

Revised Transportation Impact Letter

Calvary Knoxville

Knoxville, Tennessee

Prepared For:

Calvary Knoxville
3330 W. Governor John Sevier Highway
Knoxville, TN 37920

9-G-24-SU / 9-A-24-HPA

TIL Version 2

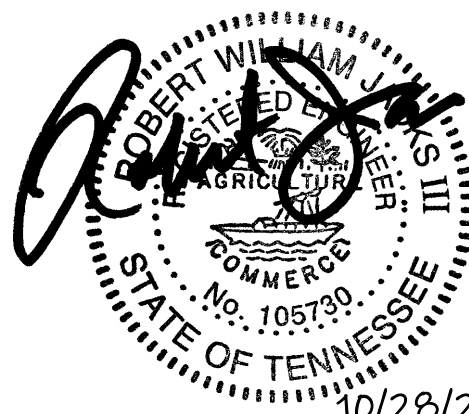
10/28/2024

**Note: also associated with previous
Special Use Case #12-B-23-SU**

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Revised October 28, 2024

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EXECUTIVE SUMMARY

Preface:

Calvary Knoxville is proposing several construction projects to expand their external road access and building capacity. Calvary Knoxville is located at 3330 W. Governor John Sevier Highway in South Knoxville, TN. The proposed road projects include constructing a new 20-foot-wide internal driveway on their campus for a Secondary Entrance to the south at Topside Road and lengthening the exiting northbound right-turn lane at their existing entrance at W. Governor John Sevier Highway by 145 feet. The building project will include constructing a larger sanctuary adjacent to their existing sanctuary, which will more than triple their seating capacity. The construction of the Secondary Entrance and exiting right-turn lane extension are anticipated to be open for vehicles by the end of 2024. The sanctuary expansion is anticipated to be built and open for worship services by 2027.

The primary purpose of this report is to determine and evaluate the potential impacts of the development on the adjacent transportation system. This report is a Transportation Impact Letter (TIL) and follows the requirements established by Knoxville/Knox County Planning. The City of Knoxville prepared the scope of work for this TIL since the Church property is in Knoxville. However, the Church's existing entrance ties into a Tennessee Department of Transportation (TDOT) highway, and the Secondary Entrance is proposed to tie into Topside Road, an existing roadway outside the City in Knox County, TN. Recommendations and mitigation measures are offered if transportation operations are projected to be below recognized engineering standards in the 2024 and 2027 conditions.

Note: This updated TIL reflects the latest proposed increase in the size and seating of their planned new sanctuary. Additionally, a site visit was made on Sunday, September 15th, 2024, during the Church's morning services. On this day, the Church had a Knoxville Police Department officer present on W. Governor John Sevier Highway at the Church's existing driveway. The results of the police officer's presence were substantial. The officer's direction of traffic significantly reduced the vehicle delays and the length of the exiting Church traffic vehicle queues compared to the original observation in December 2023, when no police officer was present at the intersection. While traffic on W. Governor John Sevier Highway experienced increased delays due to the interruptions in flow provided by the police officer, the overall intersection safety was greatly increased due to the exiting Church traffic not having to compete with conflicting traffic on the highway. While the Church plans a substantial increase in size in

the future, the observed benefits of the police officer at the intersection bode well for future traffic operations during peak Church activities.

Results:

The significant findings of this report include the following:

- In 2024, when the new Secondary Entrance to Topside Road is built, vehicle delays and queues for exiting vehicles will be reduced on the existing Church Driveway at the W. Governor John Sevier Highway intersection.
- In 2027, when the new sanctuary is built and open for worship services, the peak generated trips are estimated to be nearly three times the current levels and will significantly increase the exiting vehicle delays and queues on the existing Church Driveway at W. Governor John Sevier Highway. Due to the projected increased attendance and generated vehicle trips by the new and larger sanctuary in 2027, the existing Church Driveway at W. Governor John Sevier Highway intersection is likely to be overwhelmed during the Sunday morning peak periods, even with the availability of the Secondary Entrance to Topside Road. In particular, the exiting Church attendees during the Sunday peak periods of 10:45 – 11:45 am and 12:15 – 1:15 pm are projected to experience the most significant delays and vehicle queues while leaving the Church and attempting to enter W. Governor John Sevier Highway.

Recommendations:

The following recommendations are offered based on the analyses to minimize the impacts of the Church's expansion on the adjacent transportation system while attempting to achieve an acceptable traffic flow and improved safety. More details regarding all the recommendations are discussed at the end of the report.

W. Governor John Sevier Highway at the Existing Church Driveway:

- A Stop Sign (R1-1) is not currently posted for the Church Driveway approach at W. Governor John Sevier Highway. It is recommended that a Stop Sign (R1-1) be installed for this approach at the existing white stop bar as soon as possible.
- It is recommended that the existing eastbound right-turn lane on W. Governor John Sevier Highway at the Church Driveway be slightly widened and lengthened to accommodate the increased attendance when the new Church sanctuary is constructed. This improvement should be made before the opening of the new

sanctuary in 2027. This lane should be widened to 11 feet from its current width of 9.5 feet. It is recommended that the storage length be increased to 210 feet and the existing lane taper of 15:1 be maintained. With a lane width of 11 feet, the taper at 15:1 would be 165 feet. Thus, the total length of the taper and storage will be 375 feet, which will fit within the constraint of the existing slope and guardrail on the south side of W. Governor John Sevier Highway. The new lane taper and lane extension should begin at the end of this existing guardrail. The existing width of the paved shoulder on W. Governor John Sevier Highway (~ 3 feet) should also be maintained along the length of the proposed lane extension.

- Due to the projected failing conditions on Sunday mornings in 2027 when the new sanctuary is open for worship services, it is recommended that the Church employ law enforcement officers to direct traffic at the Church Driveway and W. Governor John Sevier Highway. A law enforcement presence will be imperative to ensure safer operations during Sunday morning services with increased traffic at the intersection in 2027. Based on the observations and calculations, at a minimum, it is recommended that law enforcement be present from 10:45 - 11:45 am and 12:30 - 1:00 pm on Sunday mornings to provide orderly and safer operations at the intersection, particularly for exiting vehicles. It should be noted that this recommendation must be coordinated with the Knoxville Police Department, and their services cannot be guaranteed.
- The Church should consider installing a single overhead roadway light to delineate the existing Church Driveway at the highway for travel at night or in low-light conditions. This lighting would be ideally placed adjacent to the Church Driveway and off W. Governor John Sevier Highway and would illuminate the intersection.

Topside Road at the Proposed Secondary Entrance:

- A Stop Sign (R1-1) with a 24" white stop bar is recommended to be installed for the Secondary Entrance approach at Topside Road. The stop bar should be applied a minimum of 4 feet away from the edge of Topside Road, placed at the desired stopping point that maximizes the sight distance.
- Intersection sight distance at the Secondary Entrance at Topside Road must not be impacted by existing vegetation, future landscaping, or signage. Any vegetation in the right-of-way that restricts sight distance at the Proposed Secondary Entrance should be removed. Based on a posted speed limit of 30-mph on Topside Road, the required intersection sight distance is 300 feet for exiting left and right-turning

vehicles. The available sight distances from the Secondary Entrance on Topside Road will be adequate based on the measurements conducted by a land surveyor.

- Due to the relative narrowness of Topside Road (pavement width ~ 18.5 feet), it is recommended that the driveway radius on the southwest corner for the Secondary Entrance at Topside Road be a minimum of 30 feet. The current radius in the design plans shows a radius of 25 feet. A larger radius will allow right-turning exiting vehicles from the Secondary Entrance to minimize encroachment onto the opposite lane on Topside Road.
- The new internal driveway for the Secondary Entrance will be a private drive, and the Church should consider a lockable gate that would prevent any unnecessary traffic from cutting through the campus. If pursued, the details and plans must be coordinated with the Knoxville Fire Department if a gated entrance is provided. If a gate is provided, the installation should comply with the Manual of Uniform Traffic Control Devices (MUTCD) and meet retro-reflectivity requirements listed in Section 2B.76 of the MUTCD. The gate should also include a sensor allowing traffic to exit to Topside Road without a key.
- The Church should post two signs on the new internal driveway facing entering traffic from Topside Road at the Secondary Entrance. Since this driveway should only be used for Church activities, a "No Thru Traffic" Sign (R5-12) and a "No Trucks" Sign (R5-2) are recommended to be installed on a single post. Likewise, a "No Thru Traffic" Sign (R5-12) should be installed off W. Governor John Sevier Highway at the existing Church Driveway. This sign at the existing Church Driveway should be installed inside the property facing W. Governor John Sevier Highway.
- The Church should consider installing a single overhead roadway light to delineate the proposed Secondary Driveway at Topside Road for travel at night or in low-light conditions while minimizing its effect on the adjacent houses. This lighting would be ideally placed adjacent to the proposed Secondary Driveway and off Topside Road and would illuminate the intersection.

DESCRIPTION OF EXISTING CONDITIONS

▪ STUDY AREA:

The location of Calvary Knoxville is shown on a map in Figure 1. This Church is located in the southeastern corner of the intersection of Alcoa Highway (US 129/SR 115) and W. Governor John Sevier Highway (SR 168), with a campus size of 42.07 acres.

The Church property is in a quasi-rural/suburban area of South Knoxville, TN. To the south of the Church, along Topside Road, there are several established neighborhoods, standalone single-family homes, and wooded areas. To the north, minimal development is located on W. Governor John Sevier Highway near the existing Church entrance. One single-family detached house is located across from the existing Church's Driveway. Most of the property north of the Church is undeveloped, forested, and owned by a private land holding company.

The Church property has challenging topography, bisected by Dearmond Spring Branch and two natural gas pipelines and easements. The Church recently finished constructing an outdoor pavilion with a small parking lot. The parking areas adjacent to the existing sanctuary have been undergoing expansion and will be co-opted with the newest proposed parking plan. The Church's existing two-lane internal driveway from W. Governor John Sevier Highway to the sanctuary is 2,082 feet long.

To the west, Alcoa Highway and its interchange with W. Governor John Sevier Highway is currently being reconstructed by TDOT. This reconstruction will elevate and separate Alcoa Highway from W. Governor John Sevier and eliminate at-grade vehicle conflicts. Skyranch Airport, a small private airport with an unpaved runway, and the Tennessee River are to the west of this highway interchange.



**View of Calvary Knoxville near Alcoa Highway and
W. Governor John Sevier Highway Interchange
Undergoing Reconstruction
(Looking Northwest)**

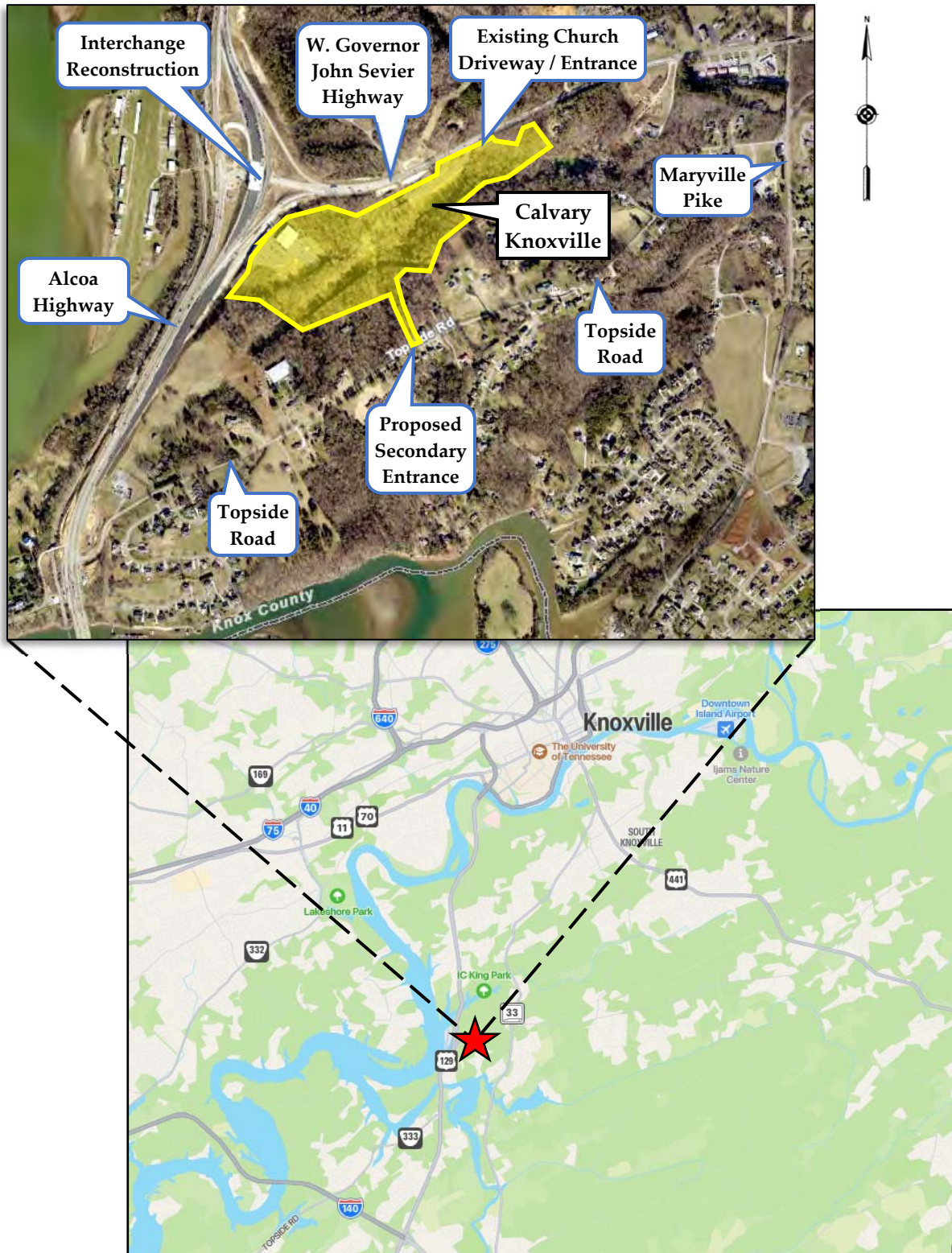


Figure 1
Location Map

▪ **EXISTING ROADWAYS:**

Table 1 lists the characteristics of the existing primary roadways adjacent to the Church property and included in the report:

TABLE 1
STUDY CORRIDOR CHARACTERISTICS

NAME	CLASSIFICATION ¹	SPEED LIMIT	LANES	ROAD WIDTH ²	TRANSIT ³	PEDESTRIAN FACILITIES	BICYCLE FACILITIES
W. Governor John Sevier Highway (SR 168)	Major Arterial	50 mph	3 lanes with TWLTL	45 feet	None	None	No bike lanes
Topside Road	Minor Collector	30 mph	2 lanes	18.5 feet	None	None	No bike lanes

¹ 2018 Major Road Plan by Knoxville/Knox County Planning

² Edge of curb to edge of curb or edge of pavements near project site

³ According to Knoxville Area Transit System Map

TWLTL = Two-way left-turn lane

W. Governor John Sevier Highway is a 3-lane major arterial with a center two-way left-turn lane (TWLTL) and traverses in a generally northeast-southwest direction. The posted speed limit on W. Governor John Sevier Highway is 50 mph at the Church Driveway. On its southwest end, W. Governor John Sevier Highway (SR 168) begins at the interchange with Alcoa Highway (US 129/SR 115). On its northeast side, East Governor John Sevier Highway (SR 168) terminates at the intersection with Asheville Highway (US 11E/US 25/US 70/SR 9) for a total length of 18.1 miles. The delineation of the East/West designation for Governor John Sevier Highway occurs at the intersection with Chapman Highway (US 441/SR 71).

W. Governor John Sevier Highway at the existing Church Driveway currently consists of asphalt pavement approximately 45 feet in total width. The provided lanes are 12 feet wide with a 4.5-foot paved surface outside the white edge lines. Grass side slopes are located immediately outside of the paved shoulders. Utility streetlights for roadway illumination are not provided on W. Governor John Sevier Highway at the Church Driveway. Bike lanes and sidewalks are also not provided on the highway. Long-term future highway expansion includes TDOT plans to widen the road from three lanes to a four-lane divided road section with a horizon year of 2040.

At the existing Church Driveway, W. Governor John Sevier Highway has an exclusive, separate eastbound right-turn lane with 100 feet of vehicle storage (deceleration) and a taper of 150 feet. Eastbound left turns into the Church are provided storage by the center TWLTL on W. Governor

John Sevier Highway. The Church driveway has two exiting lanes at the highway – one lane for left turns towards the west and the other for right turns towards the east. Each of these two exiting lanes has approximately 200 feet of vehicle storage. These exiting lanes at the highway are located along a sharp horizontal curve on the internal Church Driveway.

Topside Road is a 2-lane road with two distinct, nearby sections in Knox and Blount Counties. The section of Topside Road where the Church plans to connect is in Knox County and is bisected by Alcoa Highway on its western end. The TDOT reconstruction project has elevated Topside Road above and across Alcoa Highway while creating and allowing new access points for vehicles traveling to and from Topside Road. Topside Road has a total length of 2.9 miles and traverses in a southwest-northeast direction.

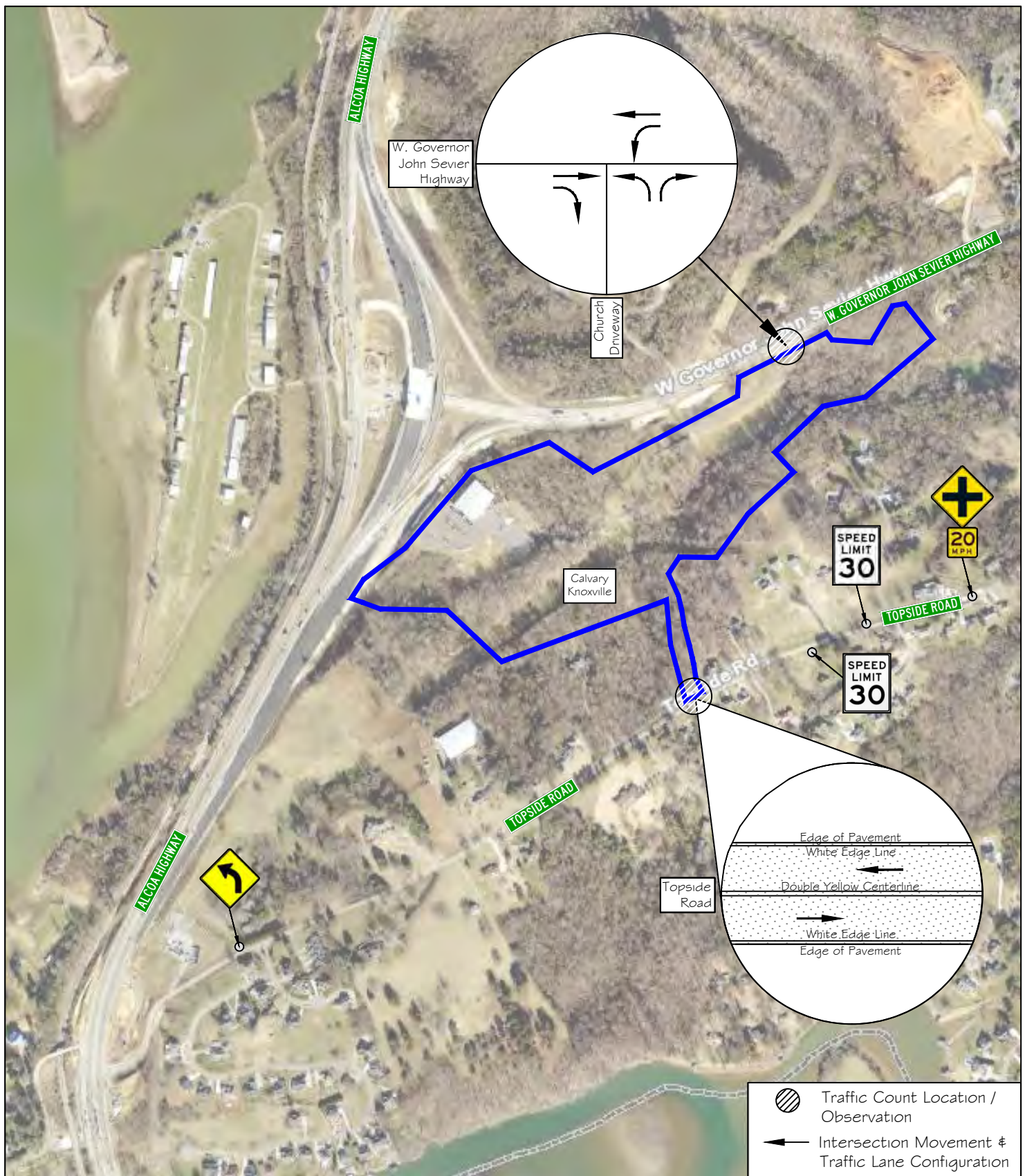


**Topside Road near the
Proposed Secondary Entrance**

The road begins on the southwest end near the Tennessee River, crosses over Alcoa Highway, and ends at a t-intersection with Maryville Pike (SR 33).

The pavement of Topside Road is 18.5 feet wide, where the Church's Secondary Entrance will be constructed. Topside Road is delineated with faded white edge lines, a double yellow centerline, and is posted with a 30-mph speed limit. The pavement surface outside the white edge lines is minimal, with a few inches of asphalt at most. Topside Road has no sidewalks, and the adjacent area has no utility lighting for roadway illumination. Topside Road is dotted with private individual residential driveways and a few public streets to established neighborhoods, including Topside Place, Topside Estates, and Lakeside Park. The proposed Secondary Entrance for the Church will be located on Topside Road, just west of an existing single-family detached house at 3429 Topside Road, utilizing a narrow sliver of land owned by the Church.

Figure 2 shows the existing lane configurations of the adjacent studied roadways, the traffic count locations conducted for the report, and the current traffic road signage in the study area. The road signage shown in Figure 2 only includes warning and regulatory signage near the Church on the studied roadway corridors. Several construction signs are currently posted for the Alcoa Highway reconstruction but were not included in the figure. The pages following Figure 2 give a further overview of the site study area with photographs.



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NOT TO SCALE

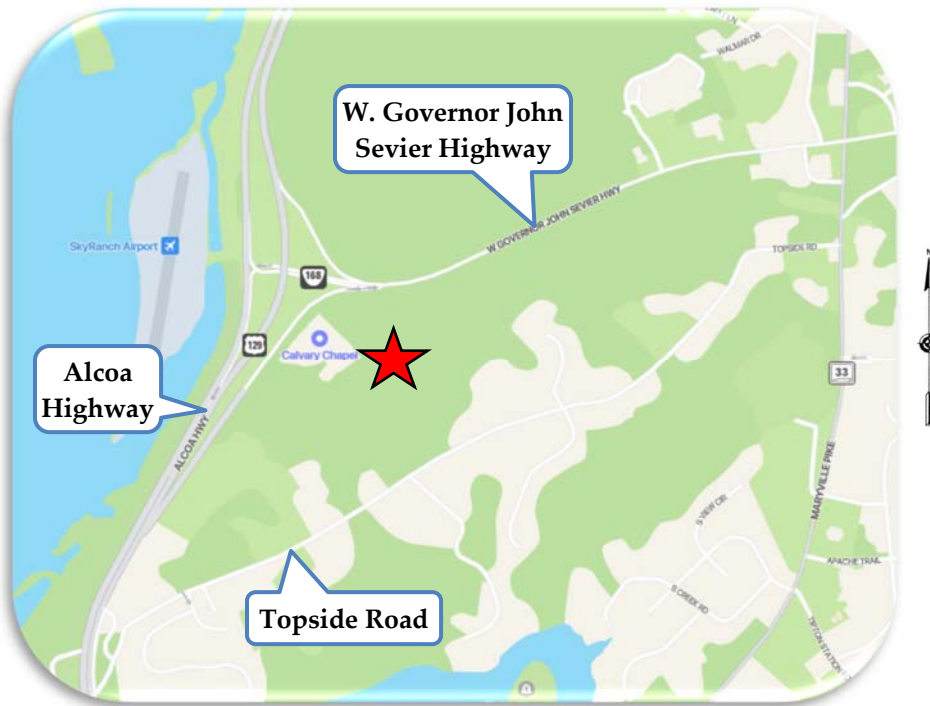


FIGURE 2

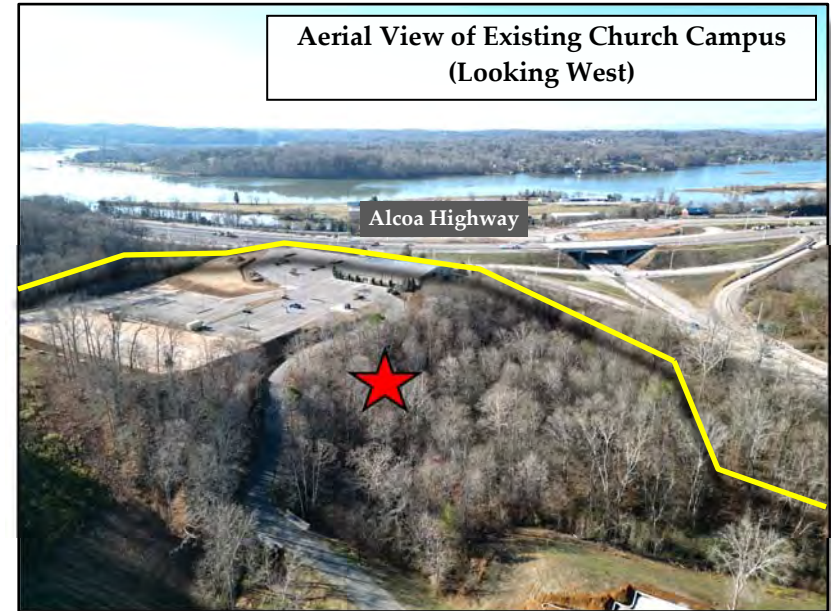
Calvary Knoxville

Traffic Count Locations, Traffic Signage & Existing Lane Configurations

PHOTO EXHIBITS



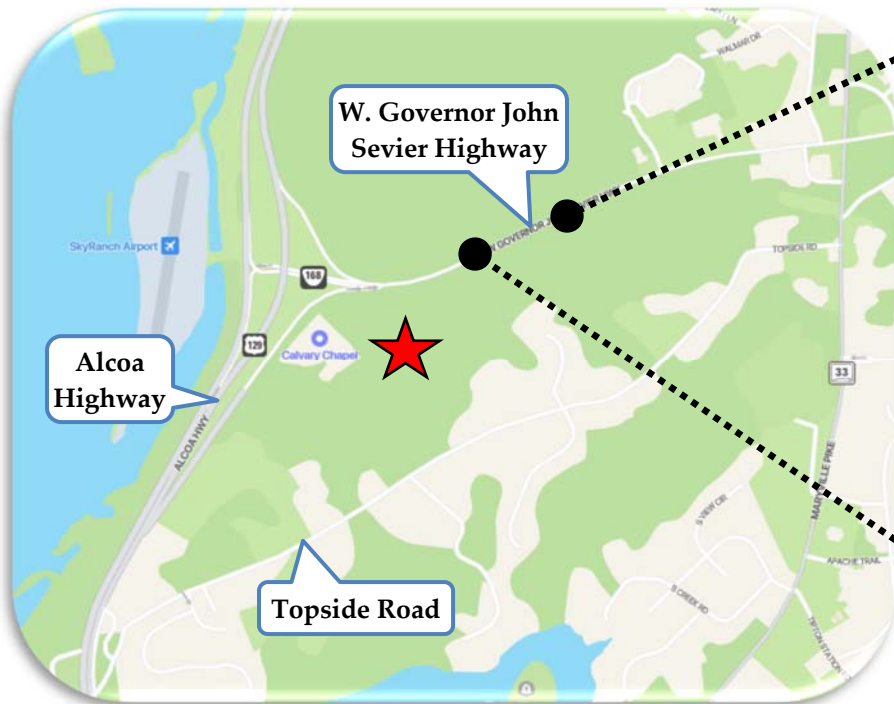
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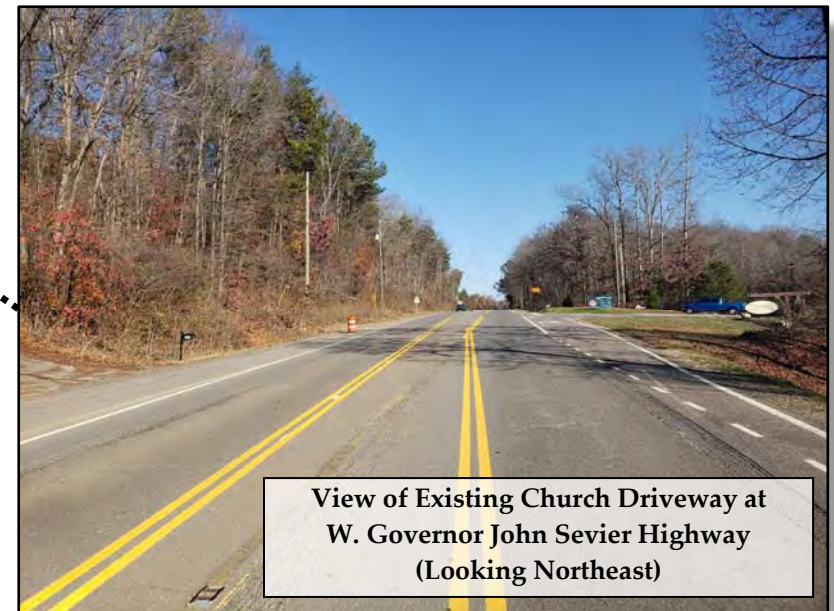
Aerial View of Existing Church Campus
(Looking West)

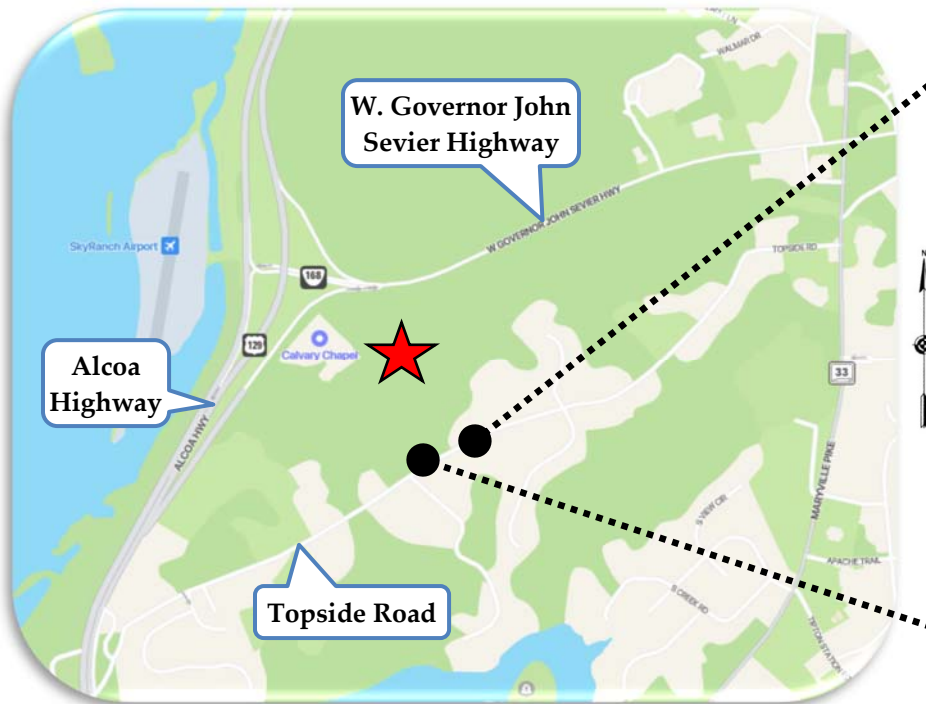


Aerial View of Existing Church Campus
(Looking Northeast)



Calvary Knoxville – Existing Church Driveway at
W. Governor John Sevier Highway





**Calvary Knoxville – Proposed Secondary Entrance
Location at Topside Road**



**View of Proposed Secondary Entrance
Location at Topside Road
(Looking Southwest)**



**View of Proposed Secondary Entrance
Location at Topside Road
(Looking Northeast)**

▪ **EXISTING TRANSPORTATION VOLUMES PER MODE:**

Two annual vehicular traffic count locations exist in the study area. TDOT conducts one, and the other is conducted sporadically by the Knoxville Transportation Planning Organization (TPO). The count location data is the following and can be viewed with further details in Appendix A:

- Existing vehicular roadway traffic:
 - TDOT reported an Average Daily Traffic (ADT) on W. Governor John Sevier Highway, just west of the existing Church Driveway, at 19,873 vehicles per day in 2022. From 2013 to 2023, this count station has indicated a +0.8% average annual traffic growth rate.
 - Knox TPO reported an ADT on Topside Road, just west of the Church's proposed Secondary Entrance, at 940 vehicles per day in 2022. From 2012 to 2022, this count station has indicated a +3.3% average annual traffic growth rate.
- Existing bicycle and pedestrian volumes:

No sidewalks or bike lanes are provided on W. Governor John Sevier Highway or Topside Road. During the traffic counts conducted for this report, no pedestrians or bicyclists were observed on either roadway. The Church is not expected to have any future reduced vehicle trips due to bicycle or pedestrian activity.
- Public transportation:

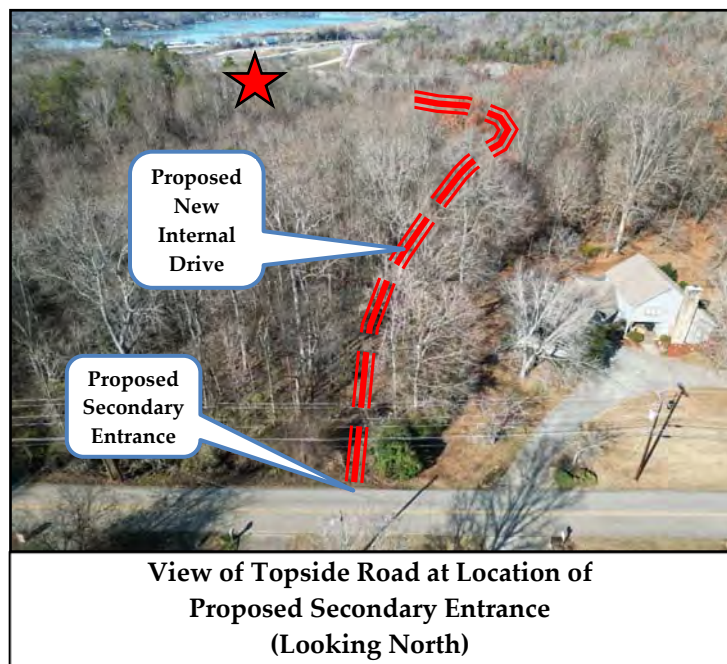
The closest public transportation is provided by the Knoxville Area Transit (KAT) and is 4.0 miles away at the corner of Maryville Pike at Joe Lewis Road. Since the distance to the nearest public bus service is so far away, the Church is not expected to have any reduced future vehicle trips due to public transit usage.

PROJECT DESCRIPTION

■ LOCATION AND SITE PLAN:

The plan layout for Calvary Knoxville is provided by Batson, Himes, Norvell, and Poe (BHN&P) and is shown in Figure 3. The existing sanctuary and parking lots are located on the western end of the campus. The existing internal drive is 2,082 feet long and crosses Dearmond Spring Branch with a box culvert. The Church recently finished constructing an outdoor pavilion with a small parking lot. The parking areas adjacent to the existing sanctuary have been undergoing expansion and will be combined with the newest proposed parking plan. The future location of the new sanctuary will be adjacent to the existing sanctuary building and will take up a portion of the existing parking lot.

The proposed internal drive towards the south to Topside Road will intersect roughly mid-way on the existing Church internal drive, cross Dearmond Spring Branch at a new box culvert, and be approximately 1,270 feet long. This new internal drive to Topside Road will be private and have a pavement width of 20 feet with stabilized shoulders. Due to the topography and the narrowness of the Church property adjacent to Topside Road, retaining walls will be constructed along the proposed internal drive. This new internal drive is proposed as an alternative access point to reduce the number of vehicles entering and exiting the existing Church Driveway at W. Governor John Sevier Highway. The City of Knoxville Fire Department also requires a new access entrance to permit a larger new sanctuary building.



Calvary Knoxville has many events throughout a typical week. Minor activities include men's and women's prayer meetings, weekday Bible studies, and Parents Day Out on Tuesdays and Thursdays. The main Church activities are services on Wednesday evening, Saturday evening, Sunday morning (two), and Sunday evening. These services occur at the following times with

the estimated number of attendees (including children) provided by the Church:

- Wednesday evening service: 7:00 – 8:30 pm with approximately 450 attendees
- Saturday evening service: 6:00 – 7:15 pm with approximately 400 attendees
- Sunday 1st morning service: 9:30 – 10:45 am with approximately 700 attendees
- Sunday 2nd morning service: 11:15 – 12:30 pm with approximately 750 attendees
- Sunday evening service: 6:00 – 7:15 pm with approximately 250 attendees

The existing Church sanctuary has a gross floor area (GFA) of 22,000 ft² and 658 seats. The proposed new sanctuary will be built adjacent to the existing sanctuary, and the existing sanctuary building will be converted into a kids' ministry area. The new building area will have three levels with a GFA of 133,033 ft² and 2,231 seats. The main level will include the new sanctuary, a large foyer, a bookstore, a café, and a coffee shop. The upper level will include offices and meeting rooms; the lower level will include a common space, work rooms, and meeting spaces. The newest parking plan proposes a two-level parking garage ("podium deck") and will provide 817 parking spaces.

The proposed internal drive to Topside Road and the extension of the exiting right-turn lane on the existing Church Driveway at W. Governor John Sevier Highway are both planned to be constructed by the end of 2024. The exiting right-turn lane on the existing Church Driveway at W. Governor John Sevier Highway will be lengthened to 345 feet from its current vehicle storage of 100 feet. The new sanctuary building is estimated to be fully constructed and occupied for worship services by 2027.

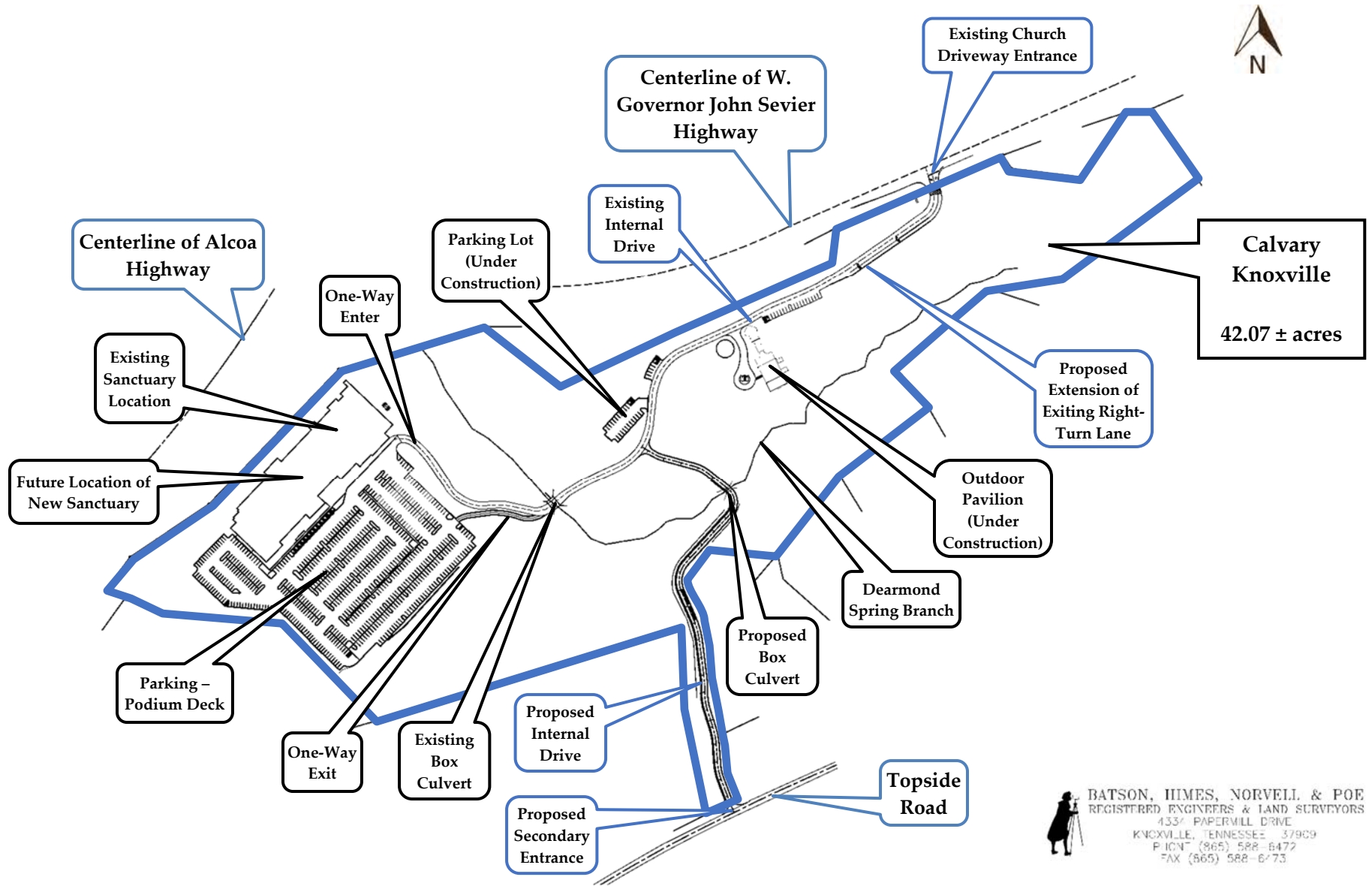


Figure 3
Plan Layout for
Calvary Knoxville

Not to Scale

ANALYSIS OF EXISTING AND PROJECTED CONDITIONS

▪ EXISTING TRAFFIC CONDITIONS:

Multi-hour traffic counts were conducted at the intersection of W. Governor John Sevier Highway at the existing Church Driveway entrance on Sunday, December 10th, 2023. A 2-way traffic count was also conducted on Topside Road, where the proposed Secondary Entrance will be constructed. Manual traffic counts were conducted to identify and tabulate the Sunday peak period volumes and the travel directions taken by the Church attendees. Specifically, traffic at the existing Church entrance was tabulated from 7:00 am to 2:00 pm and 5:00 to 9:00 pm. Two-way traffic volumes on Topside Road were collected from 8:00 am to 2:00 pm and 5:00 to 7:00 pm.

