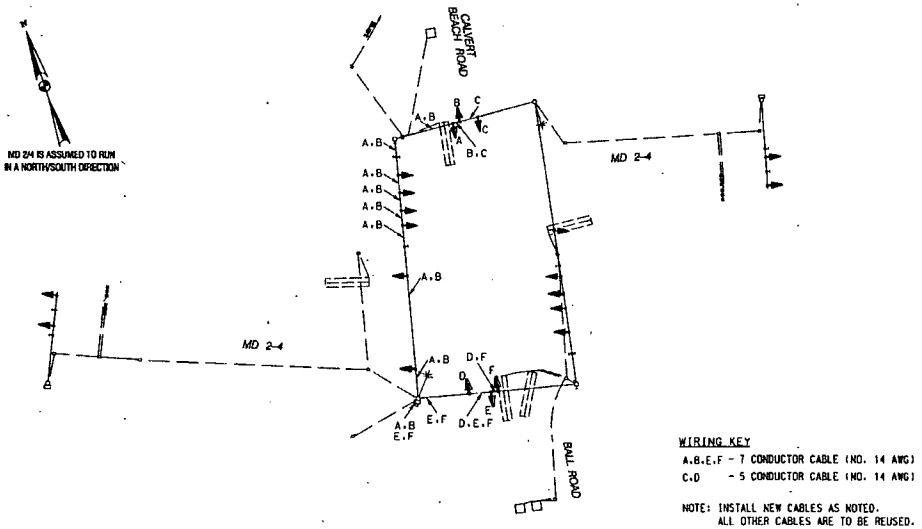
APPROVALS — APPROVAL ON FILE

REVISIONS
D 5/17/2021 PROVIDE ONE STREET NEW PHASING, LED SIGNAL HEADS, SHA# AT936A24
C 12/2/2019 AS-BUILT
B 02/2016 UPGRADE ICB TO FULL-TRAFFIC ACTUATED TRAFFIC SIGNAL

SCALE 1" = 20' DATE 1/3/97 CONTRACT NO. AW 104-651-693
DESIGNED BY G. SIMMERS
DRAWN BY B. THOMPSON
CHECKED BY
FAP NO.
COUNTY CALVERT
LOGMILE 0400021.00
TMS NO. 136X
TOD NO.
TS NO. 3378 D | DRAWING TS-1 OF 1 | SHEET NO. 1 OF 2

PLOTTED: Thursday, August 25, 2021 AT 09:39 PM
FILE: J:\2020 Projects\20-0000 SHA\Civil\Task 040 - MD 2-4 at Ball Road and Calvert Beach Road\plan-PLAN_MD2_4_ATBALLROAD_ONVERTBEACHROAD.dgn

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	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	(Y)	(Y)	(R) (4) (1) (6)	(R) (4) (1) (6)	(R) (Y) (G)	(R) (Y) (G)	(R) (Y) (G)	(Y)	(Y)	(R) (4) (1) (6)	(R) (Y) (G)	(R) (4) (1) (6)	(R) (Y) (B)	(R) (Y) (G)	(R) (Y) (B)	(R) (Y) (B) (4) (5)	(R) (Y) (G) (2)	(R) (Y) (G)	(R) (Y) (G) (3)	(R) (Y) (G) (3)	(R) (Y) (G)
PHASE 1 AND 5	FLY	FLY	+G-	+G-	R	R	R	FLY	FLY	+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	FLY	FLY	R/+R-	R	R/+R-	R	R	R	R	R	R	R	R	R
1 CHANGE	DARK	DARK	+Y-	+Y-	G	G	G	FLY	FLY	R/+R-	R	R/+R-	R	R	R	R	R	R	R	R	R
PHASE 2 AND 5	FLY	FLY	R/+R-	R/+R-	R	R	R	DARK	DARK	+G-	G	+G-	G	G	G	R	R	R	R	R	R
5 CHANGE	FLY	FLY	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	FLY	FLY	R/+R-	R/+R-	Y	Y	Y	FLY	FLY	R/+R-	Y	R/+R-	Y	Y	Y	R	R	R	R	R	R
PHASE 3	FLY	FLY	R/+R-	R/+R-	R	R	R	FLY	FLY	R/+R-	R	R/+R-	R	R	R	R	R	R	G/+G-	G/+G-	G
3 CHANGE	FLY	FLY	R/+R-	R/+R-	R	R	R	FLY	FLY	R/+R-	R	R/+R-	R	R	R	R	R	R	Y	Y	Y
PHASE 4	FLY	FLY	R/+R-	R/+R-	R	R	R	FLY	FLY	R/+R-	R	R/+R-	R	R	R	G/+G-	G/+G-	G	R	R	R
4 CHANGE	FLY	FLY	R/+R-	R/+R-	R	R	R	FLY	FLY	R/+R-	R	R/+R-	R	R	R	Y	Y	Y	R	R	R
FLASHING OPERATION	DARK	DARK	FLY/ R/+R-	FLY/ R/+R-	FLY	FLY	FLY	DARK	DARK	FLY/ R/+R-	FLY	FLY/ R/+R-	FLY	FLY	FLY	FLR	FLR	FLR	FLR	FLR	FLR

