New Mary Carroll High School TIA (Kostoryz Road Site)
Corpus Christi Independent School District (CCISD)
Saratoga Boulevard (SH 357)
Corpus Christi, Texas

P.E. *9/13/19*

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Prepared for

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August 2019

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EXECUTIVE SUMMARY

A. Purpose

The purpose of this study is to address the traffic and transportation impacts of the proposed new Mary Carroll High School on the adjacent street network and recommend any capacity related improvements. This study will also determine the existing and future Level of Service (LOS) associated with the development of the new Mary Carroll High School at surrounding signalized and un-signalized intersections within the study area including the future Carroll Lane Extension. The new Mary Carroll High School will be located at the north east quadrant at the intersection of Saratoga Boulevard (SH 357) with Kostoryz Road.

B. Development

Proposed Zoning (New Mary Carroll High School) (60 Acres) will be located at the northeast quadrant of Saratoga Boulevard (SH 357) with Kostoryz Road with the main entrance being off Saratoga Boulevard.

The new Mary Carroll High School is zoned as an educational facility, CODE 530 – High School (General Urban/ Suburban).

This TIA studies the adverse traffic impacts of the new development. The planned development will include the following facilities:

- 2400 students – High School

Trip generation for the proposed number of students was calculated using the fitted curve equations for CODE 530 – High School (General Urban/Suburban) from the *Institute of Transportation Engineers (ITE)* publication, *Trip Generation*, *10th edition*.

The new Mary Carroll High School development is expected to generate **1248** AM peak-hour trips and **336** PM peak-hour trips.

C. Study Area

Staff from the City of Corpus Christi and TxDot requested a traffic study to evaluate the traffic conditions during the AM Peak and PM Peak periods. Turning movement counts were collected in April 2019 from 7:00 AM to 9:00 AM in the AM peak period, and 4:00 PM to 6:00 PM in the PM peak period within the proximity of the proposed school at the following locations:

- Saratoga Boulevard (SH 357) at Weber Road (FM 43)
- Saratoga Boulevard (SH 357) at Kostoryz Road
- Saratoga Boulevard (SH 357) at Ayers Street
- Saratoga Boulevard (SH 357) at Ranger Avenue
- Saratoga Boulevard (SH 357) at Cabaniss Parkway
- Kostoryz Road at Masterson Drive
- Kostoryz Road at Carroll Lane Extension (FUTURE)
- Kostoryz Road at Holly Road

D. Amendment to Urban Transportation Plan (UTP)

Corpus Christi Independent School District (CCSID) has moved on an effort to amend the City's Urban Transportation Plan as it applies to the future location of Carroll Lane along the north edge of the new high school. CCISD desires to remove a portion of the future extension of Carroll Lane abutting the northern property line of the high school. The analysis that follows will show that

removing this portion of road from the UTP will not have negative impacts on the transportation system with the high school fully operational.

E. Conclusions

The new Mary Carroll High School development will have some adverse traffic impacts on the existing street network. A LOS study was performed at signalized and un-signalized intersections within the project site to determine the impact the additional traffic would have on the overall operation of the existing roadway network. The comparison of the Existing operation using traffic data collected for this report and the Background (Opening Day) operation using the same data with the traffic generated by the new development showed some impact on system delay and overall operations.

> **Existing:** All existing signalized control locations currently meet a **LOS B** or better along the proposed project site. All existing stop sign control locations currently meet a **LOS C** or better.
>
> **Background/Opening Day:** All existing signalized control locations will meet a **LOS D** or better. All existing and proposed stop sign control locations will meet a **LOS D** or better.
>
> **Projected (2026):** All existing signalized control locations will meet a **LOS D** or better. All existing and proposed stop sign control locations will meet a **LOS D** or better, except Intersection 3: Saratoga/Cabiness **LOS E** for the PM Peak.

Failing stop sign control at Intersection 3 is contributed to the growth rate on Saratoga Boulevard.

Eliminating the future Carroll Lane south of the ditch will be consistent with the City's transportation goals and policies as outlines in Plan CC and Mobility CC. Benefits would be to move thoroughfare traffic away from the new Mary Carroll High School to Masterson Drive to justify a traffic signal. Another benefit will be the signal at Masterson Drive would help move school traffic from Galvan Elementary School during school days. Masterson Drive is currently "one-way" westbound during school hours. The traffic signal would allow CCISD to submit a request to change the designation to "two-way" traffic during school hours. This new information suggests reexamination of the UTP map. The revision will have no impacts to the transportation City Master Plan.

F. Recommendations

The main objective of this study is to determine the impacts of the new Mary Carroll High School on the adjacent roadway network at signalized and unsignalized intersections along Saratoga Boulevard (SH 357) and Kostoryz Road. All major public access points were studied and analyzed for the proposed development with data that was collected in the field along with proposed land use information provided by the Client. Based on this information, we have developed the following recommended **mitigation measures:**

Intersection #6: Kostoryz Road @ Masterson Drive:
Recommend Traffic Signal Control. Warrants were justified using projected volumes.
Estimated construction cost - $250,000.00. City to install traffic signal when Carroll Lane Extension is constructed and undeveloped land gets developed.

Carroll Lane Extension:
Recommend to modify UTP with an amendment to remove the proposed section of "Carroll Lane" extension south of Wickersham Drive to Kostoryz Road on the south side of the Kostoryz/Carroll Lane DrainageDitch.

Recommend COCC and CCISD discuss opening pedestrian pathways off the hike and bike trail during

school hours to allow students a way to enter the school from the surrounding neighborhood.

City to approve UTP amendment as soon as possible.

The following are **mitigation measures** necessitated by the development with construction to be completed for opening day or shortly thereafter:

Intersection #2: Saratoga Boulevard @ Kostoryz Road:
Install a protected U-Turn movement on Saratoga Boulevard westbound. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Existing Signal Control is sufficient.

Intersection #8: Kostoryz Road @ DW8:
Recommendations shall consist of a minimum of three lanes, one lane entering the development and two lanes exiting the development, one right-turn lane and one left-turn lane. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Stop sign control is sufficient.
Recommend DW8 to be designed as a Type 2 design as shown on **Exhibit 8**.

Intersection #9: Kostoryz Road @ DW9:
Recommendations shall consist of a minimum of three lanes, one lane entering the development and two lanes exiting the development, one right-turn lane and one left-turn lane. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Stop sign control is sufficient.
Recommend DW9 to be designed as a Type 2 design as shown on **Exhibit 8**.

Intersections #10: Saratoga Boulevard @ DW10:
Recommendations shall consist of a minimum of two lanes, one lane entering the development and one lane exiting the development, right-in/right-out design. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Stop sign control is sufficient.
Recommend DW10 to be designed as a Type 4 design as shown on **Exhibit 8**.
Recommend at minimum a 100’ acceleration lane exiting the development.
Recommend a continuous auxiliary lane from DW10 to DW11.

Intersection #11: Saratoga Boulevard @ DW11:
Recommendations shall consist of one lane exiting the development right-out only design.
Recommend DW11 to be designed as a Type 2 design as shown on **Exhibit 8**.

Intersection #12: Saratoga Boulevard @ DW12:
Recommendations shall consist of one lane entering the development, right-in only design.
Recommend at minimum a 500’ deceleration lane entering the development.
Recommend DW12 to be designed as a Type 5 design as shown on **Exhibit 8**.

Roadway Network: Recommend that all roadway striping and signing to the network roadways conform with the latest TMUTCD.

Recommend installation of school zone flashers on Kostoryz Road to flash during drop-off/pick-up school hours.

Recommend school zone speed limit be extended east just beyond DW12. This section of Saratoga Boulevard has several existing school zones within the study area.

I. Introduction

A. Purpose

Maldonado-Burkett (MB) has been retained by Corpus Christi Independent School District (CCISD) to perform a Traffic Impact Analysis (TIA) for the new Mary Carroll High School to be located at the northeast corner of the intersection of Saratoga Boulevard (SH 357) and Kostoryz Road. Saratoga Boulevard will provide the southern boundary to the site as well as the main point of ingress and egress for the site. A total of five (5) driveways will be provided for student and staff parking. Kostoryz Road will provide the western boundary to the site. The new Mary Carroll High School proposes to have a maximum of **2400** high school students. **Exhibit 1** provides a site location map of the proposed new Mary Carroll High School and **Exhibit 2** provides a composite site plan.

The purpose of this study is to address the traffic and transportation impacts of the proposed new Mary Carroll High School on the adjacent street network and recommend any capacity related improvements. This study will also determine the existing and future Level of Service (LOS) associated with the development of the new Mary Carroll High School at the intersection of Saratoga Boulevard (SH 357) with Kostoryz Road and surrounding signalized and un-signalized intersections within the study area.

Part of this study includes the Carroll Lane Extension realignment amendment to the Urban Transportation Plan (UTP). CCISD is requesting an amendment to the City's Urban Transportation Plan.

B. Traffic Study

Staff from the City of Corpus Christi and TxDot requested a traffic study to evaluate the traffic conditions during the AM Peak and PM Peak periods. Turning movement counts were collected in April 2019 from 7:00 AM to 9:00 AM in the AM peak period, and 4:00 PM to 6:00 PM in the PM peak period within the proximity of the proposed new Mary Carroll High School at the following locations:

- Saratoga Boulevard (SH 357) at Weber Road (FM 43)
- Saratoga Boulevard (SH 357) at Kostoryz Road
- Saratoga Boulevard (SH 357) at Ayers Street
- Saratoga Boulevard (SH 357) at Ranger Avenue
- Saratoga Boulevard (SH 357) at Cabaniss Parkway
- Kostoryz Road at Masterson Drive
- Kostoryz Road at Carroll Lane Extension
- Kostoryz Road at Holly Road

The Existing AM and PM peak hour volumes are illustrated on **Exhibit 3**.

C. Methodology

The traffic evaluation was comprised of AM and PM peak hour Level of Service (LOS) analyses. This included the existing conditions, background (opening day) conditions and projected conditions. The PM Peak hour analysis generated by the *Trip Generation, 10th Edition* is for school let out. Traffic Volumes used for the PM analysis was the 5:00 p.m. peak hour volumes. Our traffic data on Saratoga Boulevard and Kostoryz Road was fairly equal from 4:00 p.m. to 6:00 p.m. with a slight increase for the 5:00 p.m.; approximately, 9%. Therefore, this study used the worst-case scenario of the higher traffic volumes. Analysis was accomplished via *Synchro 10* and OTISS software. All of the

information was completed in accordance with *Trip Generation, 10th Edition, Highway Capacity Manual 2016* designing to a LOS Standard – D or better.