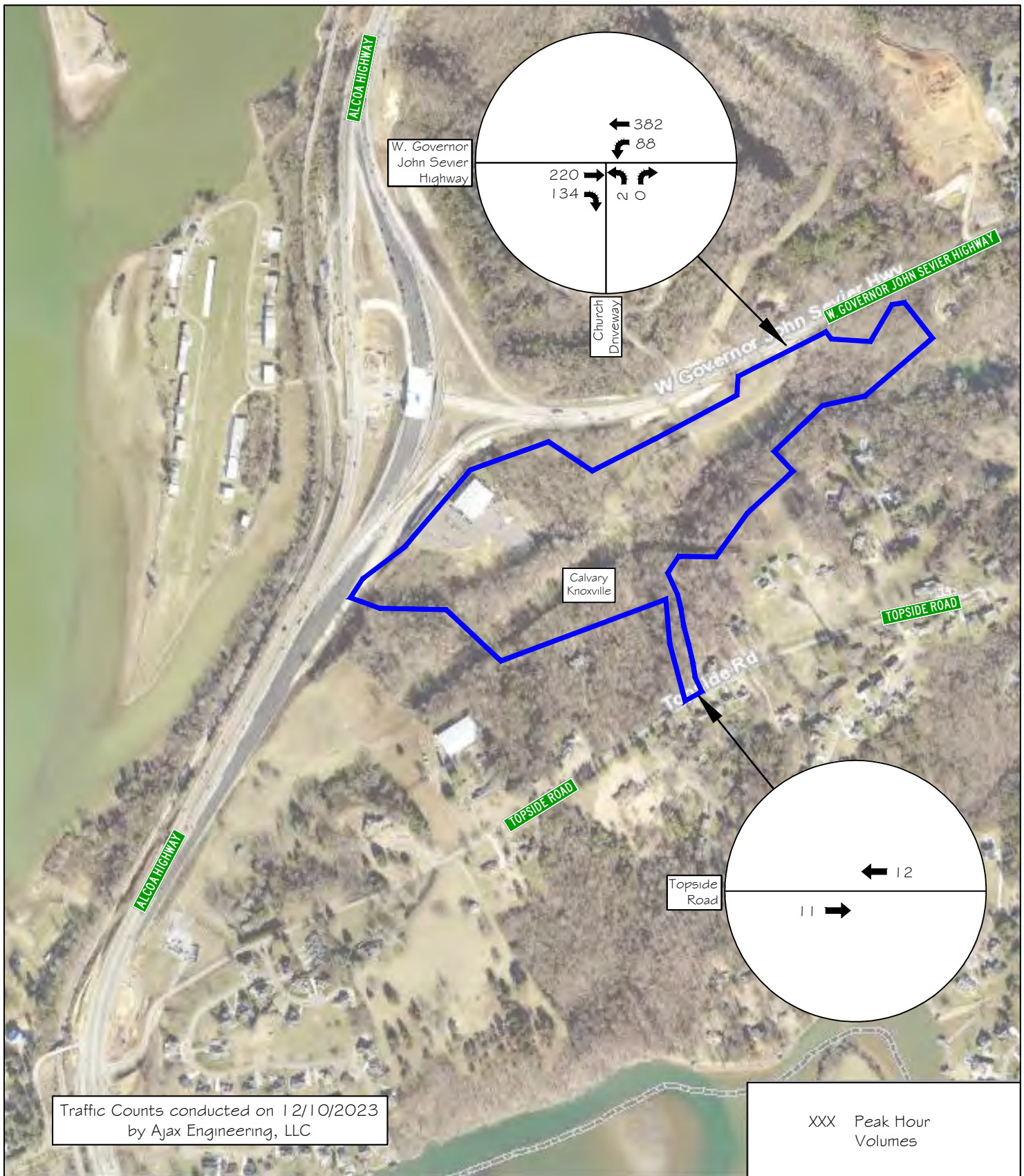
The manually tabulated traffic counts can be reviewed in Appendix B. Four distinct peak hour periods were observed during the Sunday traffic count at the existing Church Driveway. These peak periods were 8:45 – 9:45 am, 10:30 – 11:30 am, 12:15 - 1:15 pm, and 5:15 – 6:15 pm. These times correspond to the first Church service at 9:30 – 10:45 am, the second service at 11:15 am – 12:30 pm, and the evening service at 6:00 – 7:15 pm. The exiting traffic at the end of their evening service was not included in the analyses since the overall thru volumes on W. Governor John Sevier Highway on Sunday evening were tabulated to be much lower. The four Sunday peak periods observed at the intersection of W. Governor John Sevier Highway at the Church Driveway during the existing traffic count are shown in Figures 4a to 4d. The corresponding traffic volumes on Topside Road during these peak periods are also included in these figures. Traffic data was not collected on a Saturday since the Church's Saturday evening service is from 6:00 - 7:15 pm with reduced attendance and occurs during a traditional non-peak traffic period. While the Wednesday services appear well attended, their service time is far outside the traditional peak weekday afternoon/evening hours, so traffic counts and analysis were not conducted for this period either.

Some observations of the vehicular traffic at the intersection of W. Governor John Sevier Highway at the existing Church Driveway include the following:

- During the Sunday services, very little heavy truck traffic was observed on W. Governor John Sevier Highway.
- Many exiting northbound left-turn Church attendees at the intersection utilized the center TWLTL on W. Governor John Sevier Highway as a temporary refuge to enter the

westbound traffic stream when gaps in traffic were not simultaneously available in both directions.

- The exiting queues from the Church after the first and second services were fairly substantial but relatively short, around 20 to 25 minutes at most. The largest exiting queues occurred after the second service and extended to around 1,000 feet in length. Entering Church attendees from the east (WB left turns) experienced minimal vehicle queues in the TWLTL.



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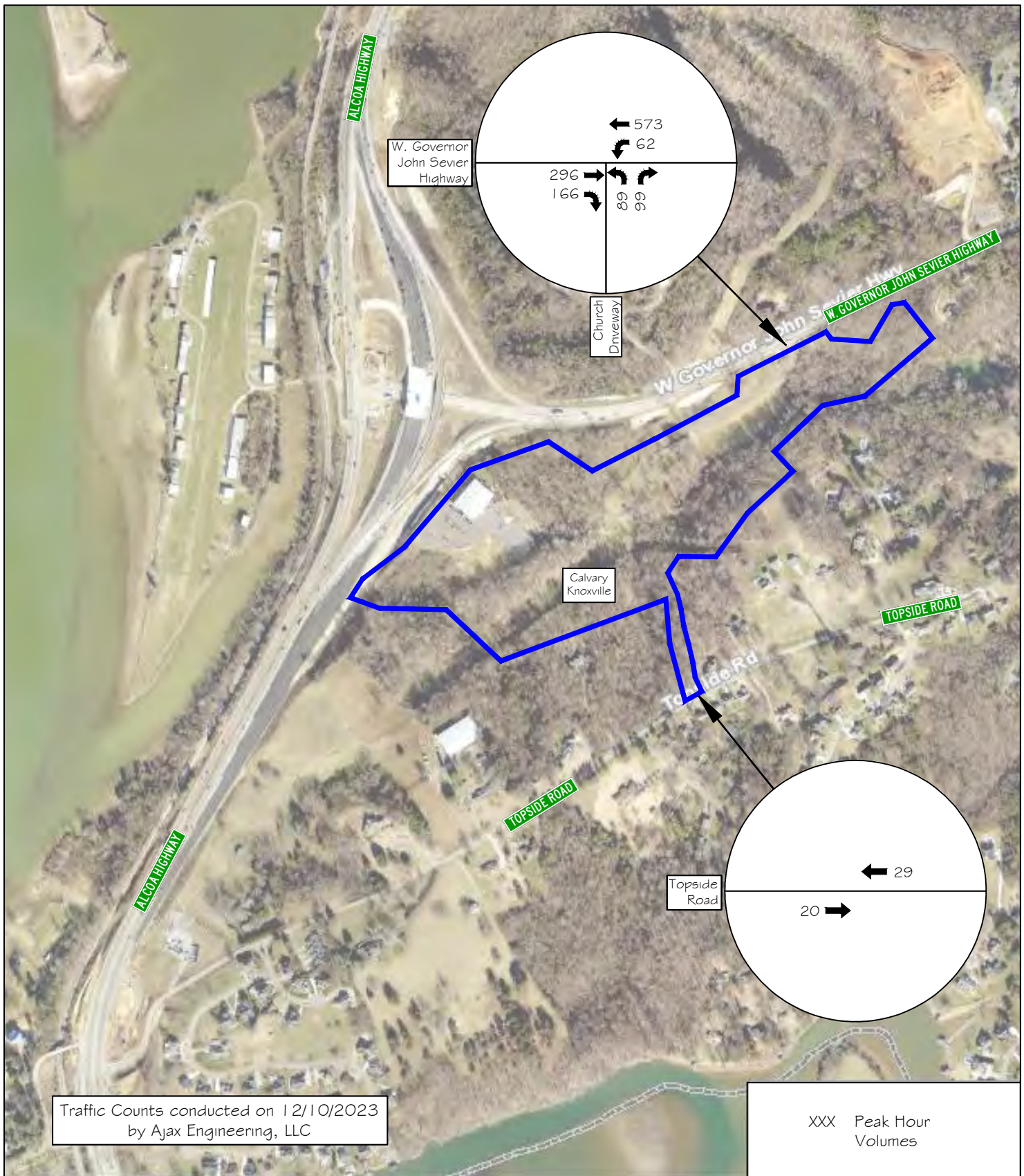
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FIGURE 4a

Calvary Knoxville

2023 Peak Hour Traffic Volumes -
EXISTING TRAFFIC CONDITIONS
8:45 - 9:45 AM



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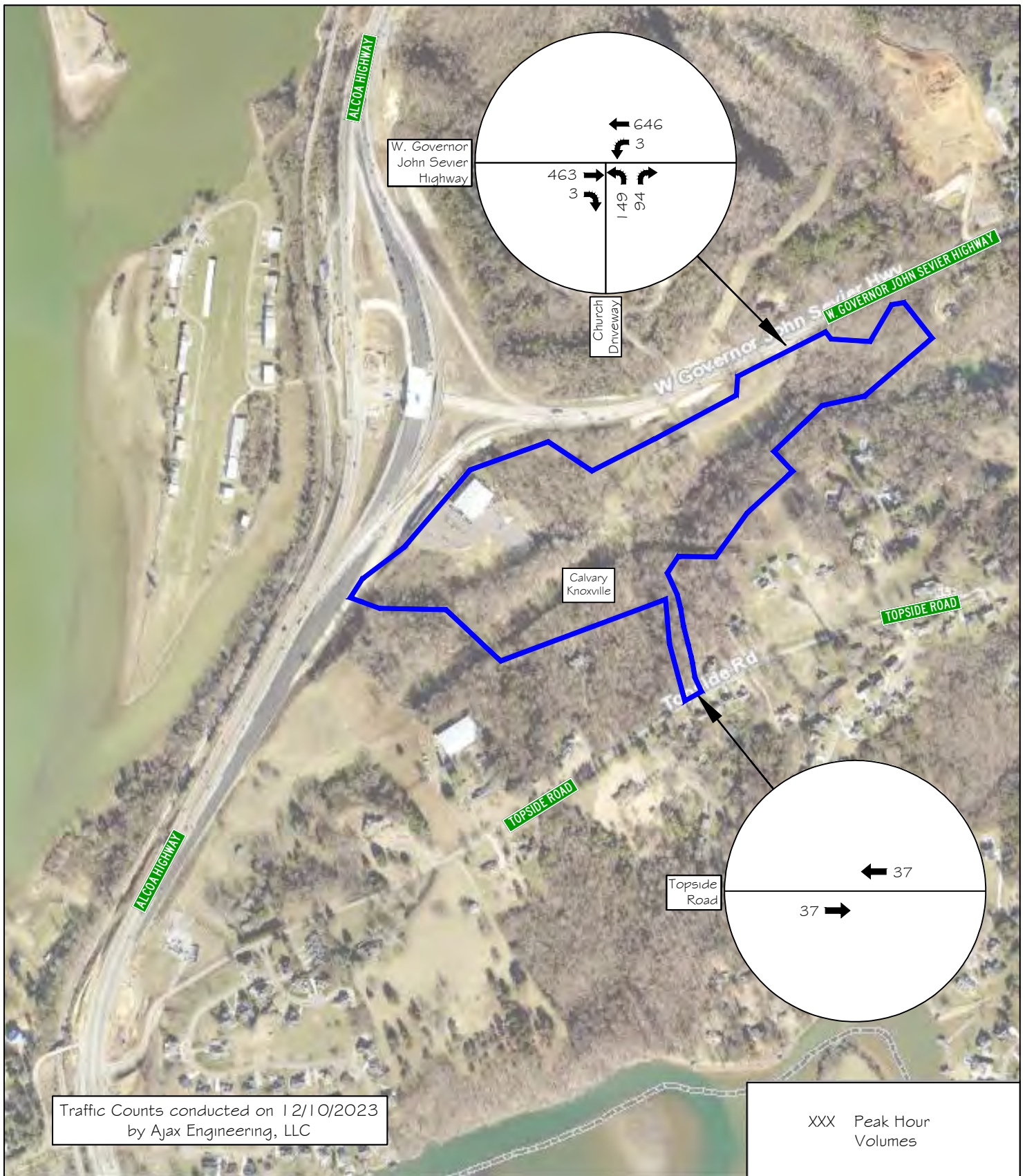
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FIGURE 4b

Calvary Knoxville

2023 Peak Hour Traffic Volumes -
EXISTING TRAFFIC CONDITIONS
10:30 - 11:30 AM



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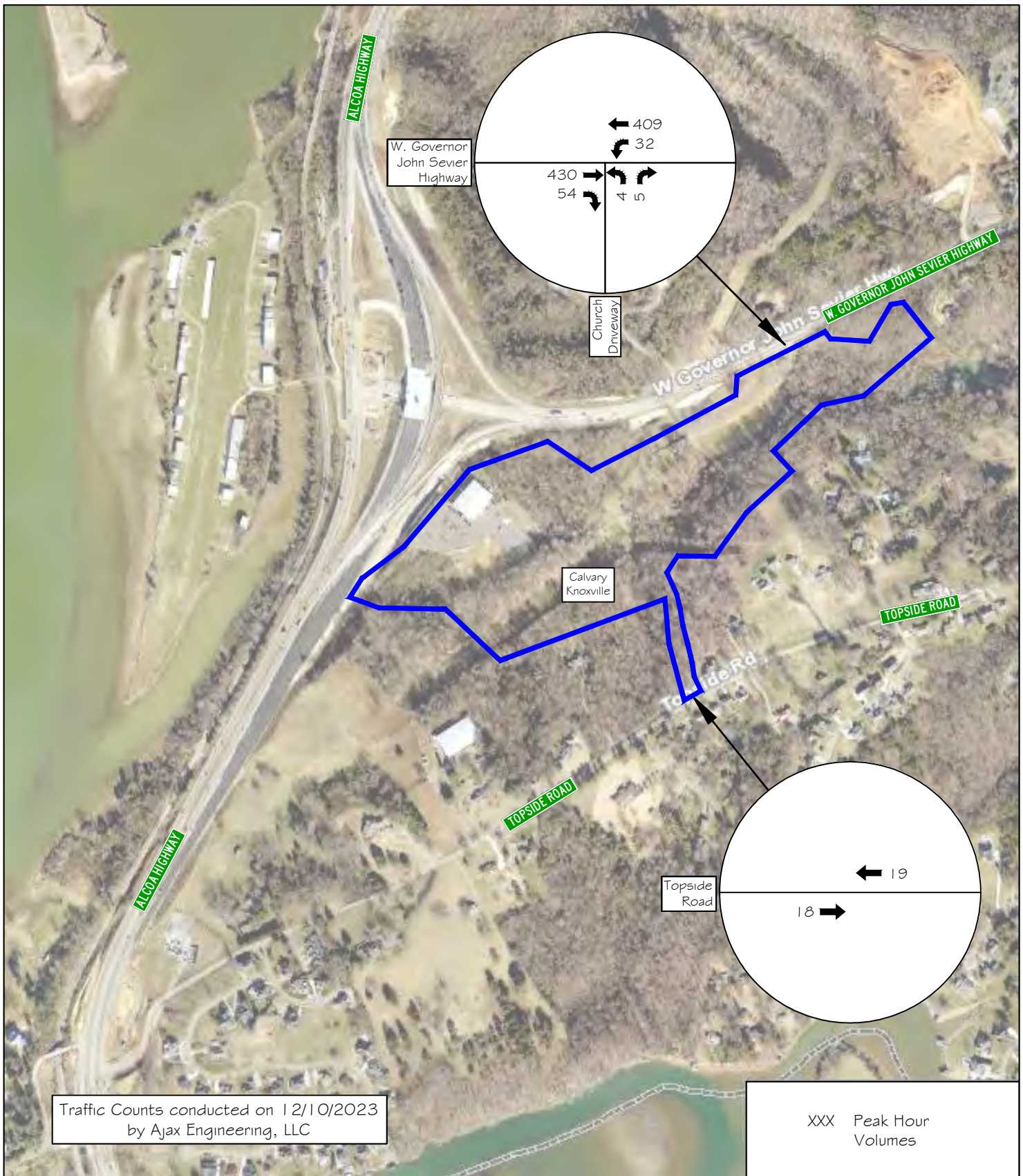
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FIGURE 4c

Calvary Knoxville

2023 Peak Hour Traffic Volumes -
EXISTING TRAFFIC CONDITIONS
12:15 - 1:15 PM



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FIGURE 4d

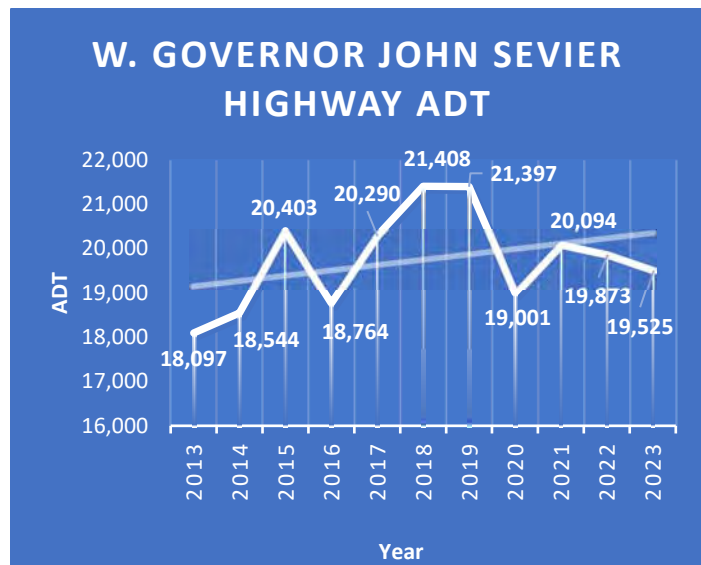
Calvary Knoxville

2023 Peak Hour Traffic Volumes -
EXISTING TRAFFIC CONDITIONS
5:15 - 6:15 PM

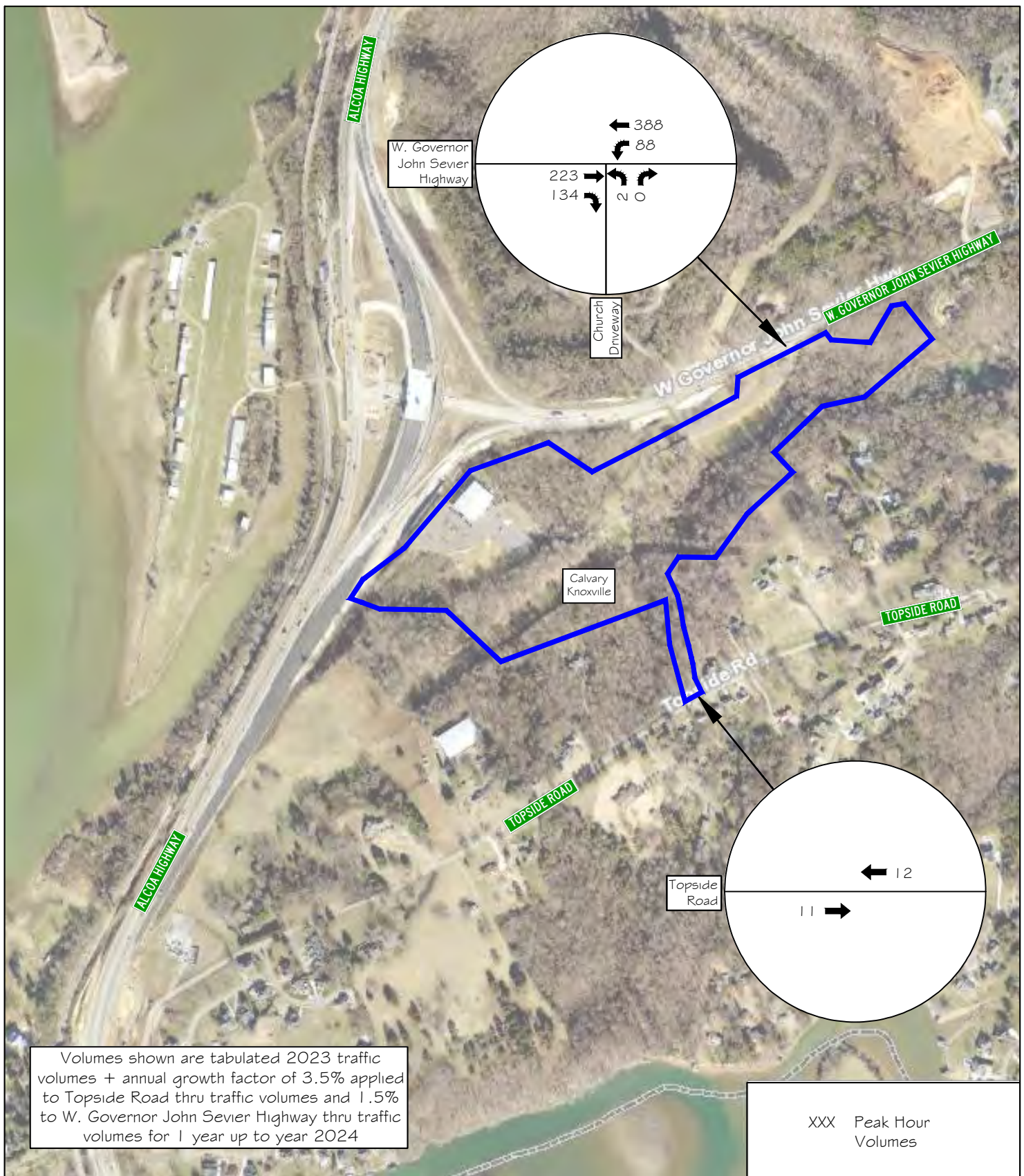
▪ **PROJECTED TRAFFIC CONDITIONS WITHOUT THE PROJECT:**

Horizon year traffic conditions represent the projected traffic volumes in the study area without the proposed project being developed (no-build option). The build-out of the Church construction projects is assumed to occur by 2024 and 2027. The new internal drive to Topside Road with a Secondary Entrance and the extension of the existing exiting right-turn lane at W. Governor John Sevier Highway is assumed to be completed by the end of 2024. The new sanctuary building is estimated to be fully built and available for worship services by 2027. Thus, this study includes the results of two horizon years, 2024 and 2027. The horizon year of 2024 is included since constructing a new internal drive with a Secondary Entrance to Topside Road will significantly alter the Church's entering and exiting traffic patterns before the Church expansion is completed.

According to the nearby TDOT count station, vehicular traffic on W. Governor John Sevier Highway has shown low growth over the past ten years. Data from the Knox TPO has shown moderate growth on Topside Road over the past ten years. Overall, the data shows that W. Governor John Sevier Highway has experienced an annual growth of +0.8%, and Topside Road has experienced an annual growth of 3.3%.



An annual growth rate was assumed and applied to the existing thru 2023 volumes tabulated on W. Governor John Sevier Highway and Topside Road to estimate the future volumes in the horizon years of 2024 and 2027. This report used a slightly higher annual growth rate of +1.5% to calculate future growth on W. Governor John Sevier Highway and +3.5% on Topside Road to account for greater future traffic growth in the study area, which results in a conservative analysis. Figures 5a to 5d show the projected 2024 horizon year traffic volumes on W. Governor John Sevier Highway and Topside Road during the four identified Sunday peak periods. Figures 6a to 6d show the projected 2027 horizon year traffic volumes on W. Governor John Sevier Highway and Topside Road during the four identified Sunday peak periods. In these figures, the Church's entering and exiting volumes are not increased (no-build option).



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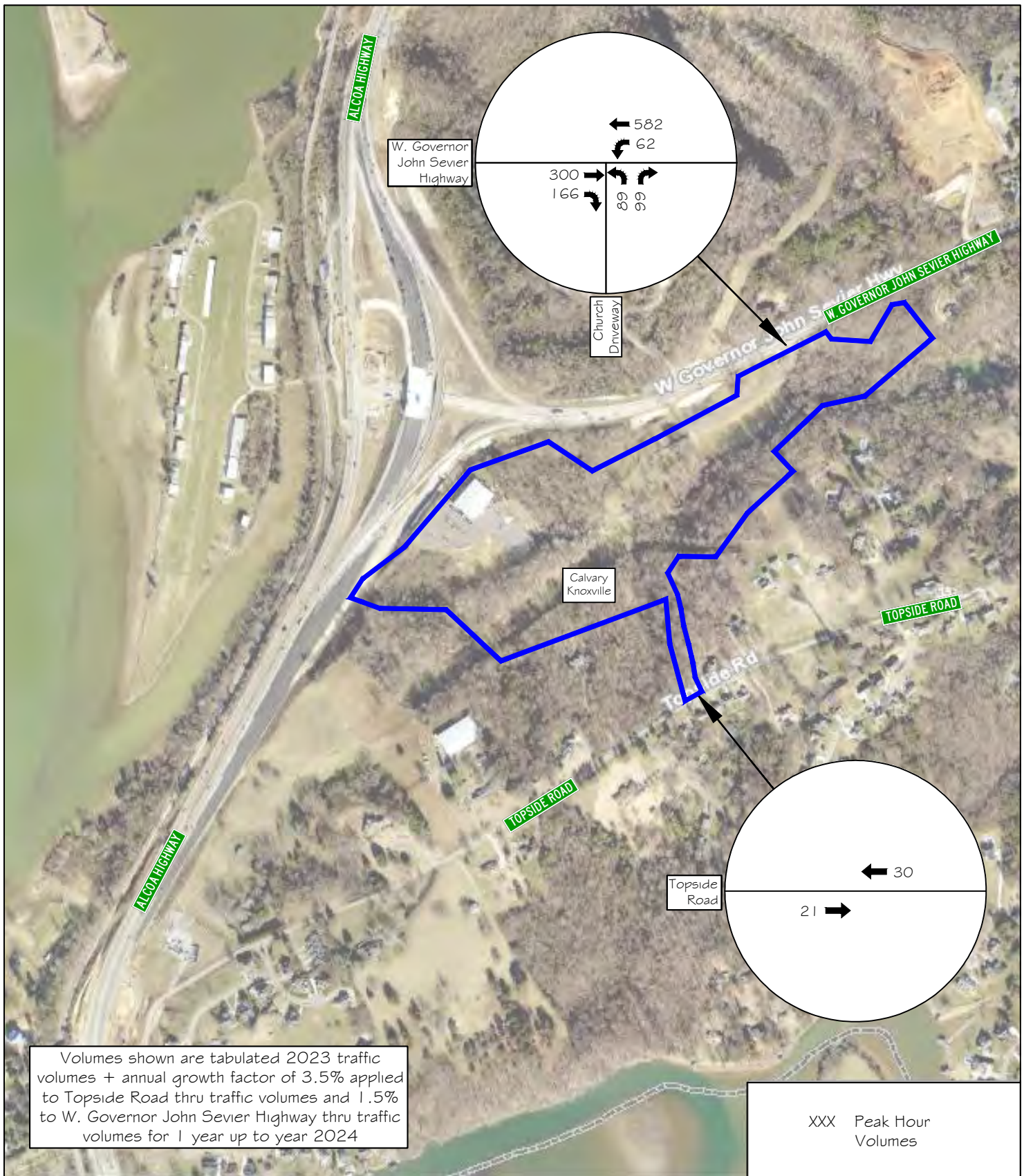
NOT TO SCALE



FIGURE 5a

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
8:45 - 9:45 AM



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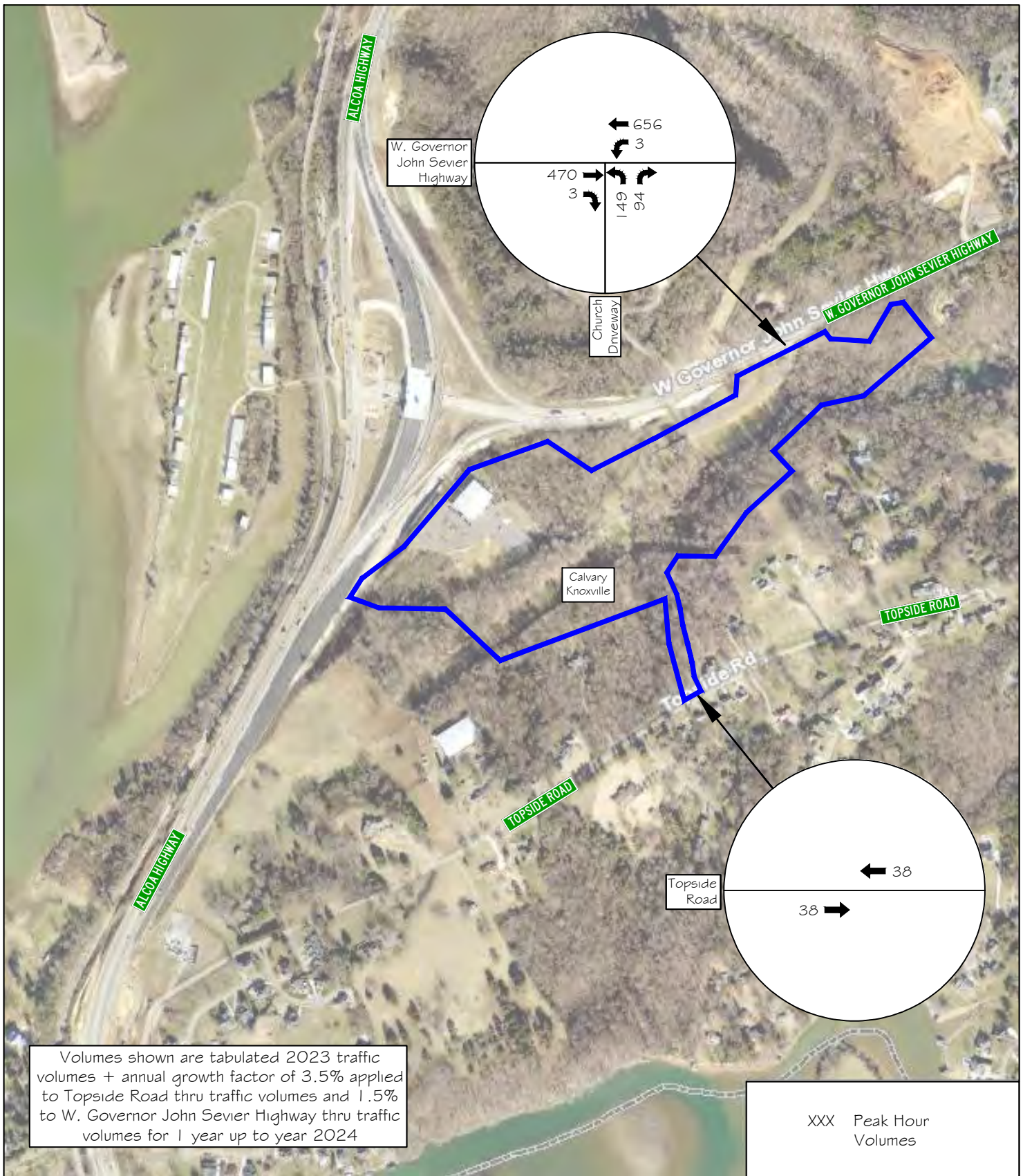
NOT TO SCALE



FIGURE 5b

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
10:30 - 11:30 AM



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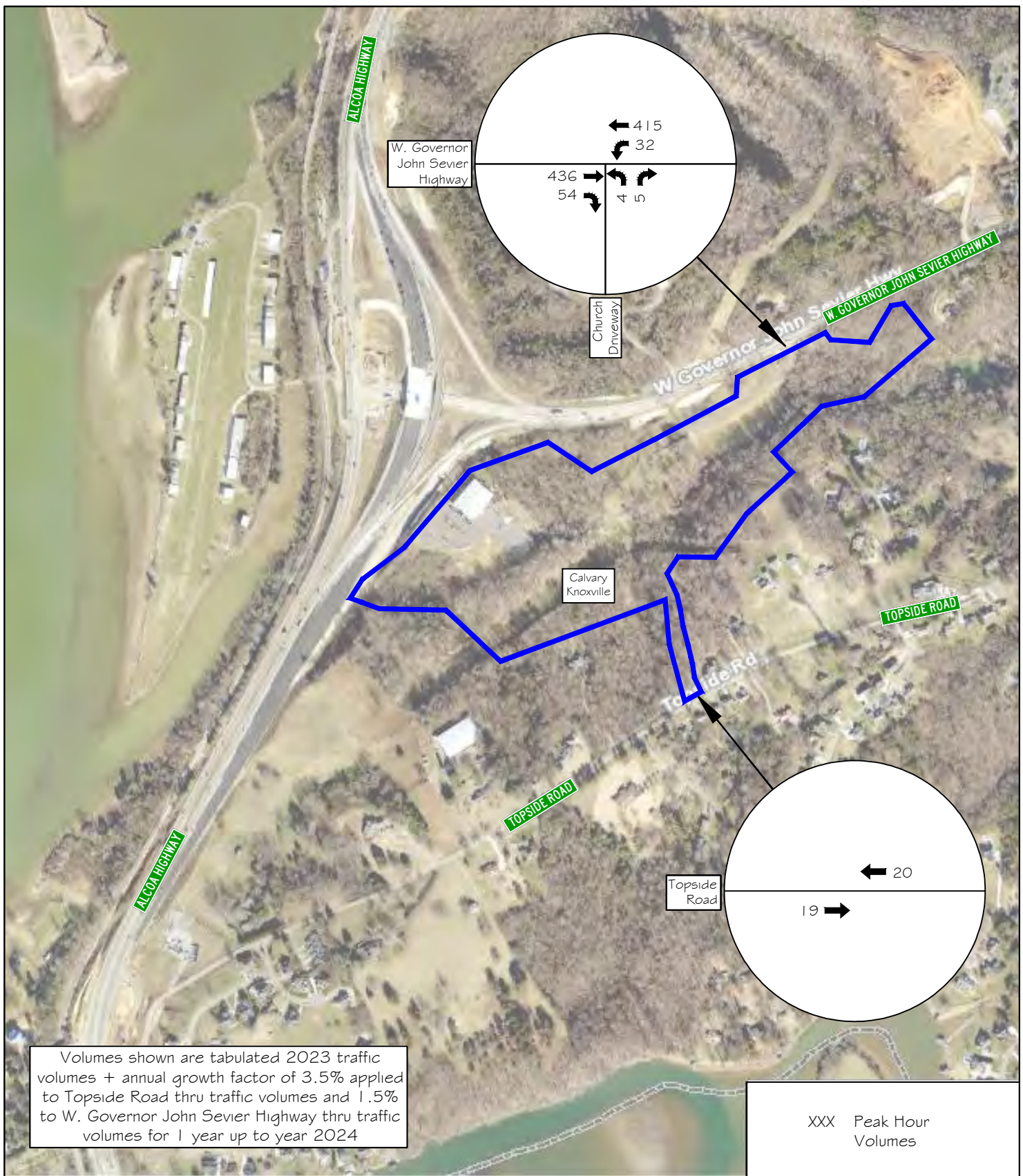
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FIGURE 5c

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
12:15 - 1:15 PM



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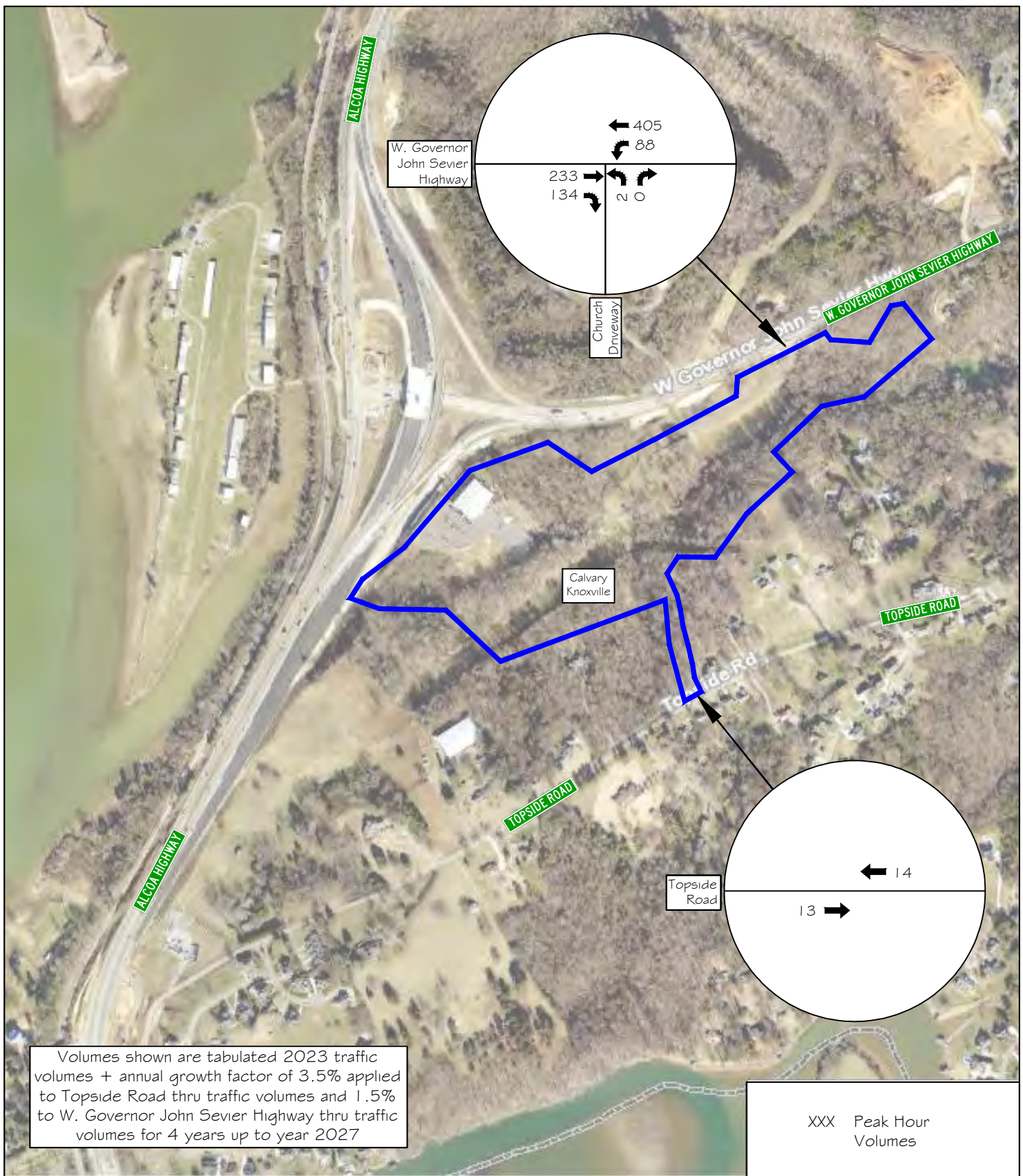
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FIGURE 5d

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
5:15 - 6:15 PM



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Phone: (865) 556-0042
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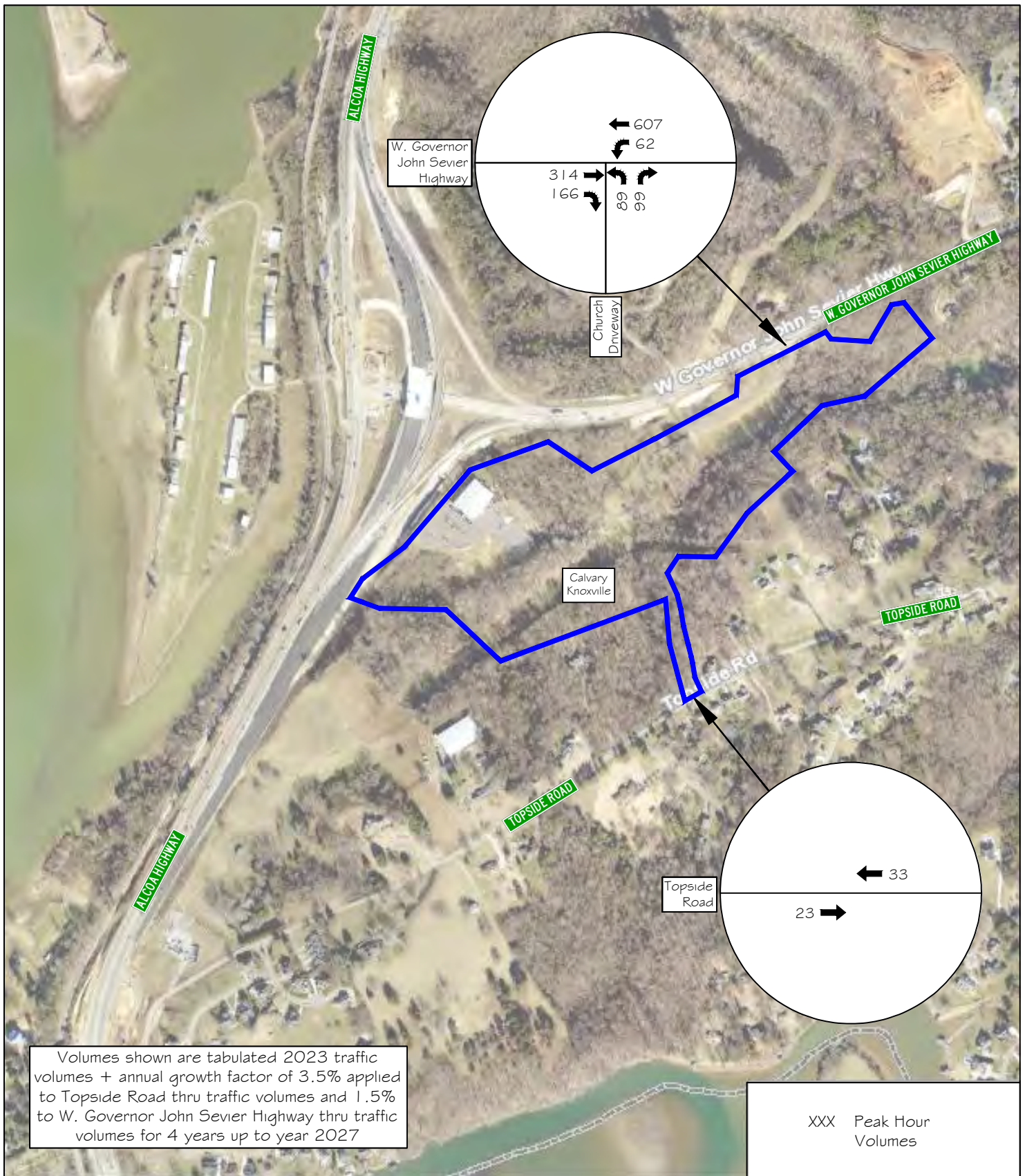
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FIGURE 6a