FIREHOUSE PREEMPTION

FIREHOUSE PREEMPTION PHASE 3	FLY	FLY	R/+R-	R/+R-	R	R	R	FLY	FLY	R/+R-	R	R/+R-	R	R	R	R	R	R	G/+G-	G/+G-	G
PREEMPTION CLEARANCE	FLY	FLY	R/+R-	R/+R-	R	R	R	FLY	FLY	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 INTERSECTION.

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 ROSENHIZER
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

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

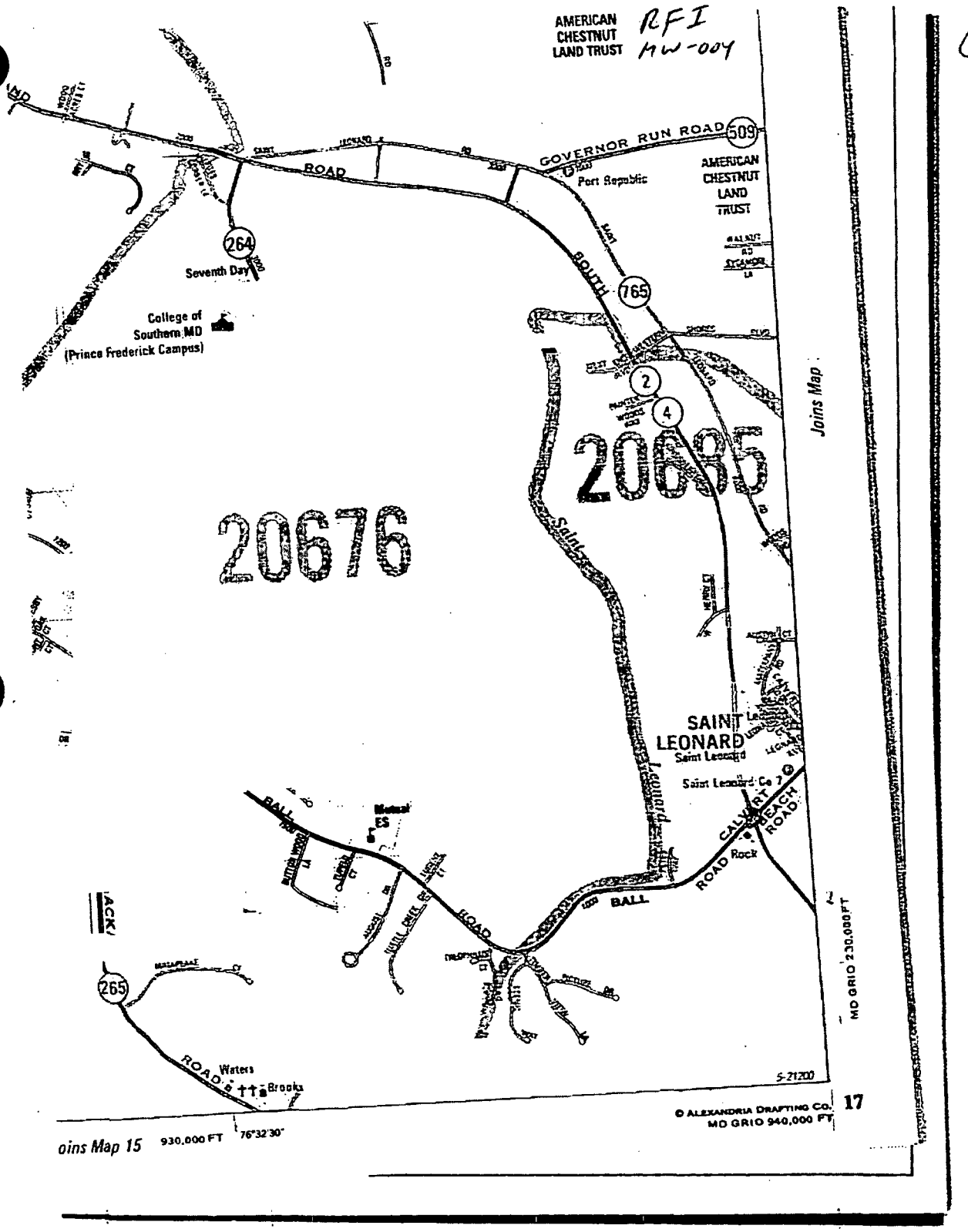
GENERAL INFORMATION SHEET

SCALE: NOT TO SCALE DATE: JUNE 2017 CONTRACT NO. AT936194

DESIGNED BY: JL DOYLE
DRAWN BY: A POWELL
CHECKED BY:
FAP NO:
COUNTY: CALVERT
LOCABLE:
TARS NO:
TOD NO:

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

Edwards and Kelcey
5633 Research Park Drive
Suite 110
Baltimore, Maryland 21228
410-747-8478


AMERICAN CHESTNUT LAND TRUST
RFI MW-004
(1)
GOVERNOR RUN ROAD
509
ROAD
Port Republic
AMERICAN CHESTNUT LAND TRUST
264
Seventh Day
College of Southern MD (Prince Frederick Campus)
SOUTH
765
2
4
20685
20676
Joins Map
Saints
SAINT LEONARD
Saint Leonard
Saint Leonard Co 7
BEACH ROAD
ROAD
Rock
BALL
265
Waters
Brooks
5-21200
© ALEXANDRIA DRAFTING CO.
MD GRID 940,000 FT
17
MD GRID 230,000 FT
oins Map 15
930,000 FT
76°32'30"

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	CALVERT 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							
DIKE GRN										
CS GREEN										
WALK										
PED CLEAR										
VEH EXT	6.0	3.0	4.0							
VEH EXT 2										
MAX EXT	30	15	15							
MAX I	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+5.5=50.5							
CARS WT										
PTREDUC										