OTISS is a cloud-based application for traffic and transportation engineers who need to perform traffic impact assessments. Featuring data from over 5,500 studies included in the *10th Edition Institute of Transportation Engineering (ITE) Trip Generation Manual*, OTISS is the most complete trip generation and analysis tool available today with 24-hour availability. OTISS software was used for the AM and PM peak period analysis reports.

Synchro Studio 10 provides the best in traffic analysis, optimization, and simulation applications. It combines the modeling capabilities of *Synchro* and the microsimulation and animation capabilities of SimTraffic to create the ultimate tool kit for viewing. *Synchro 10* is a macroscopic analysis and optimization software application. *Synchro s*upports the *Highway Capacity Manual's* methodology (2016 method) for signalized intersections and roundabouts. *Synchro* also implements the intersection Capacity Utilization method for determining intersection capacity. *Synchro* signal optimization routine allows the user to weight specific phases, thus providing users more options when developing signal timing plans.

II. Existing Area Conditions

A. Existing Traffic Volumes

The following are documented traffic volumes gathered from:

Corpus Christi Metropolitan Planning Organization (CCMPO)

- Saratoga Blvd. (SH 357) West of Weber Road – Year 2018 – 34,786 AADT (AMPS)

Corpus Christi MPO Demand Model Volumes

- Saratoga Blvd. (SH 357) West of Kostoryz Road –Year 2040 – 50,056 AADT
- Saratoga Blvd. (SH 357) East of Kostoryz Road – Year 2040 – 47,997 AADT
- Kostoryz Road North of Saratoga Blvd. – Year 2040 – 8,531 AADT

TxDot Statewide Planning Map.

- Saratoga Blvd. (SH 357) East of Ayers St. – Year 2017 – 25,961 AADT
- Weber Road (FM 43) North of Saratoga Blvd. – Year 2017 – 23,391 AADT
- Weber Road (FM 43) South of Saratoga Blvd. – Year 2017 – 24,140 AADT

Surrounding land uses consists of undeveloped land and residential on the North, undeveloped land to the South, Most Precious Blood Parish and undeveloped land to the East and John Paul II High School, Bishop Garriga Middle School, Corpus Christi Natatorium and Cabaniss Field to the West. Sight distance to the new development's driveways are excellent.

B. Existing Street System

The existing roadway network within the study includes the following un-signalized & signalized intersections:

- Saratoga Boulevard (SH 357) at Weber Road (FM 43) (Signal Control)
- Saratoga Boulevard (SH 357) at Kostoryz Road (Signal Control)
- Saratoga Boulevard (SH 357) at Ayers Street (Signal Control)
- Saratoga Boulevard (SH 357) at Ranger Avenue (Signal Control)
- Kostoryz Road at Masterson Drive (Stop Control)
- Kostoryz Road at Carroll Lane Extension (Signal Control)
- Kostoryz Road at Holly Road (Signal Control)

- Saratoga Boulevard (SH 357) at Cabaniss Parkway (Stop Control)

There are several major roadways within the study area. The following is a description of the existing conditions as of April 2019.

Saratoga Boulevard (SH 357) (State Maintained) is a six-lane divided principal arterial, with raised median containing left turn lanes and sidewalks. The roadway runs in an east-west direction on the south side of development. The posted speed limit is 45 mph.

Kostoryz Road (City Maintained) is a four-lane un-divided minor arterial, with left turn lanes and sidewalks. The roadway runs in an north-south direction on the west side of development. The posted speed limit is 40 mph.

Masterson Drive (City Maintained) is a two-lane residential street with sidewalks and intersects at Kostoryz Road. The roadway runs in an east-west direction on the northwest side of development. The posted speed limit is 30 mph.

Carroll Lane (City Maintained) is a two-lane divided residential street with sidewalks and dead-ends at Cresthill Drive. The roadway runs in an north-south direction on the north side of development. The posted speed limit is 30 mph. The UTP Plan shows Carroll Lane extension to Kostoryz Road along the drainage ditch.

Ranger Avenue (City Maintained) is a three-lane local street without sidewalks and dead-ends south of Saratoga Boulevard. The roadway runs in an north-south direction on the south-west side of development. The posted speed limit is 30 mph.

Cabaniss Parkway (City Maintained) is a two-lane undivided local street with sidewalks and dead-ends south of Saratoga Boulevard. The roadway runs in an north-south direction on the south-west side of development. The posted speed limit is 30 mph.

C. Approved Developments in Area

The School of Science and Technology located at the intersection of Evans Road with Acushnet Drive south of Saratoga Boulevard is partially opened and should be fully functional sometime in 2019. The School of Science and Technology School is expected to generate **405** AM trips and **290** PM trips. These trips were incorporated within this study and distributed throughout the roadway network.

An engineering judgement was made that the undeveloped land off the Carroll Lane Extension to Kostoryz Road would develop shortly after the new Mary Carroll High School opens. Projections for this area is expected to generate **556** AM trips and **591** PM trips. These trips were incorporated within the year 2026 Projected traffic volumes.

D. Scheduled Projects in the Area

Projects planned by TxDot:

- Saratoga Boulevard (SH 357) from .2 miles west of Greenwood to .2 miles east of Rodd Field Road – "Improve Traffic Signals and Interconnect Signals" – Letting Date, Feb 2019
- Weber Road (FM 43) from .8 miles south of Saratoga (SH 357) to .2 miles south of SH 358 – "Improve Traffic Signals and Interconnect Signals" – Letting Date, Feb 2019

Projects planned by the City of Corpus Christi:

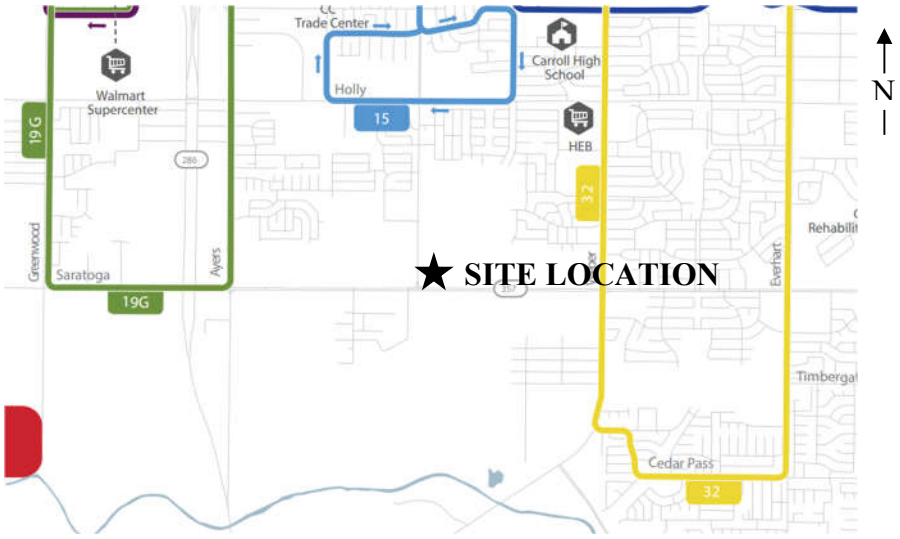
- Hike and Bike Trail parallel to future Carroll Lane Extension ditch – Off road multi use trail.

E. Corpus Christi Regional Transit Authority (CCRTA)

CCRTA current transit service is Route 32 from Port Ayers Station to Weber Road to Cedar Pass and

back to Everhart Road onto Southside Station.

CCRTA transit plan is shown below:



CCRTA and CCISD are currently working together to add a transit route to the proposed new Mary Carroll High School.

III. Proposed Development

Proposed Zoning (New Mary Carroll High School) (60 Acres) will be located at the northeast quadrant of Saratoga Boulevard (SH 357) with Kostoryz Road.

The new Mary Carroll High School is zoned as an educational facility, CODE 530 – High School (General Urban/ Suburban).

A. Trip Generation

This TIA studies the adverse traffic impacts of the new development. The planned development will include the following facilities:

- 2400 students – High School

The PM Peak hour analysis generated by the *Trip Generation, 10th Edition* is for school let out. Traffic Volumes used for the PM analysis was the 5:00 p.m. peak hour volumes. Our traffic data on Saratoga Boulevard and Kostoryz Road was fairly equal from 4:00 p.m. to 6:00 p.m. with a slight increase for the 5:00 p.m.; approximately, 9%. Therefore, this study used the worst case scenario of the higher traffic volumes.

Trip generation for the proposed number of students was calculated using the fitted curve equations for CODE 530 – High School (General Urban/Suburban) from the *Institute of Transportation Engineers (ITE)* publication, *Trip Generation*, *10th edition*.

The new Mary Carroll High School development is expected to generate **1248** AM peak-hour trips and **336** PM peak-hour trips. The **Appendix** provides a summary of the trips estimated to be generated.

B. Traffic Analysis

To determine the impact of the new Mary Carroll High School on adjacent traffic operations, the

following conditions were studied:

- Existing 2018
- Full Build (Background) 2021 (Added site generated trips to the existing volumes)
- Background Horizon 2026 (Background volumes, future development projections plus growth rate)

The new Mary Carroll High School development will have three (3) public access point on Saratoga Boulevard. Two (2) other driveways will be provided off Kostoryz Road for student parking. **Exhibit 3** identifies the location of the proposed driveways with existing peak hour volumes within the study area. **Exhibit 4** illustrates the ultimate AM and PM peak hour volumes for the new development background (opening day). Peak hour volumes were projected from the driveways and incorporated into the study locations. **Exhibit 5** illustrates the projected volumes for Year 2026, which include future developments along the future Carroll Lane Extension. The traffic count data are included in the **Appendix**.

The year 2021 is assumed as the Full Build year when the school operations would be initiated. To forecast Horizon 2026 traffic conditions, an annual growth rate of 3.0% on Saratoga Boulevard and 1.4% on Kostoryz Road was applied. Growth Rate was determined using the CCMPO Travel Demand Model and TxDot recommendations. Intersection operations were analyzed using *Synchro 10* software developed to automate procedures found in the *Highway Capacity Manual*. Since *Highway Capacity Manual 2010* does not provide the unsignalized intersection analysis for the major street with four through lanes, *Highway Capacity Manual 2000* was utilized in the *Synchro* analysis.

IV. Transportation Plan

A. Proposed Street Improvements

The following are new proposed driveways within the study area:

- Driveway DW8: Kostoryz Road @ DW8
- Driveway DW9: Kostoryz Road @ DW9
- Driveway DW10: Saratoga Boulevard @ DW10
- Driveway DW11: Saratoga Boulevard @ DW11
- Driveway DW12: Saratoga Boulevard @ DW12
- Driveway DW13: Saratoga Boulevard @ DW13 (Emergency Use Only)

The Proposed driveways are critical to maintain a decent traffic pattern flow coming in and out of the new development. See **Table 1** for driveway traffic distribution.