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
8:45 - 9:45 AM



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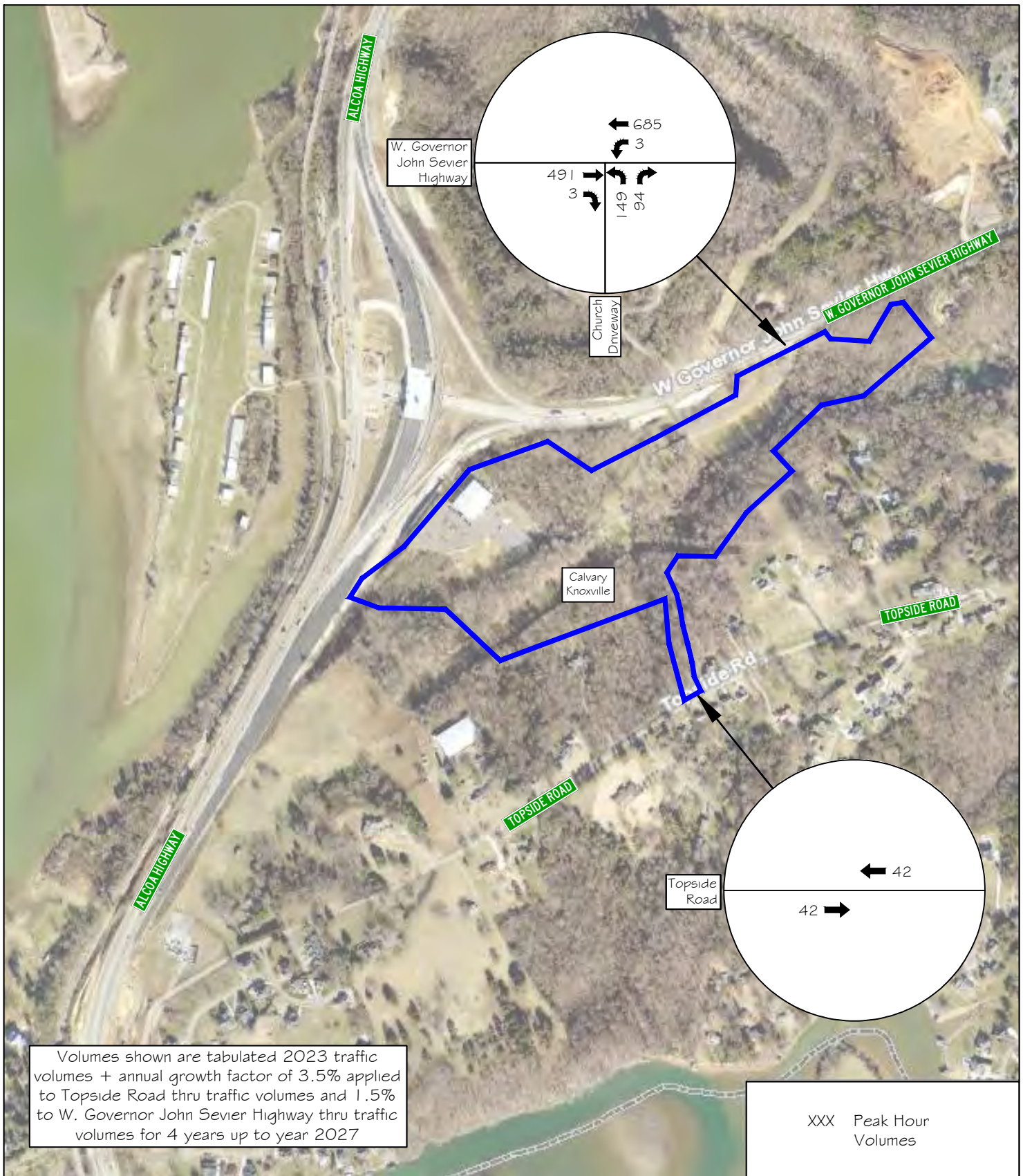
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FIGURE 6b

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
10:30 - 11:30 AM



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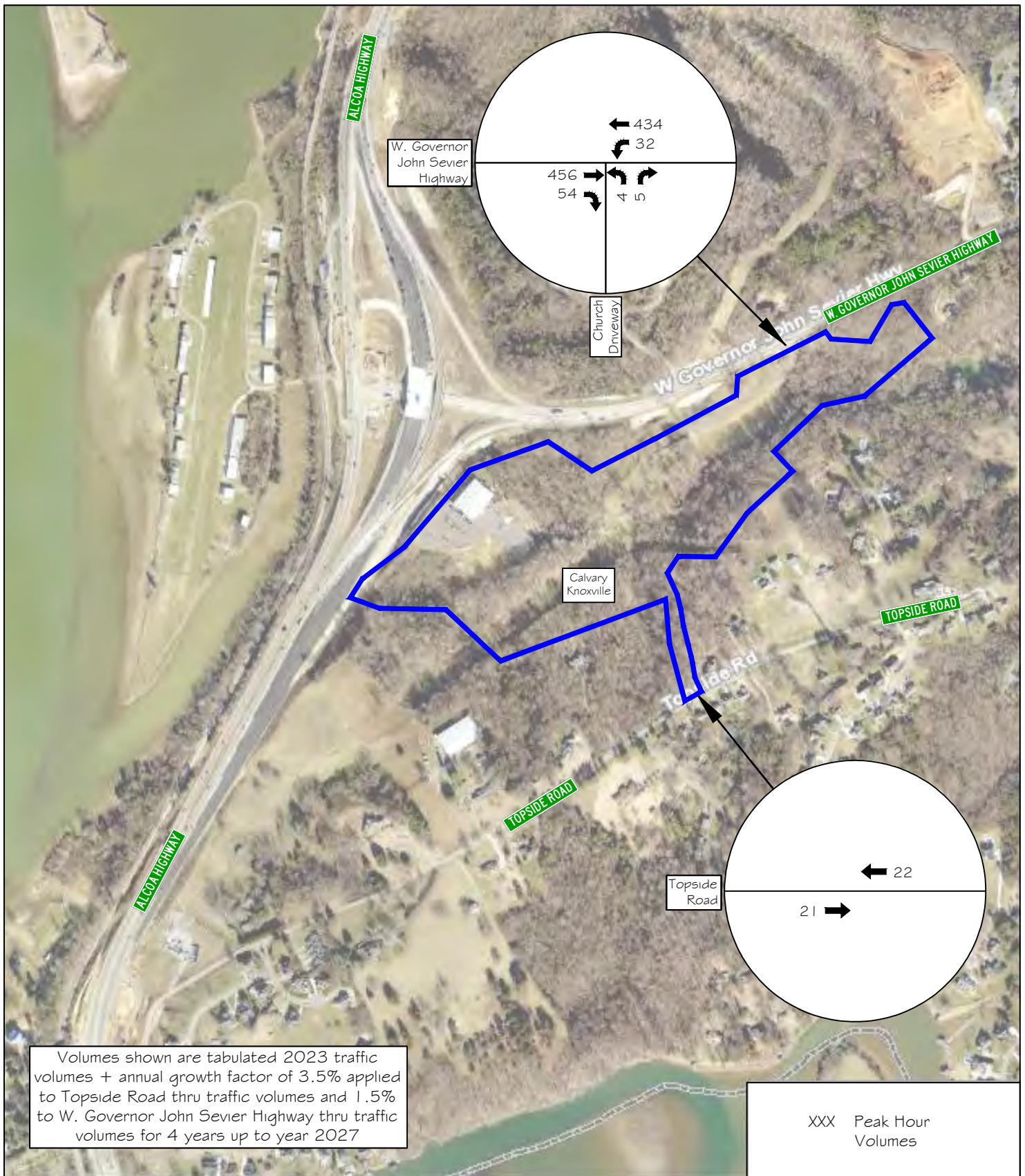
NOT TO SCALE



FIGURE 6c

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
12:15 - 1:15 PM



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FIGURE 6d

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
5:15 - 6:15 PM

▪ **TRIP GENERATION:**

A generated trip is a single or one-direction vehicle movement entering or exiting a site. The estimated amount of traffic the proposed Church expansion will generate was partially evaluated using the Trip Generation Manual, 11th Edition, an Institute of Transportation Engineers (ITE) publication. The Trip Generation Manual is the traditional and most popular resource for determining trip generation rates when transportation impact studies are produced. The trip generation data and calculations from ITE for Land Use #560, Church, are shown in Appendix C. For a Church, ITE provides trip generation data based on gross floor area (GFA) in square feet and number of seats.



Table 2a shows the actual observed trips generated by Calvary Knoxville that were tabulated on Sunday, December 10, 2023, with an existing capacity of 658 seats and a GFA of 22,000 ft². As noted in the table, the "Generated Sunday Traffic" was tabulated for only 11 hours instead of 24 hours. This observed amount would have been slightly higher if the count had been conducted for the entire day. The Sunday "Peak Hour of Generator" on December 10, 2023, for Calvary Knoxville with 416 vehicles was identified as 10:30 – 11:30 am, with 55% entering and 45% exiting vehicles.

TABLE 2a
TRIP GENERATION FOR CALVARY KNOXVILLE (OBSERVED - 12/10/23)
Existing Conditions: 22,000 GFA and 658 seats

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED SUNDAY TRAFFIC	GENERATED SUNDAY PEAK HOUR OF GENERATOR (10:30 - 11:30 AM)		
				ENTER	EXIT	TOTAL
#560	Church	22,000 GFA / 658 Seats	1,190 *	55%	45%	
				228	188	416

* Trips observed from 7 am - 2 pm and 5 pm - 9 pm (11 hours)

Table 2b presents the number of trips for Calvary Knoxville with 22,000 GFA and 658 seats that would theoretically be generated based on ITE's trip generation data. Overall, the ITE calculated trips based on GFA were much lower than the 24-hour Sunday trips and the Peak Hour of Generator trips observed on December 10, 2023. However, the ITE results for trips based on seats were slightly higher than observed for the 24-hour Sunday period. Again, if the existing count had been conducted for 24 hours, it would likely have been closer to similar values. The ITE

calculated trips based on seats were also lower than the actual observed entering and exiting trips at Calvary Knoxville during the Peak Hour of Generator on December 10, 2023.

TABLE 2b
TRIP GENERATION FOR CALVARY KNOXVILLE (EXISTING - ITE RATES)
Existing Conditions: 22,000 GFA and 658 seats

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED SUNDAY TRAFFIC	GENERATED SUNDAY PEAK HOUR OF GENERATOR		
				ENTER	EXIT	TOTAL
#560	Church	22,000 GFA	692 ^a	48%	52%	
				128	138	266
#560	Church	658 Seats	1,454 ^a	49%	51%	
				165	171	336

ITE Trip Generation Manual, 11th Edition

Trips calculated by using Fitted Curve Equation unless noted by ^a which denotes Average Rate calculation

Table 2c shows the estimated ITE trips that Calvary Knoxville would generate with the proposed sanctuary with a GFA of 133,033 ft² and 2,231 seats. Table 2c also includes an alternate method of calculating the projected trips by the Church expansion. This method involved multiplying the observed 2023 entering and exiting trips by a factor of 3.39, which is the ratio of the proposed Church expansion from 658 seats to 2,231 seats.

TABLE 2c
TRIP GENERATION FOR CALVARY KNOXVILLE (PROPOSED - ITE RATES & FACTOR)
Proposed Conditions: 133,030 GFA and 2,231 seats

ITE LAND USE CODE	LAND USE DESCRIPTION	UNITS	GENERATED SUNDAY TRAFFIC	GENERATED SUNDAY PEAK HOUR OF GENERATOR		
				ENTER	EXIT	TOTAL
#560	Church	133,033 GFA	4,185 ^a	48%	52%	
				662	716	1,378 ^a
#560	Church	2,231 Seats	4,931 ^a	49%	51%	
				569	592	1,161
Factor = 3.39	Church	133,030 GFA / 2,231 Seats	4,034 [*]	55%	45%	
				773	638	1,411

* Trips from 7 am - 2 pm and 5 pm - 9 pm (11 hours)

Trips calculated by using Fitted Curve Equation unless noted by ^a which denotes Average Rate calculation

Factor = 2,231 proposed seats / 658 existing seats = 3.39

Due to the small ITE sample sizes in the Manual for Land Use #560, Church, and the larger Sunday Peak Hour of Generator generated trips calculated by using the alternative growth factor, the method employing a factor was chosen as appropriate to simulate a worst-case scenario and a conservative analysis of the projected conditions.

Also, since the existing count at Calvary Knoxville was only 11 hours instead of 24 hours, ITE's trip generation rates based on seats were chosen as the appropriate estimate for projected 24-hour Sunday trips in 2027. Thus, the final results of the estimated trip generation used in this analysis for the projected conditions in 2027 at full build-out and occupancy of the Church are based on the following:

Sunday (24-hour) = 4,931 trips (using ITE rate based on seats)

Sunday Peak Hour of Generator = 1,411 trips (using an alternative factor of 3.39)

55% Entering = 773 trips

45% Exiting = 638 trips

NOTE: The original study based the trip generation factor on the correlation of the existing GFA and the proposed GFA. In this updated report, the trip generation factor was based on the correlation of the existing seats and the proposed seats. This change in approach was due to the unrealistic and overestimation of trips if the factor was based on the change in GFA.

▪ **TRIP DISTRIBUTION AND ASSIGNMENT:**

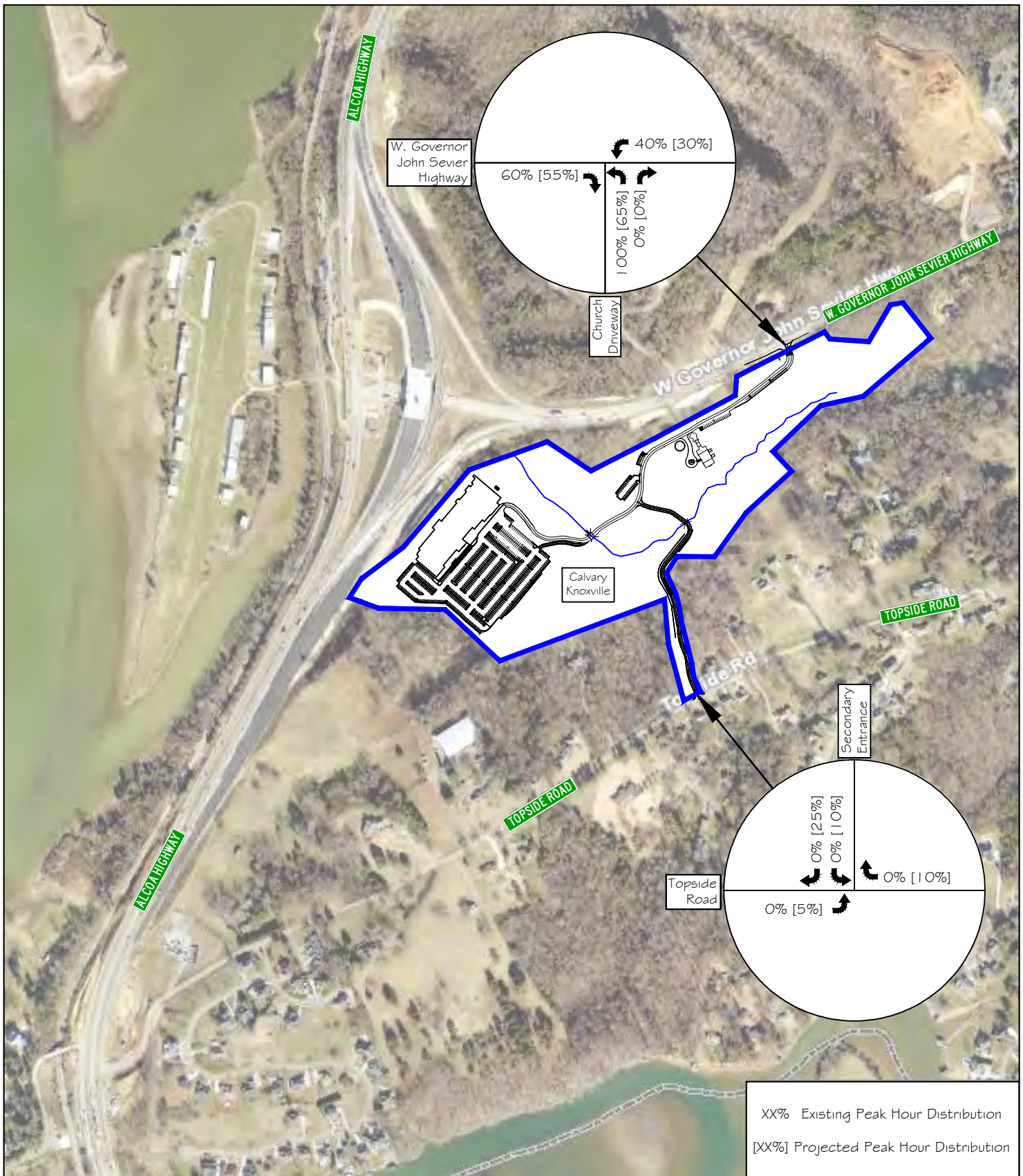
Figures 7a to 7d show the projected distribution of entering and exiting trips at the Church in 2024 and 2027 based on the existing observed traffic counts and engineering judgment. During the traffic count, distinct directional splits were observed during the four identified Sunday peak periods at the existing Church Driveway. The splits shown in Figures 7a to 7d at the existing Church Driveway are for each identified hour and paired with projected splits labeled in brackets. The figures also include the projected distribution of entering and exiting traffic at the proposed Secondary Entrance on Topside Road, which will be operational in 2024. The splits shown in Figures 7a to 7d include the existing observed and the projected in brackets.

To estimate the projected splits shown in the figures, the Church was contacted to see if they had information on their members' and attendees' addresses in a digestible form to allow insight into the possible origin and destinations. Unfortunately, this was not readily available. The Church's Facilities Manager, Brad Bassitt, estimated that 35 – 40% of attendees in the future would use the Secondary Entrance. From an engineering perspective, 35% seemed to be a reasonable approximation, considering that Topside Road via the Secondary Entrance would allow convenient access to Alcoa Highway to the west and Maryville Pike to the east.

Assuming that the Church attracts attendees equally from all surrounding areas by utilizing Alcoa Highway, W. Governor John Sevier Highway, and Maryville Pike, it would be reasonable to assume that traffic entering the Church at the existing Church Driveway would be less impacted overall than exiting traffic by the inclusion of a new Secondary Entrance. This reduced impact will be due to the low barrier of travel entering the Church versus the high barrier for exiting, especially for northbound left-turn movements attempting to travel west onto W. Governor John Sevier Highway. Thus, it was estimated that only 5% of eastbound entering right-turn movements at the existing Church Driveway would be re-routed to the new Secondary Entrance. A slightly higher percentage of 10% was assumed would be re-routed for the westbound entering left-turn movement at the existing Church Driveway since it is slightly more challenging to enter the Church from this direction due to conflicting eastbound traffic on the highway. Much higher percentages were assumed to utilize the Secondary Entrance for exiting movements. For the Secondary Entrance, 25% of Church attendees were assumed to exit towards the west on Topside Road and 10% to the east. As shown in Figures 7a to 7d, these percentages were removed from the turning movements at the existing Church Driveway at W. Governor John Sevier Highway to account for these projected modified travel decisions. As shown in

Figures 7a to 7d, these percentages were assumed and used for all four identified Sunday peak periods.

Figures 8a to 8d and 9a to 9d show the traffic assignment of entering and exiting trips during all four identified Sunday peak periods and are based on the assumed distribution of trips shown in Figures 7a to 7d. Figures 8a to 8d are the trip assignments for the 2024 horizon year. These include the existing observed entering and exiting traffic volumes that will be modified by adding the proposed Secondary Entrance (This also assumes no Church attendance growth from 2023 to 2024). Figures 9a to 9d are the trip assignments for the 2027 horizon year with the addition of new trips generated by the proposed larger sanctuary with the Secondary Entrance. The assigned trips shown in Figures 9a to 9d were calculated by applying the trip generation factor of 3.39, as described previously, to the tabulated 2023 existing entering and exiting volumes during the four identified Sunday peak periods.



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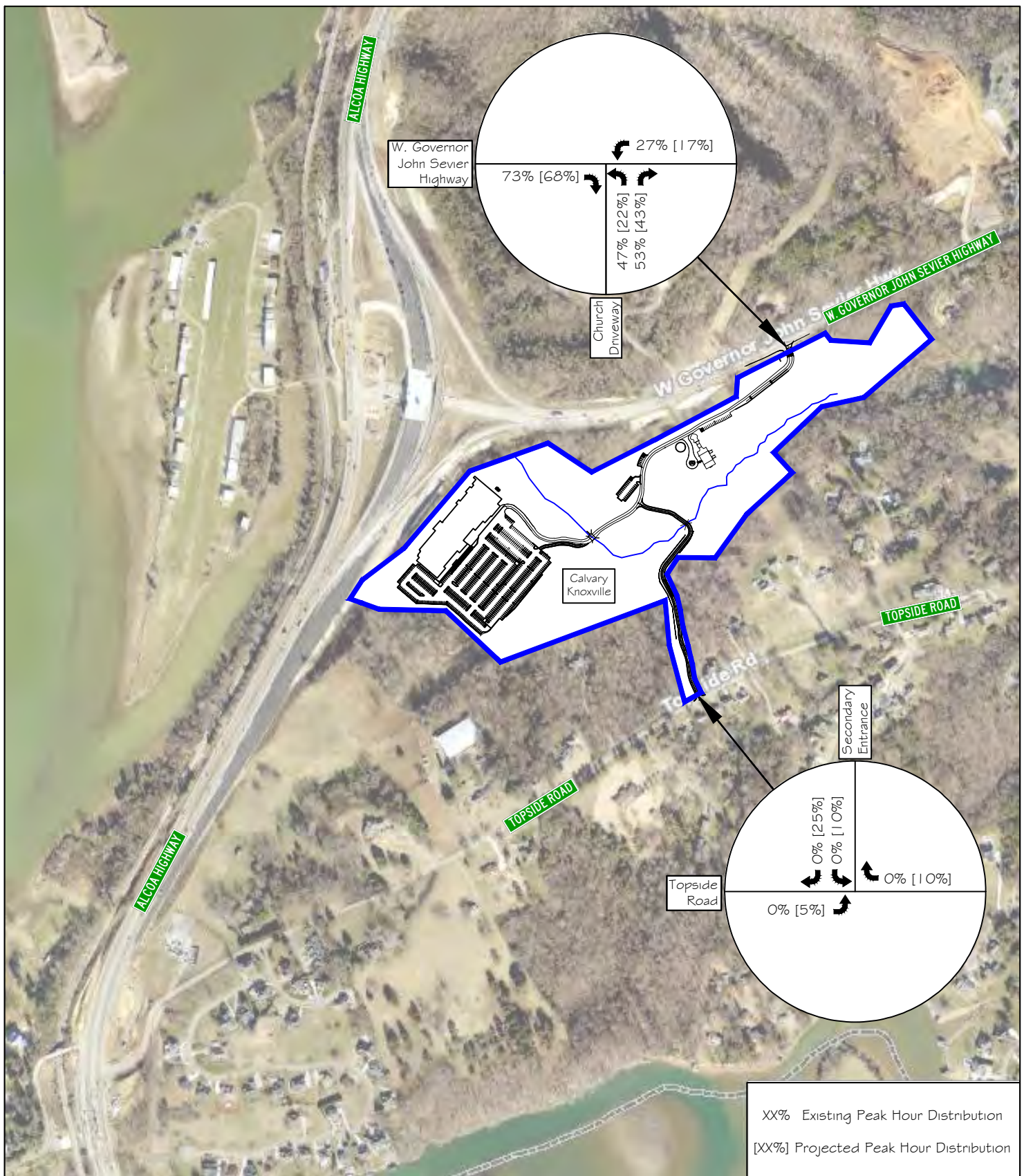
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FIGURE 7a

Calvary Knoxville

2024 & 2027 Directional Distribution of
 Generated Traffic during Peak Hour
 8:45 - 9:45 AM



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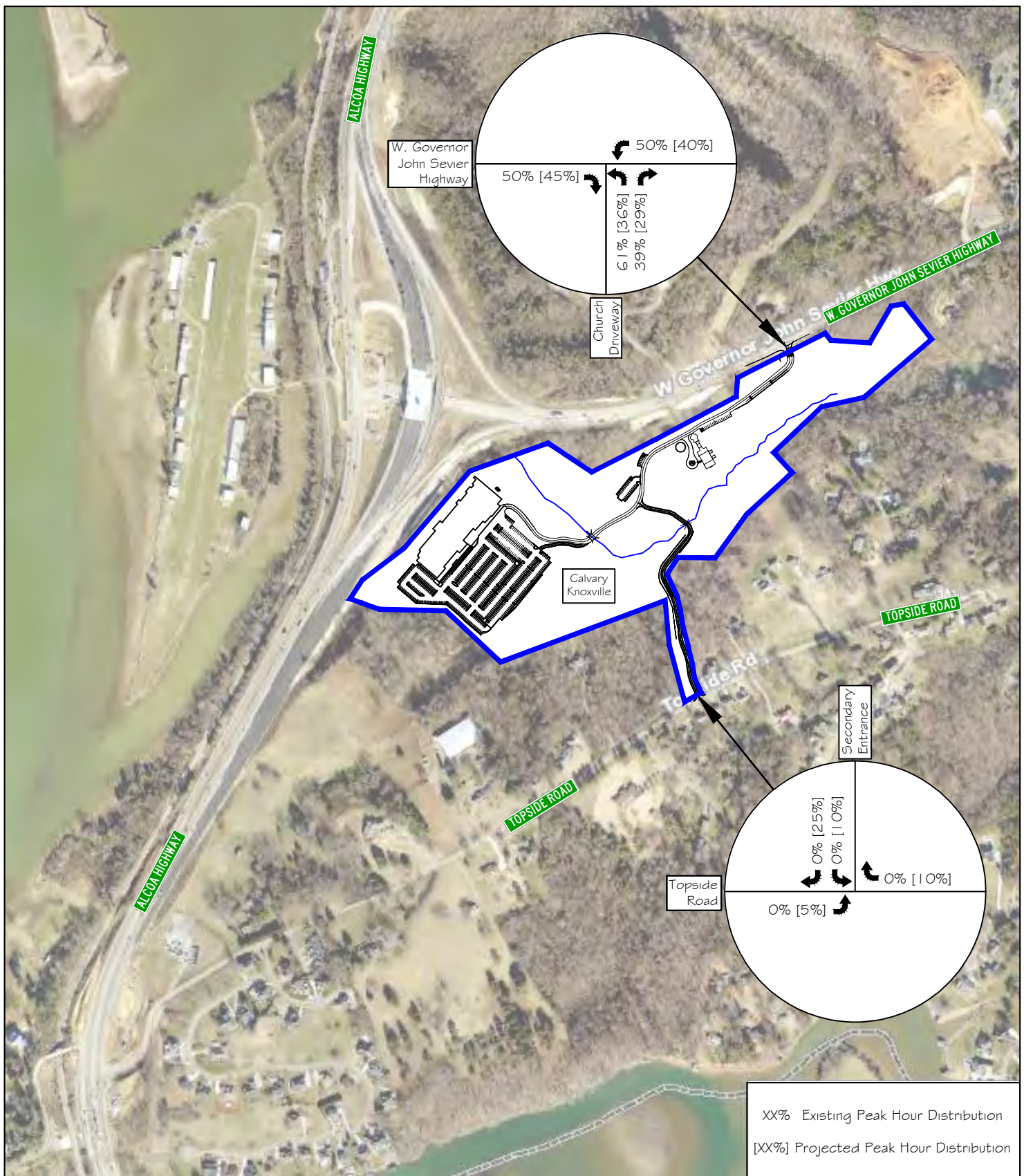
NOT TO SCALE



FIGURE 7b

Calvary Knoxville

2024 & 2027 Directional Distribution of
Generated Traffic during Peak Hour
10:30 - 11:30 AM



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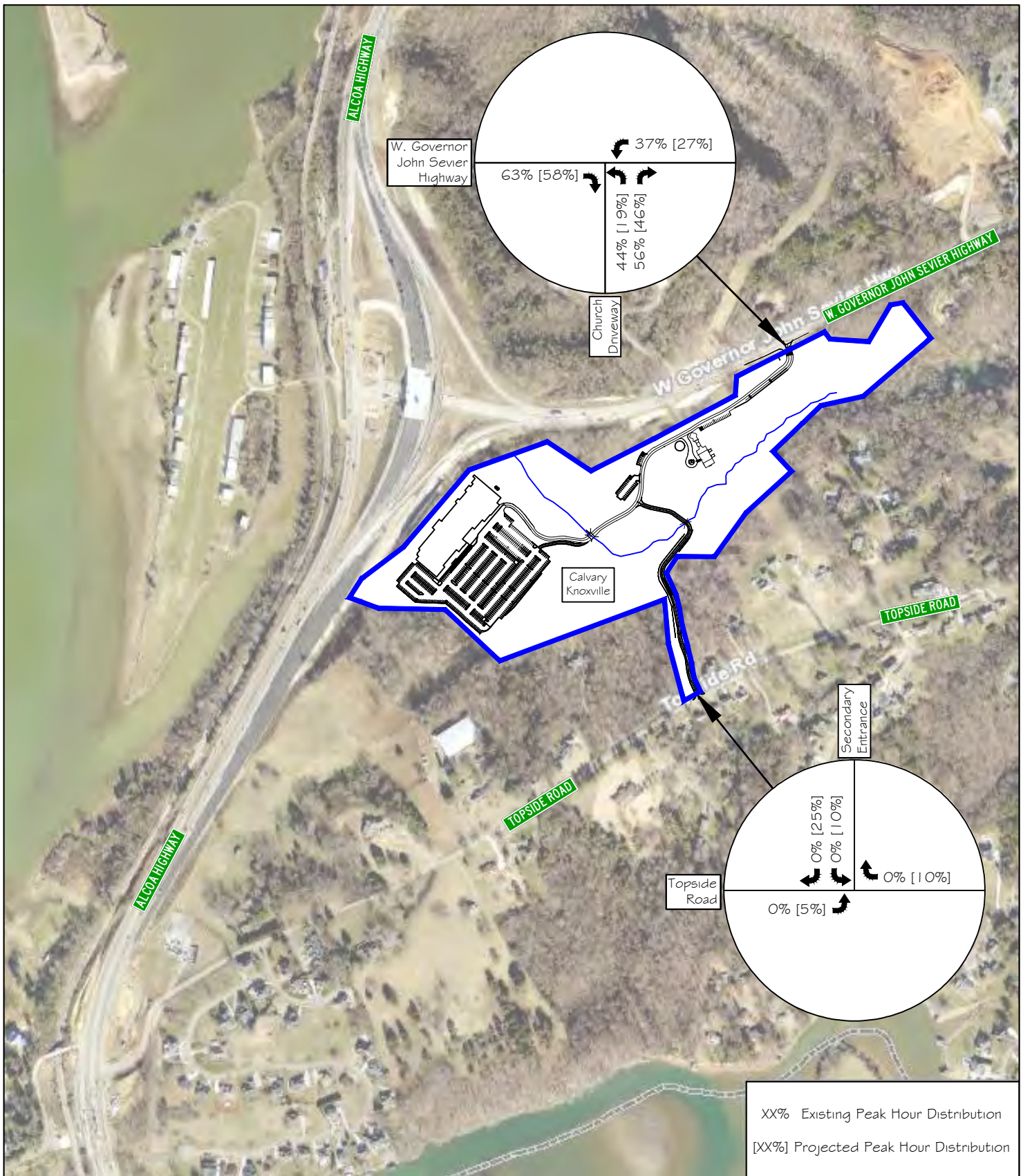
NOT TO SCALE



FIGURE 7c

Calvary Knoxville

2024 & 2027 Directional Distribution of
Generated Traffic during Peak Hour
12:15 - 1:15 PM



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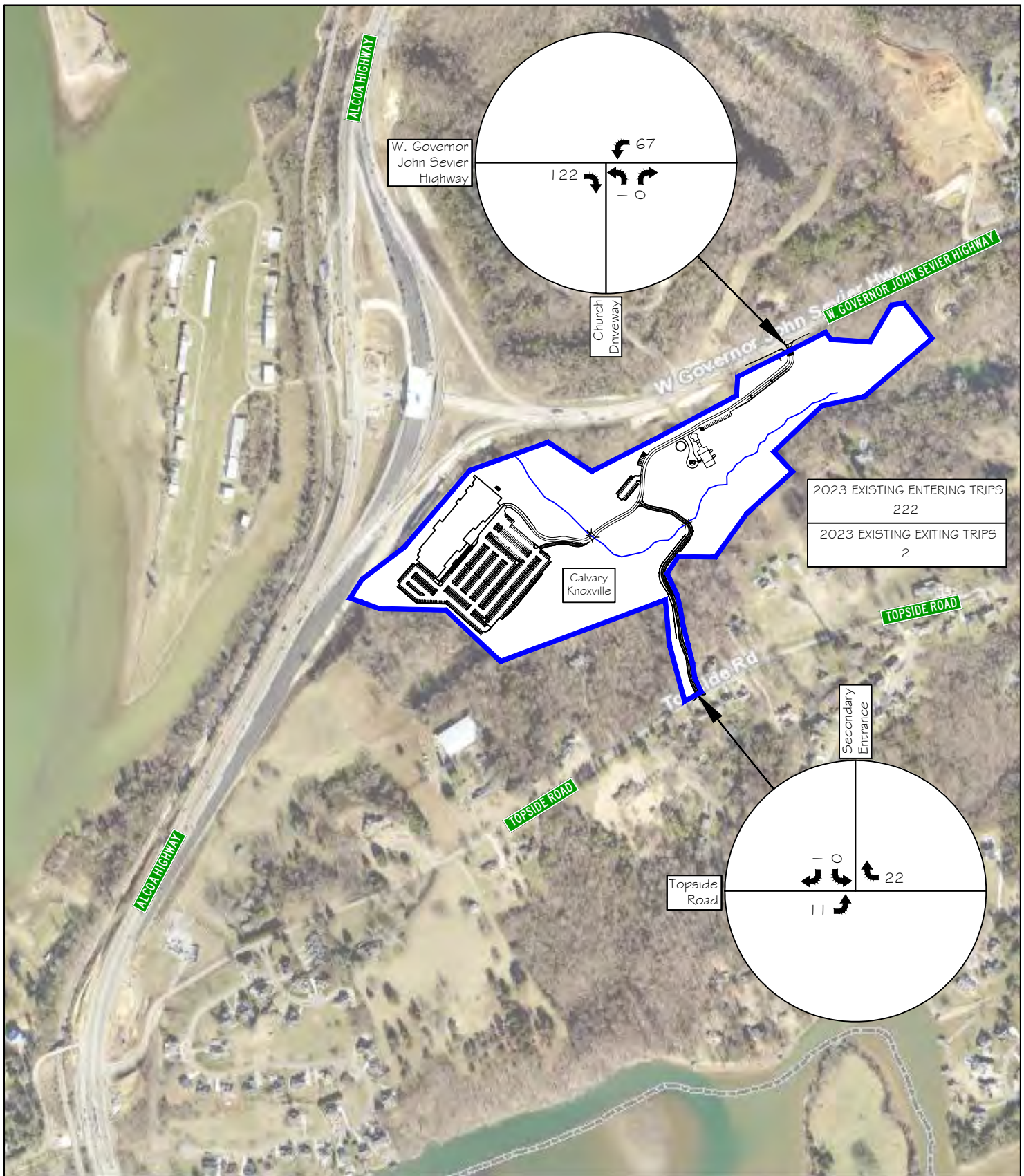
NOT TO SCALE



FIGURE 7d

Calvary Knoxville

2024 & 2027 Directional Distribution of
 Generated Traffic during Peak Hour
 5:15 - 6:15 PM



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Phone: (865) 556-0042
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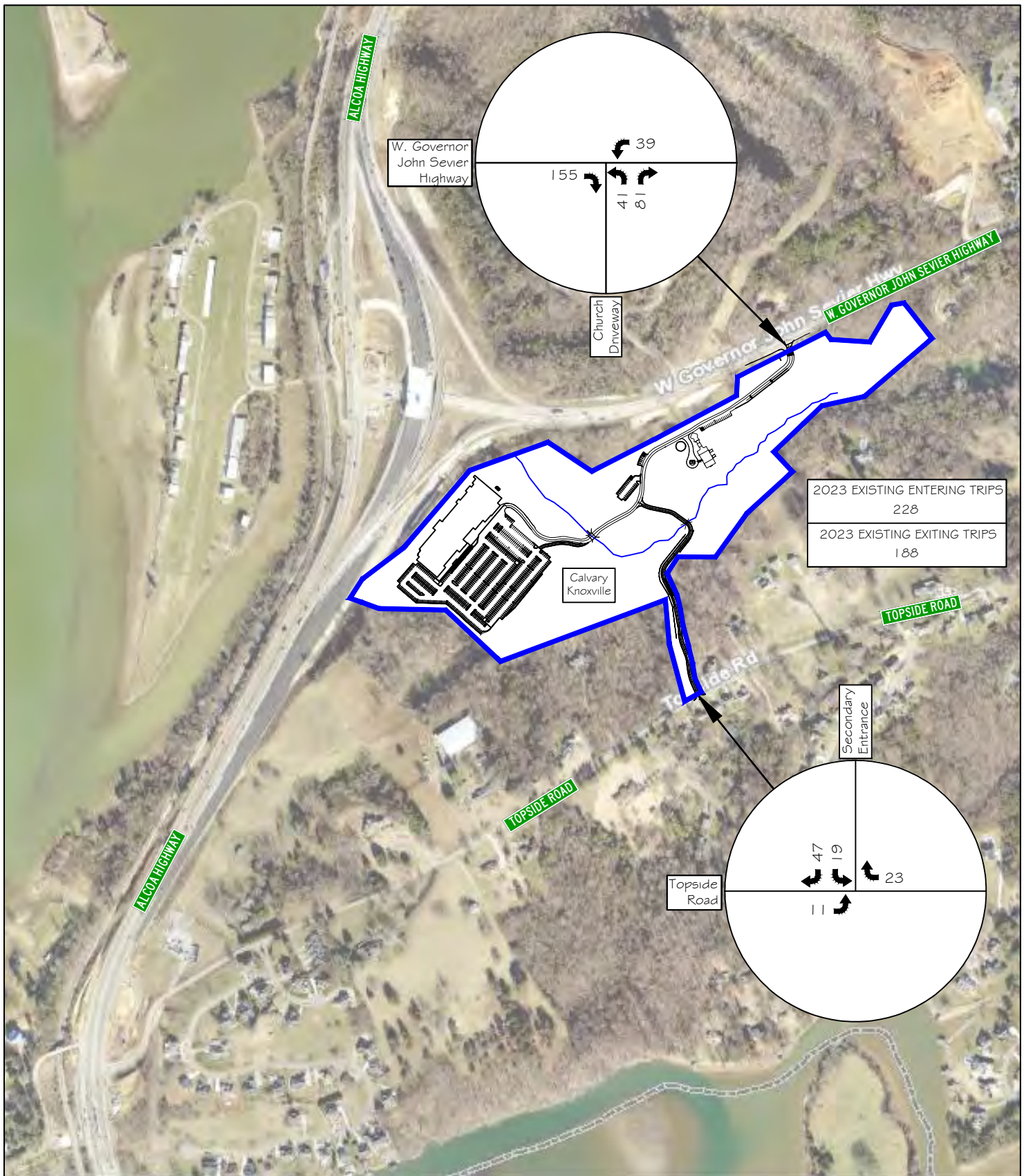
NOT TO SCALE



FIGURE 8a

Calvary Knoxville

2024 Traffic Assignment of Generated
Traffic during Peak Hour
8:45 - 9:45 AM



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Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

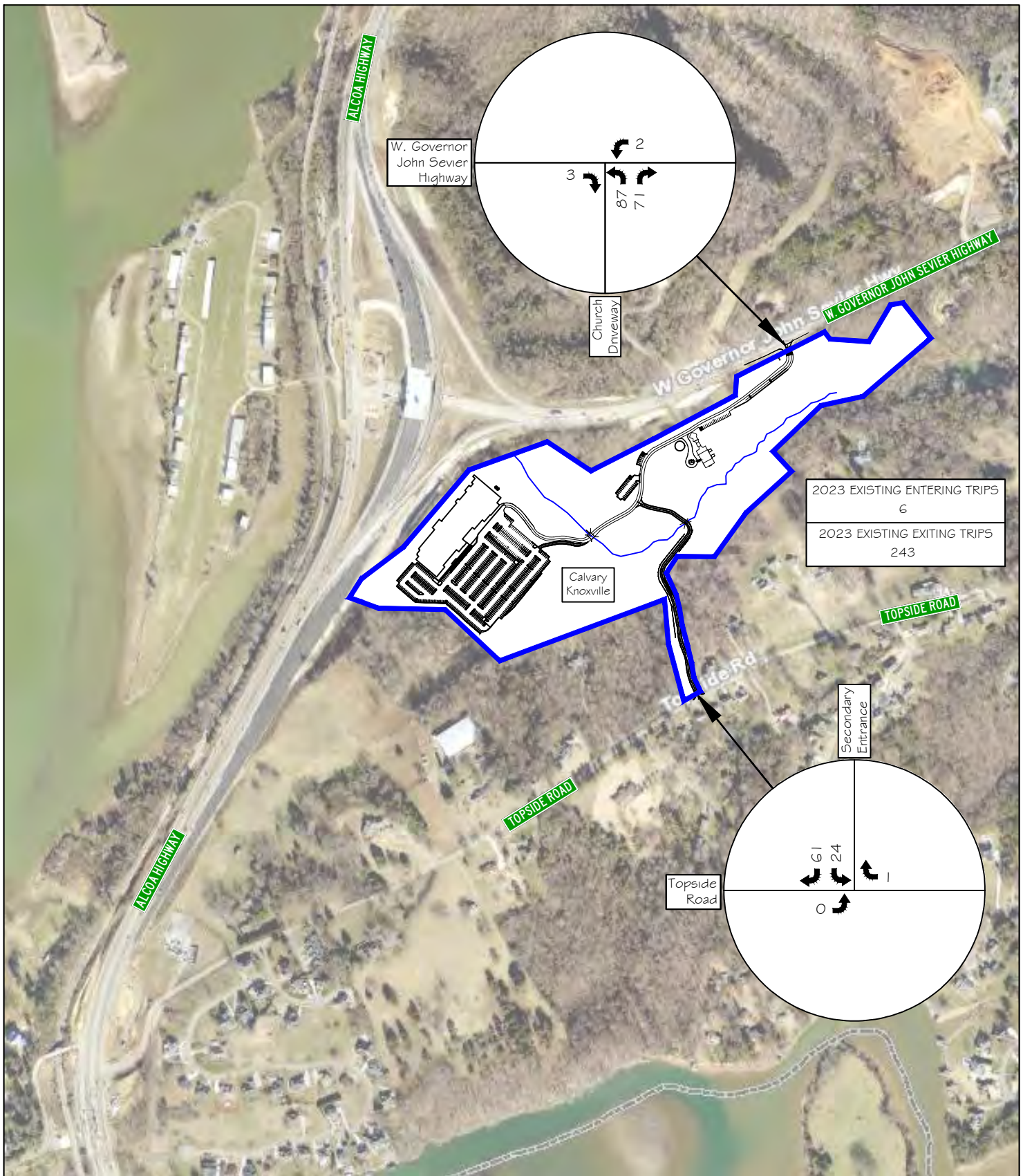
NOT TO SCALE



FIGURE 8b

Calvary Knoxville

2024 Traffic Assignment of Generated
Traffic during Peak Hour
10:30 - 11:30 AM



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Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