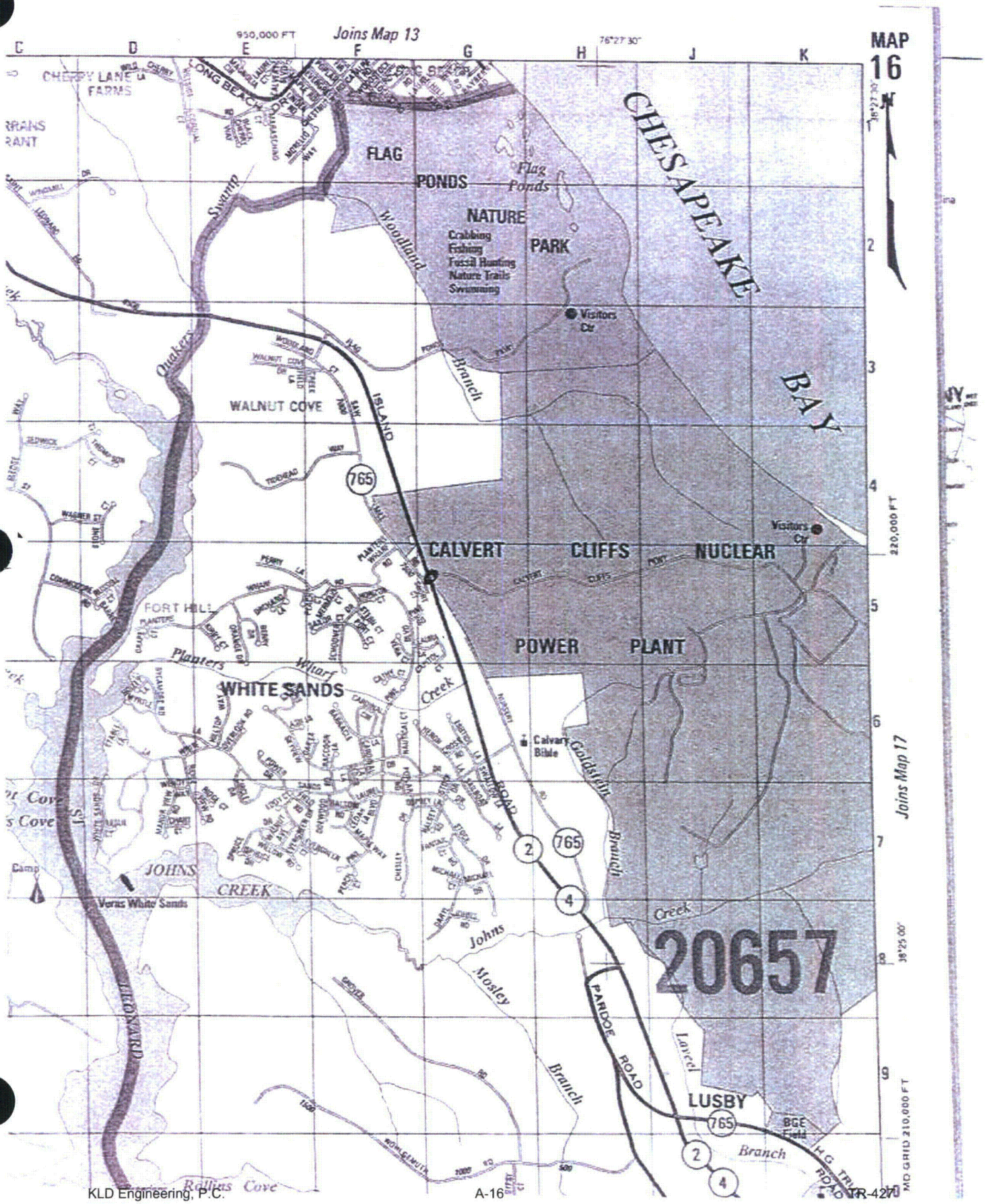
I-21 NW 004

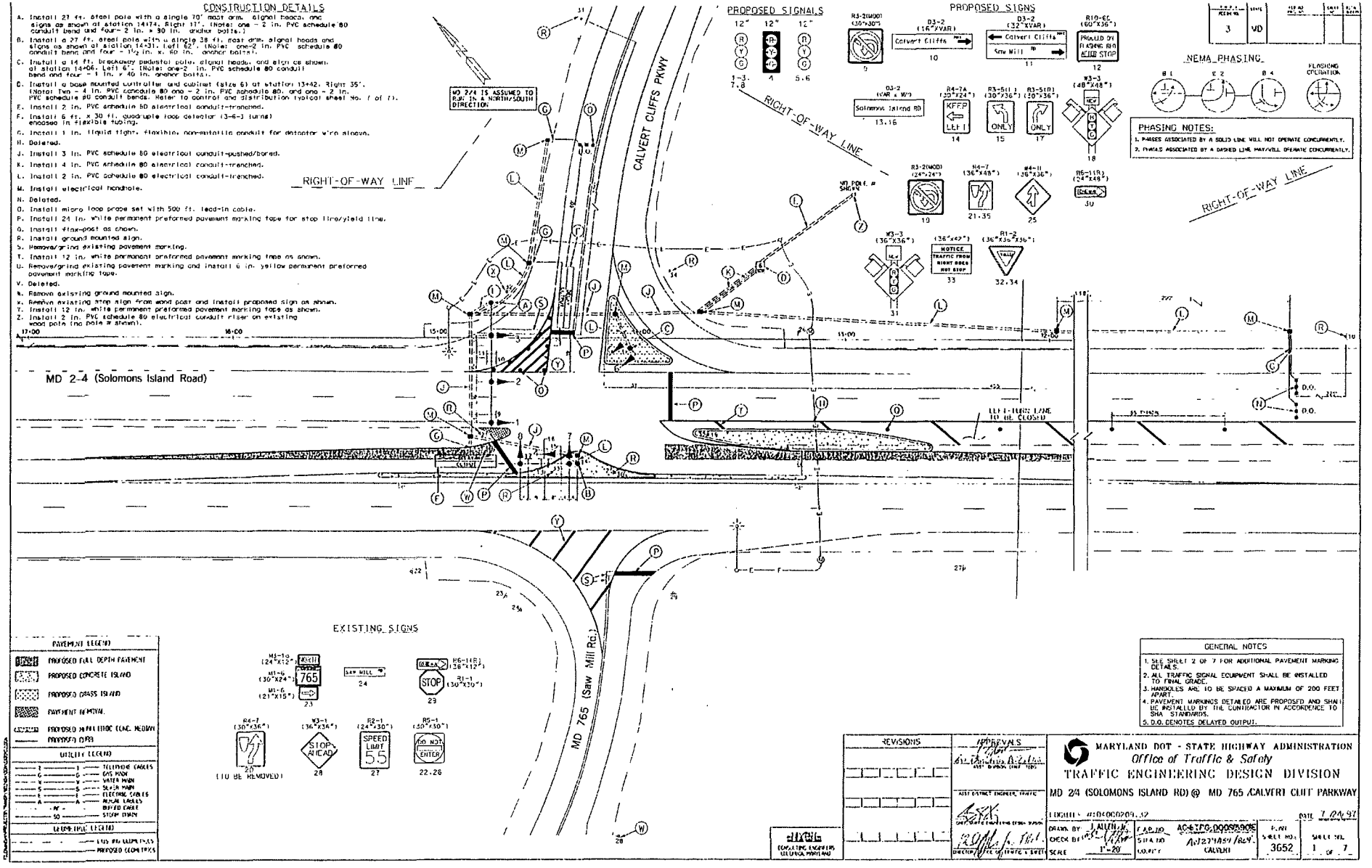
TR427 Rev. 3

04 0 002.08;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 11'. (Note: one - 2 in. PVC schedule 80 conduit bend and four - 2 in. x 30 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 and 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. quadruple loop detector (3-6-3 turns) encased in flexible tubing.
G. Install 1 in. liquid tight, flexible, nonmetallic conduit for detector wire shown.
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).
PROPOSED SIGNALS
PROPOSED SIGNS
NEMA PHASING
PHASING NOTES:
1. PHASES ASSOCIATED BY A SOLID LINE WILL NOT OPERATE CONCURRENTLY.
2. PHASES ASSOCIATED BY A DASHED LINE MAY/WILL OPERATE CONCURRENTLY.
RIGHT-OF-WAY LINE
CALVERT CLIFFS PKWY