B. Data Used for Intersection Analysis

Maldonado-Burkett collected all the traffic data for this study.

Collected 24-hour volume traffic counts:

- Saratoga Boulevard west and east of Kostoryz Road
- Kostoryz Road north of Saratoga Boulevard
- Carroll Lane south of Holly Road
- Masterson Drive west of Kostoryz Road
- Ranger Road south of Saratoga Boulevard
- Cabaniss Parkway south of Saratoga Boulevard

Collected AM & PM turning movement traffic counts:

- Saratoga Boulevard @ Weber Road

- Saratoga Boulevard @ Kostoryz Road
- Saratoga Boulevard @ Ayers Street
- Saratoga Boulevard @ Ranger Avenue
- Saratoga Boulevard @ Cabaniss Parkway
- Kostoryz Road @ Masterson Drive
- Kostoryz Road @ Carroll Lane
- Kostoryz Road @ Holly Road

V. Amendment to Urban Transportation Plan (UTP)

On a separate application, CCISD is requesting an amendment to the City's Urban Transportation Plan for the future Carroll Lane Extension. This application will address and meet the criteria supporting the UTP amendment. See **Exhibit 10** for Exhibit of Proposed UTP Amendment.

The site for the new Mary Carroll High School is located at the northeast corner of the intersection of Kostoryz and Saratoga. The Corpus Christi Independent School District (CCISD) is in the process of purchasing and platting the property. Concurrent with the platting process, CCISD is proposing an amendment to the Urban Transportation Plan (UTP). The proposed UTP amendment is aimed at eliminating a portion of the planned Carroll Lane which runs along the Carroll Ditch. Currently, Carroll Lane is planned to parallel the Carroll Ditch on the south of the ditch with one intersection onto Kostoryz.

The portion of Carroll Lane on the south side of the ditch (new Mary Carroll High School site side of the ditch) is the portion proposed to be eliminated. The proposed UTP amendment will re-align Carroll Lane such that the portion south of the Carroll Ditch is eliminated beyond the future ditch crossing at the future extension of Wickersham Street. This will result in the two Carroll Lanes converging on the north side of the ditch, with one intersection point onto Kostoryz which is the existing intersection of Kostoryz & Masterson/Carroll Lane.

A comparison of traffic volumes was compared for the traffic that would have used Carroll Lane Extension as originally planned on the UTP. Volume coming in and out would be only slightly lower for Carroll Lane Extension following its original path. However, after analyzing this intersection at Kostoryz Road, Synchro output showed a LOS E for the AM Peak and a LOS F for the PM Peak without signalization.

Table **V.1** Comparison of UTP Amendment

	Current UTP Plan on Carroll Lane					Amendment to UTP Plan on Carroll Lane				
	Carroll Volume	Approach LOS	Delay Sec	Intersection LOS	Signalized	Carroll Volume	Approach LOS	Delay Sec	Intersection LOS	Signalized
AM Peak	371	E	44.4	E	No	418	B	11.6	A	Yes
PM Peak	328	F	114.3	F	No	367	B	12.9	A	Yes

Denial of the Amendment to the UTP would create a traffic delay at the intersection of Kostoryz Road. The intersection as proposed in the current UTP plan following the Carroll Lane Ditch would be close

to the intersection of Kostoryz Road and Saratoga Boulevard, approximately 1100'.

The proposed Carroll Lane Extension is currently designated as a collector street (CI) and would serve a limited area between Holly Road and Kostoryz Road. The new Mary Carroll High School development will significantly reduce the demand for the subject roadway since they have or will displace the number of homes or businesses that were originally planned in this specific location.

UTP amendment as proposed would serve as a collector for the area south of Holly Road and would provide access to the Kostoryz/ Masterson intersection.

Beneficial Impacts:

- Planned hike and bike trail along the Carroll Ditch will create a source of students walking to school from the neighborhood along Carroll Lane and Wickersham Street.
- Eliminating the future Carroll Lane south of the ditch will be consistent with the City's transportation goals and policies as outlined in Plan CC and Mobility CC.
- Revised alignment would move thoroughfare traffic away from the new Mary Carroll High School to Masterson Drive to justify a traffic signal.
- A signal at Masterson would improve clearing the Galvan Elementary School drop-off and pick-up queuing forming in front of the school while waiting for an opening to enter Kostoryz Road. Masterson Drive is currently "one-way" westbound during school hours. The traffic signal would allow CCISD to submit a request to change the designation to "two-way" traffic during school hours.
- Removes an area of possible threats for security planning purposes.
- Carroll Lane Extension per City's Urban Transportation Plan south of the ditch would serve a limited area between Holly Road and Kostoryz Road.

This new information suggests reexamination of the UTP map. The revision will have no impacts to the transportation City Master Plan, See **Exhibit 11**.

VI. Traffic Management Plan

A Traffic Management Plan (TMP) is important to maintain an optimum level of traffic flow and circulation during peak traffic periods associated with student drop-off and pick-up. The analysis utilizes the proposed site plan to identify the projected queuing (i.e., vehicle stacking) space needed on site to accommodate the projected peak demands related to drop-off/pick-up for the school.

The new Mary Carroll High School is expected to operate on a uniform daily schedule. Classes on typical school days for the high school will begin at 8:50 AM and conclude at 4:02 PM. While these are the scheduled class times, it can be assumed that not all students will enter/exit the site at these exact times based upon normal distribution patterns.

A. Queuing/Parking

A goal for any school is to accommodate all vehicular queuing and drop-off/pick-up procedures within the school campus property. A standardized technique for projected necessary queue length does not exist, however a simulation using PTV Vissim allows you to simulate traffic patterns.

Maximum queuing at schools consistently occurs during the afternoon peak period when students are being picked up by private automobile. The morning period is typically not a significant traffic issue since the drop-off activity is more temporary distributed and occurs much more quickly than student

pick-up. In campus drop-off/pick-up queuing storage is 1050 feet plus an additional 350 feet on the auxiliary lane. This is an additional 700 feet of storage compared to Veterans Memorial High School.

Per Off-Street Parking Requirements in the City's Unified Development Code Section 7.2.2, the parking ratios (per Table 7.2.2.B) for a High School Educational Facility are the following:

10 spaces per classroom (MCHS: 95 classrooms = **950** min. parking spaces)

1 space per "2.5 seats in any area intended to be used as an auditorium" (MCHS: (3,000 seat Gymnatorium + 375 seat Auxiliary Gym) /2.5 = 3,375 seats/2.5 = **1,350** min. parking spaces)

By adding the two ratio requirements above, the total min. # of parking spaces required = **2,300** min. parking spaces.

School Architect has requested a variance:

"It is unlikely CCISD will ever have the classroom building at full capacity concurrently with the gymnatorium and the auxiliary gym. All gymnasium events which will have the potential to be at full capacity will always occur outside of when school is in session (weekends, evenings, teacher work day, etc.) Therefore, the request for variance is requesting that only the more stringent of the two requirements (as described above) be required, which is the ratio requirements of 1 space per 2.5 seats in any area intended to be used as an auditorium. This ratio requirement at MCHS is a minimum of 1,350 parking spaces, which we exceed with a total parking count of 1,540 spaces"

Queuing report for all signalized intersections were generated using *Synchro 10* and with no significant queuing problem within the roadway network. See **Appendix** for each intersection describing the Queue length 50th (ft) and 95th (ft) stacking for each approach.

B. Circulation

Site access to the new Mary Carroll High School will be provided via driveways on Saratoga Boulevard (SH 357) and Kostoryz Road.

Passenger vehicles dropping-off/picking-up students will enter the school property at DW10 via right turns from Saratoga Boulevard. Once inside the site, vehicles will form a double queue line around the one-way, counterclockwise loop road and circulate around the visitor parking lot to reach the designated drop-off/pick-up location. The designated loading/unloading area is located on the south side of the school building between student and staff parking lots. A queuing analysis was done and showed that using the front of the school as a double queue line would create approximately 1700 feet of queuing storage. Spillage into Saratoga Boulevard should not occur.

To exit, vehicles continue straight and loop back to DW10 and proceed through the intersection on Saratoga Boulevard. For a second student drop-off/pick-up and student parking, drivers can use DW9 off Kostoryz Road. For a third student drop-off/pick-up drivers can use DW8 which is designated for student parking as well. See **Exhibit 7** for driveway locations and site circulation plan.

C. Bus Circulation

According to information provided by CCISD representatives, school bus service serving the peak hour student arrivals and departures is planned for this school. The site does provide a separate, designated school bus drop-off/pick-up area on the east side of the school building for school bus traffic.

The bus loading area provides adequate queue length, which could accommodate several school buses at a space allocation of 45 feet per bus. Buses will enter school bus drop-off/pick-up area from

Saratoga Boulevard on DW12 and exit on DW11.

D. Net Increased Trip Generation, Distribution and Assignment

The additional site-generated traffic associated with the new development was assigned to the study area roadway network. See **Exhibit 6** for Existing Transportation System. The distribution and assignment were determined based on engineering judgment through generated traffic counts, knowledge of the study area network, and the proposed access locations to and from the development. See **Table 1** for distribution percentage (%) for the new driveways. See **Appendix** for Trip Generation, Distribution and Assignments.

E. Level of Service Evaluations

The analysis consists of both AM and PM intersection LOS analyses. The purpose of this analysis was to determine if any deficiencies within the network exist and to establish a standard condition.

"Level-of-Service (LOS)" represents the capacity or volume of traffic that a roadway can accommodate. LOS is a qualitative measure used to relate to the quality of traffic service. LOS is used to analyze highways by categorizing traffic flow and assigning quality levels of traffic based on performance measure such as speed, density, etc. These levels range from LOS A (free flowing) to LOS F (a congested, forced flow condition). The target LOS for this study area is a **LOS D or better** with all improvements and development resulting from the new Mary Carroll High School. A description of each operational state for signalized intersections, as defined by 2016 *Highway Capacity Manual*, is presented in **Table 2**.

Table 3 summarizes the results of the existing signalized intersections; **Table 4** summarizes the results of the Background Opening Day signalized intersections and **Table 5** summarizes the results of the Projected 2026 signalized intersections analysis for the study area. Signal timings were assumed optimized and actuated. *Synchro* output sheets are provided in the **Appendix**.

For Two-Way Stop Control, LOS for non-signalized two-way intersections is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to first-in-queue position. The levels of service criteria for stop sign controlled intersections are given in **Table 6**.