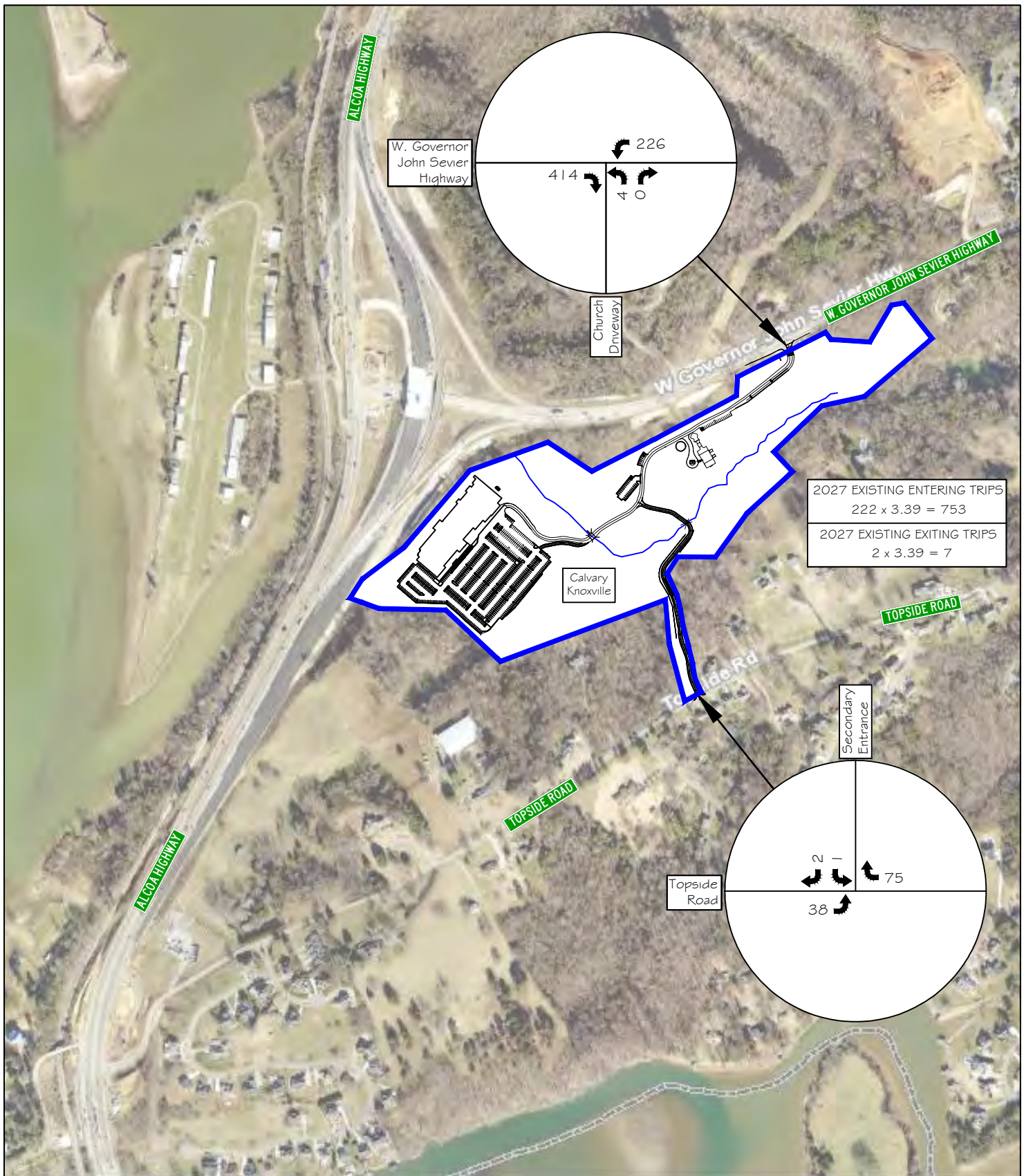
NOT TO SCALE



FIGURE 8c

Calvary Knoxville

2024 Traffic Assignment of Generated
Traffic during Peak Hour
12:15 - 1:15 PM



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 Email: ajaxengineering@gmail.com

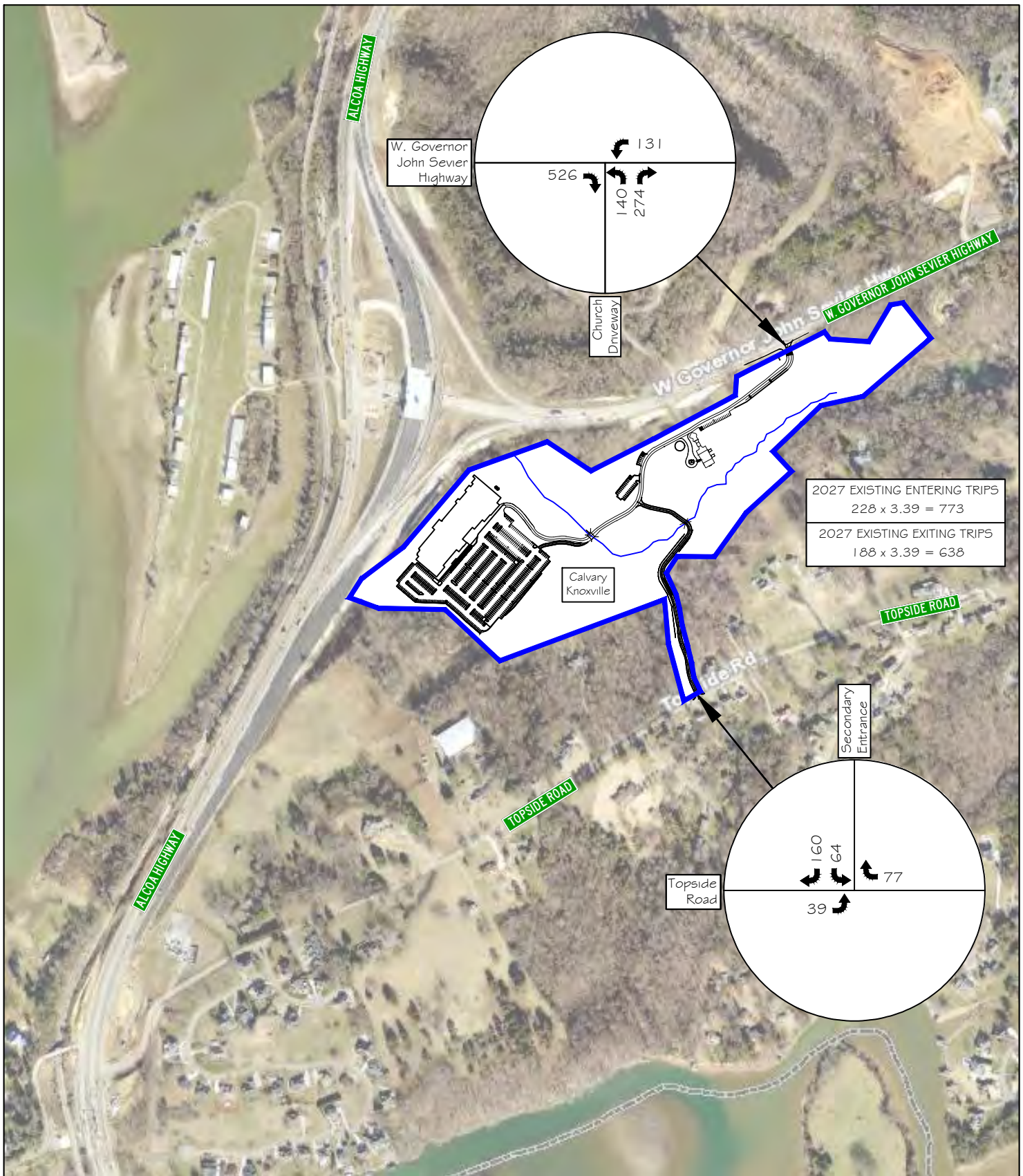
NOT TO SCALE



FIGURE 9a

Calvary Knoxville

2027 Traffic Assignment of Generated
 Traffic during Peak Hour
 8:45 - 9:45 AM



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 Email: ajaxengineering@gmail.com

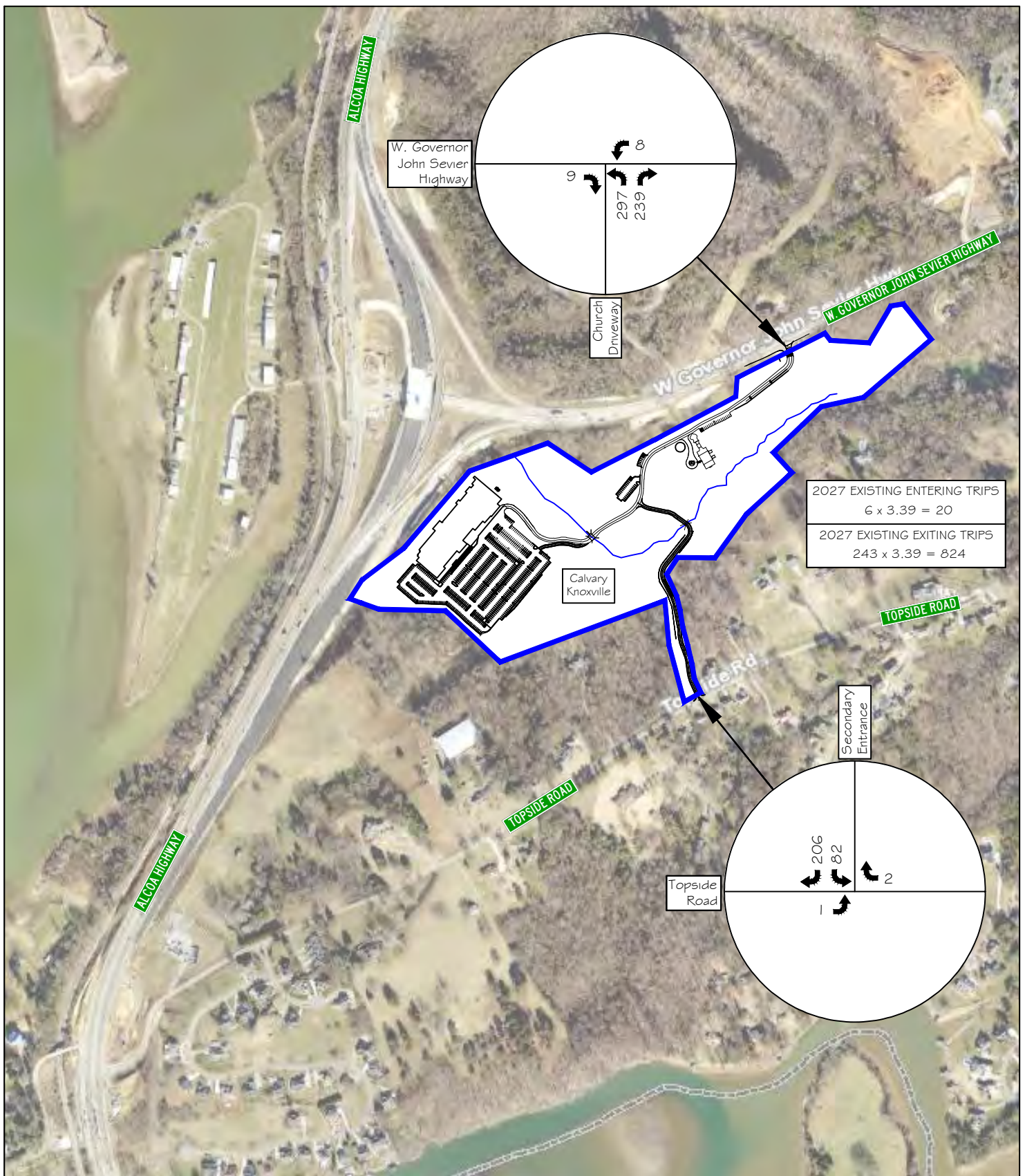
NOT TO SCALE



FIGURE 9b

Calvary Knoxville

2027 Traffic Assignment of Generated
 Traffic during Peak Hour
 10:30 - 11:30 AM



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FIGURE 9c

Calvary Knoxville

2027 Traffic Assignment of Generated
Traffic during Peak Hour
12:15 - 1:15 PM

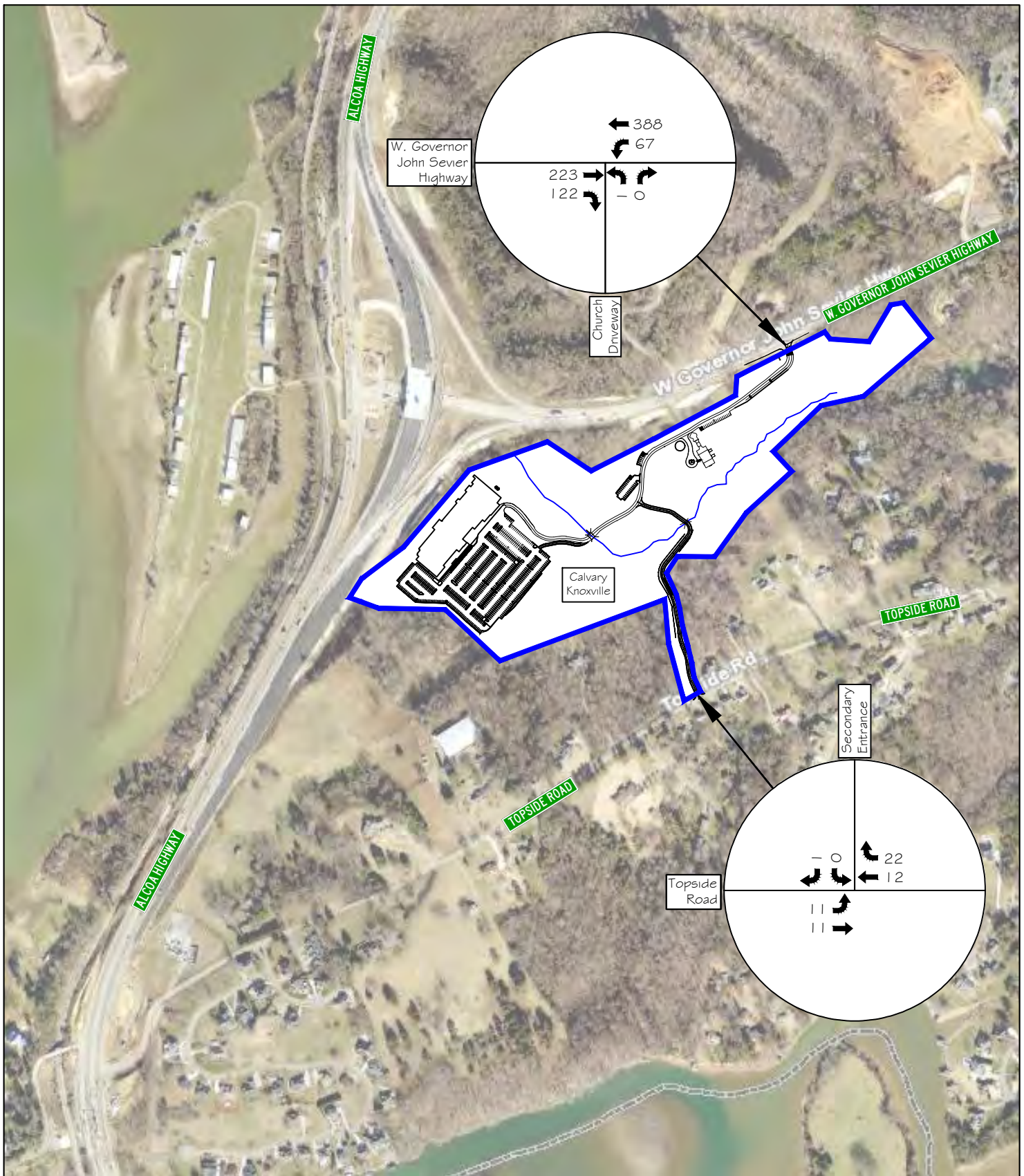
▪ **PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE AND SANCTUARY EXPANSION:**

Several additive steps were taken to estimate the total projected traffic volumes at the existing Church Driveway at W. Governor John Sevier Highway intersection and the proposed Secondary Entrance at Topside Road intersection in 2024 and 2027, when the Secondary Entrance and the sanctuary expansion are constructed, respectively.

In summary, the 2024 projected traffic volumes at the existing Church Driveway entrance and the proposed Secondary Entrance were calculated by applying an assumed growth factor to the existing thru volumes on W. Governor John Sevier Highway and Topside Road (Figures 5a – 5d) and recalibrating the existing Church trips by following the projected trip distribution (Figures 7a – 7d) and assignments (Figures 8a – 8d) due to the new Secondary Entrance. Figures 10a – 10d show the projected 2024 traffic volumes at the two entrances during the four identified Sunday peak periods.

For comparative purposes, 2027 horizon year traffic volumes were also analyzed at the existing Church Driveway with the proposed Secondary Entrance without the Church sanctuary expansion. The analysis includes this scenario to show the results if the Church does not complete the planned sanctuary expansion. These volumes are shown in Figures 11a – 11d. The volumes shown in Figures 11a – 11d are the 2027 projected volumes on W. Governor John Sevier Highway and Topside Road (Figures 6a – 6d), with the existing Church entering and exiting volumes re-assigned due to the construction of the proposed Secondary Entrance (Figures 8a – 8d).

Finally, the calculated peak hour traffic generated by the increased Church attendance due to the sanctuary expansion was added to the 2027 horizon year traffic (Figures 6a – 6d) by following the projected trip distributions and assignments (Figures 7a – 7d and 9a – 9d). This procedure was completed to obtain the total projected traffic volumes at the two entrances when the new sanctuary for Calvary Knoxville is fully built and available for worship services in 2027, with the Secondary Entrance. Figures 12a – 12d show the projected 2027 traffic volumes at the two entrances for the four identified Sunday peak periods.



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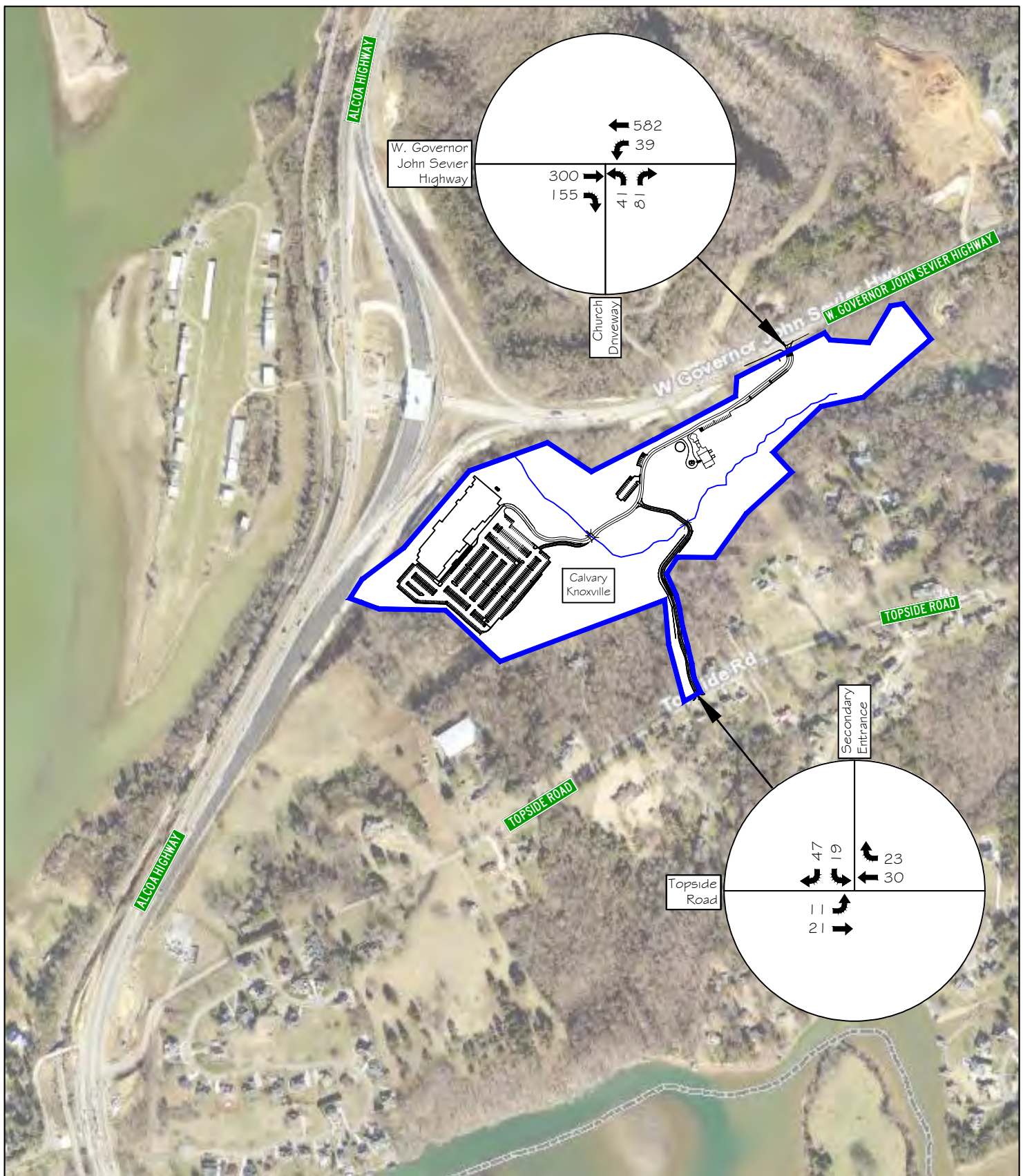
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FIGURE 10a

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
8:45 - 9:45 AM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

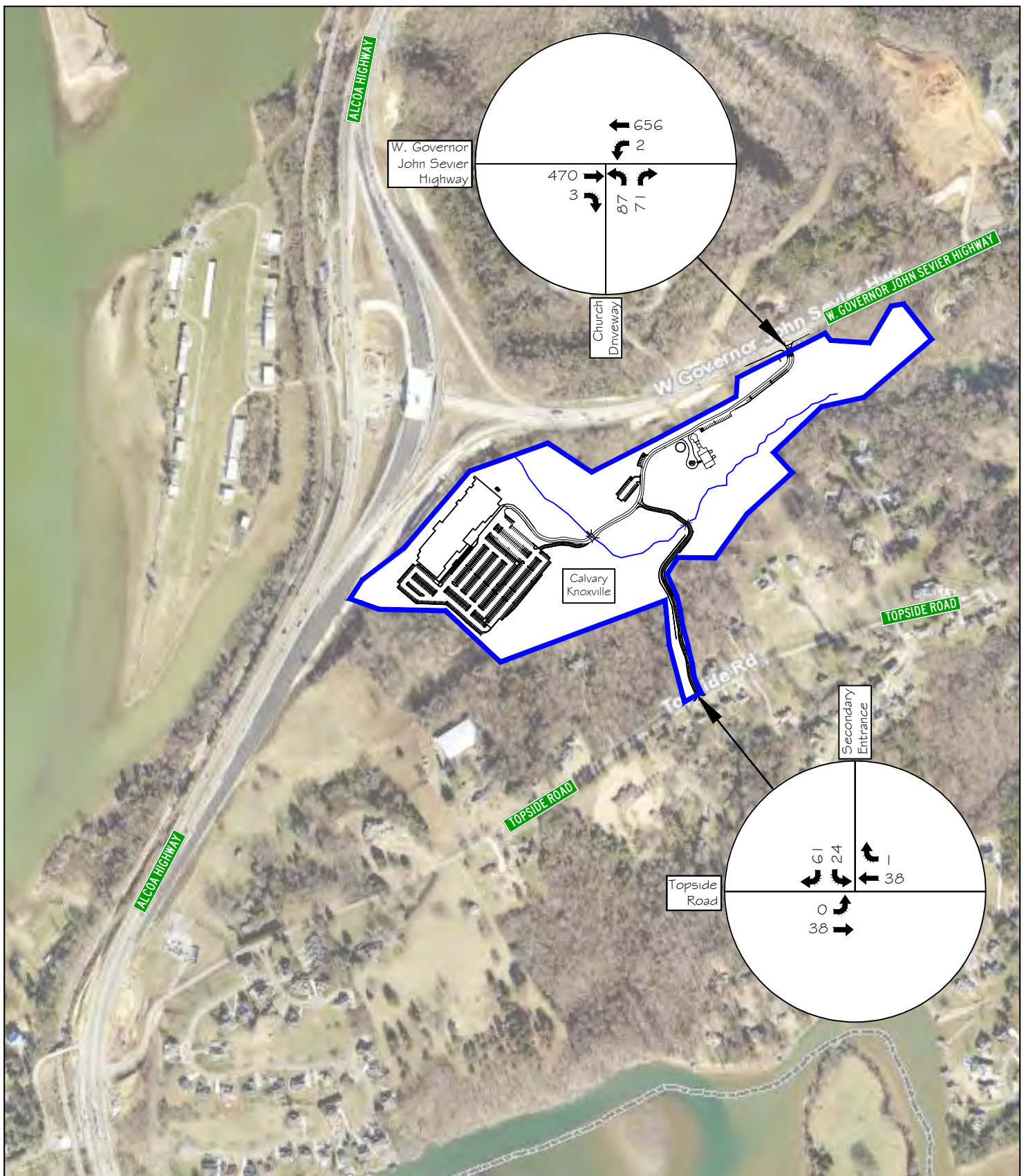
NOT TO SCALE



FIGURE 10b

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
10:30 - 11:30 AM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

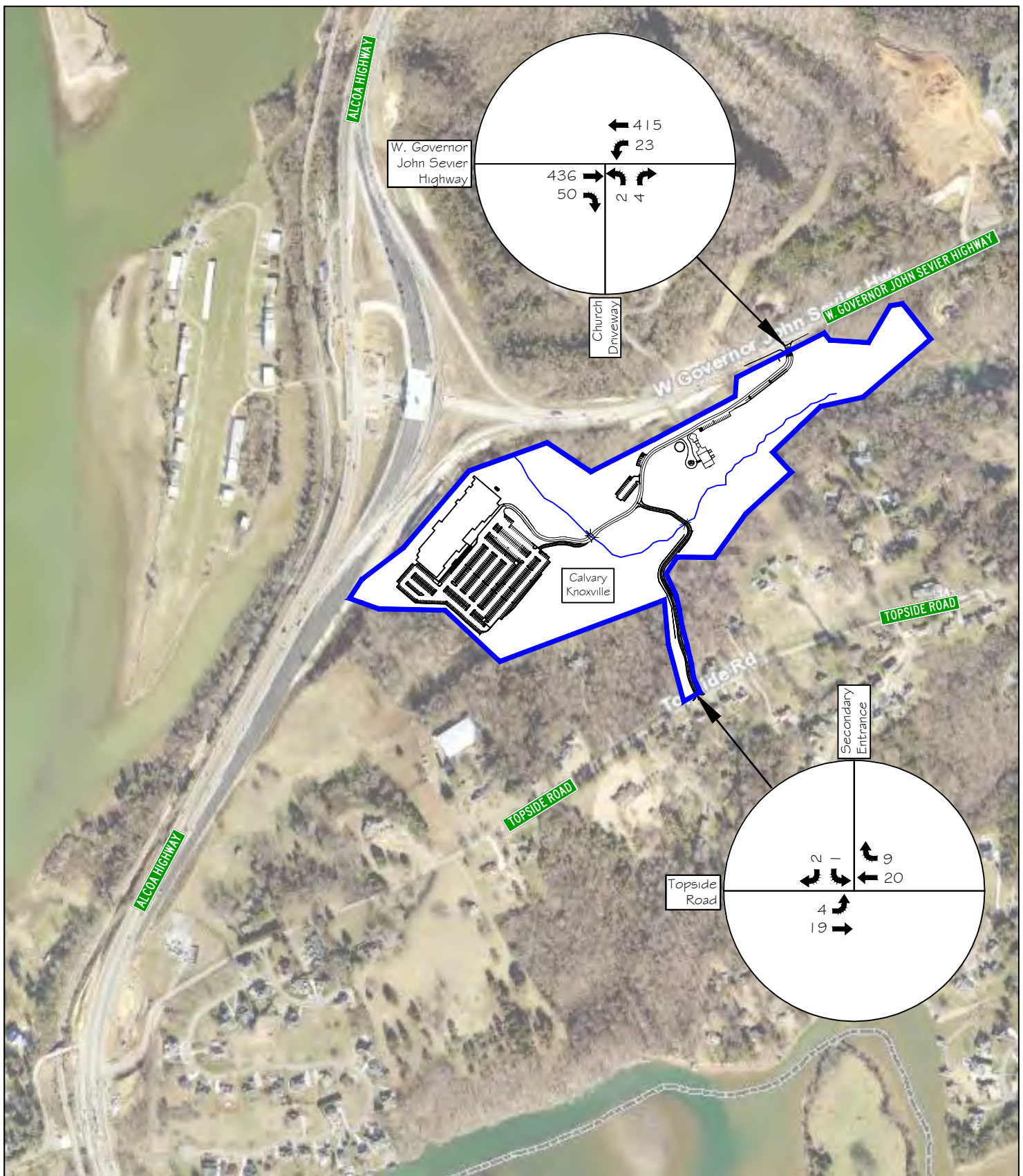
NOT TO SCALE



FIGURE 10c

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
12:15 - 1:15 PM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

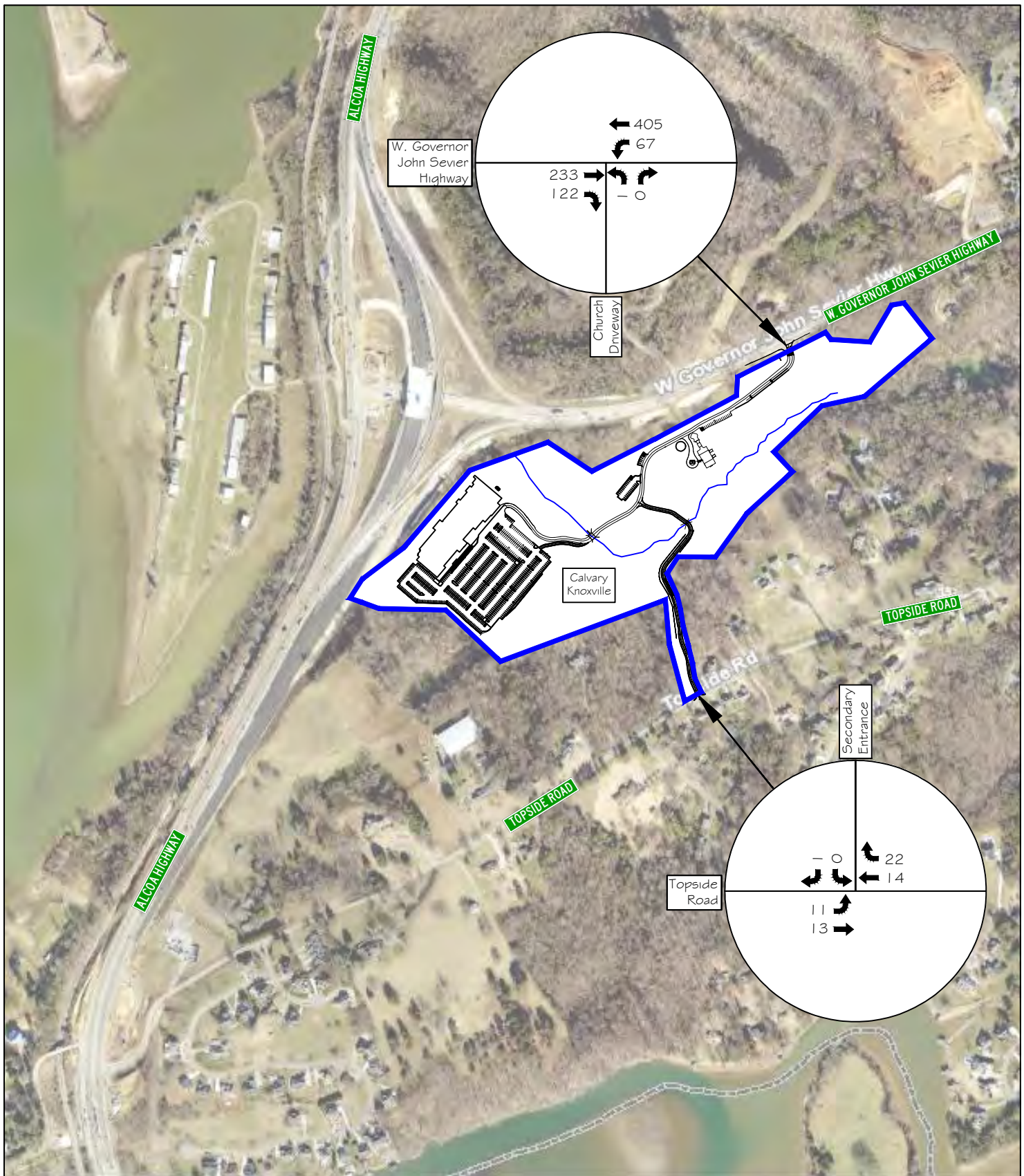
NOT TO SCALE



FIGURE 10d

Calvary Knoxville

2024 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
5:15 - 6:15 PM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

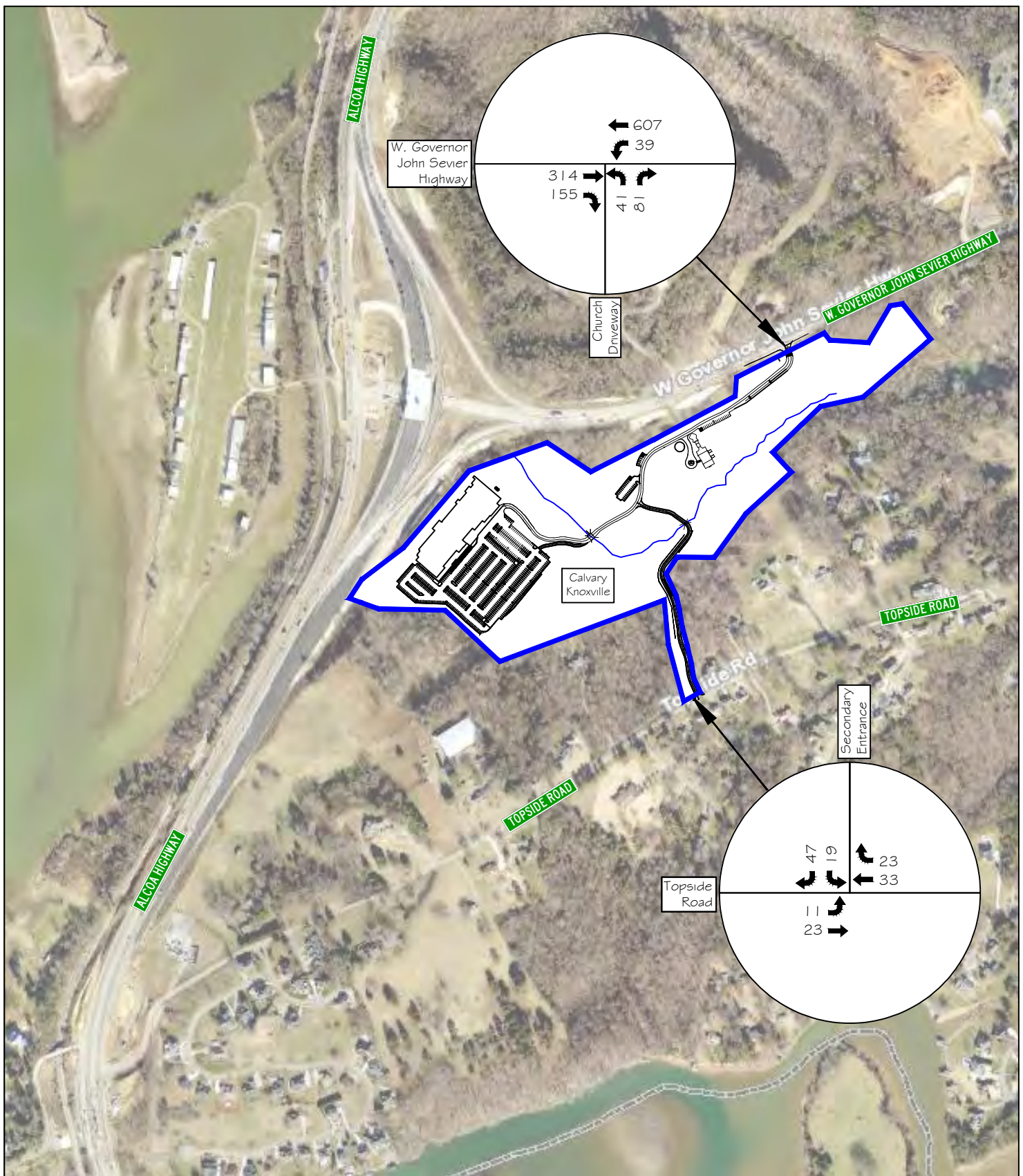
NOT TO SCALE



FIGURE 11a

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
8:45 - 9:45 AM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

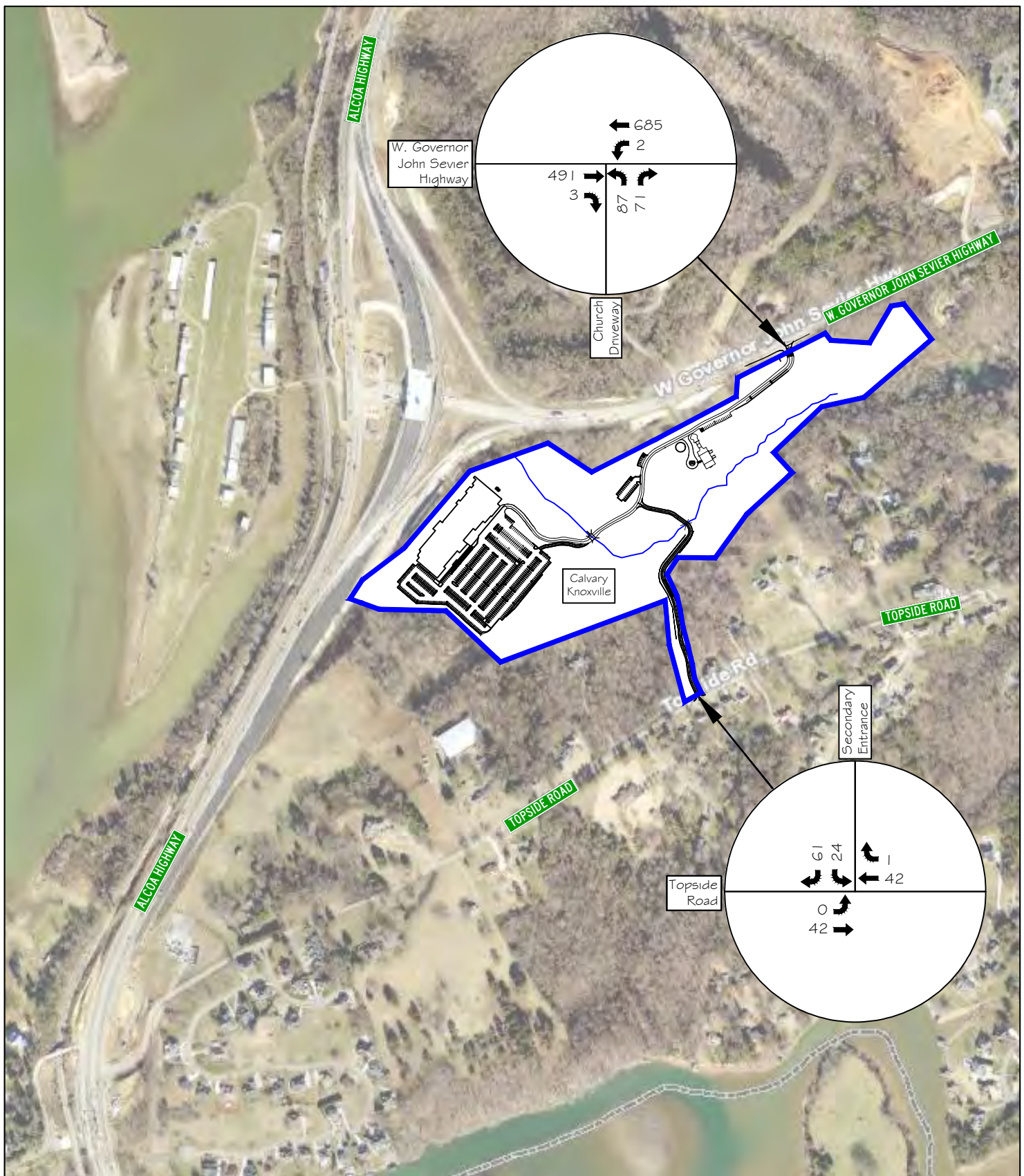
NOT TO SCALE



FIGURE 11b

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
10:30 - 11:30 AM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

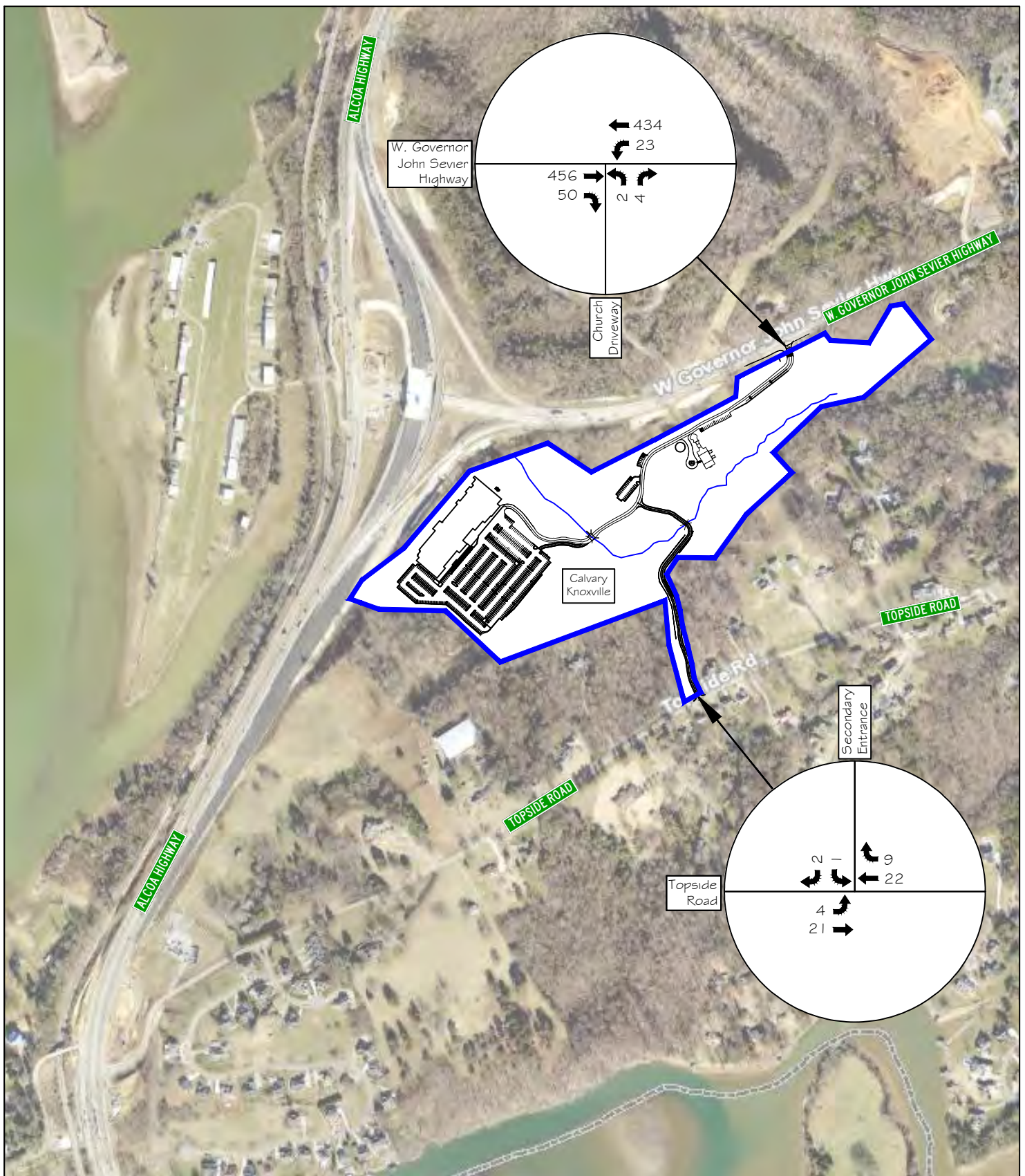
NOT TO SCALE



FIGURE 11c

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
12:15 - 1:15 PM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