MD 2/4 IS ASSUMED TO RUN IN A NORTH/SOUTH DIRECTION
MD 2-4 (Solomons Island Road)
MD 765 (Saw Mill Rd.)
LEFT-TURN LANE TO BE CLOSED
D.O.
EXISTING SIGNS
(TO BE REMOVED)
PAVEMENT LEGEND
PROPOSED FULL DEPTH PAVEMENT
PROPOSED CONCRETE ISLAND
PROPOSED GRASS ISLAND
PAVEMENT REMOVAL
PROPOSED BITUMINOUS CONC. MEDIAN
PROPOSED CURB
UTILITY LEGEND
TELEPHONE CABLES
GAS MAIN
WATER MAIN
SEWER MAIN
ELECTRIC CABLES
RURAL CABLES
BURIED CABLE
STORM DRAIN
GEOMETRIC LEGEND
EXIST. GEOMETRICS
PROPOSED GEOMETRICS
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 ACCORDANCE 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)
LOCATION: #1040020209.12
DATE: 7/24/97
DRAWN BY: J. ALLEN, JR.
CHECK BY:
SCALE: 1"=20'
F.A.P. NO.
STATE NO.
COUNTY: CALVERT
PROJECT NO.: AC-STPC-0009(906)
PLAN SHEET NO.: 3652
SHEET NO.: 1 OF 7