Table 7 summarizes the results of the Existing un-signalized intersections. **Table 8** summarizes the results of the Background Opening Day un-signalized intersections and **Table 9** summarizes the results of the Projected 2026 un-signalized intersections analysis for the study area. *Synchro* output sheets are provided in the **Appendix**.

F. Driveway Design Guidelines

The proposed driveway location balances spacing with other adjacent driveways that exist in the area. The driveways are located and designed to provide adequate spacing from the Saratoga Boulevard with Kostoryz Road intersection, approximately 480 feet to the main driveway, DW10 and approximately 640 feet to DW9. See **Exhibit 7** for proposed driveway placements.

Examples of practical driveway designs to accommodate the type of vehicles expected are shown on **Exhibit 8**.

G. Traffic Signal Warrant Analysis

Traffic signal warrant analysis were prepared for Kostoryz Road with Masterson Drive. The *Texas Manual on Uniform Traffic Control Devices (TMUTCD)* defines nine warrants, or justifying sets of

conditions, which at least one should be fully satisfied before signalization is considered as an option for traffic control. Traffic volumes, the number of traffic lanes, the prevailing traffic speeds, traffic accident experience, and measure delay for minor street traffic are the factors included in the evaluation of these warrants. The traffic volumes used for the analysis will be the existing traffic plus a projection of traffic exiting and entering from the new Mary Carroll High School development. Traffic was projected using standard trip generation and traffic assignment procedures.

The two major volume-based warrants are the most rigorous tests of the appropriateness of a signal, and can be examined in a detail in the Texas Manual on Unified Traffic Control Devices (TxMUTCD). The detailed warrant analysis worksheets, including the warrant curves are included in the **Appendix**.

Study 1: Kostoryz Road @ Masterson Drive – Existing Volumes

- Signal warrants **were not** satisfied**.**

Study 2: Kostoryz Road @ Masterson Drive – Background (Opening Day) Plus Future Development Volumes

- Signal warrants **were** satisfied, met Warrant 3.

Spacing Between proposed traffic signals

- On **Kostoryz Road** traffic signal spacing is as follows:

  Kostoryz Road @ Masterson Drive is approximately 1,960 feet from the traffic signal at Saratoga Boulevard.

The posted speed limit on Saratoga Boulevard is 45 MPH. Kostoryz Road has a posted speed limit of 40 MPH.

VII. Observations

MB's personnel conducted a site visit at Veterans Memorial High School which is of similar student size and blue print of the proposed new Mary Carroll High School. The site visit was conducted on November 13, 2018 from 8:00 AM to 9:00 AM and 3:30 PM to 4:30 PM. The day was a chilling 42 degrees in the morning and 54 degrees in the afternoon.

During our site visit we observed that the mode of transportation would be mostly cars and buses. We observed only 9 bicycles, possibly due to the cold weather. There were still a significant number of students that walked to school; however, the exact number was not counted due to the various entry points within the large school campus.

A nearby traffic signal helped clear the school traffic through the main city streets surrounding the high school significantly. The average drop-off was approximately 7 seconds per vehicles.

See **Table VII-1** and **Table VII-2** below for main entrance circulation observation.

Table **VII-1** Parent **Drop-off** Circulation Observation for Main Entrance

Time	Description	Entering Queued Vehicles	Exiting Queued Vehicles
8:00 AM	Drop-off arrivals was light	3-5	10-12
8:15 AM	Drop-off arrivals was light	5-8	12-15
8:30 AM	Drop-off arrivals was moderate	8-9	11-22
8:45 AM	Drop-off arrivals was heavy	16-21	9-11
9:00 AM	Drop-off arrivals was heavy	21-24	9-11

Table **VII-2** Parent **Pick-up** Circulation Observation for Main Entrance

Time	Description	Entering Queued Vehicles	Exiting Queued Vehicles
3:30 PM	Pick-up arrivals was light	1	1-2
3:45 PM	Pick-up arrivals was moderate	15-21	1-2
* 4:00 PM	Pick-up arrivals was heavy	45-50	4-6
4:15 PM	Pick-up arrivals was moderate	10-18	6-11
4:30 PM	Pick-up arrivals was light	2-3	10-12

*We observed 4 vehicles stacked on City street waiting to make a right-turn onto the main entrance for pick-up.

Other driveways observed were the student parking/bus and staff parking lots. These driveways were also used by parents as drop-off and pickup points. For these driveways all traffic entering and exiting for both AM and PM cleared traffic fairly quickly without much delay.

We also observed several vehicles exiting the school campus making a left turn, completely ignoring the regulatory sign of "RIGHT TURN ONLY".

The number of parking spaces were adequate as recommended in the *Corpus Christi Unified Development Code* under section 7.2.2. During our observation we noted that around ¾ of the parking was being utilized once school started. There was plenty of unused parking spaces remaining.

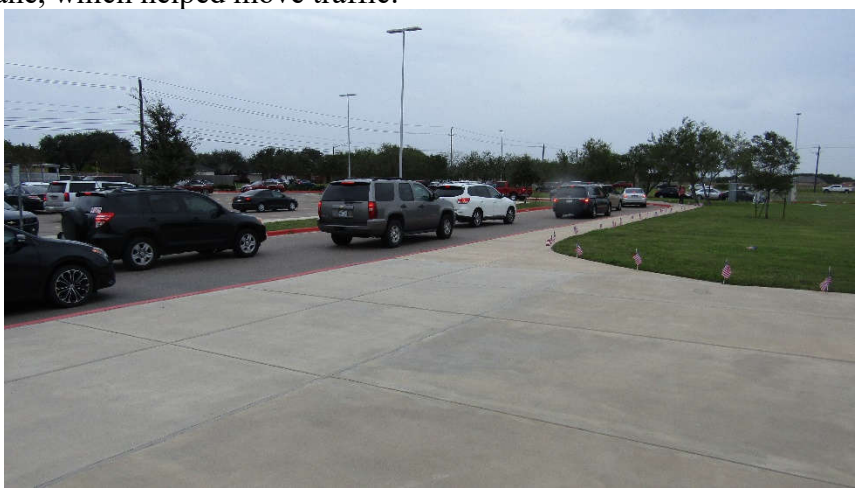
A. Site Visit at Veterans Memorial High School – AM Peak Drop-Off Entering

Parents entered the Campus were using the near curb lane to park and drop-off kids for a distance of over 400 feet and maneuvering left to proceed towards the exit as shown below.

AM Drop-Off Entering

B. Site Visit at Veterans Memorial High School – AM Peak Drop-Off Exiting

Parents exiting the Campus proceeded straight or maneuvered left and headed towards the exit. 2 lanes of traffic merged into 1 lane near the exit and proceeded onto the City street. Exiting onto city street is a right-turn only lane, which helped move traffic.



AM Drop-Off Exiting

C. Site Visit at Veterans Memorial High School – PM Peak Pick-Up Entering

Parents parked near the curb lane for pick-up stacked up throughout the entire loop road. As students were picked-up parents would maneuver left and proceed to the exit.

PM Pick-Up Entering

D. Site Visit at Veterans Memorial High School – PM Peak Pick-Up Exiting

Parents exiting the pick-up loop road would merge into 1 lane and proceeded to a right-turn only onto the city street.

PM Pick-Up Exiting

E. Site Visit at Veterans Memorial High School – PM Peak Pick-Up

MB noticed 4 vehicles stacked on the city street waiting to make a right-turn onto the main pick-up entrance. This only occurred once during the site visit.

PM Pick-Up

Lessons learned from this site visit is to provide additional queuing storage for student drop-off/pick-up circulation plan to not spill traffic onto the major street.

VIII. Conclusions and Recommendations

A. Conclusions:

The new Mary Carroll High School development will have some adverse traffic impacts on the existing street network. A LOS study was performed at signalized and un-signalized intersections within the project site to determine the impact the additional traffic would have on the overall operation of the existing roadway network. The comparison of the Existing operation using traffic data collected for this report and the Background (Opening Day) operation using the same data with the traffic generated by the new development showed some impact on system delay and overall operations.

> **Existing:** All existing signalized control locations currently meet a **LOS B** or better along the proposed project site. All existing stop sign control locations currently meet a **LOS C** or better.
>
> **Background/Opening Day:** All existing signalized control locations will meet a **LOS D** or better. All existing and proposed stop sign control locations will meet a **LOS D** or better.
>
> **Projected (2026):** All existing signalized control locations will meet a **LOS D** or better. All existing and proposed stop sign control locations will meet a **LOS D** or better, except Intersection 3: Saratoga/Cabiness **LOS E** for the PM Peak.

Failing stop sign control at Intersection 3 is contributed to the growth rate on Saratoga Boulevard.

Eliminating the future Carroll Lane south of the ditch will be consistent with the City's transportation goals and policies as outlines in Plan CC and Mobility CC. Benefits would be to move thoroughfare traffic away from the new Mary Carroll High School to Masterson Drive to justify a traffic signal. Another benefit will be the signal at Masterson Drive would help move school traffic from Galvan Elementary School during school days. Masterson Drive is currently "one-way" westbound during school hours. The traffic signal would allow CCISD to submit a request to change the designation to "two-way" traffic during school hours. This new information suggests reexamination of the UTP map. Publication FHWA/TX-04/4286-2 are practical guidelines for entries to a high school. Even though the guidelines suggest entry of a high school can be located along a collector street, entry points need to be controlled by CCISD in order to try and prevent unauthorized trespassers.

B. Recommendations:

The main objective of this study is to determine the impacts of the new Mary Carroll High School on the adjacent roadway network at signalized and unsignalized intersections along Saratoga Boulevard (SH 357) and Kostoryz Road. All major public access points were studied and analyzed for the proposed development with data that was collected in the field along with proposed land use information provided by the Client, see **Exhibit 9**. Based on this information, we have developed the following recommended **mitigation measures:**

Intersection #6: Kostoryz Road @ Masterson Drive:
Recommend Traffic Signal Control. Warrants were justified using projected volumes.
Estimated construction cost - $250,000.00. City to install traffic signal when Carroll Lane Extension is constructed and undeveloped land gets developed.

Carroll Lane Extension:
Recommend to modify UTP with an amendment to remove the proposed section of "Carroll Lane" extension south of Wickersham Drive to Kostoryz Road on the south side of the Kostoryz/ Carroll Lane Drainage Ditch.

Recommend COCC and CCISD discuss opening pedestrian pathways off the hike and bike trail during school hours to allow students a way to enter the school from the surrounding neighborhood.

City to approve UTP amendment as soon as possible.