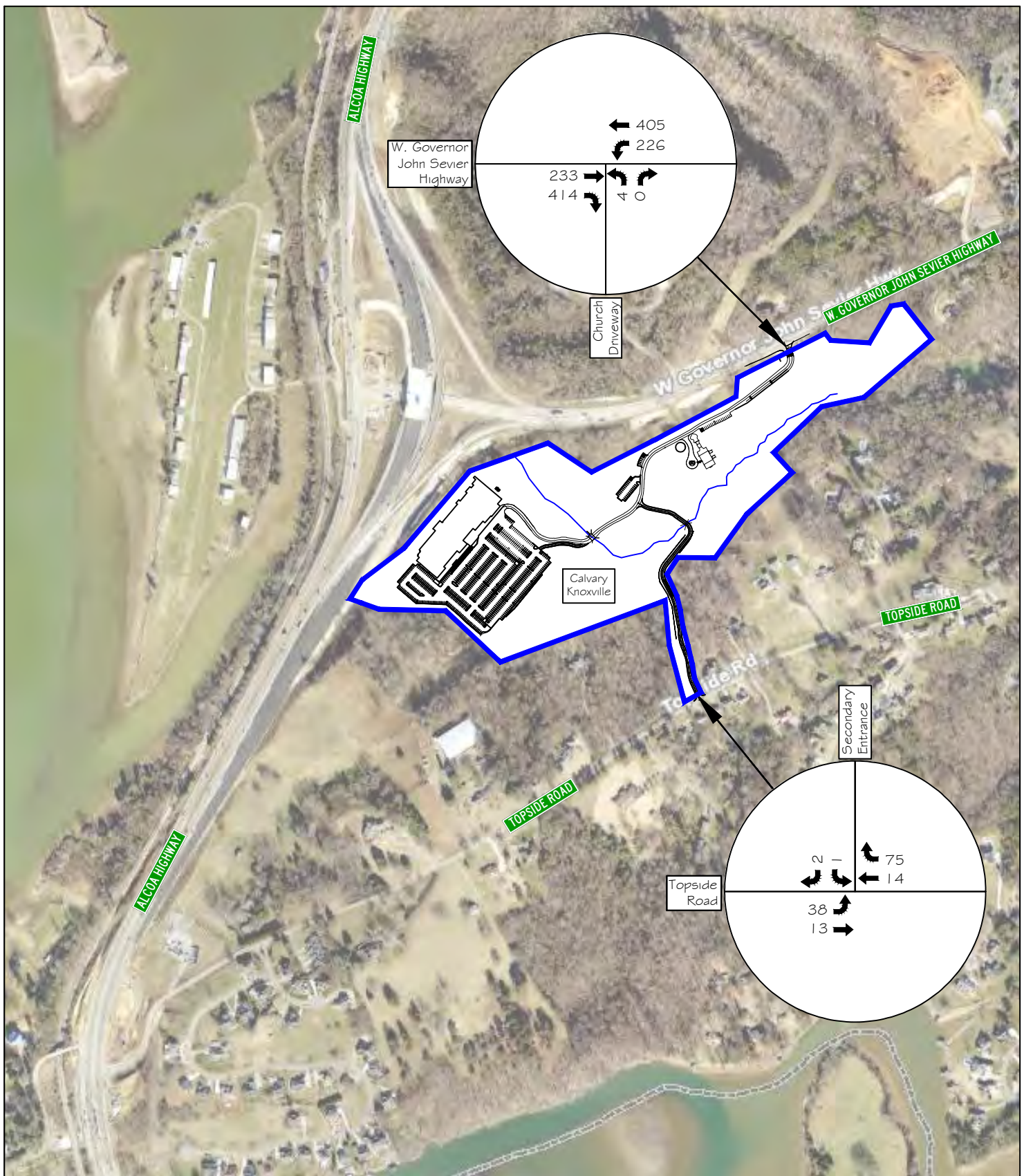
NOT TO SCALE



FIGURE 11d

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS
WITH THE SECONDARY ENTRANCE ONLY
5:15 - 6:15 PM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

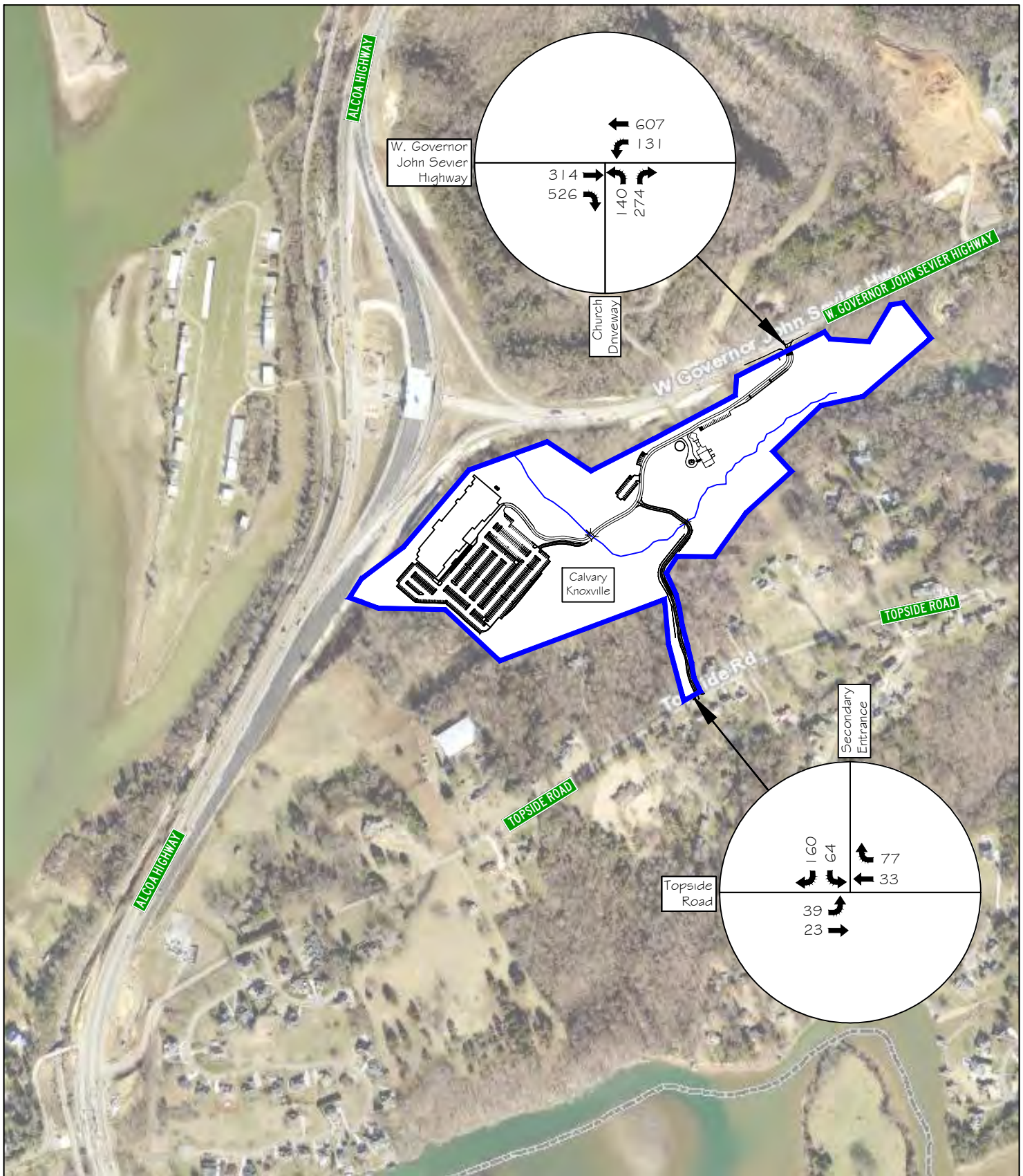
NOT TO SCALE



FIGURE 12a

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS WITH THE
SECONDARY ENTRANCE & SANCTUARY EXPANSION
8:45 - 9:45 AM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

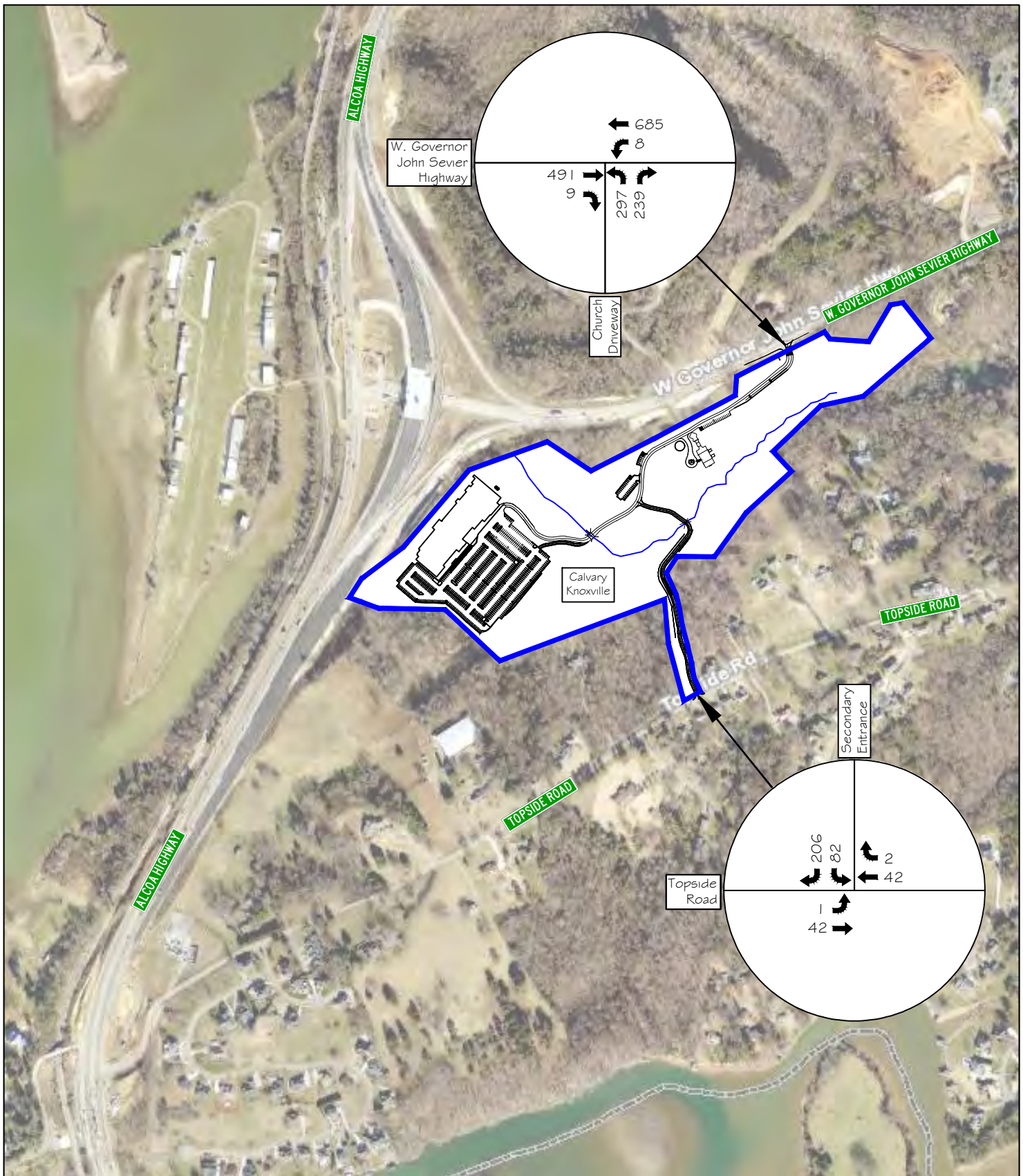
NOT TO SCALE



FIGURE 12b

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS WITH THE
SECONDARY ENTRANCE & SANCTUARY EXPANSION
10:30 - 11:30 AM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

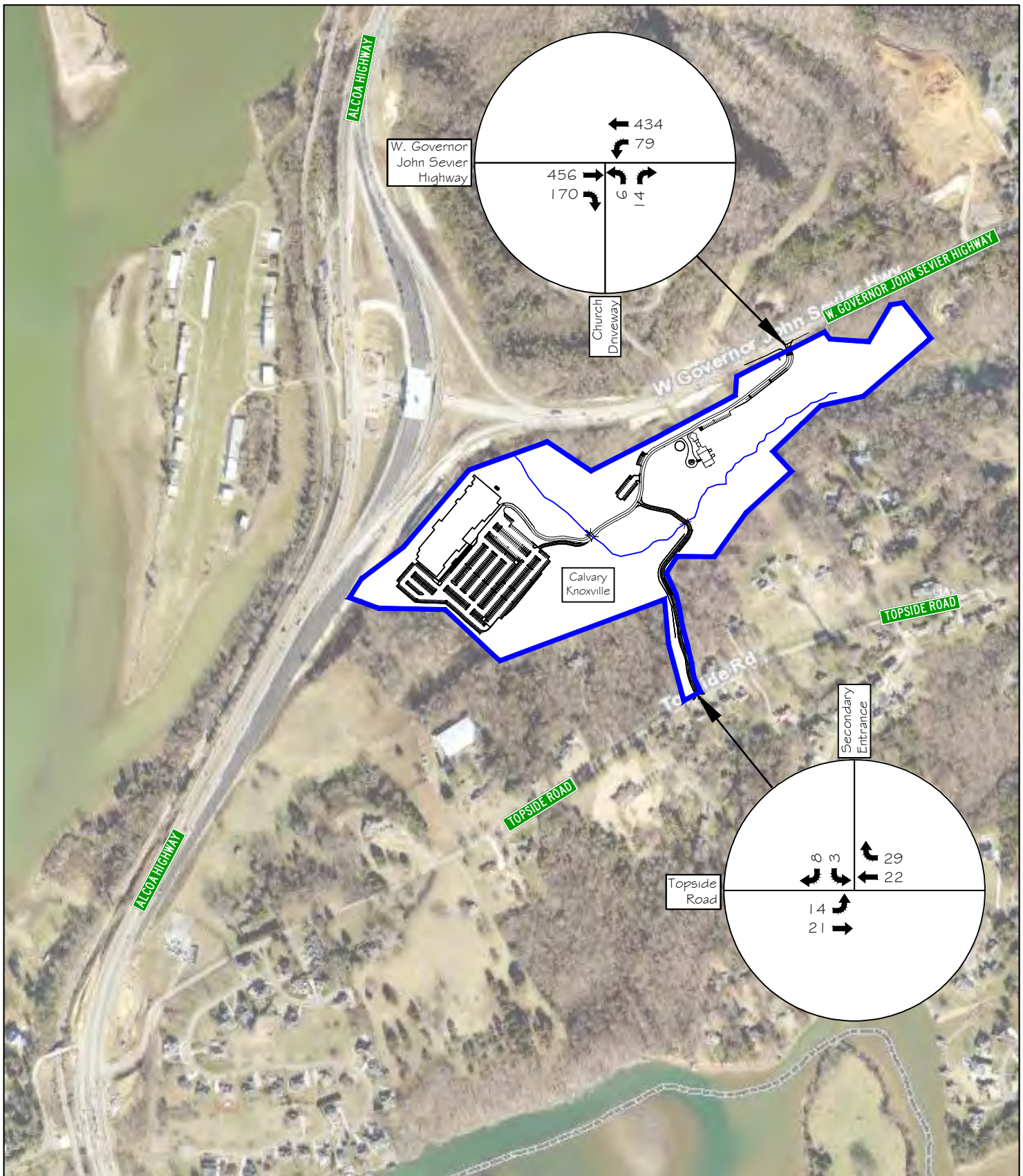
NOT TO SCALE



FIGURE 12c

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS WITH THE
SECONDARY ENTRANCE & SANCTUARY EXPANSION
12:15 - 1:15 PM



11812 Black Road
Knoxville, TN 37932
Phone: (865) 556-0042
Email: ajaxengineering@gmail.com

NOT TO SCALE



FIGURE 12d

Calvary Knoxville

2027 Peak Hour Traffic Volumes -
PROJECTED TRAFFIC CONDITIONS WITH THE
SECONDARY ENTRANCE & SANCTUARY EXPANSION
5:15 - 6:15 PM

Intersection capacity analyses were conducted to determine the level of service (LOS) during the four identified Sunday peak periods at the existing Church Driveway and the proposed Secondary Entrance in 2024 and 2027, as shown in Figures 10a – 10d, 11a - 11d, and 12a – 12d. The existing 2023 conditions were also analyzed. The capacity analyses were calculated following the Highway Capacity Manual (HCM) methods and utilizing Synchro Traffic Software (Version 11).

Methodology:

LOS is a qualitative measurement developed by the transportation profession to express how well an intersection or roadway performs based on a driver's perception. LOS designations include LOS A through LOS F. The designation of LOS A signifies a roadway or intersection operating at best, while LOS F signifies road operations at worst. This grading system provides a reliable, straightforward means to communicate road operations to the public. The HCM lists the level of service criteria for unsignalized intersections and signalized intersections.



LOS is defined by delay per vehicle (seconds), and roadway facilities are also characterized by the volume-to-capacity ratio (v/c). LOS designations, which are based on delay, are reported differently for unsignalized and signalized intersections. For example, a delay of 20 seconds at an unsignalized intersection would indicate LOS C, representing the additional delay a motorist would experience traveling through the intersection. Also, for example, a v/c ratio of 0.75 for an approach at an unsignalized intersection would indicate that it is operating at 75% of its available capacity. This difference is primarily due to motorists' different expectations between the two road facilities. Generally, for most instances, the LOS D / LOS E boundary is considered the upper limit of acceptable delay during peak periods in urban and suburban areas.

For unsignalized intersections, LOS is measured in terms of delay (in seconds). This measure attempts to quantify delay, including travel time, driver discomfort, and fuel consumption. For unsignalized intersections, the analysis assumes that the mainline thru

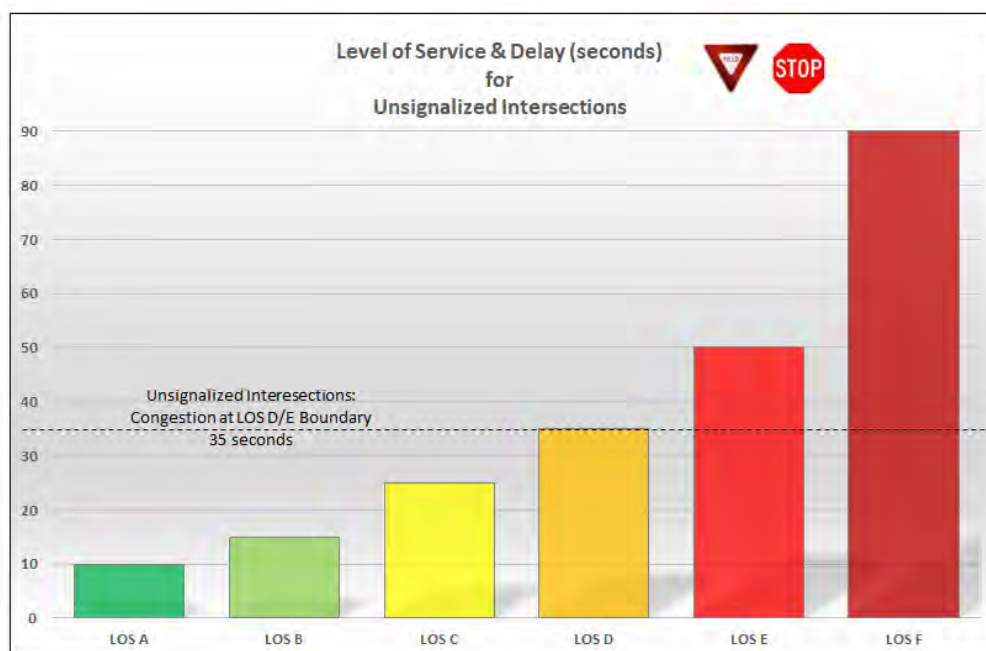
and right-turn traffic does not stop and is not affected by the traffic on the minor side streets. Thus, the LOS for a two-way stop (or yield) controlled intersection is defined by the delay for each minor approach and major street left-turn movements. Table 3 lists the level of service criteria for unsignalized intersections. The analysis results of unsignalized intersections using the HCM methodologies are conservative due to the more significant vehicle gap parameters used in the method. More often, in normal road conditions, drivers are more willing to accept smaller gaps in traffic than what is modeled using the HCM methodology. The unsignalized intersection methodology also does not account for more significant gaps sometimes produced by nearby upstream and downstream signalized intersections. For unsignalized intersections, in most instances, the upper limit of acceptable delay during peak hours is the LOS D/E boundary at 35 seconds.

TABLE 3
LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS



LEVEL OF SERVICE	DESCRIPTION	CONTROL DELAY (seconds/vehicle)
A	Little or no delay	0 - 10
B	Short Traffic Delays	>10 -15
C	Average Traffic Delays	>15 - 25
D	Long Traffic Delays	>25 - 35
E	Very Long Traffic Delays	>35 - 50
F	Extreme Traffic Delays	>50

Source: Highway Capacity Manual, 6th Edition



Intersection capacity results for the two intersections from the existing 2023, projected 2024, and projected 2027 peak periods are shown in Tables 4a to 4g. The studied intersections in the tables are shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the four identified Sunday peak periods of 8:45 – 9:45 am, 10:30 – 11:30 am, 12:15 - 1:15 pm, and 5:15 – 6:15 pm. Appendix D includes the worksheets for these peak period capacity analyses.





The results for the existing 2023 conditions (Table 4a) show that all vehicle movements at the existing entrance operate with acceptable delays during the four identified Sunday peak periods except for the existing Church Driveway's northbound left-turn lane. This movement is calculated to operate at LOS F during the 10:30 – 11:30 am and 12:15 – 1:15 pm Sunday periods.

The results for the projected 2024 conditions (Table 4b) with the new Secondary Entrance on Topside Road are nearly identical to the existing 2023 results but with much shorter vehicle delays for the northbound left-turn lane at W. Governor John Sevier Highway. The vehicle delays for this movement are calculated to be shorter in the projected 2024 conditions due to the construction of the Secondary Entrance on Topside Road, attracting away some of the motorists that would have otherwise continued using the existing Church Driveway. Vehicle delays at the intersection of Topside Road at the Secondary Entrance (Table 4c) are expected to be very short in the projected 2024 conditions.

The results for the projected 2027 conditions (Table 4d) without the expanded sanctuary but with a Secondary Entrance show average to poor results for the exiting northbound left and right-turn movements at the existing Church Driveway, even with the new Secondary Entrance on Topside Road. The vehicle delays for these movements are calculated to be long in the projected 2027 conditions, especially for the 10:30 – 11:30 am and 12:15 – 1:15 pm periods. Vehicle delays at the intersection of Topside Road at the Secondary Entrance (Table 4e) are expected to be very short in these projected 2027 conditions.

The results for the projected 2027 conditions (Table 4f) with the expanded sanctuary show poor results for the exiting northbound left and right-turn movements at the existing Church Driveway, even with the new Secondary Entrance on Topside Road. The vehicle delays for these movements are calculated to be extremely long in the projected 2027 conditions, especially for the 8:45 – 9:45 am, 10:30 – 11:30 am, and 12:15 – 1:15 pm periods. However, the vehicle delays for the intersection of Topside Road at the Secondary Entrance (Table 4g) are expected to be very short in the projected 2027 conditions.





TABLE 4a
2023 INTERSECTION CAPACITY ANALYSIS RESULTS -
EXISTING TRAFFIC CONDITIONS
W. GOVERNOR JOHN SEVIER HIGHWAY AT CHURCH DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
			8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	20.2	
		Northbound Left	C	20.2	0.017
		Northbound Right	A	0.0	-
		Westbound Left	A	9.0	0.138
			10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	F	93.1	
		Northbound Left	F	184.9	1.221
		Northbound Right	C	15.0	0.441
		Westbound Left	A	9.4	0.126
			12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	F	108.6	
		Northbound Left	F	188.9	1.235
		Northbound Right	C	17.3	0.429
		Westbound Left	A	8.4	0.011
			5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	17.0	
		Northbound Left	C	20.3	0.049
		Northbound Right	B	12.0	0.015
		Westbound Left	A	8.9	0.057

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service, ^b Average Delay (sec/vehicle), ^c Volume-to-Capacity Ratio





TABLE 4b
2024 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE ONLY
W. GOVERNOR JOHN SEVIER HIGHWAY AT CHURCH DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
			8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	18.4	
		Northbound Left	C	18.4	0.007
		Northbound Right	A	0.0	-
		Westbound Left	A	8.8	0.103
			10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	20.5	
		Northbound Left	D	34.6	0.484
		Northbound Right	B	13.8	0.363
		Westbound Left	A	9.2	0.078
			12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	E	36.5	
		Northbound Left	F	60.3	0.729
		Northbound Right	C	15.6	0.328
		Westbound Left	A	8.4	0.008
			5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	15.6	
		Northbound Left	C	19.4	0.024
		Northbound Right	B	12.0	0.012
		Westbound Left	A	8.8	0.041

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service, ^b Average Delay (sec/vehicle), ^c Volume-to-Capacity Ratio





TABLE 4c
2024 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE ONLY
TOPSIDE ROAD AT SECONDARY DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
			8:45 - 9:45 AM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.3	0.008
		Southbound Approach	A	8.5	
		Southbound Left/Right	A	8.5	0.001
			10:30 - 11:30 AM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.4	0.008
		Southbound Approach	A	9.1	
		Southbound Left/Right	A	9.1	0.077
			12:15 - 1:15 PM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	0.0	-
		Southbound Approach	A	9.2	
		Southbound Left/Right	A	9.2	0.098
			5:15 - 6:15 PM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.3	0.003
		Southbound Approach	A	8.7	
		Southbound Left/Right	A	8.7	0.003

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service , ^b Average Delay (sec/vehicle) , ^c Volume-to-Capacity Ratio





TABLE 4d
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE ONLY
W. GOVERNOR JOHN SEVIER HIGHWAY AT CHURCH DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
			8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	18.8	
		Northbound Left	C	18.8	0.008
		Northbound Right	A	0.0	-
		Westbound Left	A	8.8	0.104
			10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	21.7	
		Northbound Left	E	37.4	0.508
		Northbound Right	B	14.2	0.373
		Westbound Left	A	9.2	0.079
			12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	E	41.4	
		Northbound Left	F	70.0	0.775
		Northbound Right	C	16.2	0.340
		Westbound Left	A	8.5	0.008
			5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	16.1	
		Northbound Left	C	20.1	0.025
		Northbound Right	B	12.3	0.013
		Westbound Left	A	8.9	0.042

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service , ^b Average Delay (sec/vehicle) , ^c Volume-to-Capacity Ratio





TABLE 4e
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE ONLY
TOPSIDE ROAD AT SECONDARY DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
		8:45 - 9:45 AM			
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.3	0.008
		Southbound Approach	A	8.5	
		Southbound Left/Right	A	8.5	0.001
		10:30 - 11:30 AM			
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.4	0.008
		Southbound Approach	A	9.1	
		Southbound Left/Right	A	9.1	0.078
		12:15 - 1:15 PM			
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	0.0	-
		Southbound Approach	A	9.2	
		Southbound Left/Right	A	9.2	0.099
		5:15 - 6:15 PM			
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.3	0.003
		Southbound Approach	A	8.7	
		Southbound Left/Right	A	8.7	0.003

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service , ^b Average Delay (sec/vehicle) , ^c Volume-to-Capacity Ratio





TABLE 4f
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE & SANCTUARY EXPANSION
W. GOVERNOR JOHN SEVIER HIGHWAY AT CHURCH DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
			8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	F	74.0	
		Northbound Left	F	74.0	0.133
		Northbound Right	A	0.0	-
		Westbound Left	C	17.9	0.575
			10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	F	711.4	
		Northbound Left	F	1869.9	4.914
		Northbound Right	F	151.5	1.261
		Westbound Left	C	19.4	0.500
			12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	F	481.7	
		Northbound Left	F	894.2	2.861
		Northbound Right	F	114.4	1.144
		Westbound Left	A	8.6	0.031
			5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	 Unsignalized	Northbound Approach	C	19.8	
		Northbound Left	D	28.7	0.107
		Northbound Right	B	12.5	0.044
		Westbound Left	B	10.7	0.179

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service , ^b Average Delay (sec/vehicle) , ^c Volume-to-Capacity Ratio

TABLE 4g
2027 INTERSECTION CAPACITY ANALYSIS RESULTS -
PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE & SANCTUARY EXPANSION
TOPSIDE ROAD AT SECONDARY DRIVEWAY

INTERSECTION	TRAFFIC CONTROL	APPROACH/ MOVEMENT	LOS ^a	DELAY ^b (seconds)	v/c ^c
			8:45 - 9:45 AM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.5	0.028
		Southbound Approach	A	9.0	
		Southbound Left/Right	A	9.0	0.004
			10:30 - 11:30 AM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.5	0.030
		Southbound Approach	B	10.8	
		Southbound Left/Right	B	10.8	0.287
			12:15 - 1:15 PM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.3	0.001
		Southbound Approach	B	10.7	
		Southbound Left/Right	B	10.7	0.338
			5:15 - 6:15 PM		
Topside Road (EB & WB) at Secondary Driveway (SB)	 Unsignalized	Eastbound Left	A	7.4	0.010
		Southbound Approach	A	8.9	
		Southbound Left/Right	A	8.9	0.013

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

^a Level of Service , ^b Average Delay (sec/vehicle) , ^c Volume-to-Capacity Ratio

▪ **POTENTIAL TRANSPORTATION SAFETY ISSUES:**

The study area was investigated for potential existing and future safety issues when the Church is expanded. These transportation features are discussed in the following pages.

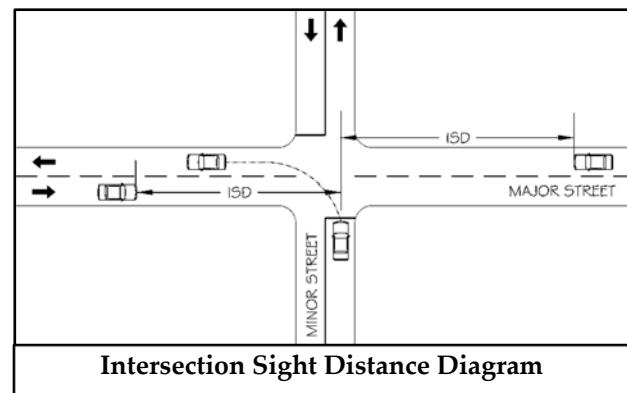
○ **EVALUATION OF SIGHT DISTANCE**

For intersections, sight distance evaluations have two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD).

Methodology:

SSD is the distance required for a motorist on a major street to perceive and react and for the vehicle to come to a complete stop before colliding with an object on the road. For evaluating intersections, this object would be another vehicle entering the intersection from a minor street. SSD can be considered the minimum visibility distance standard for evaluating the safety of an intersection.

ISD is the required visibility distance standard for evaluating the safety of an intersection. ISD is based on the time required to perceive, react, and complete the desired traffic maneuver once a motorist on a minor street decides to perform a traffic maneuver. Three traffic maneuvers are available for vehicles stopped on a minor street



at a 4-way intersection: (1) left-turn, (2) right-turn, (3) or a crossing maneuver across the major street. For turns from the minor street, ISD is needed to allow a stopped motorist to turn onto a major street without being overtaken by an approaching vehicle. The most critical ISD is for left turns from the minor street. The ISD for this maneuver includes the time to turn left and clear half of the intersection without conflicting with the oncoming traffic from the left and accelerating to the road's operating speed without causing the approaching vehicles from the right to reduce their speed substantially.

With a posted speed limit of 50-mph on W. Governor John Sevier Highway at the existing Church Driveway, the ISD is 590 feet calculated based on AASHTO's (American Association of State

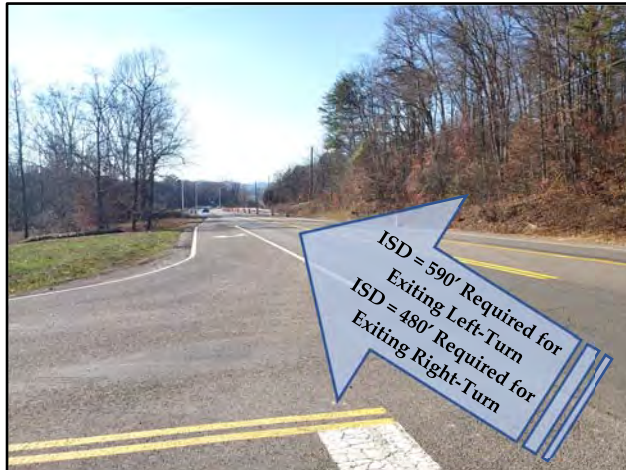
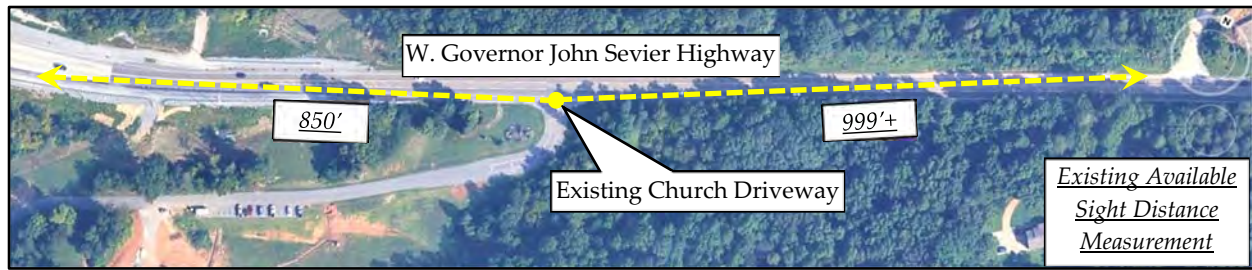
Highway Transportation Officials) and TDOT's guidance. This distance is required for a motorist to safely make a left turn to exit the Church Driveway at W. Governor John Sevier Highway. The ISD for exiting right turns is 480 feet.

Visual observations of the sight distances at the existing Church Driveway at W. Governor John Sevier Highway were undertaken as a safety review. Using a Nikon Laser Rangefinder at the existing Church Driveway, the available sight distance was visually estimated to be 850 feet to the southwest and greater than 999 feet (limit of the laser rangefinder) to the northeast on W. Governor John Sevier Highway. Based on visual observation, the available sight distance from the existing Church Driveway is more than adequate for exiting motorists.

Topside Road is posted with a speed limit of 30-mph and is in Knox County. With a posted speed limit of 30-mph on Topside Road at the proposed Secondary Entrance, the ISD is calculated to be 300 feet for exiting left and right turns based on Knox County's policy of requiring 10 feet of sight distance per 1-mph of speed.

At the proposed Secondary Entrance on Topside Road, a BHN&P land surveyor measured the available sight distance. The sight distance was measured to be 319.1 feet to the northeast and 345.4 feet to the southwest. Thus, according to Knox County standards, the available sight distance will be adequate for exiting left-turning vehicles. The sight distance is reduced to the northeast due to the vertical curvature of Topside Road. Furthermore, the sight distance observation at this location required the land surveyor to make measurements through existing vegetation on the northeast side of the narrow sliver of the Church property, which will require removal for construction.

Images of the sight distances at the existing and proposed Church entrance locations are labeled below with the required ISD, rangefinder-measured sight distances at the existing Church Driveway, and the land surveyor-measured sight distances at the proposed Secondary Entrance location on Topside Road.



View of Sight Distance on W. Governor John Sevier Highway at the Existing Church Driveway (Looking Southwest)



View of Sight Distance on W. Governor John Sevier Highway at the Existing Church Driveway (Looking Northeast)



View of Sight Distance on Topside Road at the Proposed Secondary Entrance Location (Looking Northeast)



View of Sight Distance on Topside Road at the Proposed Secondary Entrance Location (Looking Southwest)

○ **EVALUATION OF TURN LANE THRESHOLDS**

The need for separate entering turn lanes was evaluated in the projected 2027 conditions for the Secondary Entrance at Topside Road. This evaluation was not conducted for the existing Church Driveway at W. Governor John Sevier Highway since separate entering turn lanes are already provided.

The criteria used for these turn lane evaluations were based on Knox County's "Access Control and Driveway Design Policy". This design policy relates vehicle volume thresholds based on prevailing speeds for two-lane and four-lane roadways. The location of the proposed Secondary Entrance on Topside Road is within a 30-mph speed zone; thus, it was evaluated based on this speed.

According to Knox County's guidelines with a posted speed limit of 30-mph, separate entering left and right-turn lanes on Topside Road at the proposed Secondary Entrance are not warranted based on the projected peak period 2027 traffic volumes. The worksheets for these evaluations are provided in Appendix E and were conducted for each of the four identified Sunday peak periods.

○ **PROJECTED VEHICLE QUEUES**

The Synchro software also calculated the projected 2024 and 2027 peak period vehicle queues at the studied intersections. The 95th percentile vehicle queue is the recognized measurement in the transportation engineering profession as the design standard used when considering vehicle queue lengths. A 95th percentile vehicle queue length means 95% certainty that the vehicle queue will not extend beyond that point. The 95th percentile vehicle queue lengths at the intersections are shown in Tables 5a – 5c for the projected 2024 and 2027 conditions, respectively. The vehicle queues are shown in the capacity analysis worksheets provided in Appendix D, and the queue lengths are reported in the following tables as number of vehicles and feet (assuming 25 feet/vehicle). It should be noted that the Synchro software does not include the possibility of vehicle queue lane blocking, which will likely result in longer queues than are reported in the following tables.

Table 5a shows that the projected 95th percentile queues in 2024 with the proposed Secondary Entrance will be adequately contained in the storage lanes at the existing Church Driveway at W. Governor John Sevier Highway during the four identified Sunday peak periods. The northbound

right-turn lane vehicle queues will be fully contained, especially since the lane will be expanded in 2024 to 345 feet. The vehicle queues at the intersection of Topside Road at the Secondary Entrance will be minimal in 2024.

Table 5b shows that the projected 95th percentile queues in 2027 with the proposed Secondary Entrance without the sanctuary expansion will be adequately contained in the storage lanes at the existing Church Driveway at W. Governor John Sevier Highway during the four identified Sunday peak periods. If the sanctuary expansion is not completed, the vehicle queues at the intersection of Topside Road at the Secondary Entrance will also be minimal in 2027.

Table 5c shows that the projected 95th percentile queues for 2027, with the proposed Secondary Entrance and the sanctuary expansion, will be excessive at the Church Driveway at W. Governor John Sevier Highway intersection for the exiting northbound approach during two of the four identified Sunday peak periods. The peak periods with excessive queue lengths and exceeding the provided storage will be 10:30 – 11:30 am and 12:15 – 1:15 pm. During the 10:30 – 11:30 am period, the queue for northbound exiting left turns will be 1,027.5 feet, and the exiting right turns will exceed the provided storage of 345 feet by 405 feet. During the 12:15 – 1:15 pm period, the queue for northbound exiting left turns will be 1,110 feet, and the exiting right turns were calculated with a vehicle queue of 485 feet. However, due to the excessive northbound left-turn queue during this time period, the northbound right-turn lane will be "starved" due to vehicle blocking by left-turning motorists. In this scenario, the vehicle queues at the intersection of Topside Road at the Secondary Entrance are projected to be minimal in 2027.

TABLE 5a
VEHICLE QUEUE SUMMARY -
2024 PROJECTED PEAK HOUR TRAFFIC WITH THE SECONDARY ENTRANCE ONLY

INTERSECTION	APPROACH/ MOVEMENT	SYNCHRO 95th PERCENTILE QUEUE LENGTH (# of vehicles / ft)	AVAILABLE STORAGE (ft)	ADEQUATE
		8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.3 / 7.5	TWLTL	✓
	Northbound Left	0 / 0	n/a	✓
	Northbound Right	-	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0 / 0	n/a	✓
		10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.3 / 7.5	TWLTL	✓
	Northbound Left	2.4 / 60	n/a	✓
	Northbound Right	1.7 / 42.5	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0.2 / 5	n/a	✓
		12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0 / 0	TWLTL	✓
	Northbound Left	4.7 / 117.5	n/a	✓
	Northbound Right	1.4 / 35	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0.3 / 7.5	n/a	✓
		5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.1 / 2.5	TWLTL	✓
	Northbound Left	0.1 / 2.5	n/a	✓
	Northbound Right	0 / 0	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0 / 0	n/a	✓

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

*Includes additional length provided due to lane extension constructed in 2024

TABLE 5b
VEHICLE QUEUE SUMMARY -
2027 PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE ONLY

INTERSECTION	APPROACH/ MOVEMENT	SYNCHRO 95th PERCENTILE QUEUE LENGTH (ft) (# of vehicles / ft)	AVAILABLE STORAGE (ft)	ADEQUATE
		8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.3 / 7.5	TWLTL	✓
	Northbound Left	0 / 0	n/a	✓
	Northbound Right	-	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0 / 0	n/a	✓
		10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.3 / 7.5	TWLTL	✓
	Northbound Left	2.6 / 65	n/a	✓
	Northbound Right	1.7 / 42.5	345*	a
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0.3 / 7.5	n/a	✓
		12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0 / 0	TWLTL	✓
	Northbound Left	5.2 / 130	n/a	✓
	Northbound Right	1.5 / 37.5	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0.3 / 7.5	n/a	✓
		5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.1 / 2.5	TWLTL	✓
	Northbound Left	0.1 / 2.5	n/a	✓
	Northbound Right	0 / 0	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0 / 0	n/a	✓

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

*Includes additional length provided due to lane extension constructed in 2024

TABLE 5c
VEHICLE QUEUE SUMMARY -
2027 PROJECTED TRAFFIC CONDITIONS WITH THE SECONDARY ENTRANCE & SANCTUARY EXPANSION

INTERSECTION	APPROACH/ MOVEMENT	SYNCHRO 95th PERCENTILE QUEUE LENGTH (ft) (# of vehicles / ft)	AVAILABLE STORAGE (ft)	ADEQUATE
		8:45 - 9:45 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	3.7 / 92.5	TWLTL	✓
	Northbound Left	0.4 / 10	n/a	✓
	Northbound Right	-	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0.1 / 2.5	n/a	✓
	Southbound Left/Right	0 / 0	n/a	✓
		10:30 - 11:30 AM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	2.8 / 70	TWLTL	✓
	Northbound Left	41.1 / 1027.5	n/a	✓
	Northbound Right	30 / 750	345*	NO
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0.1 / 2.5	n/a	✓
	Southbound Left/Right	1.2 / 30	n/a	✓
		12:15 - 1:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.1 / 2.5	TWLTL	✓
	Northbound Left	44.4 / 1110	n/a	✓
	Northbound Right	19.4 / 485	345*	NO
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	1.5 / 37.5	n/a	✓
		5:15 - 6:15 PM		
W. Governor John Sevier Highway (EB & WB) at Church Driveway (NB)	Eastbound Right	-	100	✓
	Westbound Left	0.7 / 17.5	TWLTL	✓
	Northbound Left	0.4 / 10	n/a	✓
	Northbound Right	0.1 / 2.5	345*	✓
Topside Road (EB & WB) at Secondary Driveway (SB)	Eastbound Left	0 / 0	n/a	✓
	Southbound Left/Right	0 / 0	n/a	✓

Note: All analyses were calculated in Synchro 11 software and reported using HCM 6th Edition intersection methodology

*Includes additional length provided due to lane extension constructed in 2024

CONCLUSIONS & RECOMMENDATIONS

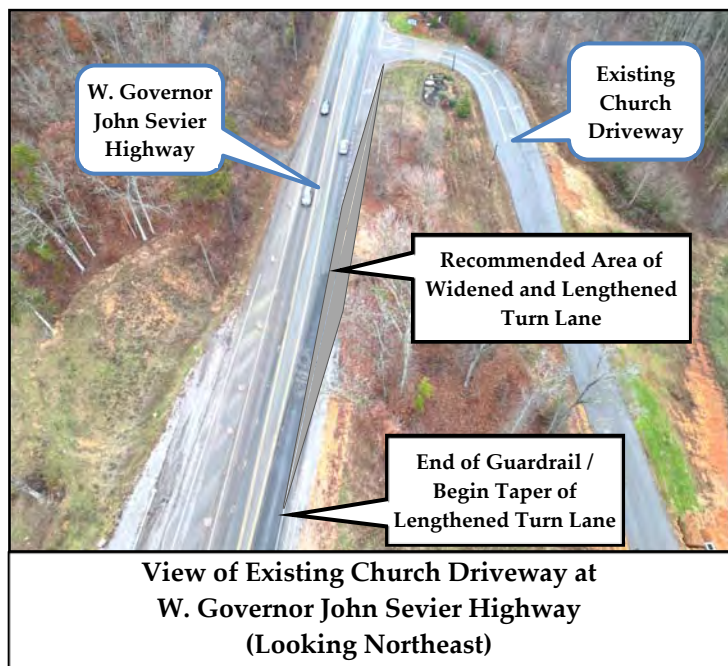
The following is an overview of recommendations to minimize the transportation impacts of the Calvary Knoxville proposed expansion on the adjacent transportation system while attempting to achieve an acceptable traffic flow and safety level.