AC 10.25.06 JD

③

SIGNAL NUMBER: 04000207.43 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						

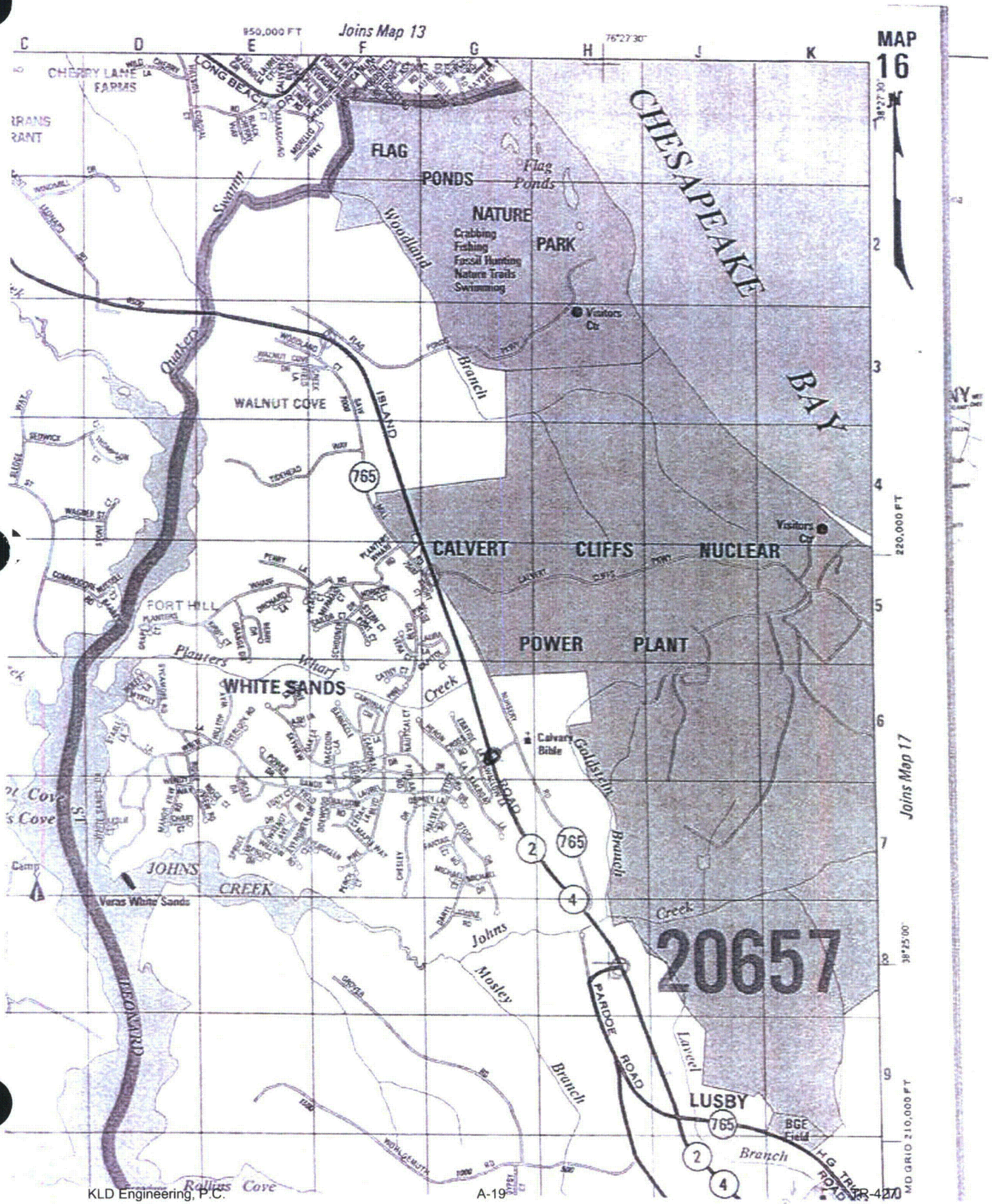
INTERVALS	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5	PHASE 6	PHASE 7	PHASE 8	PHASE 9	PHASE 10
		25	5	5						
WALK		5								
PED CLEAR		7								
VEH EXT		6.0	3.0	3.0						
VEH EXT 2										
MAX EXT		15	10	10						
MAX I		60	25	35						
MAX II		6.0	25	35						
MAX III		90	35	45						
DET MAX										
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										
TTREDUC										