The following are **mitigation measures** necessitated by the development with construction to be completed for opening day or shortly thereafter.

Intersection #2: Saratoga Boulevard @ Kostoryz Road:
Install a protected U-Turn movement on Saratoga Boulevard westbound. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Existing Signal Control is sufficient.

Intersection #8: Kostoryz Road @ DW8:
Recommendations shall consist of a minimum of three lanes, one lane entering the development and two lanes exiting the development, one right-turn lane and one left-turn lane. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Stop sign control is sufficient.
Recommend DW8 to be designed as a Type 2 design as shown on **Exhibit 8**.

Intersection #9: Kostoryz Road @ DW9:
Recommendations shall consist of a minimum of three lanes, one lane entering the development and two lanes exiting the development, one right-turn lane and one left-turn lane. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Stop sign control is sufficient.
Recommend DW9 to be designed as a Type 2 design as shown on **Exhibit 8**.

Intersections #10: Saratoga Boulevard @ DW10:
Recommendations shall consist of a minimum of two lanes, one lane entering the development and one lane exiting the development, right-in/right-out design. All pavement markings and roadway signs should be in compliance with the latest TMUTCD. Stop sign control is sufficient.
Recommend DW10 to be designed as a Type 4 design as shown on **Exhibit 8**.
Recommend at minimum a 100’ acceleration lane exiting the development.
Recommend a continuous auxiliary lane from DW10 to DW11.

Intersection #11: Saratoga Boulevard @ DW11:
Recommendations shall consist of one lane exiting the development right-out only design.
Recommend DW11 to be designed as a Type 2 design as shown on **Exhibit 8**.

Intersection #12: Saratoga Boulevard @ DW12:
Recommendations shall consist of one lane entering the development, right-in only design.
Recommend at minimum a 500’ deceleration lane entering the development.
Recommend DW12 to be designed as a Type 5 design as shown on **Exhibit 8**.

Roadway Network: Recommend that all roadway striping and signing to the network roadways conform with the latest TMUTCD.

Recommend installation of school zone flashers on Kostoryz Road to flash during drop-off/pick-up school hours.

Recommend school zone speed limit be extended east just beyond DW12. This section of Saratoga Boulevard has several existing school zones within the study area.

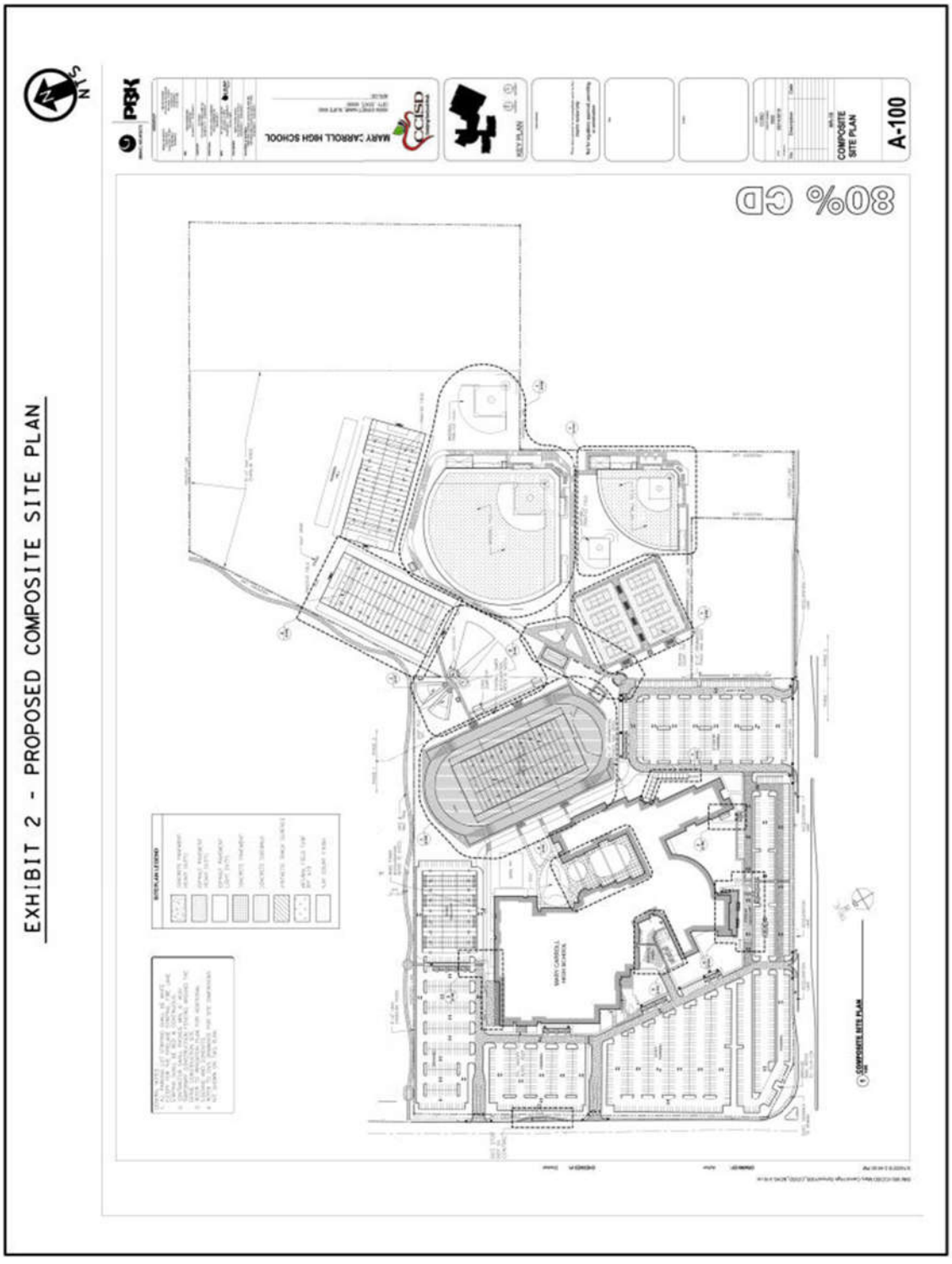
References

1. *Trip Generation Manual, 10th Edition.* Institute of Transportation Engineers, Washington, D.C., 2012.
2. *Texas Manual on Uniform Traffic Control Devices, 2011 Edition*. Texas Department of Transportation, Austin, Texas.
3. *Highway Capacity Manual, (SR 209), Transportation Research Board, Washington, DC, 2016*.
4. *Texas Department of Transportation's Transportation Divisions Statewide Planning Map, 2013*.
5. *Texas Manual on Uniform Traffic Control Device (TMUTCD)*.
6. *Texas Department of Transportation's Access Management Manual*.
7. *Traffic Operations and Safety at Schools:* Recommended Guidelines (Report No. FHWA/TX-04/4286-2)

Exhibits

EXHIBIT 1 - LOCATION MAP

EXHIBIT 2 - PROPOSED COMPOSITE SITE PLAN



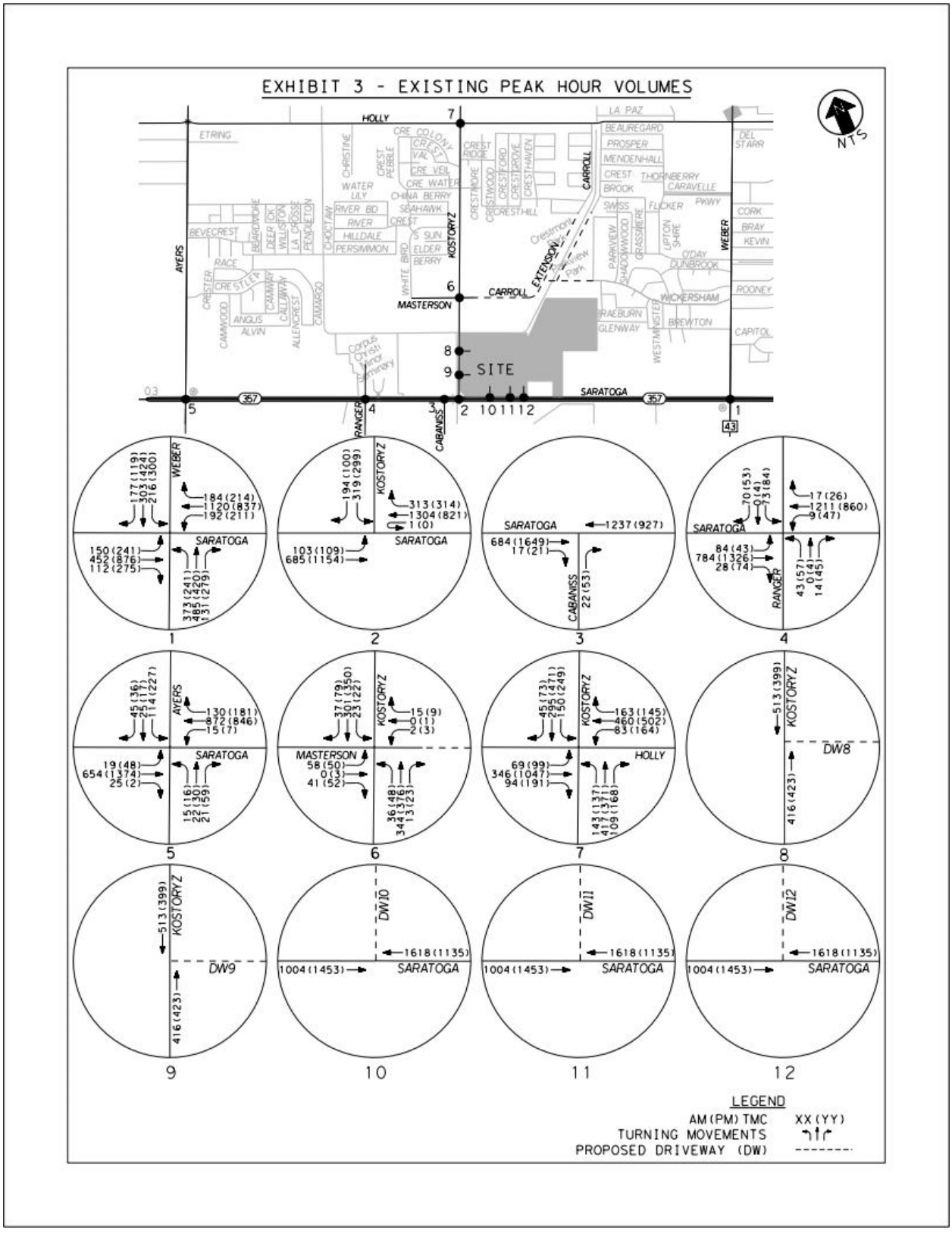


EXHIBIT 3 - EXISTING PEAK HOUR VOLUMES
NTS
HOLLY
ETRING
AYERS
WEBER
KOSTORYZ
CARROLL
EXTENSION
MASTERSON
SARATOGA
RANGER
CABANISS
SITE
LA PAZ
BEAUREGARD
PROSPER
MENDENHALL
THORNBERRY
CARAVELLE
PKWY
CORK
BRAY
KEVIN
O'DAY
DUNBROOK
ROONEY
WICKERSHAM
BREWTON
CAPITOL
DEL STARR
357
43
LEGEND
AM(PM) TMC XX(YY)
TURNING MOVEMENTS
PROPOSED DRIVEWAY (DW)
DW8
DW9
DW10
DW11
DW12