W. Governor John Sevier Highway at the Existing Church Entrance: When the Secondary Entrance to Topside Road for Calvary Knoxville is constructed and opened by 2024, the Sunday peak period calculations for the intersection of W. Governor John Sevier Highway at the existing Church Entrance resulted in reasonable vehicle delays and queues. Providing a Secondary Entrance will reduce the existing northbound vehicle delays and queues currently being experienced by Church attendees. However, once the new sanctuary is constructed and open for worship services in 2027, the Sunday peak period projected level of service calculations for this intersection resulted in very high vehicle delays and queues for exiting vehicles even with a Secondary Entrance.

1a) A Stop Sign (R1-1) is not currently posted for the Church Driveway approach at W. Governor John Sevier Highway. It is recommended that a Stop Sign (R1-1) be installed for this approach at the existing white stop bar as soon as possible.

1b) It is recommended that the existing eastbound right-turn lane on W. Governor John Sevier Highway at the Church Driveway be slightly widened and lengthened to accommodate the increased attendance when the new Church sanctuary is constructed. This improvement should be made before the opening of the new sanctuary in 2027. This lane should be widened



to 11 feet from its current width of 9.5 feet. It is recommended that the storage length be increased to 210 feet and the existing lane taper of 15:1 be maintained. With a lane

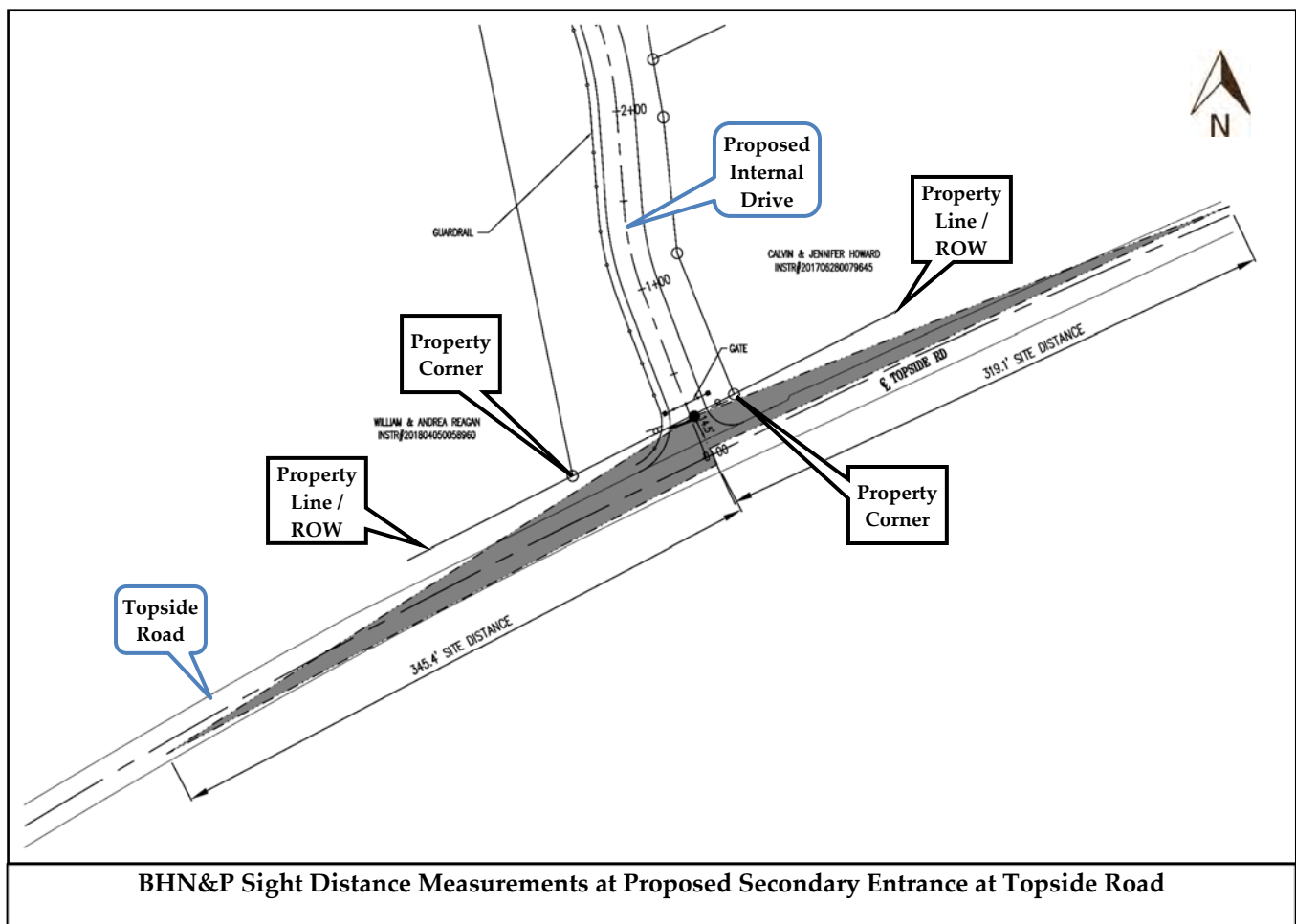
width of 11 feet, the taper at 15:1 would be 165 feet. Thus, the total length of the taper and storage will be 375 feet, which will fit within the constraint of the existing slope and guardrail on the south side of W. Governor John Sevier Highway. The new lane taper and lane extension should begin at the end of this existing guardrail. The existing width of the paved shoulder on W. Governor John Sevier Highway (~ 3 feet) should also be maintained along the length of the proposed lane extension.

- 1c) Due to the projected failing conditions on Sunday mornings in 2027 when the new sanctuary is open for worship services, it is recommended that the Church employ law enforcement officers to direct traffic at the Church Driveway and W. Governor John Sevier Highway. As discussed previously, a site visit was made during the Church's morning services, and the Church had a Knoxville Police Department officer present on W. Governor John Sevier Highway at the Church's existing driveway. The results of the police officer's presence were substantially positive and should be continued in the future. A law enforcement presence will be imperative to ensure safer operations during Sunday morning services with increased traffic at the intersection. Based on the observations and calculations, at a minimum, it is recommended that law enforcement be present from 10:45 - 11:45 am and 12:30 - 1:00 pm on Sunday mornings to provide orderly and safer operations at the intersection, particularly for exiting vehicles. It should be noted that this recommendation must be coordinated with the Knoxville Police Department, and their services cannot be guaranteed. If a law enforcement presence is not made available, the exiting Church vehicle delays and queues can be expected to be very large and potentially result in additional exiting traffic using the Secondary Entrance at Topside Road.
- 1d) The Church should consider installing a single overhead roadway light to delineate the existing Church Driveway at the highway for travel at night or in low-light conditions. This lighting would be ideally placed adjacent to the Church Driveway and off W. Governor John Sevier Highway and would illuminate the intersection.
- 1e) It is possible that more or fewer motorists will use the Secondary Entrance than estimated in this report, which would directly impact the existing Church Driveway entrance operations. After construction has been completed in 2024 and 2027, follow-up studies may be necessary if the projected conditions presented in this study do not materialize.



Topside Road at the Proposed Secondary Entrance: This intersection's 2024 and 2027 projected level of service calculations resulted in low vehicle delays and queues.

- 2a) A Stop Sign (R1-1) with a 24" white stop bar is recommended to be installed for the Secondary Entrance approach at Topside Road. The stop bar should be applied a minimum of 4 feet away from the edge of Topside Road, placed at the desired stopping point that maximizes the sight distance.
- 2b) Intersection sight distance at the Secondary Entrance at Topside Road must not be impacted by existing vegetation, future landscaping, or signage. Any vegetation in the right-of-way that restricts sight distance at the Proposed Secondary Entrance should be removed.



Based on a posted speed limit of 30-mph on Topside Road, the required intersection sight distance is 300 feet for exiting left and right-turning vehicles. The available sight

distances from the Secondary Entrance on Topside Road will be adequate based on the measurements conducted by BHN&P's land surveyor, as shown in the image.

- 2c) Due to the relative narrowness of Topside Road (pavement width ~ 18.5 feet), it is recommended that the driveway radius on the southwest corner for the Secondary Entrance at Topside Road be a minimum of 30 feet. The current radius in the BHN&P plans shows a radius of 25 feet. A larger radius will allow right-turning exiting vehicles from the Secondary Entrance to minimize encroachments onto the opposite lane on Topside Road.

The Secondary Entrance is shown in BHN&P's plans 60 feet from the existing driveway at the 3429 Topside Road residence. The driveway edge clearance is 16 feet, greater than the minimum edge clearance of 5 feet shown in Knox County's regulations.

- 2d) The new internal driveway for the Secondary Entrance will be a private drive, and the Church should consider a lockable gate that would prevent any unnecessary traffic from cutting through the campus. If pursued, the details and plans must be coordinated with the Knoxville Fire Department if a gated entrance is provided. If a gate is provided, the installation should comply with the Manual of Uniform Traffic Control Devices (MUTCD) and meet retro-reflectivity requirements listed in Section 2B.76 of the MUTCD. The gate should also include a sensor allowing traffic to exit to Topside Road without a key. A sensor would prevent motorists from traveling south towards Topside Road, finding the gate closed, and having to turn around.

- 2e) The Church should post two signs on the new internal driveway facing entering traffic from Topside Road at the Secondary Entrance. Since this driveway should only be used for Church activities, a "No Thru Traffic" Sign (R5-12) and a "No Trucks" Sign (R5-2) are recommended to be installed on a single post. Likewise, a "No Thru Traffic" Sign (R5-12) should be installed off W. Governor John Sevier Highway at the existing Church Driveway. This sign at the existing Church Driveway should be installed inside the property facing W. Governor John Sevier Highway.



- 2f) The Church should consider installing a single overhead roadway light to delineate the proposed Secondary Driveway at Topside Road for travel at night or in low-light

conditions while minimizing its effect on the adjacent houses. This lighting would be ideally placed adjacent to the proposed Secondary Driveway and off Topside Road and would illuminate the intersection.

- 2g) It is possible that more or fewer motorists will use the Secondary Entrance than estimated in this report, which would directly impact the intersection operations. After construction has been completed in 2024 and 2027, follow-up studies may be necessary if the projected conditions presented in this study do not materialize.

APPENDIX A

HISTORICAL TRAFFIC COUNT DATA

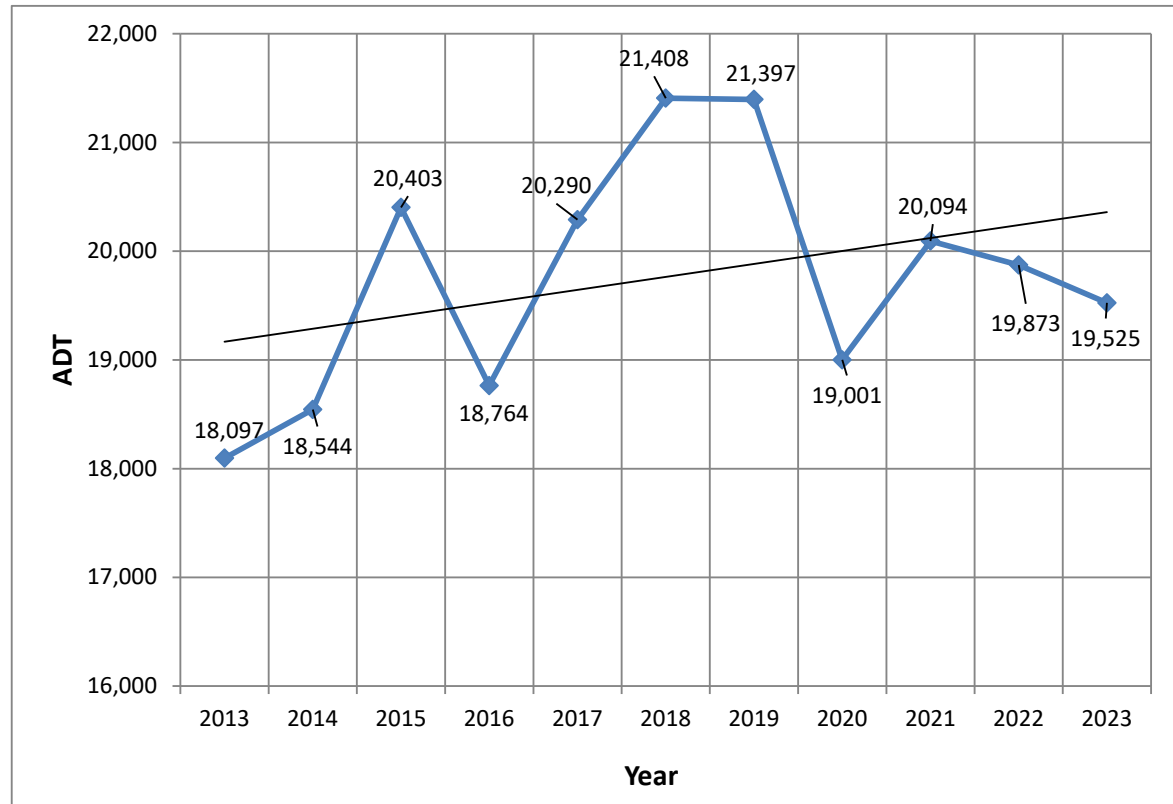
Historical Traffic Counts

Organization: TDOT

Station ID #: 470000289

Location: West Governor John Sevier Highway, west of Calvary Knoxville Driveway

YEAR	ADT	Trendline ↓
2013	18,097	
2014	18,544	
2015	20,403	
2016	18,764	
2017	20,290	
2018	21,408	
2019	21,397	
2020	19,001	
2021	20,094	
2022	19,873	
2023	19,525	



2013 - 2023 Growth Rate = 7.9%

Average Annual Growth Rate = 0.8%

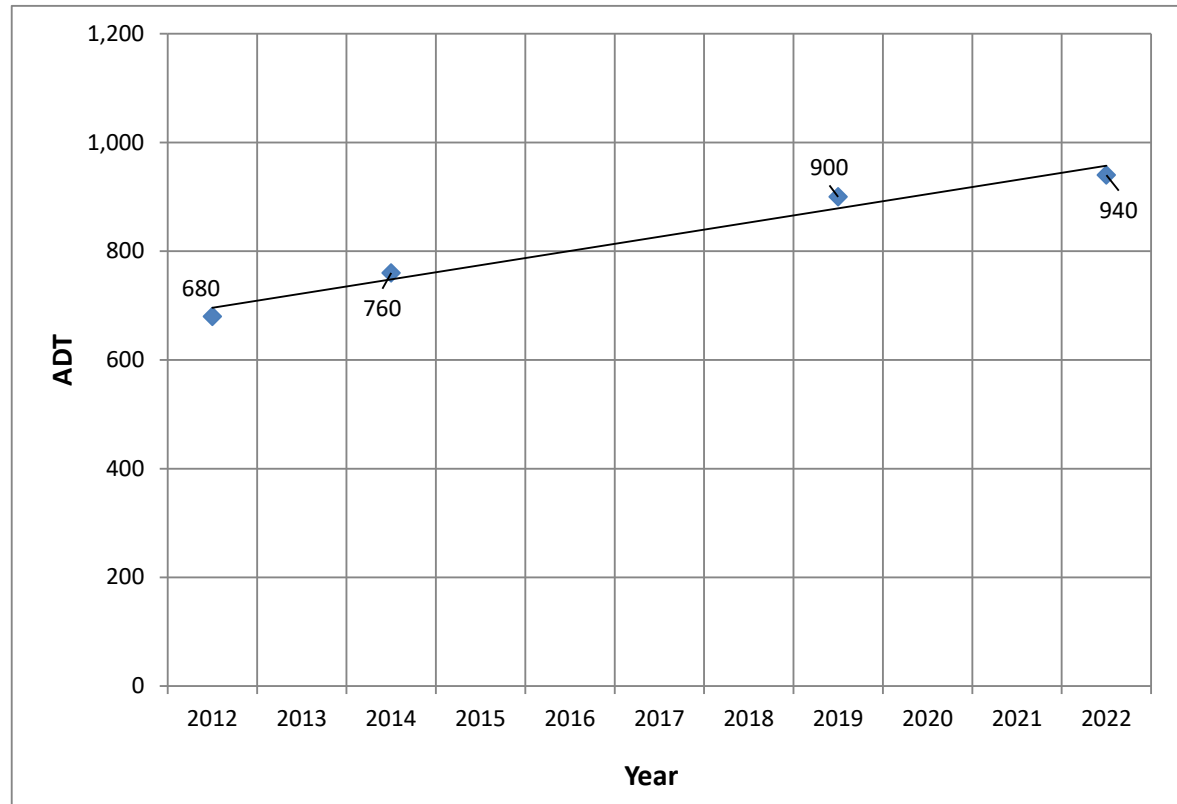
Historical Traffic Counts

Organization: Knox TPO

Station ID #: 093M050

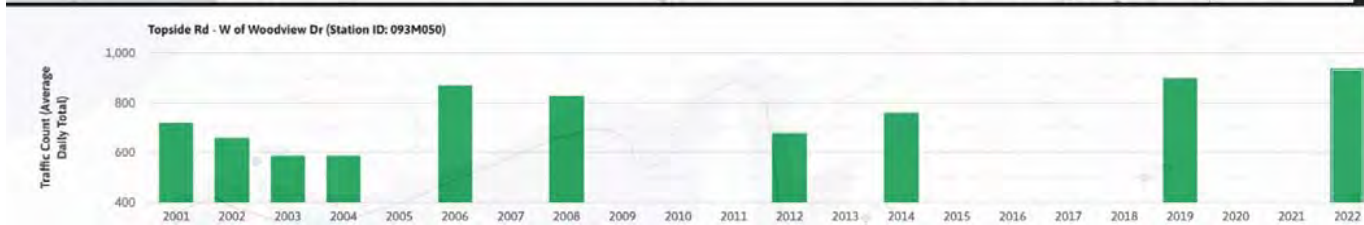
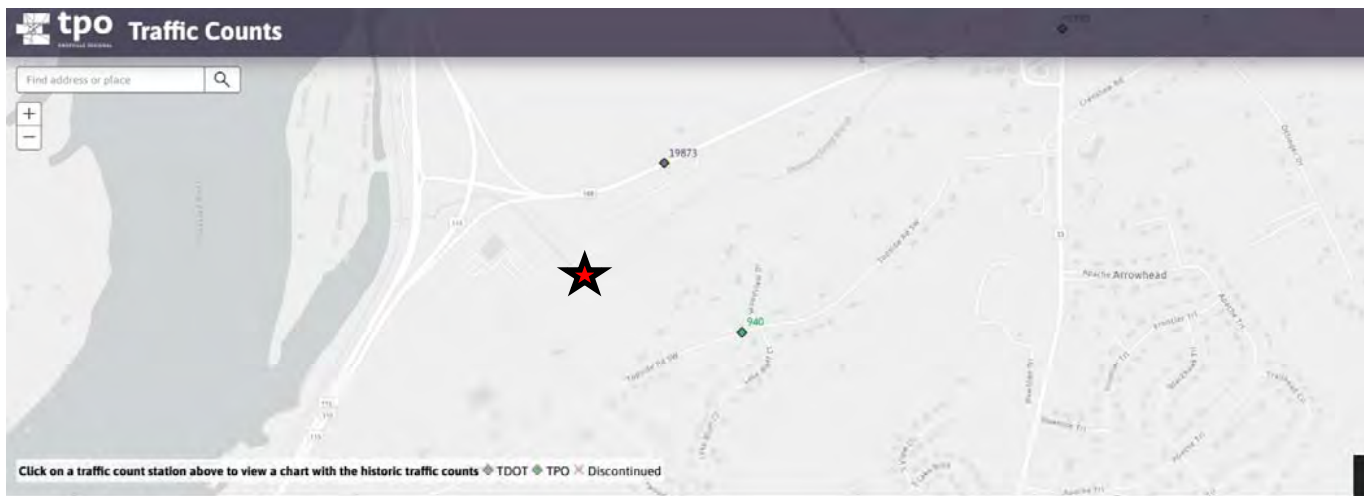
Location: Topside Road, west of Lake Bluff Court / Woodview Drive

YEAR	ADT	
2012	680	Trendline ↓
2013		
2014	760	
2015		
2016		
2017		
2018		
2019	900	
2020		
2021		
2022	940	



2012 - 2022 Growth Rate = 38.2%

Average Annual Growth Rate = 3.3%



APPENDIX B

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: W. Governor John Sevier Highway (EB and WB)

Minor Street: Calvary Knoxville Driveway (NB)

Traffic Control: Stop Conditions on Minor Street

12/10/2023 (Sunday)

Rain and Turning Colder

Conducted by: Ajax Engineering

	W. Governor John Sevier Highway		Calvary Knoxville Driveway		W. Governor John Sevier Highway			
TIME	WESTBOUND		NORTHBOUND		EASTBOUND		VEHICLE	PEAK
BEGIN	LT	THRU	LT	RT	THRU	RT	TOTAL	HOUR
7:00 AM	0	23	0	0	14	0	37	
7:15 AM	0	35	0	0	25	2	62	
7:30 AM	1	68	0	0	30	4	103	
7:45 AM	5	44	0	0	25	0	74	
8:00 AM	1	50	0	0	29	4	84	
8:15 AM	0	45	0	0	25	0	70	
8:30 AM	1	81	0	0	20	1	103	
8:45 AM	10	99	0	0	47	13	169	8:45 AM - 9:45 AM
9:00 AM	25	91	0	0	54	41	211	
9:15 AM	36	86	1	0	67	66	256	
9:30 AM	17	106	1	0	52	14	190	
9:45 AM	0	108	0	0	65	2	175	
10:00 AM	0	93	1	0	50	0	144	
10:15 AM	1	93	2	0	81	4	181	
10:30 AM	3	147	0	0	81	14	245	10:30 AM - 11:30 AM
10:45 AM	20	149	60	70	72	41	412	
11:00 AM	29	131	26	25	56	82	349	
11:15 AM	10	146	3	4	87	29	279	
11:30 AM	2	166	6	0	81	7	262	
11:45 AM	0	188	1	0	110	1	300	
12:00 PM	0	168	2	0	87	2	259	
12:15 PM	0	200	2	0	125	0	327	12:15 PM - 1:15 PM
12:30 PM	0	163	62	55	111	1	392	
12:45 PM	3	151	43	30	114	0	341	
1:00 PM	0	132	42	9	113	2	298	
1:15 PM	0	151	18	7	94	1	271	
1:30 PM	1	178	6	2	131	1	319	
1:45 PM	1	153	5	0	123	1	283	
TOTAL	166	3245	281	202	1969	333	6196	
5:00 PM	1	93	0	1	93	3	191	
5:15 PM	3	121	0	2	104	4	234	5:15 PM - 6:15 PM
5:30 PM	14	131	0	0	119	11	275	
5:45 PM	10	78	3	1	104	30	226	
6:00 PM	5	79	1	2	103	9	199	
6:15 PM	2	76	0	0	99	1	178	
6:30 PM	0	80	0	0	103	0	183	
6:45 PM	0	69	0	0	80	0	149	
7:00 PM	0	52	1	1	84	0	138	
7:15 PM	1	62	21	24	93	0	201	
7:30 PM	0	44	7	5	65	0	121	
7:45 PM	1	59	5	6	67	2	140	
8:00 PM	0	51	9	2	70	0	132	
8:15 PM	0	31	3	1	63	0	98	
8:30 PM	0	35	4	5	64	0	108	
8:45 PM	0	32	6	0	53	1	92	
TOTAL	37	1093	60	50	1364	61	2665	

2023 Peak Hour of Morning Services

8:45 AM - 9:45 AM

	W. Governor John Sevier Highway		Calvary Knoxville Driveway		W. Governor John Sevier Highway	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
8:45 AM	10	99	0	0	47	13
9:00 AM	25	91	0	0	54	41
9:15 AM	36	86	1	0	67	66
9:30 AM	17	106	1	0	52	14
TOTAL	88	382	2	0	220	134
PHF	0.61	0.90	0.50	-	0.82	0.51
Truck %	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%

2023 Peak Hour of Morning Services

10:30 AM - 11:30 AM

	W. Governor John Sevier Highway		Calvary Knoxville Driveway		W. Governor John Sevier Highway	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
10:30 AM	3	147	0	0	81	14
10:45 AM	20	149	60	70	72	41
11:00 AM	29	131	26	25	56	82
11:15 AM	10	146	3	4	87	29
TOTAL	62	573	89	99	296	166
PHF	0.53	0.96	0.37	0.35	0.85	0.51
Truck %	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%

2023 Peak Hour of Morning Services

12:15 PM - 1:15 PM

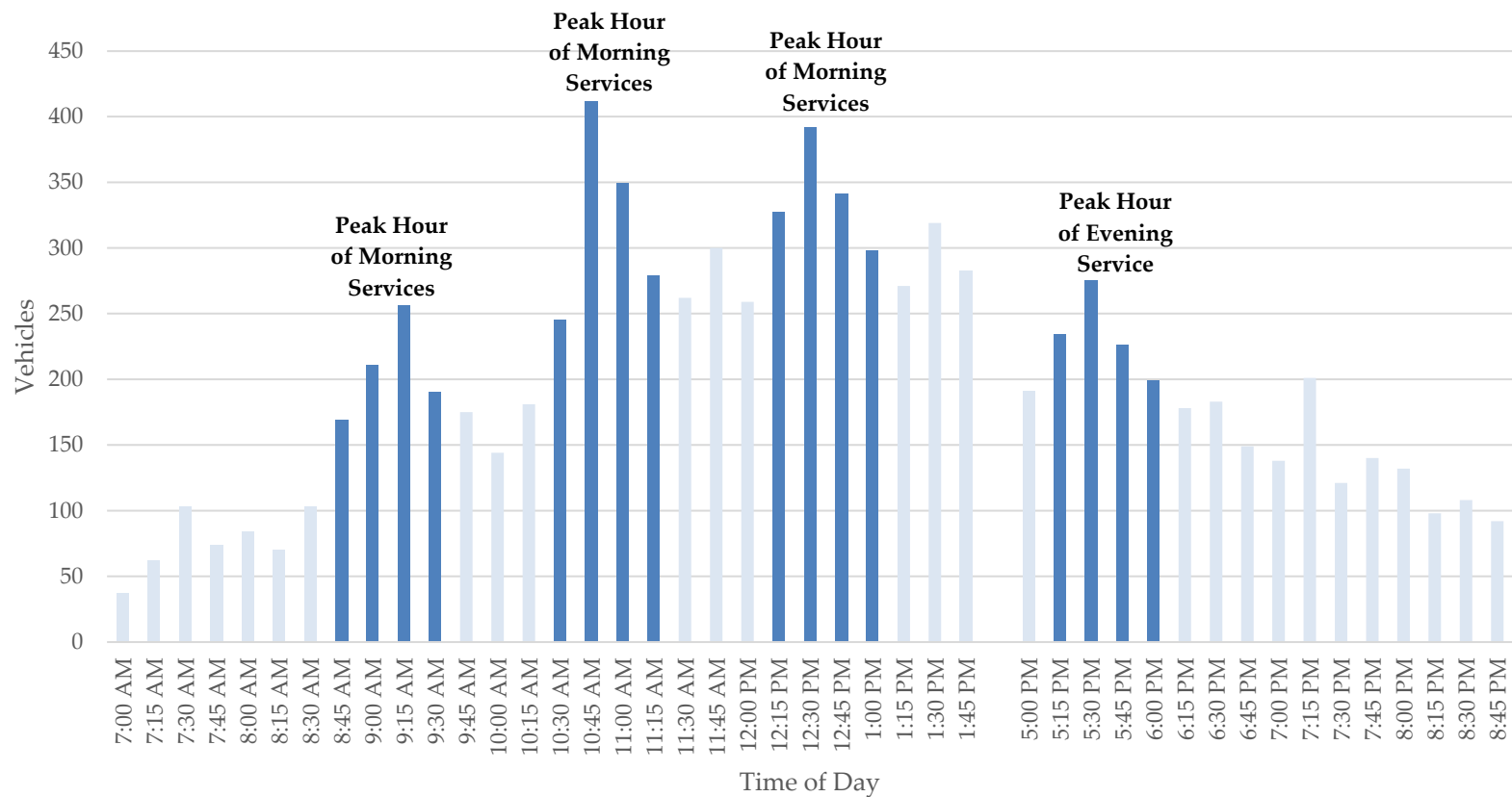
	W. Governor John Sevier Highway		Calvary Knoxville Driveway		W. Governor John Sevier Highway	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
12:15 PM	0	200	2	0	125	0
12:30 PM	0	163	62	55	111	1
12:45 PM	3	151	43	30	114	0
1:00 PM	0	132	42	9	113	2
TOTAL	3	646	149	94	463	3
PHF	0.25	0.81	0.60	0.43	0.93	0.38
Truck %	0.0%	0.8%	0.0%	0.0%	0.4%	0.0%

2023 Peak Hour of Evening Service

5:15 PM - 6:15 PM

	W. Governor John Sevier Highway		Calvary Knoxville Driveway		W. Governor John Sevier Highway	
TIME	WESTBOUND		NORTHBOUND		EASTBOUND	
BEGIN	LT	THRU	LT	RT	THRU	RT
5:15 PM	3	121	0	2	104	4
5:30 PM	14	131	0	0	119	11
5:45 PM	10	78	3	1	104	30
6:00 PM	5	79	1	2	103	9
TOTAL	32	409	4	5	430	54
PHF	0.57	0.78	0.33	0.63	0.90	0.45
Truck %	0.0%	0.2%	0.0%	0.0%	0.9%	0.0%

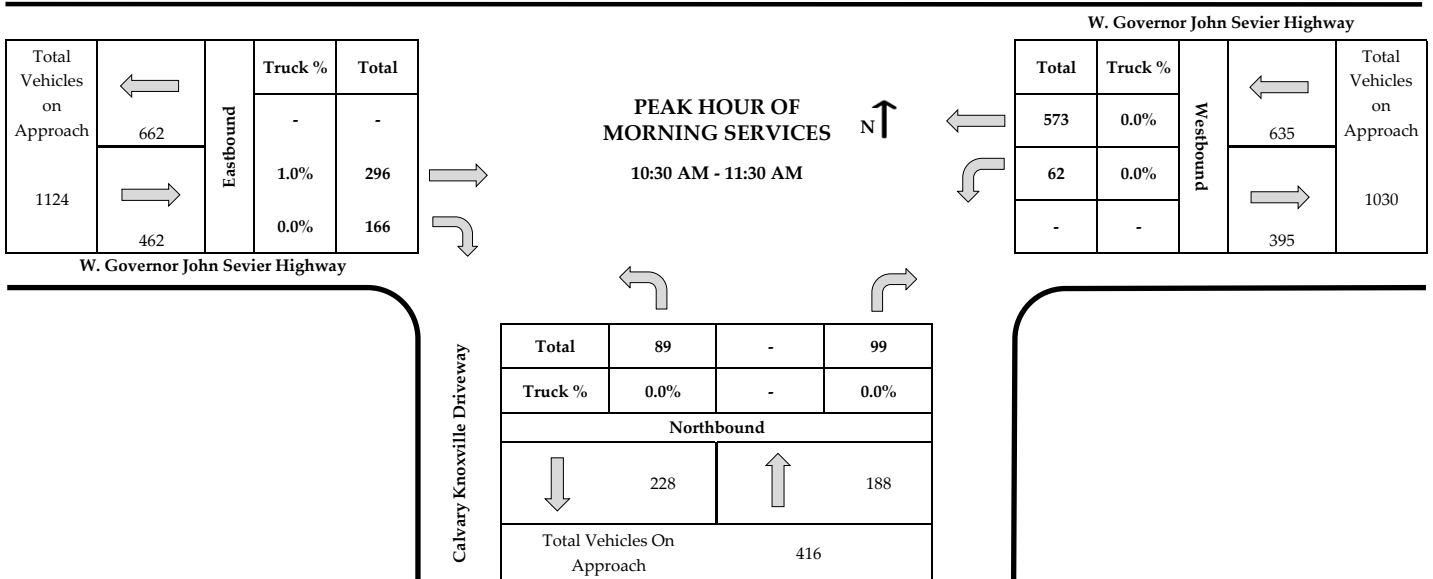
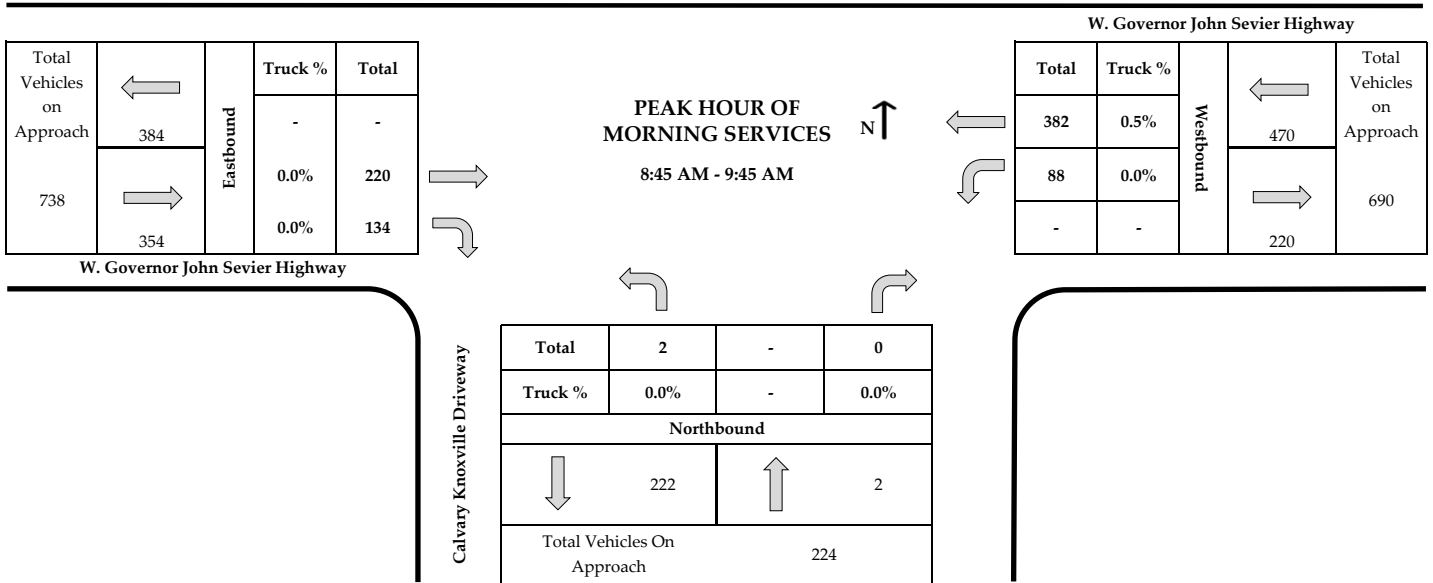
W. Governor John Sevier Highway at Calvary Knoxville Driveway
Intersection Traffic Count Totals
12/10/2023



PEAK HOUR DATA

Major Street: W. Governor John Sevier Highway (EB and WB)
 Minor Street: Calvary Knoxville Driveway (NB)
 Traffic Control: Stop Conditions on Minor Street

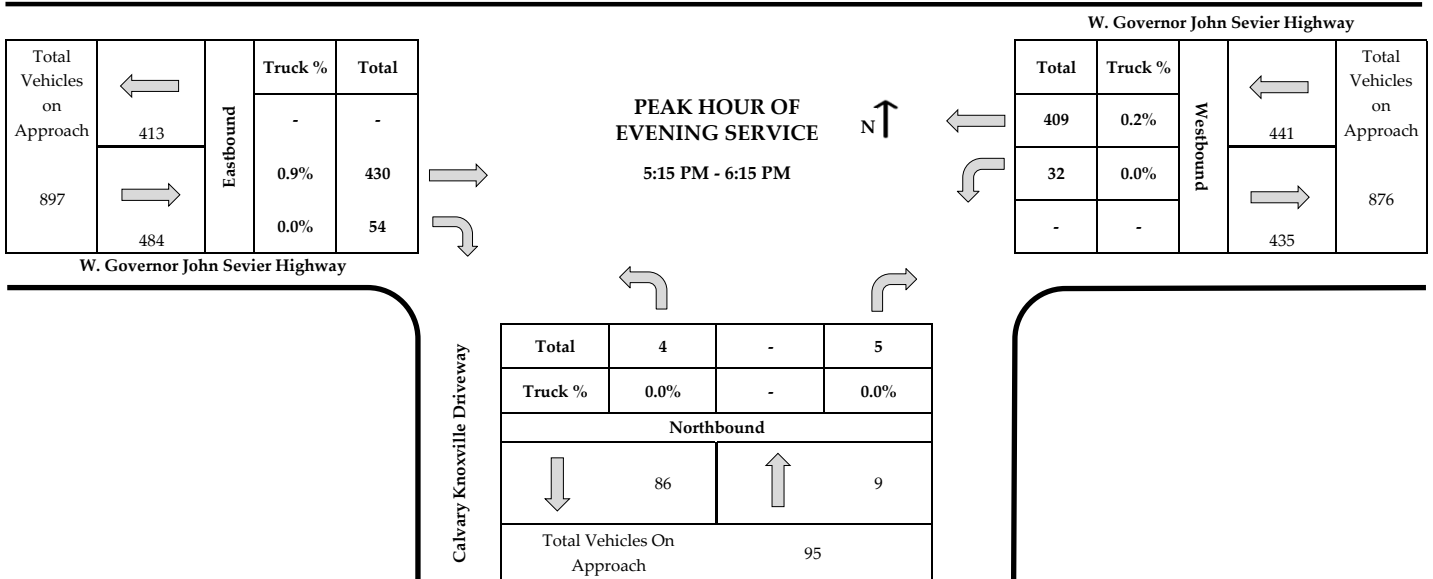
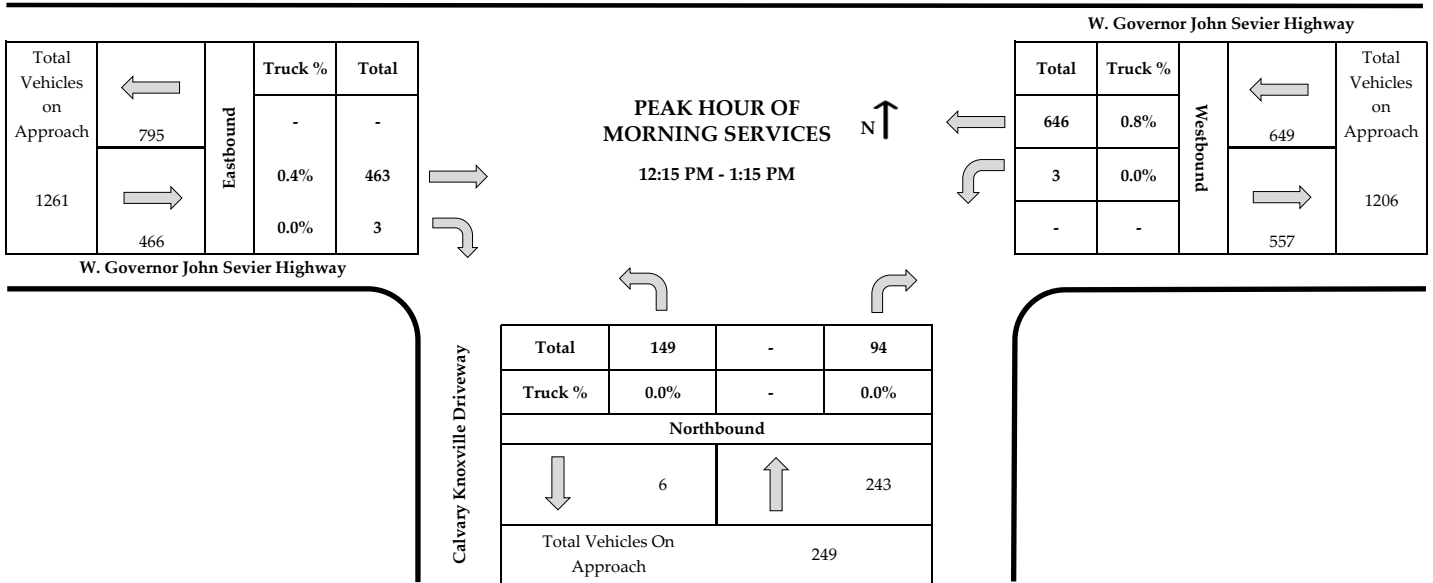
12/10/2023 (Sunday)
 Rain and Turning Colder
 Conducted by: Ajax Engineering



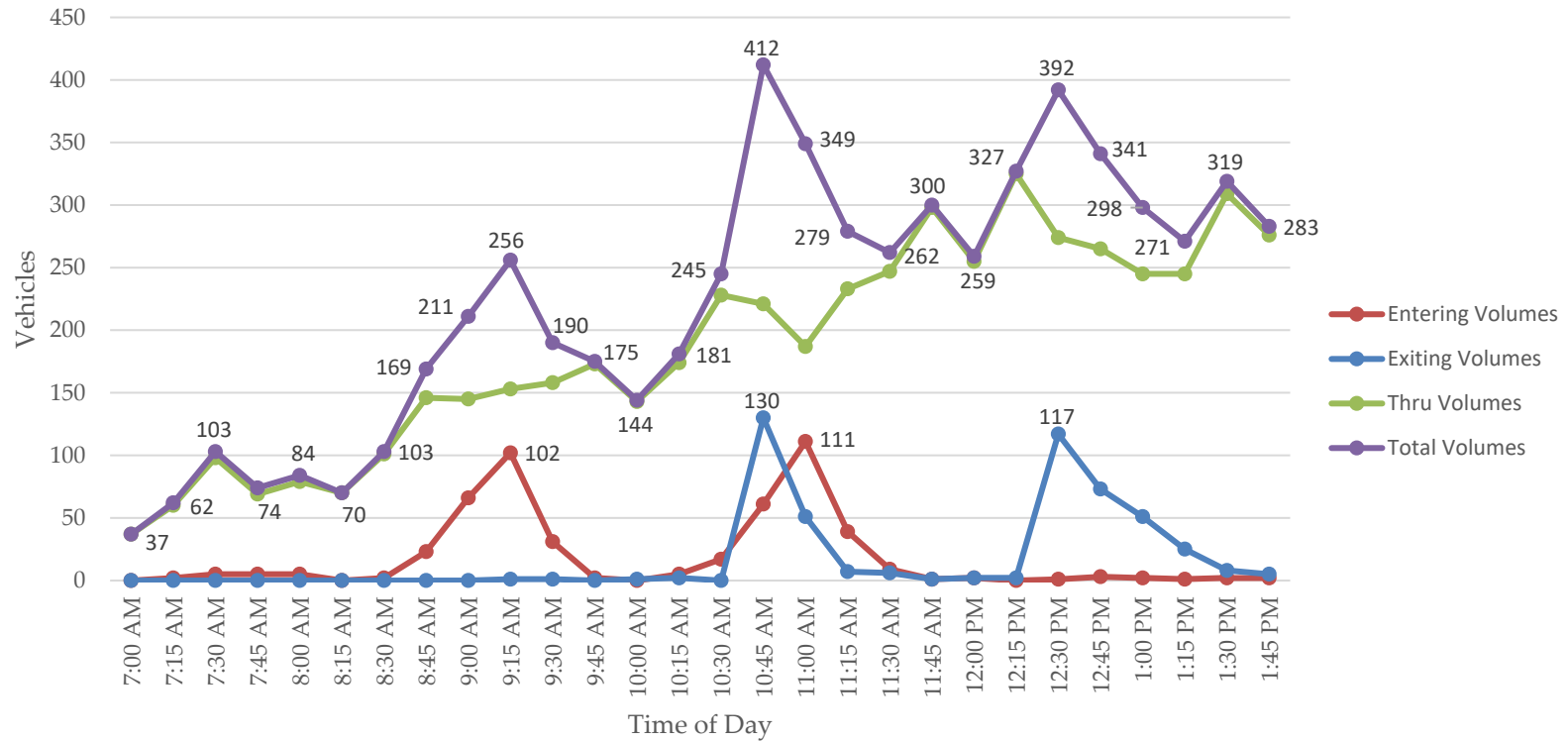
PEAK HOUR DATA

Major Street: W. Governor John Sevier Highway (EB and WB)
 Minor Street: Calvary Knoxville Driveway (NB)
 Traffic Control: Stop Conditions on Minor Street