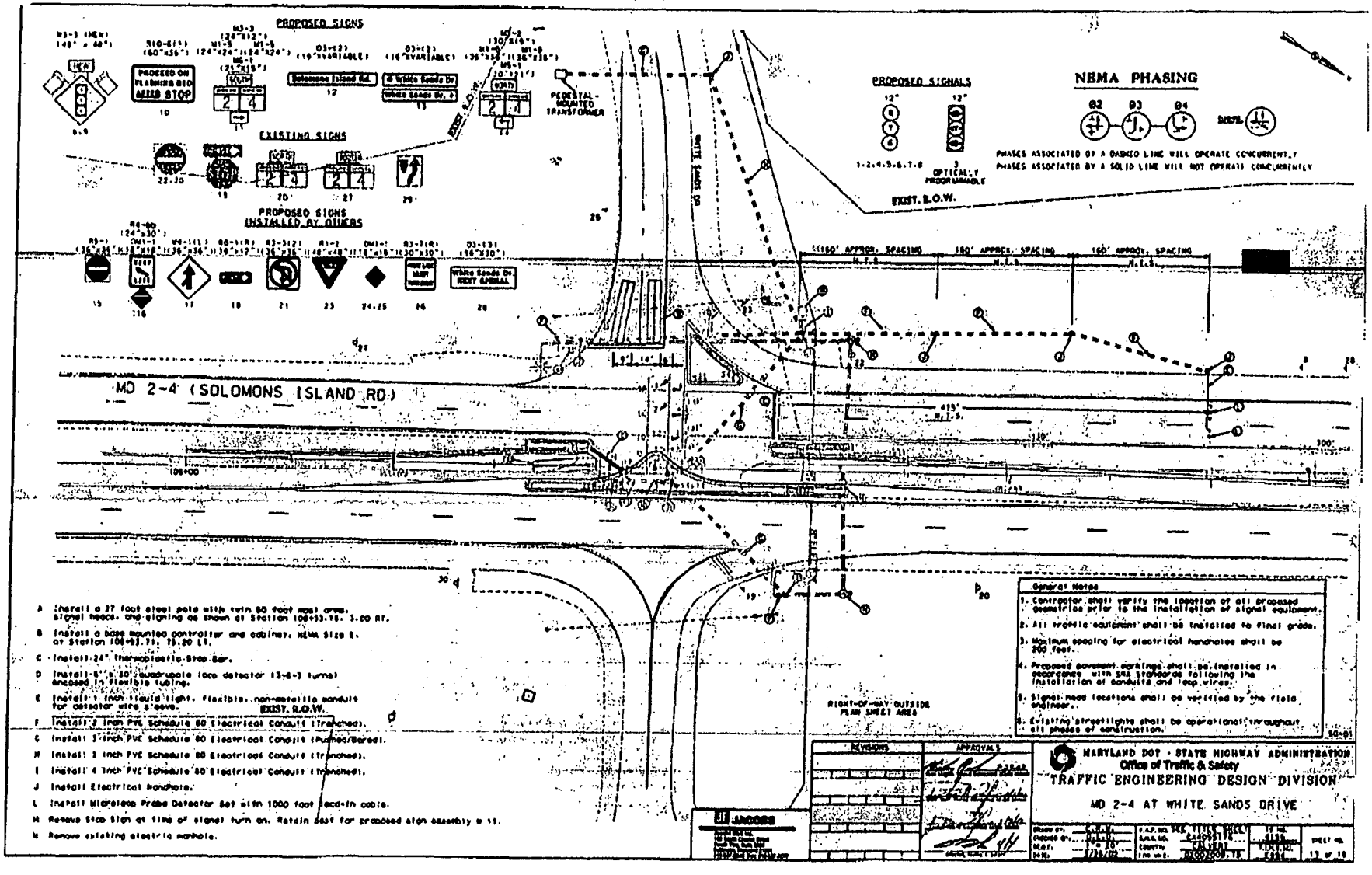
REF NW-007

04-0-002 0743

RFI MW-004

(3)




PROPOSED SIGNS
EXISTING SIGNS
PROPOSED SIGNS INSTALLED BY OTHERS
PROPOSED SIGNALS
NEMA PHASING
EXIST. R.O.W.
MD 2-4 (SOLOMONS ISLAND RD.)
RIGHT-OF-WAY OUTSIDE PLAN SHEET AREA
General Notes
1. Contractor shall verify the location of all proposed geometrics 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.
A Install a 27 foot steel pole with twin 60 foot mast arms, signal heads and signing as shown at Station 106+53.18, 3.00 Rt.
B Install a base mounted controller and cabinet, NEMA Size 6, at Station 106+93.71, 15.20 Lt.
C Install 24" thermoplastic Stop Bar.
D Install 6' x 30' quadrupole loop detector (3-6-3 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.
JACOBS
MARYLAND DOT - STATE HIGHWAY ADMINISTRATION
Office of Traffic & Safety
TRAFFIC ENGINEERING DESIGN DIVISION
MD 2-4 AT WHITE SANDS DRIVE