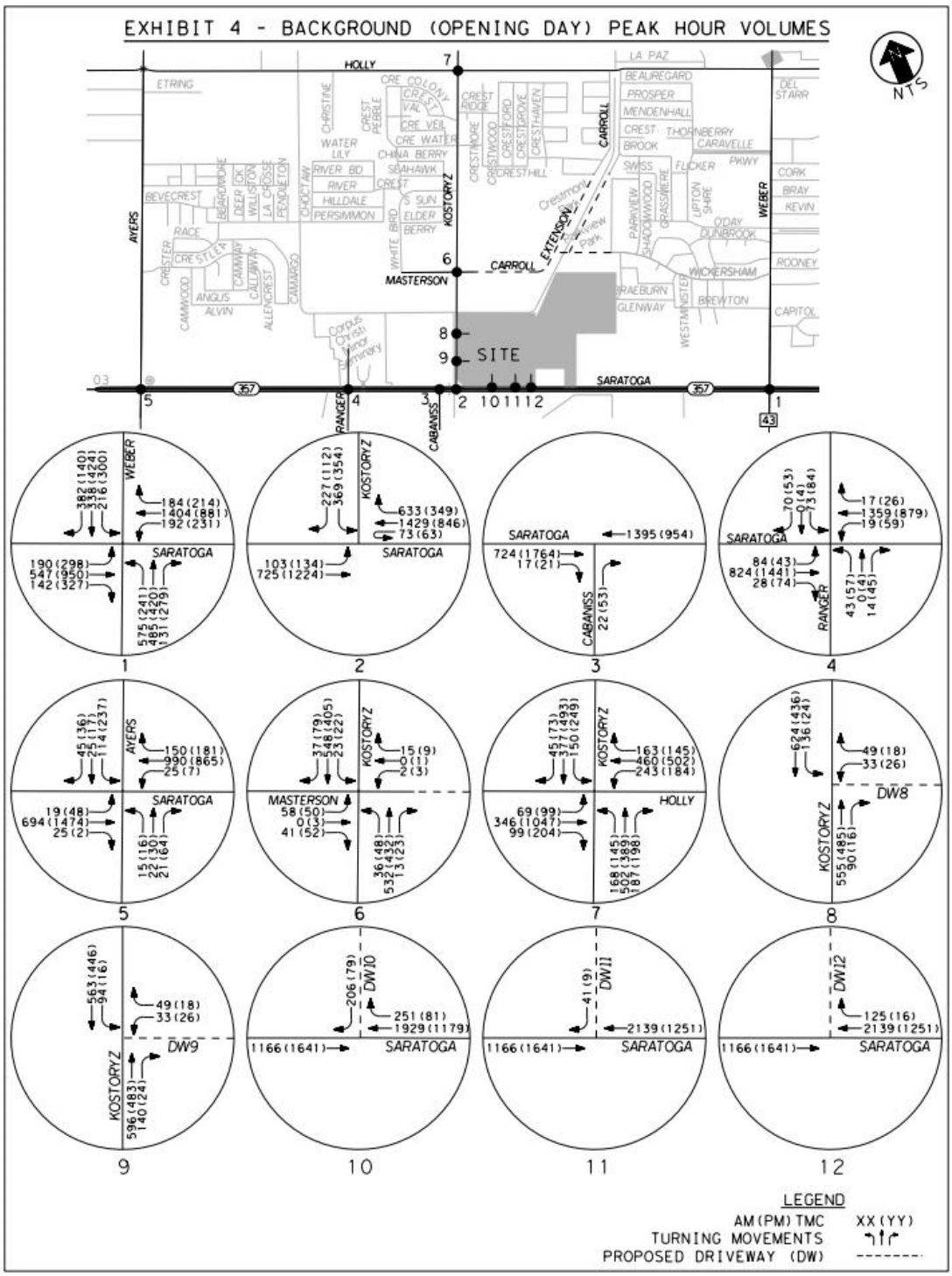


EXHIBIT 4 - BACKGROUND (OPENING DAY) PEAK HOUR VOLUMES
NTS
HOLLY
ETRING
AYERS
WEBER
KOSTORYZ
CARROLL
MASTERSON
SARATOGA
RANGER
CABANISS
SITE
LA PAZ
BEAUREGARD
PROSPER
MENDENHALL
THORNBERRY
CARAVELLE
CORK
BRAY
KEVIN
ROONEY
WICKERSHAM
BREWTON
CAPITOL
DUNBROOK
O'DAY
RAEBURN
GLENWAY
WESTMINSTER
1
2
3
4
5
6
7
8
9
10
11
12
DW8
DW9
DW10
DW11
DW12
LEGEND
AM(PM) TMC XX(YY)
TURNING MOVEMENTS
PROPOSED DRIVEWAY (DW)

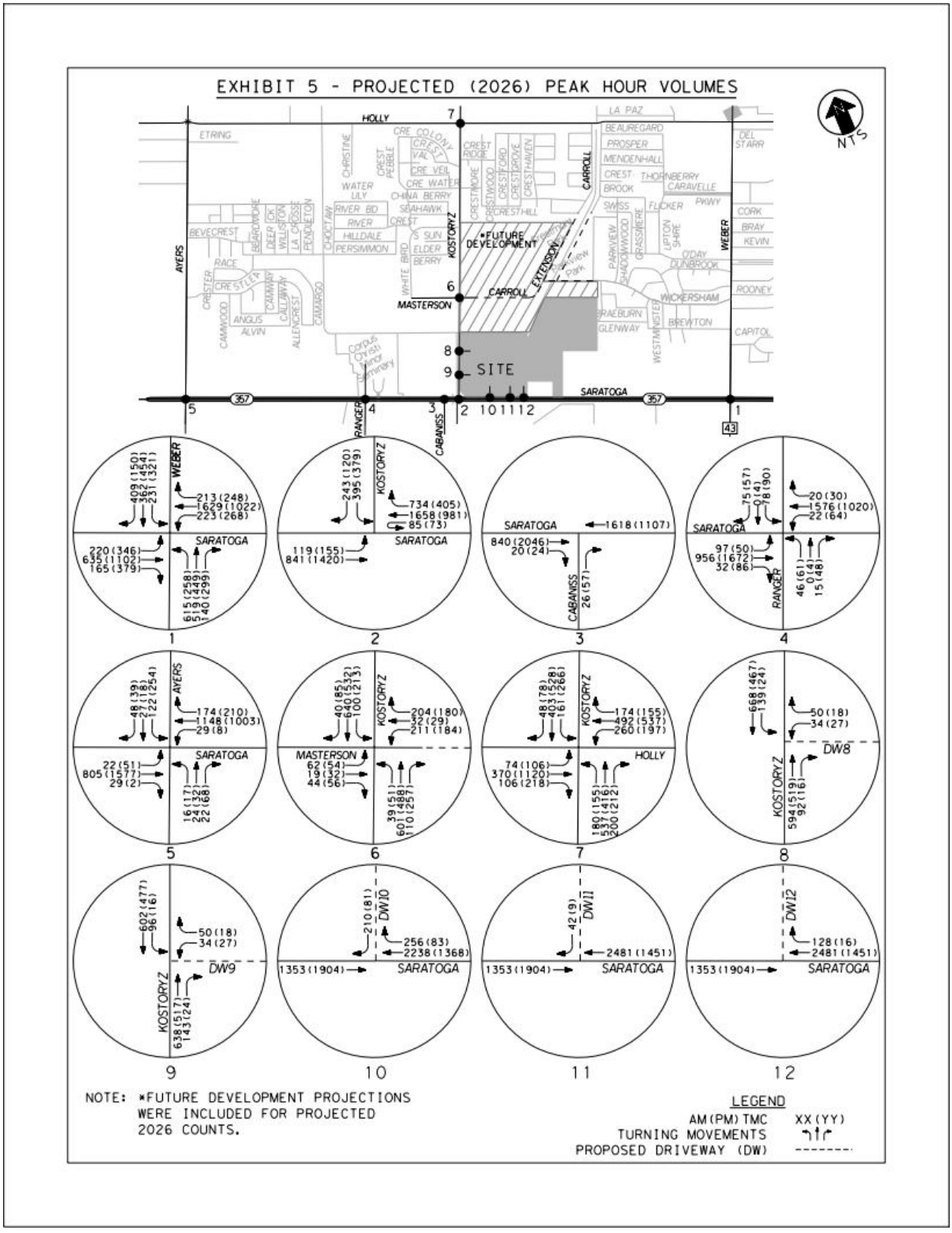


EXHIBIT 5 - PROJECTED (2026) PEAK HOUR VOLUMES
NTS
HOLLY
ETRING
AYERS
WEBER
CARROLL
KOSTORYZ
MASTERSON
SARATOGA
RANGER
CABANISS
*FUTURE DEVELOPMENT
EXTENSION
SITE
LA PAZ
BEAUREGARD
PROSPER
MENDENHALL
CARAVELLE
CORK
BRAY
KEVIN
DUNBROOK
ROONEY
WICKERSHAM
BREWTON
CAPITOL
RAEBURN
GLENWAY
DW8
DW9
DW10
DW11
DW12
NOTE: *FUTURE DEVELOPMENT PROJECTIONS WERE INCLUDED FOR PROJECTED 2026 COUNTS.
LEGEND
AM(PM) TMC XX(YY)
TURNING MOVEMENTS
PROPOSED DRIVEWAY (DW)