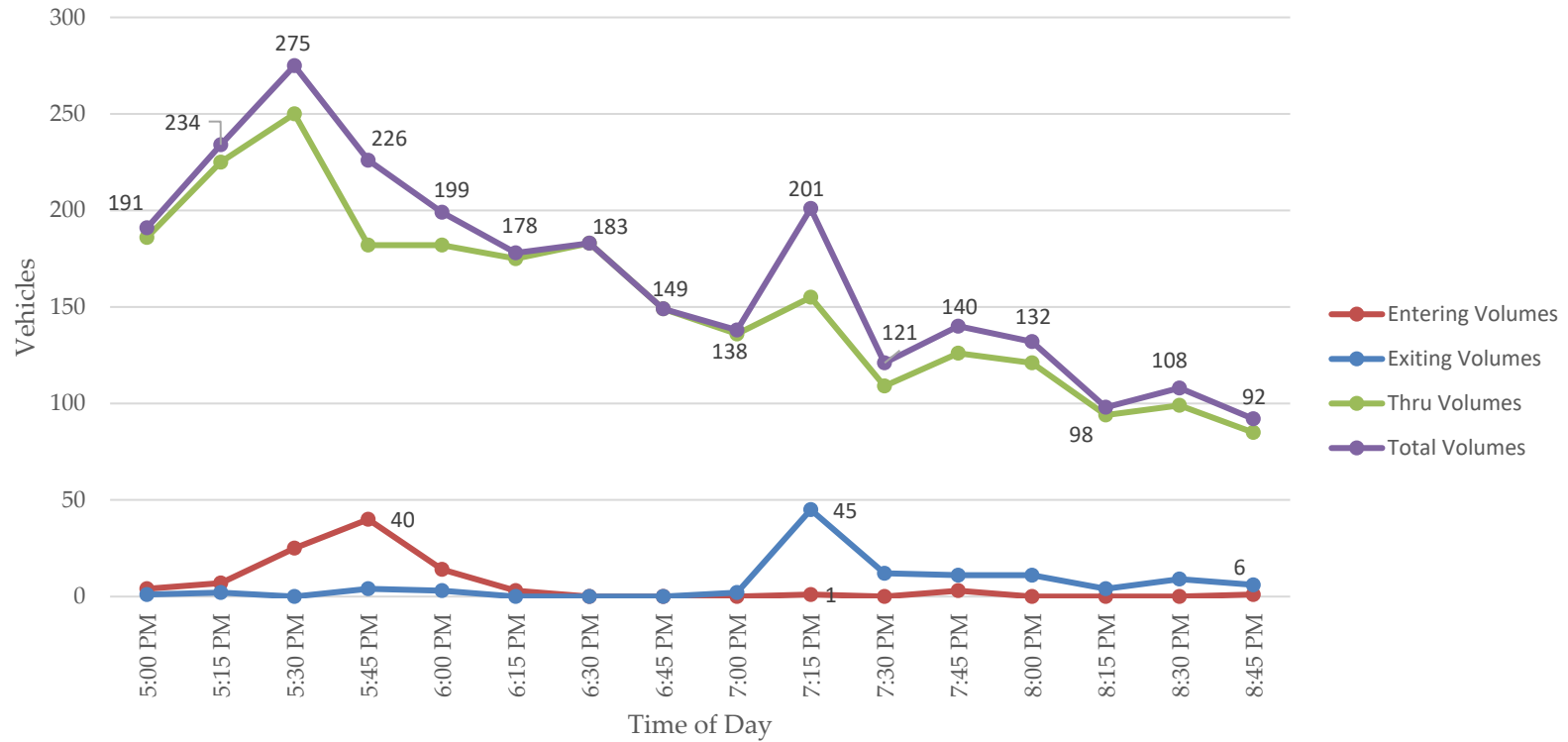
12/10/2023 (Sunday)
 Rain and Turning Colder
 Conducted by: Ajax Engineering



W. Governor John Sevier Highway at Calvary Knoxville Driveway
Entering Church Volumes, Exiting Church Volumes, Thru Volumes on
W. Governor John Sevier Highway, & Total Volumes at the Intersection
12/10/2023 (7:0)



W. Governor John Sevier Highway at Calvary Knoxville Driveway
Entering Church Volumes, Exiting Church Volumes, Thru Volumes on
W. Governor John Sevier Highway, & Total Volumes at the Intersection
12/10/2023 (5:0)



TRAFFIC COUNT DATA

Major Street: Topside Road (WB-EB)
 Minor Street: (near 3511 Topside Road)
 Traffic Control: n/a

12/10/2023 (Sunday)
 Rain and Turning Colder
 Conducted by: Ajax Engineering

	Topside Road	Topside Road		
TIME	WESTBOUND	EASTBOUND	VEHICLE	PEAK
BEGIN	THRU	THRU	TOTAL	HOUR
8:00 AM	1	0	1	
8:15 AM	1	1	2	
8:30 AM	2	0	2	
8:45 AM	2	2	4	8:45 AM - 9:45 AM
9:00 AM	1	3	4	
9:15 AM	6	3	9	
9:30 AM	3	3	6	
9:45 AM	3	4	7	
10:00 AM	4	6	10	
10:15 AM	4	4	8	
10:30 AM	5	5	10	10:30 AM - 11:30 AM
10:45 AM	9	7	16	
11:00 AM	11	4	15	
11:15 AM	4	4	8	
11:30 AM	1	4	5	
11:45 AM	0	6	6	
12:00 PM	8	4	12	
12:15 PM	11	7	18	12:15 PM - 1:15 PM
12:30 PM	14	11	25	
12:45 PM	6	10	16	
1:00 PM	6	9	15	
1:15 PM	6	11	17	
1:30 PM	7	10	17	
1:45 PM	4	4	8	
TOTAL	113	119	232	
5:00 PM	7	7	14	
5:15 PM	5	4	9	5:15 PM - 6:15 PM
5:30 PM	10	6	16	
5:45 PM	3	3	6	
6:00 PM	1	5	6	
6:15 PM	6	7	13	
6:30 PM	7	0	7	
6:45 PM	4	10	14	
TOTAL	43	42	85	

2023 Peak Hour of Morning Services**8:45 AM - 9:45 AM**

	Topside Road	Topside Road
TIME	WESTBOUND	EASTBOUND
BEGIN	THRU	THRU
8:45 AM	2	2
9:00 AM	1	3
9:15 AM	6	3
9:30 AM	3	3
TOTAL	12	11
PHF	0.50	0.92
Truck %	0.0%	0.0%

2023 Peak Hour of Morning Services**10:30 AM - 11:30 AM**

	Topside Road	Topside Road
TIME	WESTBOUND	EASTBOUND
BEGIN	THRU	THRU
10:30 AM	5	5
10:45 AM	9	7
11:00 AM	11	4
11:15 AM	4	4
TOTAL	29	20
PHF	0.66	0.71
Truck %	0.0%	0.0%

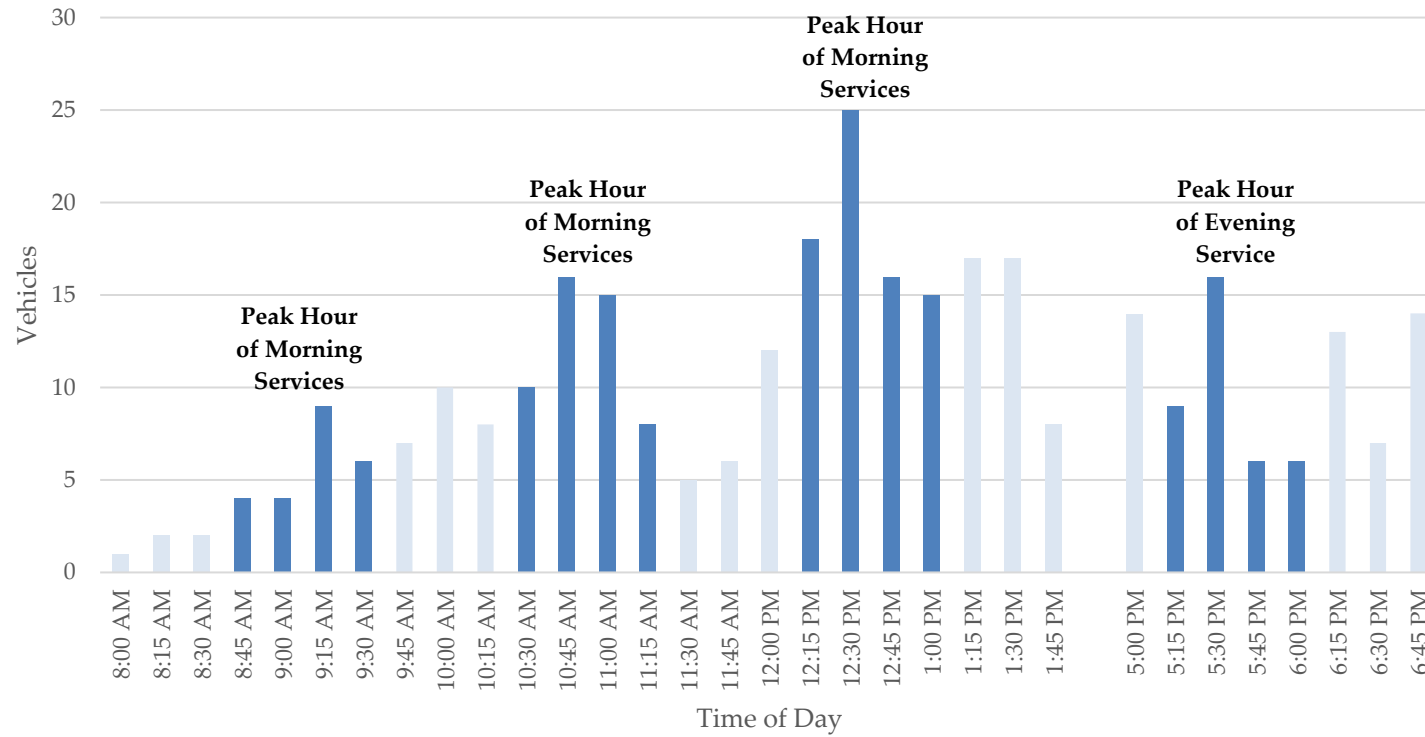
2023 Peak Hour of Morning Services**12:15 PM - 1:15 PM**

	Topside Road	Topside Road
TIME	WESTBOUND	EASTBOUND
BEGIN	THRU	THRU
12:15 PM	11	7
12:30 PM	14	11
12:45 PM	6	10
1:00 PM	6	9
TOTAL	37	37
PHF	0.66	0.84
Truck %	0.0%	0.0%

2023 Peak Hour of Evening Service**5:15 PM - 6:15 PM**

	Topside Road	Topside Road
TIME	WESTBOUND	EASTBOUND
BEGIN	THRU	THRU
5:15 PM	5	4
5:30 PM	10	6
5:45 PM	3	3
6:00 PM	1	5
TOTAL	19	18
PHF	0.48	0.75
Truck %	0.0%	0.0%

Topside Road (near 3511 Topside Road)
Traffic Count Totals
12/10/2023



APPENDIX C

TRIP GENERATION RATES

Land Use: 560

Church

Description

A church is a building in which public worship services are held. A church houses an assembly hall or sanctuary. It may also house meeting rooms, classrooms, and, occasionally, dining, catering, or event facilities. Synagogue (Land Use 561) and mosque (Land Use 562) are related uses.

Additional Data

Worship services are typically held on Sundays. Some of the surveyed churches offered day care or extended care programs during the week.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), California, Colorado, Florida, New Hampshire, New Jersey, New York, Oregon, Pennsylvania, Texas, and Virginia.

Source Numbers

169, 170, 423, 428, 436, 554, 571, 583, 629, 631, 704, 903, 904, 957, 971, 981, 1080

Church (560)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Sunday

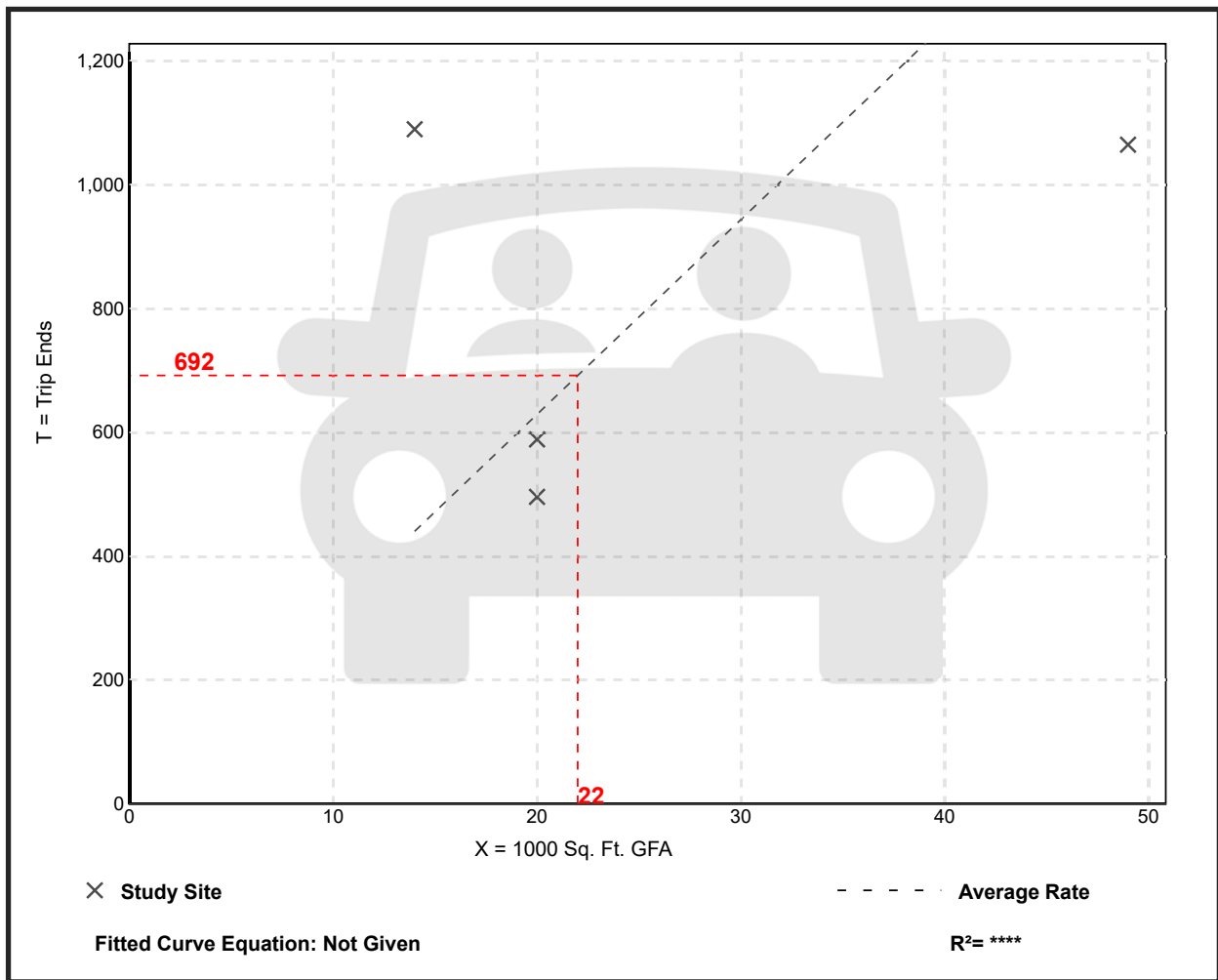
Setting/Location: General Urban/Suburban
Number of Studies: 4
Avg. 1000 Sq. Ft. GFA: 26
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
31.46	21.73 - 77.86	21.51

Data Plot and Equation

Caution – Small Sample Size



Church (560)

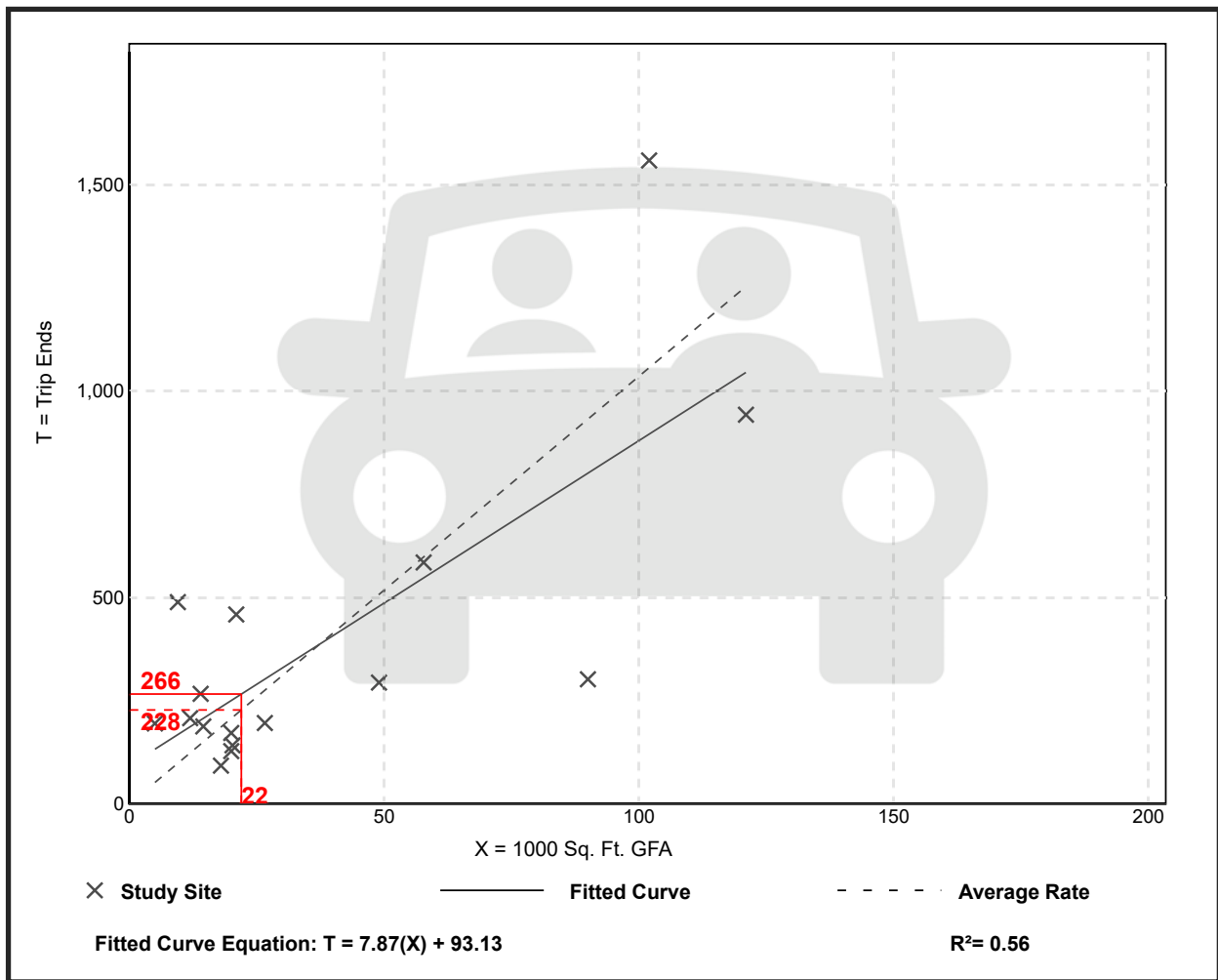
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Sunday, Peak Hour of Generator

Setting/Location: General Urban/Suburban
Number of Studies: 16
Avg. 1000 Sq. Ft. GFA: 38
Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
10.36	3.36 - 51.31	7.83

Data Plot and Equation



Church (560)

Vehicle Trip Ends vs: Seats
On a: Sunday

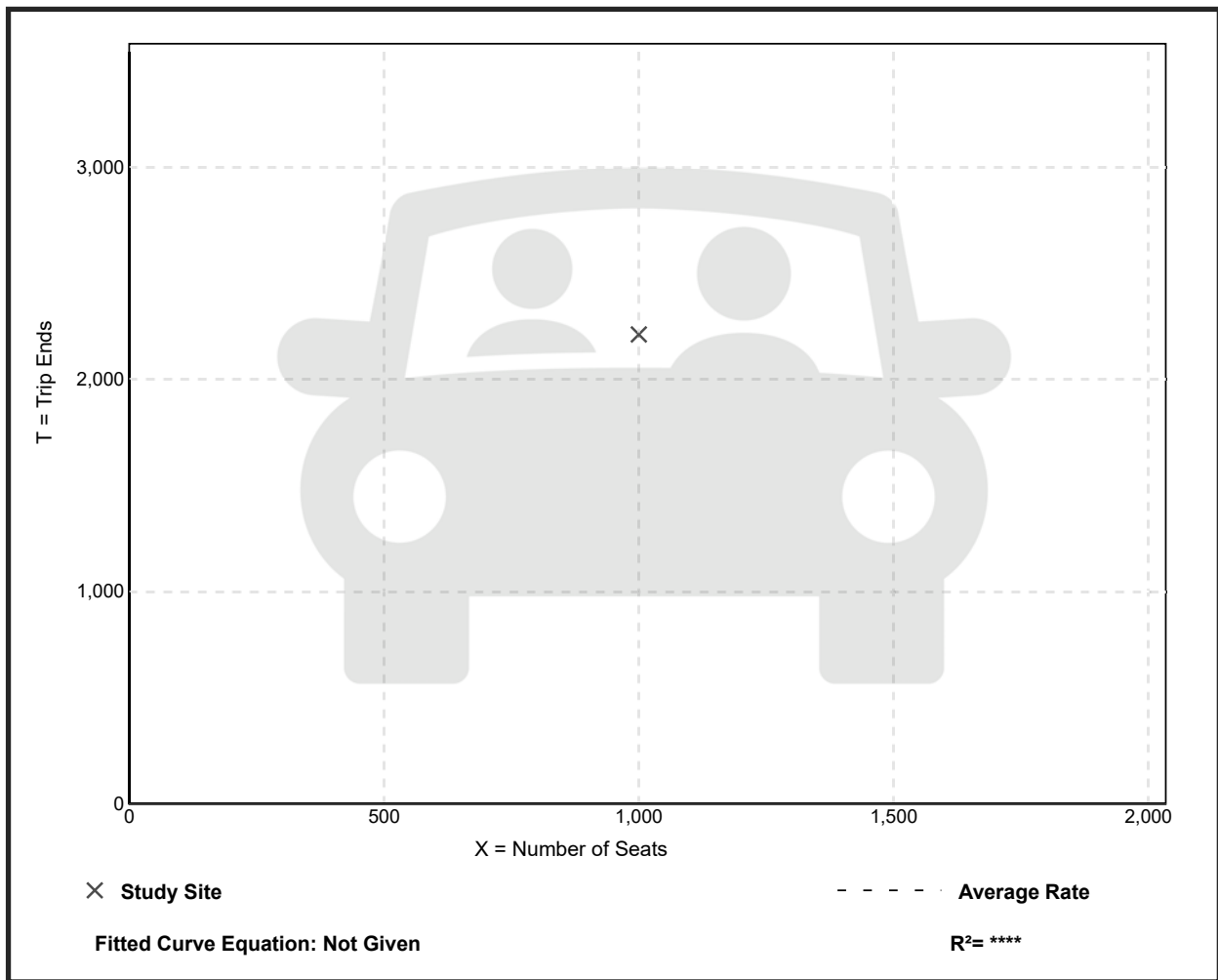
Setting/Location: General Urban/Suburban
Number of Studies: 1
Avg. Num. of Seats: 1000
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Seat

Average Rate	Range of Rates	Standard Deviation
2.21	2.21 - 2.21	*

Data Plot and Equation

Caution – Small Sample Size



Church (560)

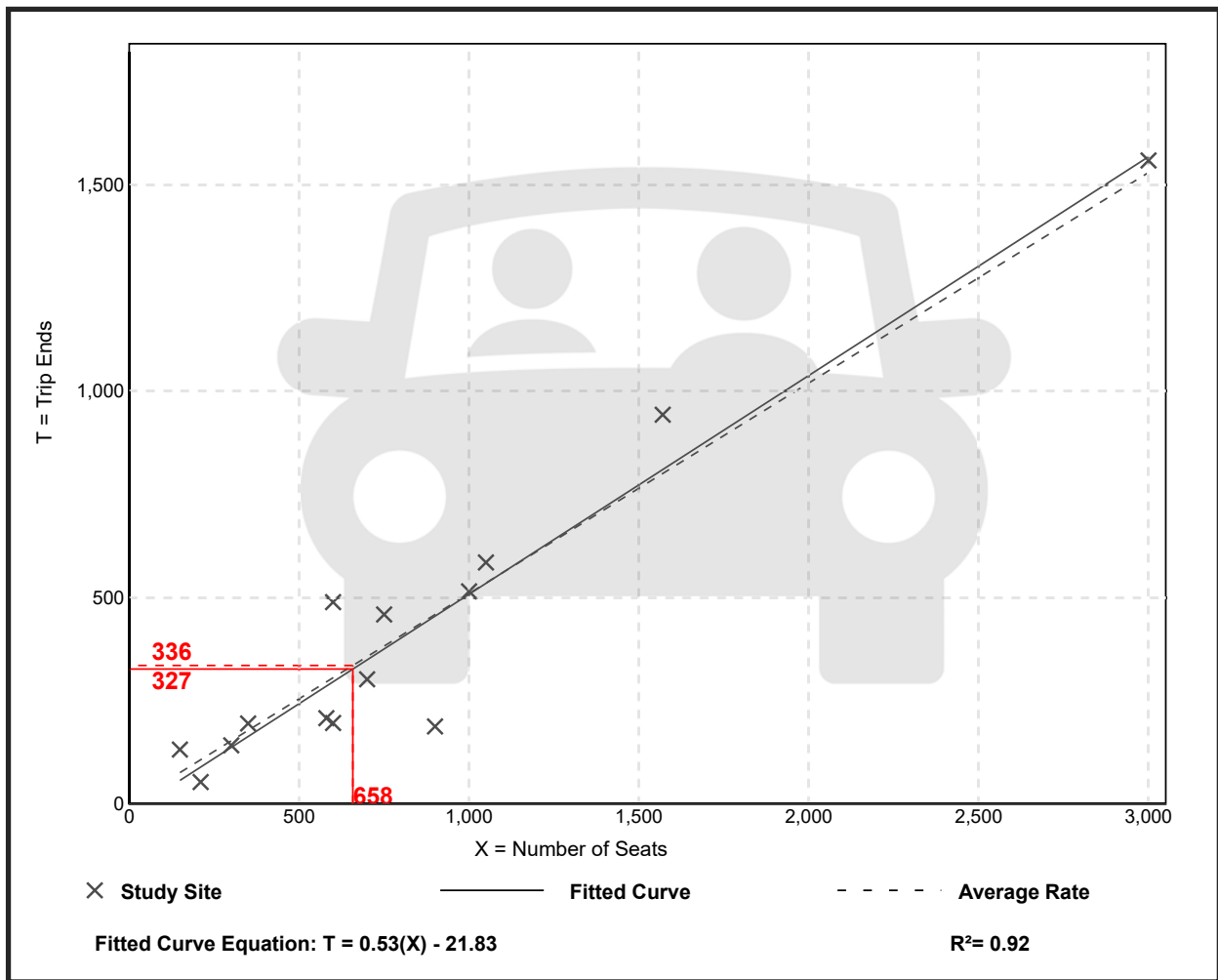
Vehicle Trip Ends vs: Seats
On a: Sunday, Peak Hour of Generator

Setting/Location: General Urban/Suburban
Number of Studies: 14
Avg. Num. of Seats: 840
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per Seat

Average Rate	Range of Rates	Standard Deviation
0.51	0.21 - 0.89	0.15

Data Plot and Equation



Church (560)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Sunday

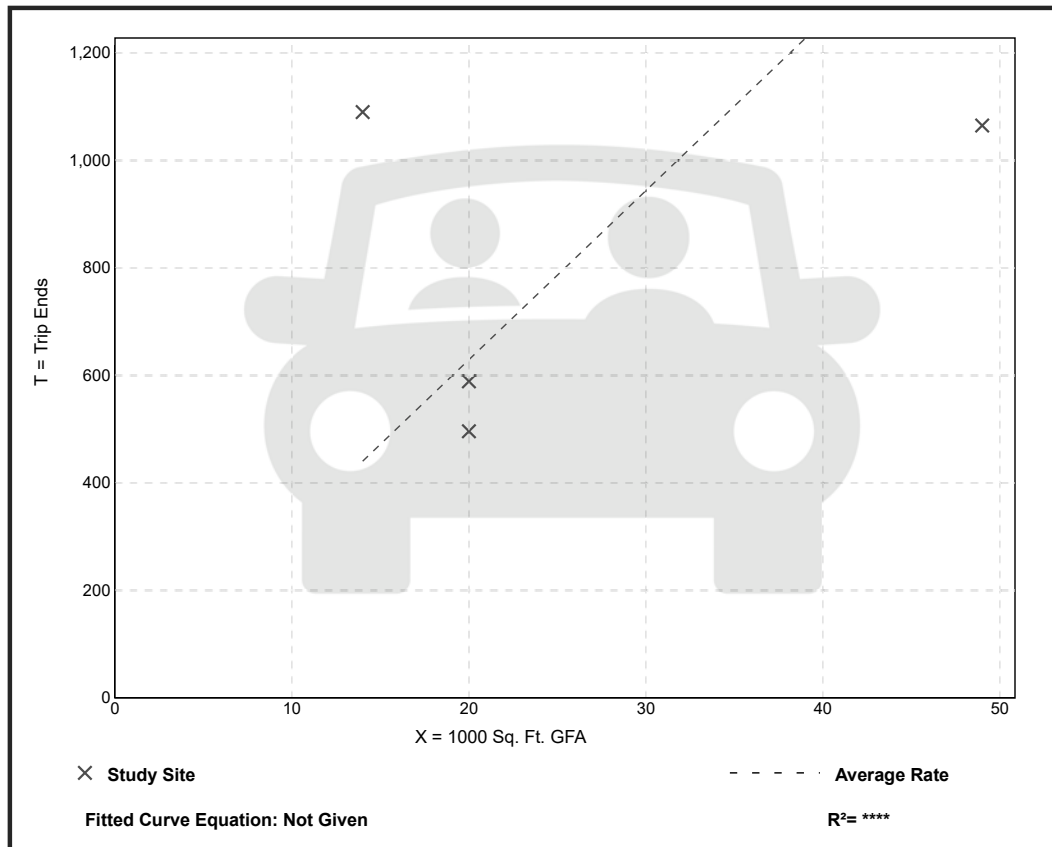
Setting/Location: General Urban/Suburban
Number of Studies: 4
Avg. 1000 Sq. Ft. GFA: 26
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
31.46	21.73 - 77.86	21.51

Data Plot and Equation

Caution – Small Sample Size



Church (560)

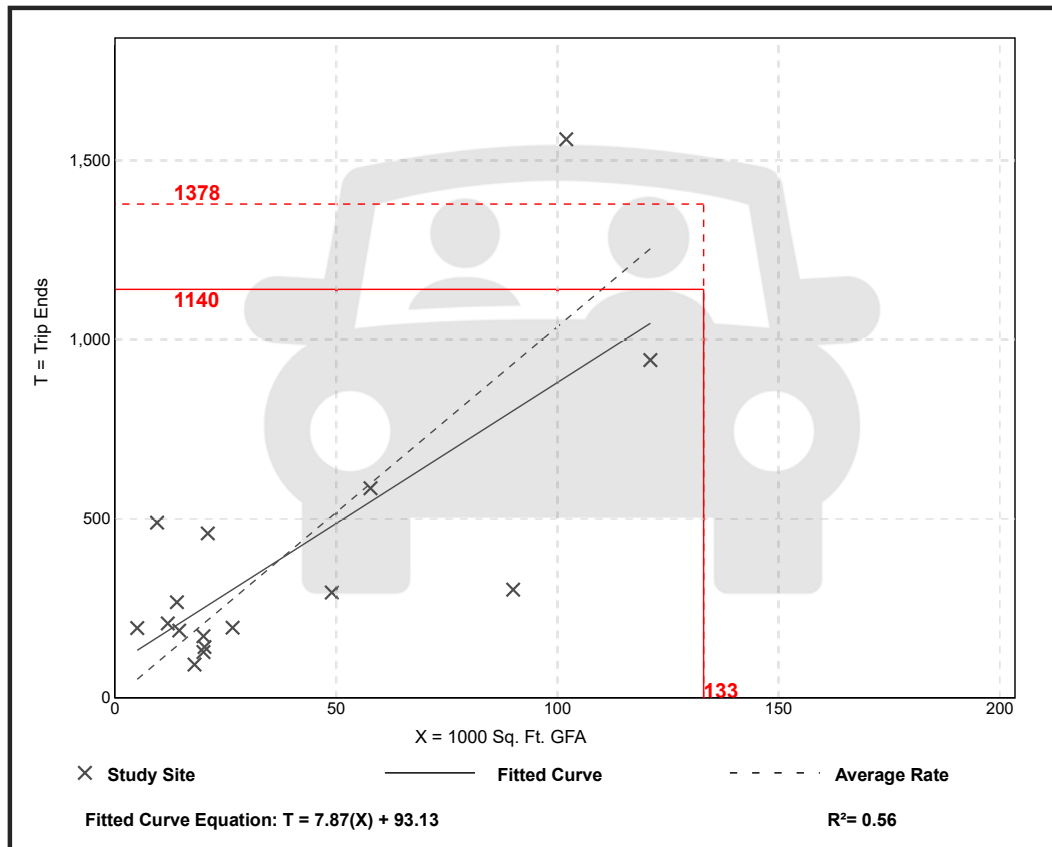
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Sunday, Peak Hour of Generator

Setting/Location: General Urban/Suburban
Number of Studies: 16
Avg. 1000 Sq. Ft. GFA: 38
Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
10.36	3.36 - 51.31	7.83

Data Plot and Equation



Church (560)

Vehicle Trip Ends vs: Seats
On a: Sunday

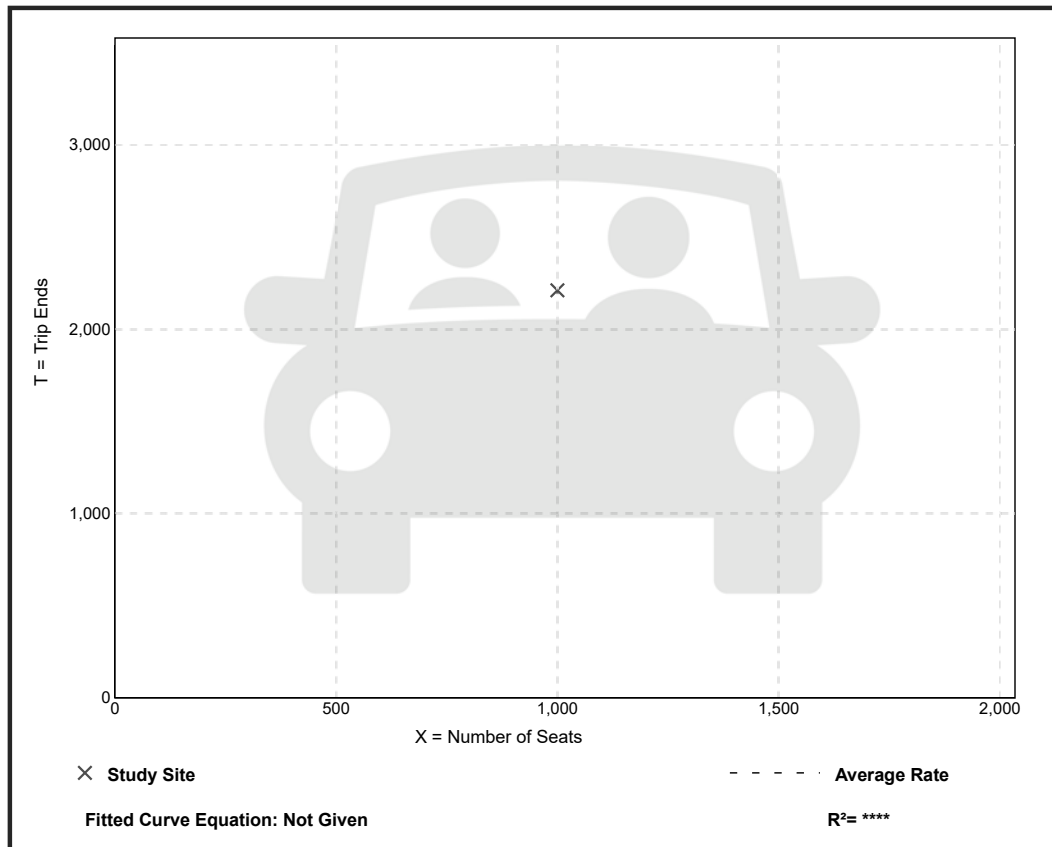
Setting/Location: General Urban/Suburban
Number of Studies: 1
Avg. Num. of Seats: 1000
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Seat

Average Rate	Range of Rates	Standard Deviation
2.21	2.21 - 2.21	*

Data Plot and Equation

Caution – Small Sample Size



Church (560)

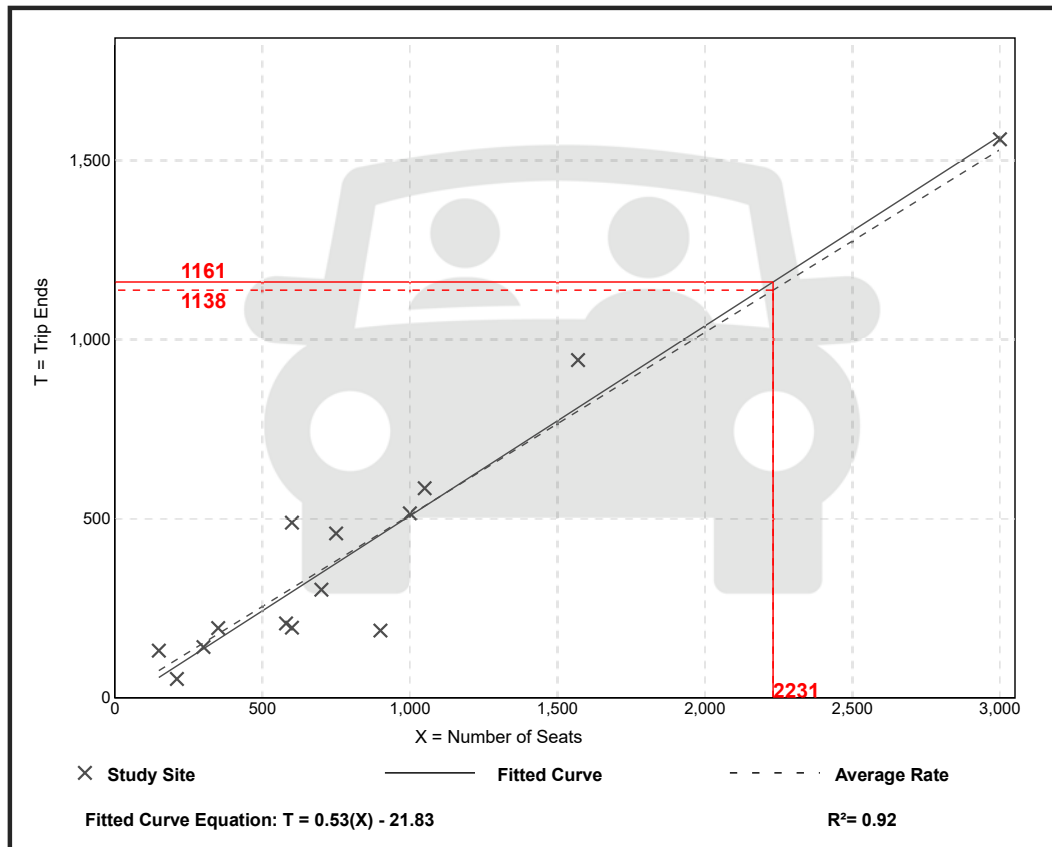
Vehicle Trip Ends vs: **Seats**
On a: **Sunday, Peak Hour of Generator**

Setting/Location: General Urban/Suburban
Number of Studies: 14
Avg. Num. of Seats: 840
Directional Distribution: 49% entering, 51% exiting

Vehicle Trip Generation per Seat

Average Rate	Range of Rates	Standard Deviation
0.51	0.21 - 0.89	0.15

Data Plot and Equation



APPENDIX D

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 11)

EXISTING CONDITIONS

Intersection

Int Delay, s/veh 1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Vol, veh/h	220	134	88	382	2	0
Future Vol, veh/h	220	134	88	382	2	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	82	51	61	90	50	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	268	263	144	424	4	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	531
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1047
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1047
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.3	20.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	241	-	-	-	1047	-
HCM Lane V/C Ratio	0.017	-	-	-	0.138	-
HCM Control Delay (s)	20.2	0	-	-	9	-
HCM Lane LOS	C	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	-	0.5	-

Intersection

Int Delay, s/veh 26.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	296	166	62	573	89	99
Future Vol, veh/h	296	166	62	573	89	99
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	85	51	53	96	37	35
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	348	325	117	597	241	283

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	673
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	927
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	927
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.5	93.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	197	641	-	-	927	-
HCM Lane V/C Ratio	1.221	0.441	-	-	0.126	-
HCM Control Delay (s)	184.9	15	-	-	9.4	-
HCM Lane LOS	F	C	-	-	A	-
HCM 95th %tile Q(veh)	12.6	2.3	-	-	0.4	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 28.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	463	3	3	646	149	94
Future Vol, veh/h	463	3	3	646	149	94
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	93	38	25	81	60	43
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	498	8	12	798	248	219

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	506
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1069
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1069
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	108.6
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	201	509	-	-	1069	-
HCM Lane V/C Ratio	1.235	0.429	-	-	0.011	-
HCM Control Delay (s)	188.9	17.3	-	-	8.4	-
HCM Lane LOS	F	C	-	-	A	-
HCM 95th %tile Q(veh)	13.1	2.1	-	-	0	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection

Int Delay, s/veh 0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Vol, veh/h	430	54	32	409	4	5
Future Vol, veh/h	430	54	32	409	4	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	90	45	57	78	33	63
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	478	120	56	524	12	8

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	598
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	989
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	989
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	17
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	247	525	-	-	989	-
HCM Lane V/C Ratio	0.049	0.015	-	-	0.057	-
HCM Control Delay (s)	20.3	12	-	-	8.9	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.2	0	-	-	0.2	-