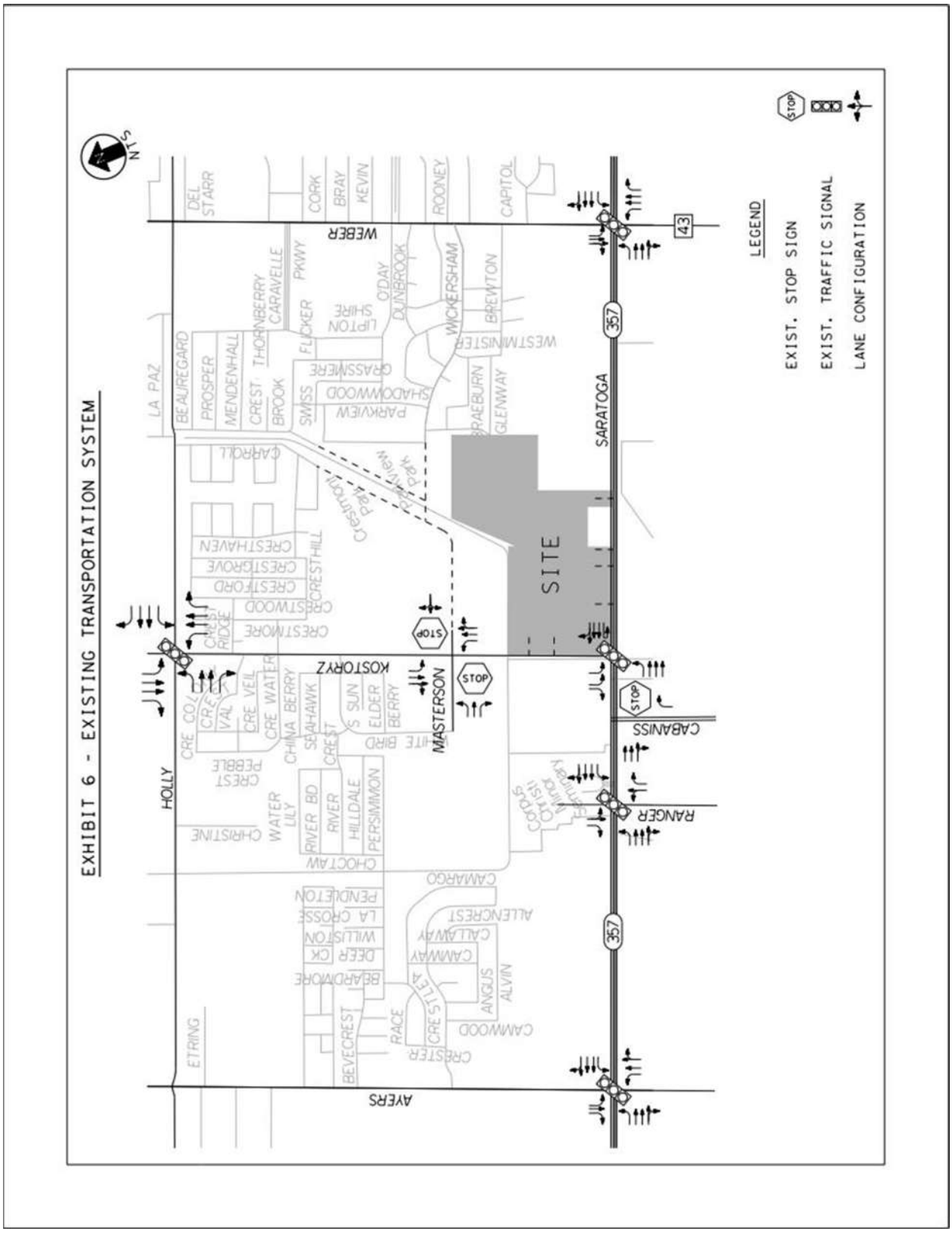


EXHIBIT 6 - EXISTING TRANSPORTATION SYSTEM
NTS
LEGEND
EXIST. STOP SIGN
EXIST. TRAFFIC SIGNAL
LANE CONFIGURATION
SITE
WEBER
KOSTORYZ
AVERS
SARATOGA
CABANISS
RANGER
MASTERSON
HOLLY
ETRING
43
357
STOP

EXHIBIT 7 - SITE CIRCULATION TRAFFIC MANAGEMENT PLAN

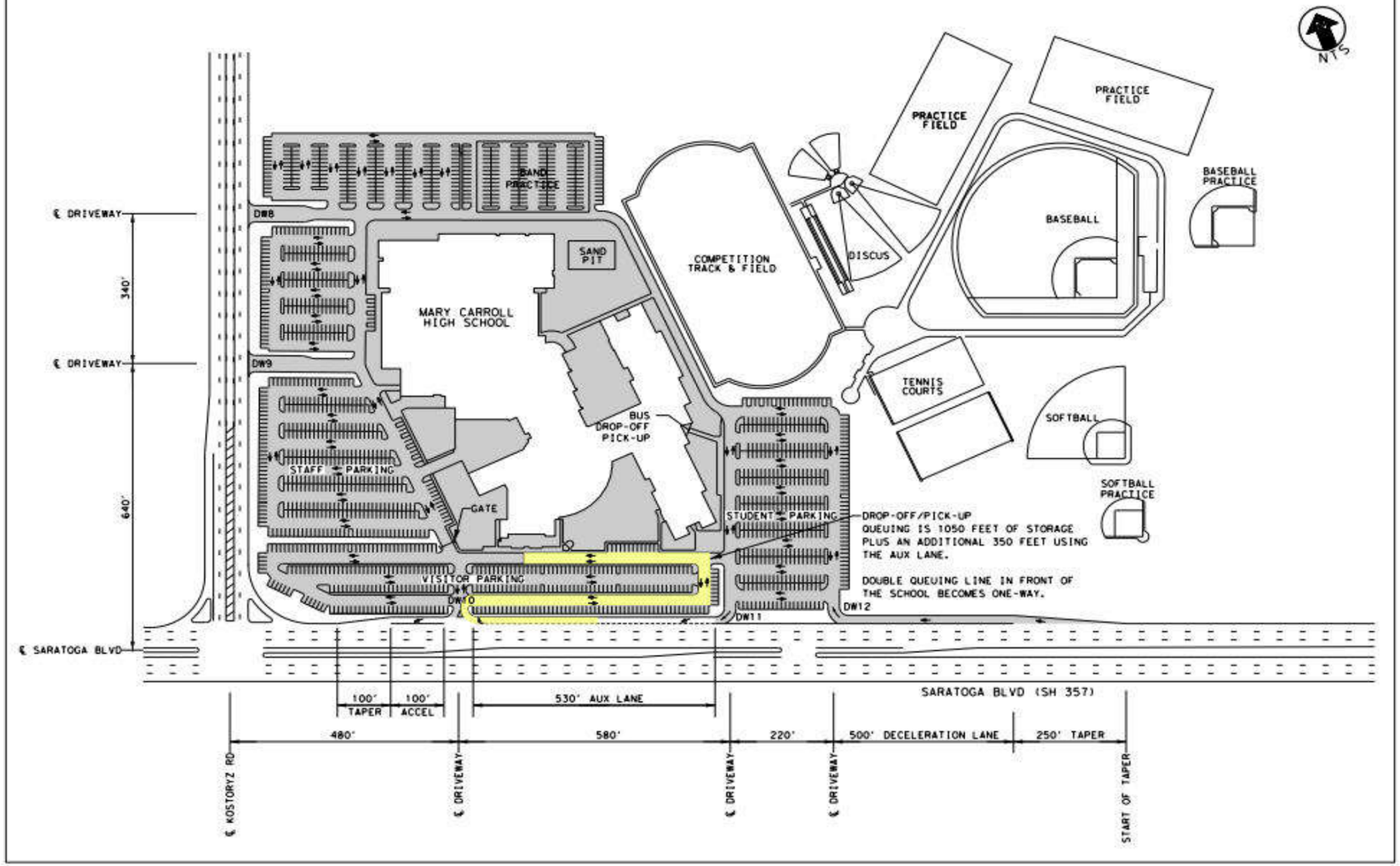
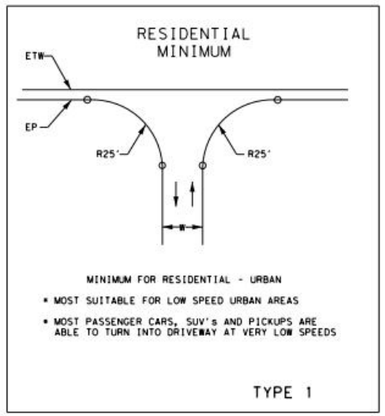
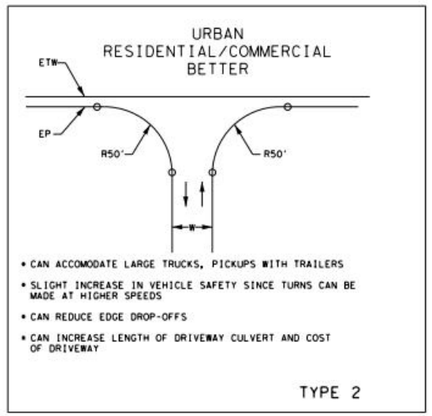