PROJECTED 2024 CONDITIONS WITH THE SECONDARY ENTRANCE ONLY

Intersection

Int Delay, s/veh 1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Vol, veh/h	223	122	67	388	1	0
Future Vol, veh/h	223	122	67	388	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	82	51	61	90	50	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	272	239	110	431	2	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	511
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1065
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1065
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	18.4
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	271	-	-	-	1065	-
HCM Lane V/C Ratio	0.007	-	-	-	0.103	-
HCM Control Delay (s)	18.4	0	-	-	8.8	-
HCM Lane LOS	C	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	-	0.3	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	11	11	12	22	0	1
Future Vol, veh/h	11	11	12	22	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	92	50	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	12	24	24	0	1

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	48	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1572	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1572	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	3.7	0	8.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1572	-	-	-	1036
HCM Lane V/C Ratio	0.008	-	-	-	0.001
HCM Control Delay (s)	7.3	0	-	-	8.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 4.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	300	155	39	582	41	81
Future Vol, veh/h	300	155	39	582	41	81
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	85	51	53	96	37	35
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	353	304	74	606	111	231

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	657
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	940
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	940
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	20.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	229	637	-	-	940	-
HCM Lane V/C Ratio	0.484	0.363	-	-	0.078	-
HCM Control Delay (s)	34.6	13.8	-	-	9.2	-
HCM Lane LOS	D	B	-	-	A	-
HCM 95th %tile Q(veh)	2.4	1.7	-	-	0.3	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 4.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	11	21	30	23	19	47
Future Vol, veh/h	11	21	30	23	19	47
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	71	66	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	30	45	26	21	52

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	71	0	0 112 58
Stage 1	-	-	- 58 -
Stage 2	-	-	- 54 -
Critical Hdwy	4.1	-	- 7.6 6.8
Critical Hdwy Stg 1	-	-	- 6.6 -
Critical Hdwy Stg 2	-	-	- 6.6 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	1542	-	- 857 1004
Stage 1	-	-	- 951 -
Stage 2	-	-	- 956 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1542	-	- 850 1004
Mov Cap-2 Maneuver	-	-	- 850 -
Stage 1	-	-	- 943 -
Stage 2	-	-	- 956 -

Approach	EB	WB	SB
HCM Control Delay, s	2.2	0	9.1
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1542	-	-	-	954
HCM Lane V/C Ratio	0.008	-	-	-	0.077
HCM Control Delay (s)	7.4	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection

Int Delay, s/veh 6.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	470	3	2	656	87	71
Future Vol, veh/h	470	3	2	656	87	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	93	38	25	81	60	43
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	505	8	8	810	145	165

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	513
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1063
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1063
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	36.5
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	199	503	-	-	1063	-
HCM Lane V/C Ratio	0.729	0.328	-	-	0.008	-
HCM Control Delay (s)	60.3	15.6	-	-	8.4	-
HCM Lane LOS	F	C	-	-	A	-
HCM 95th %tile Q(veh)	4.7	1.4	-	-	0	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon




HCM 6th TWSC

8: Topside Road & Secondary Driveway

09/01/2024

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	38	38	1	24	61
Future Vol, veh/h	0	38	38	1	24	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	84	66	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	45	58	1	27	68

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	59	0	0 104 59
Stage 1	-	-	- 59 -
Stage 2	-	-	- 45 -
Critical Hdwy	4.1	-	- 7.6 6.8
Critical Hdwy Stg 1	-	-	- 6.6 -
Critical Hdwy Stg 2	-	-	- 6.6 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	1558	-	- 868 1002
Stage 1	-	-	- 950 -
Stage 2	-	-	- 968 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1558	-	- 868 1002
Mov Cap-2 Maneuver	-	-	- 868 -
Stage 1	-	-	- 950 -
Stage 2	-	-	- 968 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1558	-	-	-	960
HCM Lane V/C Ratio	-	-	-	-	0.098
HCM Control Delay (s)	0	-	-	-	9.2
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection

Int Delay, s/veh 0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Vol, veh/h	436	50	23	415	2	4
Future Vol, veh/h	436	50	23	415	2	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	90	45	57	78	33	63
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	484	111	40	532	6	6

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	595
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	991
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	991
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	15.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	256	520	-	-	991	-
HCM Lane V/C Ratio	0.024	0.012	-	-	0.041	-
HCM Control Delay (s)	19.4	12	-	-	8.8	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 0.7







Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	19	20	9	1	2
Future Vol, veh/h	4	19	20	9	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	75	48	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	25	42	10	1	2

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	52	0	80
Stage 1	-	-	47
Stage 2	-	-	33
Critical Hdwy	4.1	-	7.6
Critical Hdwy Stg 1	-	-	6.6
Critical Hdwy Stg 2	-	-	6.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	1567	-	903
Stage 1	-	-	965
Stage 2	-	-	984
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1567	-	900
Mov Cap-2 Maneuver	-	-	900
Stage 1	-	-	962
Stage 2	-	-	984

Approach	EB	WB	SB
HCM Control Delay, s	1.1	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1567	-	-	-	977
HCM Lane V/C Ratio	0.003	-	-	-	0.003
HCM Control Delay (s)	7.3	0	-	-	8.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

PROJECTED 2027 CONDITIONS WITH THE SECONDARY ENTRANCE ONLY

Intersection						
Int Delay, s/veh	0.9					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	233	122	67	405	1	0
Future Vol, veh/h	233	122	67	405	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	82	51	61	90	50	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	284	239	110	450	2	0
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	523	0	954	284
Stage 1	-	-	-	-	284	-
Stage 2	-	-	-	-	670	-
Critical Hdwy	-	-	4.1	-	8.2	7.1
Critical Hdwy Stg 1	-	-	-	-	7.2	-
Critical Hdwy Stg 2	-	-	-	-	7.2	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1054	-	180	708
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	367	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1054	-	161	708
Mov Cap-2 Maneuver	-	-	-	-	262	-
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	329	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		1.7		18.8	
HCM LOS					C	
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	262		-	-	-	1054
HCM Lane V/C Ratio	0.008		-	-	-	0.104
HCM Control Delay (s)	18.8		0	-	-	8.8
HCM Lane LOS	C		A	-	-	A
HCM 95th %tile Q(veh)	0		-	-	-	0.3




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	11	13	14	22	0	1
Future Vol, veh/h	11	13	14	22	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	92	50	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	14	28	24	0	1

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	52	0	0 78 40
Stage 1	-	-	- 40 -
Stage 2	-	-	- 38 -
Critical Hdwy	4.1	-	- 7.6 6.8
Critical Hdwy Stg 1	-	-	- 6.6 -
Critical Hdwy Stg 2	-	-	- 6.6 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	1567	-	- 906 1030
Stage 1	-	-	- 975 -
Stage 2	-	-	- 977 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1567	-	- 899 1030
Mov Cap-2 Maneuver	-	-	- 899 -
Stage 1	-	-	- 967 -
Stage 2	-	-	- 977 -

Approach	EB	WB	SB
HCM Control Delay, s	3.4	0	8.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1567	-	-	-	1030
HCM Lane V/C Ratio	0.008	-	-	-	0.001
HCM Control Delay (s)	7.3	0	-	-	8.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection

Int Delay, s/veh 4.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	314	155	39	607	41	81
Future Vol, veh/h	314	155	39	607	41	81
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	85	51	53	96	37	35
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	369	304	74	632	111	231

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	673
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	927
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	927
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1	21.7
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	218	621	-	-	927	-
HCM Lane V/C Ratio	0.508	0.373	-	-	0.079	-
HCM Control Delay (s)	37.4	14.2	-	-	9.2	-
HCM Lane LOS	E	B	-	-	A	-
HCM 95th %tile Q(veh)	2.6	1.7	-	-	0.3	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 3.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	11	23	33	23	19	47
Future Vol, veh/h	11	23	33	23	19	47
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	71	66	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	32	50	26	21	52

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	76	0	0 119 63
Stage 1	-	-	- 63 -
Stage 2	-	-	- 56 -
Critical Hdwy	4.1	-	- 7.6 6.8
Critical Hdwy Stg 1	-	-	- 6.6 -
Critical Hdwy Stg 2	-	-	- 6.6 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	1536	-	- 847 997
Stage 1	-	-	- 945 -
Stage 2	-	-	- 954 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1536	-	- 840 997
Mov Cap-2 Maneuver	-	-	- 840 -
Stage 1	-	-	- 937 -
Stage 2	-	-	- 954 -

Approach	EB	WB	SB
HCM Control Delay, s	2	0	9.1
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1536	-	-	-	946
HCM Lane V/C Ratio	0.008	-	-	-	0.078
HCM Control Delay (s)	7.4	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection

Int Delay, s/veh 7.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	491	3	2	685	87	71
Future Vol, veh/h	491	3	2	685	87	71
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	93	38	25	81	60	43
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	528	8	8	846	145	165

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	536
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	1042
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	1042
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	41.4
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	187	486	-	-	1042	-
HCM Lane V/C Ratio	0.775	0.34	-	-	0.008	-
HCM Control Delay (s)	70	16.2	-	-	8.5	-
HCM Lane LOS	F	C	-	-	A	-
HCM 95th %tile Q(veh)	5.2	1.5	-	-	0	-

Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 4.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	42	42	1	24	61
Future Vol, veh/h	0	42	42	1	24	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	84	66	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	50	64	1	27	68

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	65	0	0 115 65
Stage 1	-	-	- - 65 -
Stage 2	-	-	- - 50 -
Critical Hdwy	4.1	-	- - 7.6 6.8
Critical Hdwy Stg 1	-	-	- - 6.6 -
Critical Hdwy Stg 2	-	-	- - 6.6 -
Follow-up Hdwy	2.2	-	- - 3.5 3.3
Pot Cap-1 Maneuver	1550	-	- - 853 994
Stage 1	-	-	- - 942 -
Stage 2	-	-	- - 961 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1550	-	- - 853 994
Mov Cap-2 Maneuver	-	-	- - 853 -
Stage 1	-	-	- - 942 -
Stage 2	-	-	- - 961 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1550	-	-	-	950
HCM Lane V/C Ratio	-	-	-	-	0.099
HCM Control Delay (s)	0	-	-	-	9.2
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection

Int Delay, s/veh 0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	456	50	23	434	2	4
Future Vol, veh/h	456	50	23	434	2	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	90	45	57	78	33	63
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	507	111	40	556	6	6

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	618
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	972
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	972
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	16.1
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	244	502	-	-	972	-
HCM Lane V/C Ratio	0.025	0.013	-	-	0.042	-
HCM Control Delay (s)	20.1	12.3	-	-	8.9	-
HCM Lane LOS	C	B	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

01/15/2024

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	4	21	22	9	1	2
Future Vol, veh/h	4	21	22	9	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	75	48	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	4	28	46	10	1	2

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	56	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.1	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.2	-	-
Pot Cap-1 Maneuver	1562	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1562	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	1	0	8.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1562	-	-	-	969
HCM Lane V/C Ratio	0.003	-	-	-	0.003
HCM Control Delay (s)	7.3	0	-	-	8.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

**PROJECTED 2027 CONDITIONS WITH THE SECONDARY ENTRANCE AND
CHURCH EXPANSION**

Intersection

Int Delay, s/veh 3.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	233	414	226	405	4	0
Future Vol, veh/h	233	414	226	405	4	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	82	51	61	90	50	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	284	812	370	450	8	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1096
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	644
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	644
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	8.1	74
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	60	-	-	-	644	-
HCM Lane V/C Ratio	0.133	-	-	-	0.575	-
HCM Control Delay (s)	74	0	-	-	17.9	-
HCM Lane LOS	F	A	-	-	C	-
HCM 95th %tile Q(veh)	0.4	-	-	-	3.7	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

09/02/2024

Intersection

Int Delay, s/veh 2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	38	13	14	75	1	2
Future Vol, veh/h	38	13	14	75	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	92	50	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	42	14	28	83	1	2

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	111	0	0 168 70
Stage 1	-	-	- 70 -
Stage 2	-	-	- 98 -
Critical Hdwy	4.1	-	- 7.6 6.8
Critical Hdwy Stg 1	-	-	- 6.6 -
Critical Hdwy Stg 2	-	-	- 6.6 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	1492	-	- 782 987
Stage 1	-	-	- 936 -
Stage 2	-	-	- 901 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1492	-	- 760 987
Mov Cap-2 Maneuver	-	-	- 760 -
Stage 1	-	-	- 910 -
Stage 2	-	-	- 901 -

Approach	EB	WB	SB
HCM Control Delay, s	5.6	0	9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1492	-	-	-	898
HCM Lane V/C Ratio	0.028	-	-	-	0.004
HCM Control Delay (s)	7.5	0	-	-	9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0.1	-	-	-	0

Intersection

Int Delay, s/veh 241.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Vol, veh/h	314	526	131	607	140	274
Future Vol, veh/h	314	526	131	607	140	274
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	85	51	53	96	37	35
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	369	1031	247	632	378	783

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1400
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	494
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	494
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.4	\$ 711.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	77	621	-	-	494	-
HCM Lane V/C Ratio	4.914	1.261	-	-	0.5	-
HCM Control Delay (s)	\$ 1869.9	151.5	-	-	19.4	-
HCM Lane LOS	F	F	-	-	C	-
HCM 95th %tile Q(veh)	41.1	30	-	-	2.8	-




Notes

-: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

HCM 6th TWSC

8: Topside Road & Secondary Driveway

09/02/2024

Intersection						
Int Delay, s/veh	6.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	23	33	77	64	160
Future Vol, veh/h	39	23	33	77	64	160
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	71	66	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	43	32	50	86	71	178
Major/Minor	Major1	Major2		Minor2		
Conflicting Flow All	136	0	-	0	211	93
Stage 1	-	-	-	-	93	-
Stage 2	-	-	-	-	118	-
Critical Hdwy	4.1	-	-	-	7.6	6.8
Critical Hdwy Stg 1	-	-	-	-	6.6	-
Critical Hdwy Stg 2	-	-	-	-	6.6	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1461	-	-	-	729	955
Stage 1	-	-	-	-	907	-
Stage 2	-	-	-	-	877	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1461	-	-	-	707	955
Mov Cap-2 Maneuver	-	-	-	-	707	-
Stage 1	-	-	-	-	880	-
Stage 2	-	-	-	-	877	-
Approach	EB	WB		SB		
HCM Control Delay, s	4.3	0		10.8		
HCM LOS				B		
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1461	-	-	-	868	
HCM Lane V/C Ratio	0.03	-	-	-	0.287	
HCM Control Delay (s)	7.5	0	-	-	10.8	
HCM Lane LOS	A	A	-	-	B	
HCM 95th %tile Q(veh)	0.1	-	-	-	1.2	

Intersection						
Int Delay, s/veh	204.2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↖	↑	↖	↗
Traffic Vol, veh/h	491	9	8	685	297	239
Future Vol, veh/h	491	9	8	685	297	239
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	93	38	25	81	60	43
Heavy Vehicles, %	0	0	0	1	0	0
Mvmt Flow	528	24	32	846	495	556
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	552	0	1438	528
Stage 1	-	-	-	-	528	-
Stage 2	-	-	-	-	910	-
Critical Hdwy	-	-	4.1	-	8.2	7.1
Critical Hdwy Stg 1	-	-	-	-	7.2	-
Critical Hdwy Stg 2	-	-	-	-	7.2	-
Follow-up Hdwy	-	-	2.2	-	3.5	3.3
Pot Cap-1 Maneuver	-	-	1028	-	~ 72	~ 486
Stage 1	-	-	-	-	~ 457	-
Stage 2	-	-	-	-	~ 251	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1028	-	~ 70	~ 486
Mov Cap-2 Maneuver	-	-	-	-	~ 173	-
Stage 1	-	-	-	-	~ 457	-
Stage 2	-	-	-	-	~ 243	-
Approach	EB		WB		NB	
HCM Control Delay, s	0		0.3		\$ 481.7	
HCM LOS	F					
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	173	486	-	-	1028	-
HCM Lane V/C Ratio	2.861	1.144	-	-	0.031	-
HCM Control Delay (s)	\$ 894.2	114.4	-	-	8.6	-
HCM Lane LOS	F	F	-	-	A	-
HCM 95th %tile Q(veh)	44.4	19.4	-	-	0.1	-
Notes						
~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon						




HCM 6th TWSC

8: Topside Road & Secondary Driveway

09/02/2024

Intersection

Int Delay, s/veh 7.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	1	42	42	2	82	206
Future Vol, veh/h	1	42	42	2	82	206
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	84	66	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	1	50	64	2	91	229

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	66	0	0 117 65
Stage 1	-	-	- - 65 -
Stage 2	-	-	- - 52 -
Critical Hdwy	4.1	-	- - 7.6 6.8
Critical Hdwy Stg 1	-	-	- - 6.6 -
Critical Hdwy Stg 2	-	-	- - 6.6 -
Follow-up Hdwy	2.2	-	- - 3.5 3.3
Pot Cap-1 Maneuver	1549	-	- - 850 994
Stage 1	-	-	- - 942 -
Stage 2	-	-	- - 959 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1549	-	- - 849 994
Mov Cap-2 Maneuver	-	-	- - 849 -
Stage 1	-	-	- - 941 -
Stage 2	-	-	- - 959 -

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	10.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1549	-	-	-	948
HCM Lane V/C Ratio	0.001	-	-	-	0.338
HCM Control Delay (s)	7.3	0	-	-	10.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	1.5

Intersection

Int Delay, s/veh 1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↘	↗
Traffic Vol, veh/h	456	170	79	434	6	14
Future Vol, veh/h	456	170	79	434	6	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	100	250	-	0	345
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	4	-	-	-4	9	-
Peak Hour Factor	90	45	57	78	33	63
Heavy Vehicles, %	1	0	0	0	0	0
Mvmt Flow	507	378	139	556	18	22

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	885
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	4.1
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	2.2
Pot Cap-1 Maneuver	-	-	773
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	773
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	19.8
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	170	502	-	-	773	-
HCM Lane V/C Ratio	0.107	0.044	-	-	0.179	-
HCM Control Delay (s)	28.7	12.5	-	-	10.7	-
HCM Lane LOS	D	B	-	-	B	-
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0.7	-




HCM 6th TWSC

8: Topside Road & Secondary Driveway

09/02/2024

Intersection

Int Delay, s/veh 1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	14	21	22	29	3	8
Future Vol, veh/h	14	21	22	29	3	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	4	-4	-	6	-
Peak Hour Factor	90	75	48	90	90	90
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	16	28	46	32	3	9

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	78	0	0 122 62
Stage 1	-	-	- 62 -
Stage 2	-	-	- 60 -
Critical Hdwy	4.1	-	- 7.6 6.8
Critical Hdwy Stg 1	-	-	- 6.6 -
Critical Hdwy Stg 2	-	-	- 6.6 -
Follow-up Hdwy	2.2	-	- 3.5 3.3
Pot Cap-1 Maneuver	1533	-	- 843 998
Stage 1	-	-	- 946 -
Stage 2	-	-	- 949 -
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1533	-	- 834 998
Mov Cap-2 Maneuver	-	-	- 834 -
Stage 1	-	-	- 936 -
Stage 2	-	-	- 949 -

Approach	EB	WB	SB
HCM Control Delay, s	2.6	0	8.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1533	-	-	-	947
HCM Lane V/C Ratio	0.01	-	-	-	0.013
HCM Control Delay (s)	7.4	0	-	-	8.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

APPENDIX E

KNOX COUNTY TURN LANE VOLUME THRESHOLD WORKSHEETS

TABLE 4A

LEFT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170 150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	<div> <p>Topside Road at the Proposed Secondary Entrance</p> <p>2027 Projected 8:45 - 9:45 am EB Left Turns = 38</p> <p>EB Left-Turn Lane NOT Warranted</p> </div>		95 85	80 70	65 60
400 - 449 450 - 499	120 105			75 70	65 60	55 50
500 - 549 550 - 599	95 85			65 60	55 50	50 45
600 - 649 650 - 699	75 70			55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149 150 - 199	100 90	80 75	70 65	60 55	55 50	50 45
200 - 249 250 - 299	80 70	72 65	60 55	55 50	50 45	45 40
300 - 349 350 - 399	65 60	60 55	50 50	50 45	45 40	40 40
400 - 449 450 - 499	55 50	50 45	45 45	45 40	40 35	35 35
500 - 549 550 - 599	50 45	45 40	40 40	40 35	35 35	35 35
600 - 649 650 - 699	40 35	35 35	35 35	35 30	35 30	30 30
700 - 749 750 or More	30 30	30 30	30 30	30 30	30 30	30 30

* Or through volume only if a right-turn lane exists.

TABLE 4B
RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25						
25 - 49						
50 - 99						
100 - 149						
150 - 199						
200 - 249						
250 - 299						Yes
300 - 349					Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599		Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Topside Road at the
Proposed Secondary Entrance

2027 Projected 8:45 - 9:45 am
WB Right Turns = 75

WB Right-Turn Lane NOT
Warranted

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25						Yes
25 - 49						Yes
50 - 99					Yes	Yes
100 - 149				Yes	Yes	Yes
150 - 199			Yes	Yes	Yes	Yes
200 - 249		Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

TABLE 4A

LEFT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170 150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	<div> Topside Road at the Proposed Secondary Entrance 2027 Projected 10:30 - 11:30 am EB Left Turns = 39 EB Left-Turn Lane NOT Warranted </div>		95 85	80 70	65 60
400 - 449 450 - 499	120 105			75 70	65 60	55 50
500 - 549 550 - 599	95 85			65 60	55 50	50 45
600 - 649 650 - 699	75 70			55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149 150 - 199	100 90	80 75	70 65	60 55	55 50	50 45
200 - 249 250 - 299	80 70	72 65	60 55	55 50	50 45	45 40
300 - 349 350 - 399	65 60	60 55	50 50	50 45	45 40	40 40
400 - 449 450 - 499	55 50	50 45	45 45	45 40	40 35	35 35
500 - 549 550 - 599	50 45	45 40	40 40	40 35	35 35	35 35
600 - 649 650 - 699	40 35	35 35	35 35	35 30	35 30	30 30
700 - 749 750 or More	30 30	30 30	30 30	30 30	30 30	30 30

* Or through volume only if a right-turn lane exists.

TABLE 4B
RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25						
25 - 49						
50 - 99						
100 - 149						
150 - 199						
200 - 249						
250 - 299						Yes
300 - 349					Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599		Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

Topside Road at the
Proposed Secondary Entrance

2027 Projected 10:30 - 11:30 am
WB Right Turns = 77

WB Right-Turn Lane NOT
Warranted

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25						Yes
25 - 49						Yes
50 - 99					Yes	Yes
100 - 149				Yes	Yes	Yes
150 - 199			Yes	Yes	Yes	Yes
200 - 249		Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

TABLE 4A

**LEFT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS**

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149 150 - 199	300 245	235 200	185 160	145 130	120 110	100 90
200 - 249 250 - 299	205 175	170 150	140 125	115 105	100 90	80 70
300 - 349 350 - 399	155 135	<div style="border: 1px dashed green; padding: 5px; text-align: center;"> Topside Road at the Proposed Secondary Entrance 2027 Projected 12:15 - 1:15 pm EB Left Turns = 1 EB Left-Turn Lane NOT Warranted </div>		95 85	80 70	65 60
400 - 449 450 - 499	120 105			75 70	65 60	55 50
500 - 549 550 - 599	95 85			65 60	55 50	50 45
600 - 649 650 - 699	75 70			55 50	45 40	40 35
700 - 749 750 or More	65 60	55 50	50 45	45 40	35 35	30 30

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149 150 - 199	100 90	80 75	70 65	60 55	55 50	50 45
200 - 249 250 - 299	80 70	72 65	60 55	55 50	50 45	45 40
300 - 349 350 - 399	65 60	60 55	50 50	50 45	45 40	40 40
400 - 449 450 - 499	55 50	50 45	45 45	45 40	40 35	35 35
500 - 549 550 - 599	50 45	45 40	40 40	40 35	35 35	35 35
600 - 649 650 - 699	40 35	35 35	35 35	35 30	35 30	30 30
700 - 749 750 or More	30 30	30 30	30 30	30 30	30 30	30 30

* Or through volume only if a right-turn lane exists.

TABLE 4B
RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
<div>2</div> <div>Fewer Than 25</div> <div>25 - 49</div> <div>50 - 99</div>	<div>42</div>					
100 - 149		<div>Topside Road at the Proposed Secondary Entrance</div> <div>2027 Projected 12:15 - 1:15 pm WB Right Turns = 2</div> <div>WB Right-Turn Lane NOT Warranted</div>				
150 - 199						
200 - 249						
250 - 299						Yes
300 - 349				Yes	Yes	Yes
350 - 399				Yes	Yes	Yes
400 - 449			Yes	Yes	Yes	Yes
450 - 499			Yes	Yes	Yes	Yes
500 - 549		Yes	Yes	Yes	Yes	Yes
550 - 599		Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
<div>Fewer Than 25</div> <div>25 - 49</div> <div>50 - 99</div>					Yes	Yes
100 - 149				Yes	Yes	Yes
150 - 199			Yes	Yes	Yes	Yes
200 - 249		Yes	Yes	Yes	Yes	Yes
250 - 299	Yes	Yes	Yes	Yes	Yes	Yes
300 - 349	Yes	Yes	Yes	Yes	Yes	Yes
350 - 399	Yes	Yes	Yes	Yes	Yes	Yes
400 - 449	Yes	Yes	Yes	Yes	Yes	Yes
450 - 499	Yes	Yes	Yes	Yes	Yes	Yes
500 - 549	Yes	Yes	Yes	Yes	Yes	Yes
550 - 599	Yes	Yes	Yes	Yes	Yes	Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

TABLE 4A

LEFT-TURN LANE VOLUME THRESHOLDS FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS


(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	21	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
		100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149		300	235	185	145	120	100
150 - 199		245	200	160	130	110	90
200 - 249		205	170	140	115	100	80
250 - 299		175	150	125	105	90	70
300 - 349		155	<div> Topside Road at the Proposed Secondary Entrance 2027 Projected 5:15 - 6:15 pm EB Left Turns = 14 EB Left-Turn Lane NOT Warranted </div>	110	95	80	65
350 - 399		135			85	70	60
400 - 449		120			75	65	55
450 - 499		105			70	60	50
500 - 549		95			65	55	50
550 - 599		85			60	50	45
600 - 649		75			55	45	40
650 - 699		70			50	40	35
700 - 749		65	55	50	45	35	30
750 or More		60	50	45	40	35	30

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	= / > 600
100 - 149	100	80	70	60	55	50
150 - 199	90	75	65	55	50	45
200 - 249	80	72	60	55	50	45
250 - 299	70	65	55	50	45	40
300 - 349	65	60	50	50	45	40
350 - 399	60	55	50	45	40	40
400 - 449	55	50	45	45	40	35
450 - 499	50	45	45	40	35	35
500 - 549	50	45	40	40	35	35
550 - 599	45	40	40	35	35	35
600 - 649	40	35	35	35	35	30
650 - 699	35	35	35	30	30	30
700 - 749	30	30	30	30	30	30
750 or More	30	30	30	30	30	30

* Or through volume only if a right-turn lane exists.

TABLE 4B
RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 35 MPH OR LESS

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	<100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
<div>29</div> Fewer Than 25 <div>25 - 49</div> 50 - 99	<div>22</div> 					
100 - 149 150 - 199		<div> Topside Road at the Proposed Secondary Entrance 2027 Projected 5:15 - 6:15 pm WB Right Turns = 29 WB Right-Turn Lane NOT Warranted </div>				
200 - 249 250 - 299						Yes
300 - 349 350 - 399					Yes Yes	Yes Yes
400 - 449 450 - 499			Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599		Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99					Yes	Yes Yes
100 - 149 150 - 199			Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

APPENDIX F

LETTER RESPONSE DOCUMENT TO ADDRESS COMMENTS – 1.22.24



11812 Black Road
Knoxville, Tennessee 37932
Phone (865) 556-0042
ajaxengineering@gmail.com

January 22, 2024

PROJECT NAME: Calvary Knoxville Church Expansion (12-B-23-SU)
TO: Knoxville-Knox County Planning
SUBJECT: Response Document for Calvary Knoxville Church Expansion TIL Review
Comments

Knoxville-Knox County Planning, City of Knoxville Department of Engineering, Knox County Engineering and Public Works, and Tennessee Department of Transportation:

The following response document addresses the comments in a letter from Mike Conger, PE, with Knoxville-Knox County Planning, dated January 12, 2024. This letter is added to the end of the revised report in Appendix F.

1. General:

- a. **For all Synchro analysis, the city generally prefers analysis using the newest HCM editions. Please confirm that the 2010 analysis conducted is not expected to be considerably different than HCM 7th edition (or 6th since you are on Synchro v11), if this is true. If not, please list major differences in the model output (LOS, delay, etc.).**

Response: All analyses were re-conducted using HCM 6th Edition (Synchro v11) and noted in all the LOS tables. The output worksheets are also included in the revised report. There were no differences in output between the 2010 analysis and the HCM 6th Edition.

2. Page 6:

- a. **Please verify the horizon year for the W Governor John Sevier Hwy widening project. This does not seem to be the year listed in the Mobility Plan.**

Response: On Page 7, the horizon year for the Governor John Sevier Highway widening project has been changed from 2050 to 2040, as shown on the Mobility Plan.

3. Page 13:

- a. **There is a concern with the proposed new driveway width at only 16', i.e. 8' lanes for 2-way traffic. The City of Knoxville is requesting a minimum of 20' for this**

driveway therefore please coordinate with the site engineer and update references in the TIL as appropriate.

Response: The site engineer is revising the internal driveway with a width of 20 feet. The reference to the width of the proposed internal driveway has been updated in the report on Pages 1 and 14.

4. Page 16:

- a. Please add a small paragraph to this section justifying only evaluating the Sunday peaks and not the other church service days. Reasoning similar to what was provided in previous correspondence is sufficient.**

Response: On Page 17, at the end of the 2nd paragraph, a couple of sentences have been added discussing the reasoning for only evaluating the Sunday peak periods.

5. Page 39:

- a. Please remove or modify the legend in figures 8, 9, and 10 to avoid possible confusion with AM/PM time periods.**

Response: The legends have been removed in Figures 8, 9, and 10 (and 11).

6. Page 56:

- a. Notice only: Please update to Synchro 12 when possible.**

Response: As noted. Updating to Synchro 12 will be completed soon.

7. Page 59:

- a. Please add LOS analysis for background case (2027, no church expansion)**
- b. For the analysis shown in Table 4, please add approach LOS to the table, when applicable (driveway exits).**

Response: a. A LOS analysis for the 2027 projected scenario with a Secondary Entrance and without a Church expansion has been incorporated in the revised report. This change has been made on multiple pages and includes new Figures and Tables. The new Figures include 11a – 11d, and the new Tables include 4d, 4e, and 5b.

b. Tables 4a – 4g have been updated to include an approach LOS where applicable.

8. Page 63:

- a. For the left-turning ISD onto W. Governor John Sevier Hwy, please account for time gap increases due to crossing the additional lane. From my calculations, this should be 588', but please verify.**
- b. For the sight distance evaluation – please coordinate with the site plan design engineer to ensure that the necessary sight distance clear zones are on property controlled by this applicant or within the ROW and if not then appropriate easements on other properties will be necessary.**

Response: a. The left-turning ISD at West Governor John Sevier Highway has been corrected to 590' (rounded up from 588') on Pages 70 and 71.
b. According to the site engineer: "as long as vegetation is removed from the right-of-way on Topside Road, the clear zones will be on the Church property. We do not anticipate them needing a sight distance easement."

9. Page 65:

- a. **This is the first time the turn lane expansion is noted in the report for the existing driveway. Please note this storage length extension in the "existing roadways" section.**

Response: Actually, the proposed turn lane extension was noted in the report before Page 65 on Pages 1, 14, and in Figure 3 on Page 15 (all page numbers have since been updated). However, to reiterate this proposed construction, the turn lane extension is described again in the last paragraph on Page 15.

10. Page 66:

- a. **Please note in the report that Synchro and HCM (to my knowledge) do not account for queue lane blocking in either their percentile queue or delay analyses. (See Synchro 11 User manual pages 20-10, 20-20, and 20-25). This would likely result in higher delays and actual queue lengths than reported.**
- b. **Please provide 95% queues for background scenario (2027, no church expansion)**

Response: a. A sentence has been added to the end of the second to last paragraph on Page 72 stating this possibility.
b. 95th percentile queues have been provided for the 2027 scenario without the Church expansion in Table 5b.

11. Page 68:

- a. **Please clarify in the narrative, will the ~3' shoulder be maintained with recommendation 1b?**

Response: On Pages 2 (2nd bullet point) and 78 (#1b), the narrative has been updated to state, "The existing width of the paved shoulder on W. Governor John Sevier Highway (~ 3 feet) should also be maintained along the proposed extension."

12. Page 69:

- a. **Please note that recommendation 1c would need to be coordinated with KPD and cannot be guaranteed. The City Transportation office has no objections with this if KPD agrees.**
- b. **Please emphasize/ clarify that the "officer modeling" results would be very rough/approximate, as the HCM/Synchro models were not intended for this application, although we would expect an officer to perform better than a signal in most instances.**
- c. **If you do want to provide a model like this, an officer is probably more like an actuated signal than a pretimed one. I would recommend the following settings to best simulate an officer:**

- d. No RTOR
- e. Long cycle/long max green
 - i. very short min green
 - ii. short gap time
 - iii. long detection zones
 - iv. short/minimum clearance intervals.

Response: a. A sentence has been added to the top of Page 3 and on Page 78 (#1b) that the recommendation must be coordinated with the Knoxville Police Department and that their services are not guaranteed.

b. To avoid confusion and since this information is beyond the scope of what is required, the discussion of modeling the intersection with a law enforcement officer as a traffic signal has been removed from the report.

13. Page 70:

- a. **For recommendation 1d, please clarify where you are recommending installing lighting. Is this on West Governor John Sevier Highway near the driveway, or is this along the driveway itself? Please make the same clarification for Topside Rd recommendation 2f.**

Response: Clarification for the recommendation of illuminating the Church entrances has been added on Pages 3 (1st bullet point), 4 (last bullet point), 72 (#1d), and 80 (#2f).

14. Page 72:

- a. **For recommendation 2d, please note any gates installed should be compliant with the relevant MUTCD section, MUTCD 2B.76. Most notably, please meet retroreflectivity requirements.**
- b. **The new MUTCD (11th Edition), has a standard sign for the thru traffic sign (R5-12). Please use the new sign. Not critical, but consider installing the R5-12 to the other driveway for consistency.**

Response: a. Sentences have been added to the report on Pages 3 (last bullet point) and 79-80 (#2d) to reflect this comment.

b. On Pages 4 (1st bullet point) and 74 (#2e), the recommended sign for thru traffic has been modified, and additional language has been added to recommend the same sign at the existing Church Driveway.

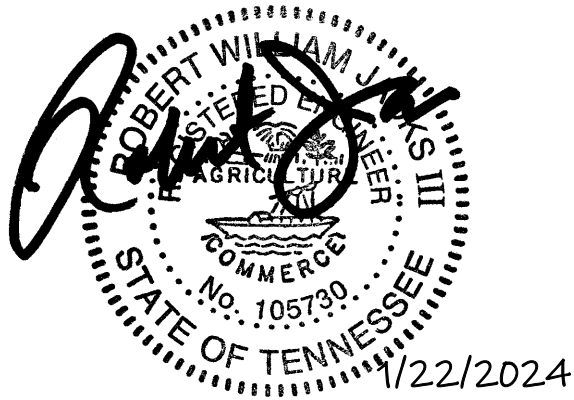
In addition to the revisions listed above, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents and Page Numbers
- Updated Page Footers
- Minor changes to improve report
- Added Appendix F to include this response letter

If you have any questions or further comments, please get in touch with me. We look forward to your approval.

Sincerely,

Ajax Engineering, LLC
Robert W. Jacks, P.E.



APPENDIX G

LETTER FOR UPDATED TRANSPORTATION IMPACT LETTER – 9.16.24



11812 Black Road
Knoxville, Tennessee 37932
Phone (865) 556-0042
ajaxengineering@gmail.com

September 16, 2024

PROJECT NAME: Calvary Knoxville Church Expansion
TO: Knoxville-Knox County Planning
SUBJECT: Updated Calvary Knoxville Transportation Impact Letter

Knoxville-Knox County Planning, City of Knoxville Department of Engineering, Knox County Engineering and Public Works, and Tennessee Department of Transportation:

The following document explains the revisions to the original Transportation Impact Letter (TIL) submitted dated January 22, 2024. This letter is added to the end of this revised TIL in Appendix G. This updated TIL reflects the changes due to the increased proposed gross floor area (GFA) and seats for the new sanctuary. The original TIL analyzed the impact of the Church expanding to a new sanctuary with a GFA of 63,000 ft² and 1,828 seats. This updated TIL includes the results of a proposed sanctuary with a GFA of 133,033 ft² and 2,231 seats.

The results of this increased planned expansion were similar but worse regarding the level of service (LOS) grades, vehicle delays, and queues for the Church entrance at W. Governor John Sevier Highway. However, except for one new recommendation (see #8 below), the conclusions and recommendations of the updated TIL have not been changed since the primary recommendation is still reliant on the City of Knoxville Police Department providing traffic control during the peak periods of the Church's arrival and departures on Sunday mornings.

The list of revisions and changes in the TIL includes the following:

- 1) The slightly revised site plan has been updated in all the figures in the TIL. This slight revision is reflected in the parking area adjacent to the existing and proposed sanctuary and the size increase of the new sanctuary.
- 2) The historical average daily traffic (ADT) for the TDOT traffic count on W. Governor John Sevier Highway was updated in the TIL discussion of the report and Appendix A. Since the original TIL was submitted, TDOT has published traffic counts for 2023. The 2023 data was included in the updated historical data, resulting in a slightly lower 10-year average growth rate from 1.0% to 0.8%. However, the assumed and proposed traffic growth rates for the future conditions were not changed in the updated TIL.
- 3) Updated trip generation calculations and results were provided in Table 2c of the TIL and Appendix C. Table 2c includes the updated trip generation results for the new sanctuary

with a GFA of 133,033 ft² and 2,231 seats. A note has also been added to Page 34, stating, "The original study based the trip generation factor on the correlation of the existing GFA and the proposed GFA. In this updated report, the trip generation factor was based on the correlation between the existing and proposed seats. This change in approach was due to the unrealistic and overestimation of trips if the factor was based on the change in GFA."

- 4) Figures 9a – 9d and 12a – 12d were updated. Figures 9a – 9d show the trip assignment in the projected 2027 conditions with the new entrance to Topside Road and the new sanctuary with a GFA of 133,033 ft² and 2,231 seats. Figures 12a – 12d show the traffic volumes in the projected 2027 conditions with the new entrance to Topside Road and the new larger sanctuary.
- 5) Table 4c was updated for the intersection of Topside Road at the new Secondary Entrance during the 12:15 – 1:15 pm time period. This update was made due to a discovered, original transposed number for a turning movement volume at the intersection. This error was corrected in the Synchro software, reflected in an updated LOS capacity worksheet in Appendix D, and updated in Table 4c. The vehicle queue results from the same worksheet were also updated in Table 5a. This error and the subsequent correction had little impact on the results.
- 6) The LOS capacity worksheets in Appendix D and Tables 4f and 4g were updated to reflect the increase in trips generated in the 2027 projected conditions due to the proposed increase in the size of the new sanctuary. These changes were also reflected in the vehicle queue results shown in Table 5c.
- 7) Due to the 2027 projected traffic volumes being updated, the turn lane worksheets for the Secondary Entrance at Topside Road were updated in Appendix E. The results of this update did not change the recommendation that the entrance would not warrant the need for separate left or right-turn entering turn lanes on Topside Road.
- 8) This updated TIL includes a new recommendation about the proposed gate for the proposed access road to Topside Road on Pages 4 and 80.

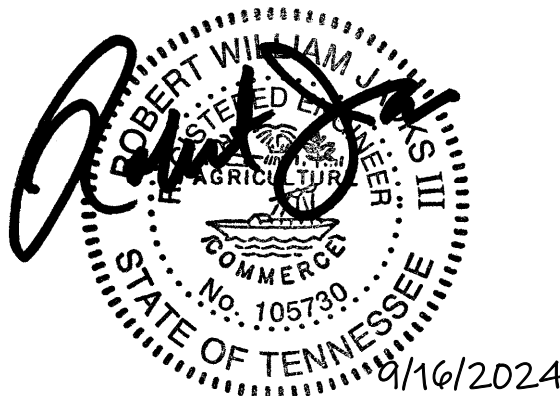
In addition to the revisions listed above, other changes in the report include the following:

- Updated title page
- Updated report headers and footers to reflect changes in report date and title
- Minor grammatical changes to improve the report

If you have any questions or further comments, please get in touch with me. We look forward to your approval.

Sincerely,

Ajax Engineering, LLC
Robert W. Jacks, P.E.



APPENDIX H

RESPONSE LETTER TO ADDRESS COMMENTS – 10.28.24



11812 Black Road
Knoxville, Tennessee 37932
Phone (865) 556-0042
ajaxengineering@gmail.com

October 28, 2024

PROJECT NAME: Calvary Knoxville Church Expansion
TO: Knoxville-Knox County Planning
SUBJECT: Response Document for Calvary Knoxville Church Expansion TIL Review
Comments

Knoxville-Knox County Planning, City of Knoxville Department of Engineering, Knox County Engineering and Public Works, and Tennessee Department of Transportation Staff:

The following response document addresses the comments in an email from Mike Conger, PE, dated October 21, 2024. This letter is added to the end of the revised report in Appendix H.

- 1) **On page 78 of the TIL it states "A law enforcement officer currently does not direct traffic on Sundays at the intersection, and the Church has been told in the past that they are not available" Is this reference carried over from the original version of the TIL from last year or is it still true that no officers are directing traffic? It seems to conflict with earlier statements that an officer is now present, please clarify.**

Response: This statement inadvertently carried over from the original version of the TIL. The TIL discussion regarding law enforcement has been revised on Page 78.

- 2) **Please coordinate with the site engineer to further refine the sight distance evaluation to determine if the required amount is achievable. Furthermore, please specifically locate the adjacent property corners and ensure that the vegetation/obstructions that need to be removed and maintained to achieve this required sight distance is within the existing public right-of-way or if easements along private property will need to be obtained.**

Response: The BHN&P survey crew returned to the site, made additional measurements, and determined that the required sight distance is within the existing public ROW, and easements will not be required from the adjacent property owners. The required sight distance of 300 feet on Topside Road is met in both directions from the Proposed Secondary Entrance. The measured sight distance to the west was 345.4 feet, and the sight distance to the east was 319.1 feet. A new image was added to the Revised TIL on Page 79. These updated measurements are also included on Page 71.

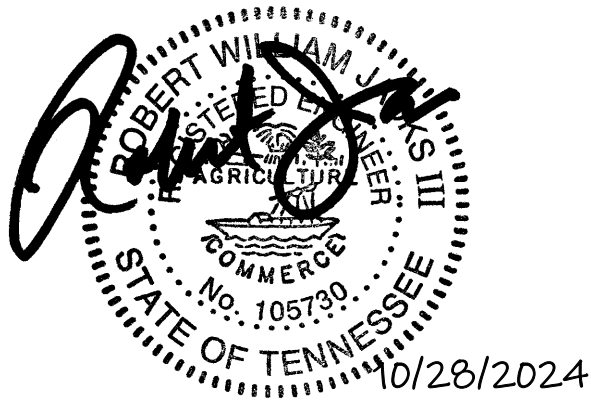
In addition to the revisions listed above, other changes in the report include the following:

- Updated Title Page
- Updated Table of Contents
- Updated Page Footers
- Added Appendix H to include this response letter

If you have any questions or further comments, please contact me. We look forward to your approval.

Sincerely,

Ajax Engineering, LLC
Robert W. Jacks, P.E.



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Knoxville, TN 37932
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CIVIL ENGINEERING / TRAFFIC ENGINEERING