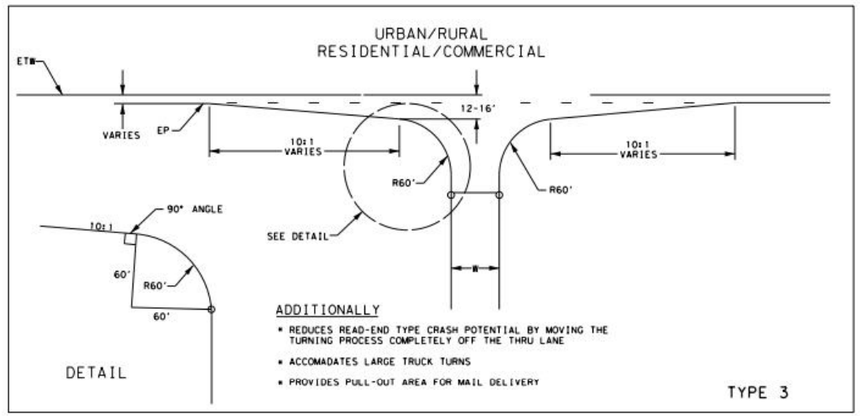
EXHIBIT 8 - PROPOSED DRIVEWAY

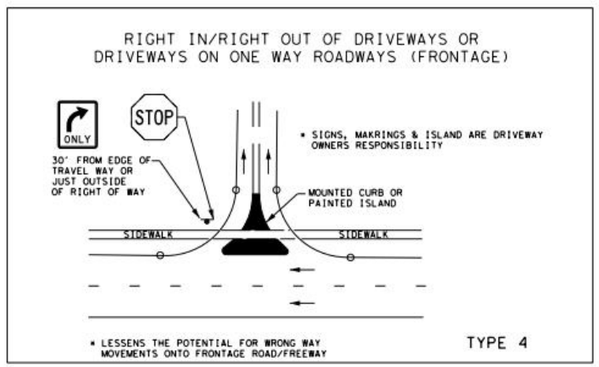
LEGEND:
ETW-EDGE OF TRAVEL WAY
EP-EDGE OF PAVEMENT

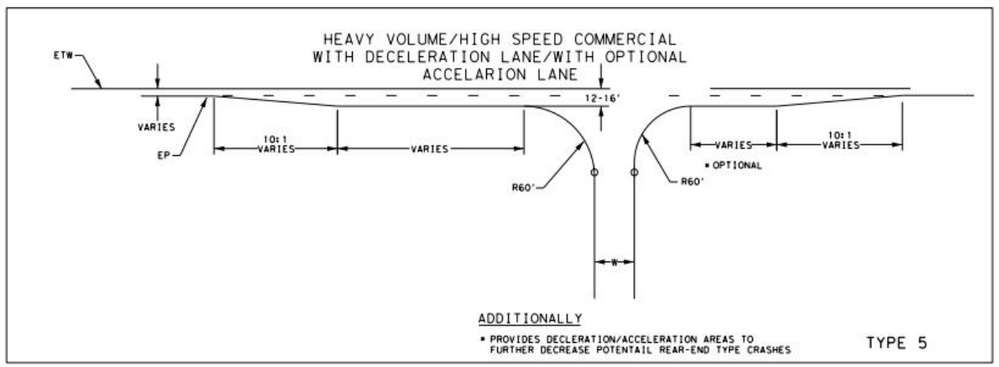
TYPICAL DRIVWAY DESIGNS











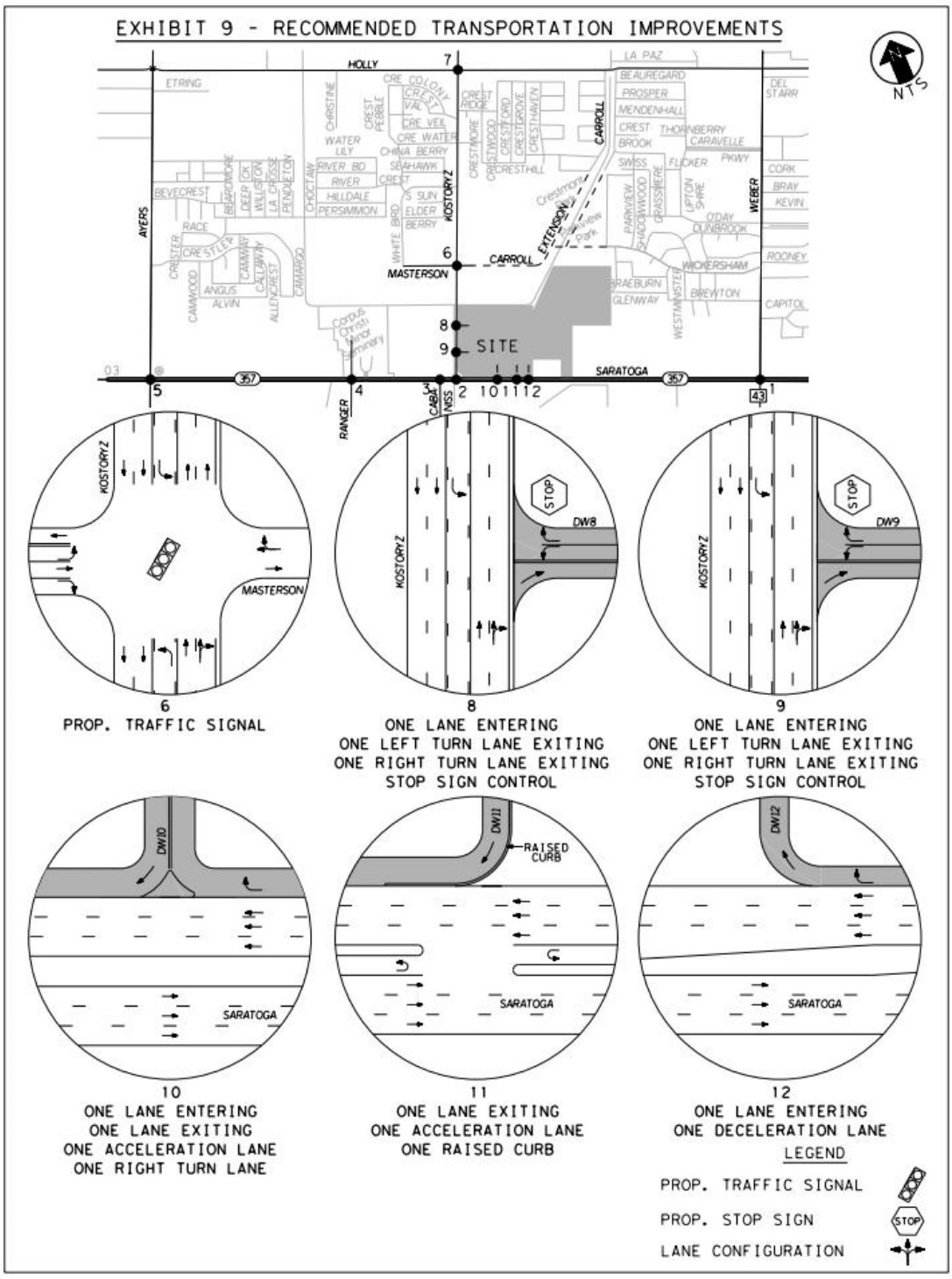


EXHIBIT 9 - RECOMMENDED TRANSPORTATION IMPROVEMENTS
NTS
HOLLY
LA PAZ
CARROLL
MASTERSON
SARATOGA
KOSTORYZ
WEBER
AYERS
SITE
CARROLL EXTENSION
RANGER
CABLE
WSS
6
PROP. TRAFFIC SIGNAL
8
ONE LANE ENTERING
ONE LEFT TURN LANE EXITING
ONE RIGHT TURN LANE EXITING
STOP SIGN CONTROL
DW8
9
ONE LANE ENTERING
ONE LEFT TURN LANE EXITING
ONE RIGHT TURN LANE EXITING
STOP SIGN CONTROL
DW9
STOP
10
ONE LANE ENTERING
ONE LANE EXITING
ONE ACCELERATION LANE
ONE RIGHT TURN LANE
DW10
11
ONE LANE EXITING
ONE ACCELERATION LANE
ONE RAISED CURB
DW11
RAISED CURB
12
ONE LANE ENTERING
ONE DECELERATION LANE
DW12
LEGEND
PROP. TRAFFIC SIGNAL
PROP. STOP SIGN
LANE CONFIGURATION

EXHIBIT 10 - CARROLL LANE AMENDMENT TO UTP.
REMOVAL OF C1 COLLECTOR SOUTH OF DITCH

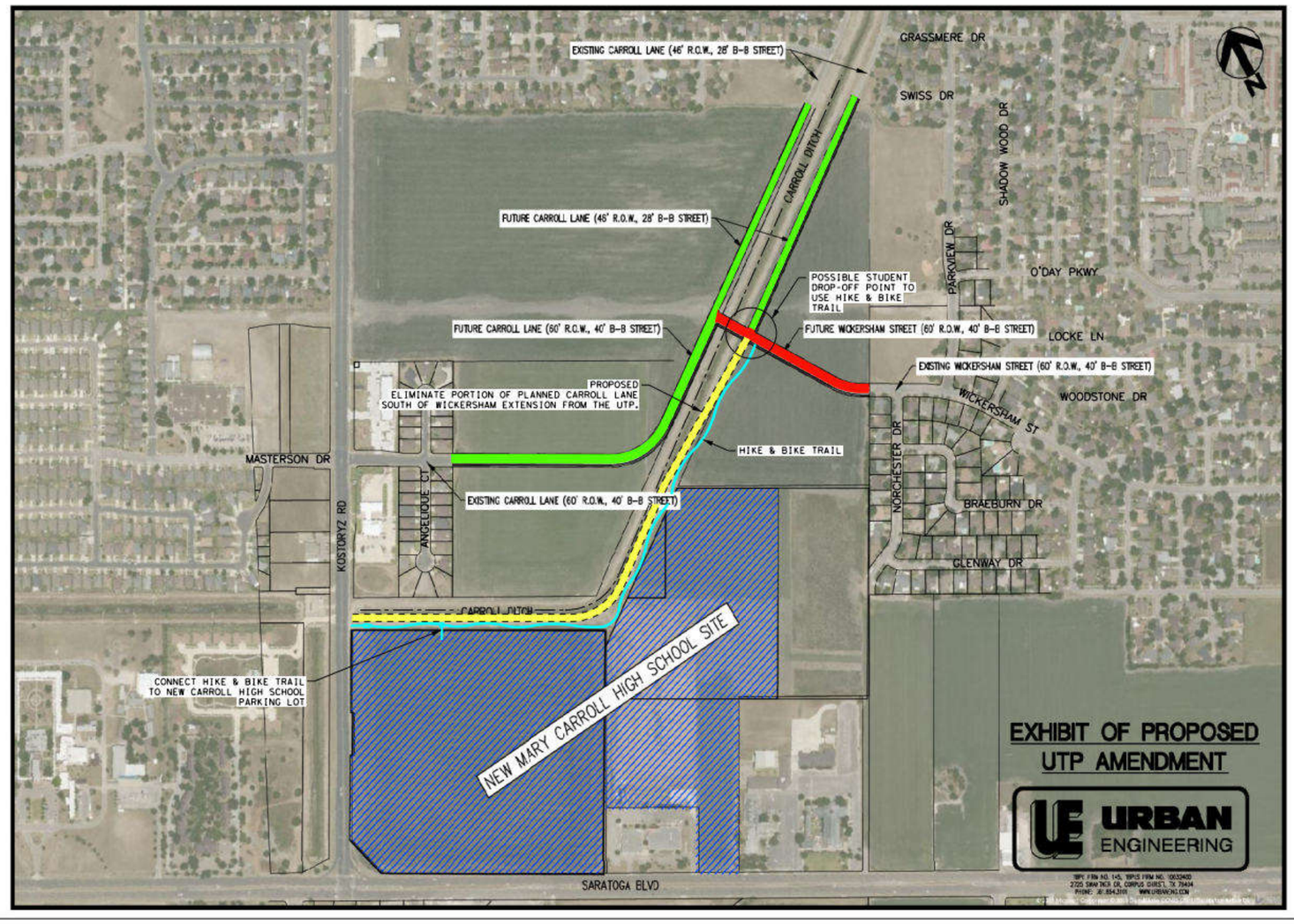
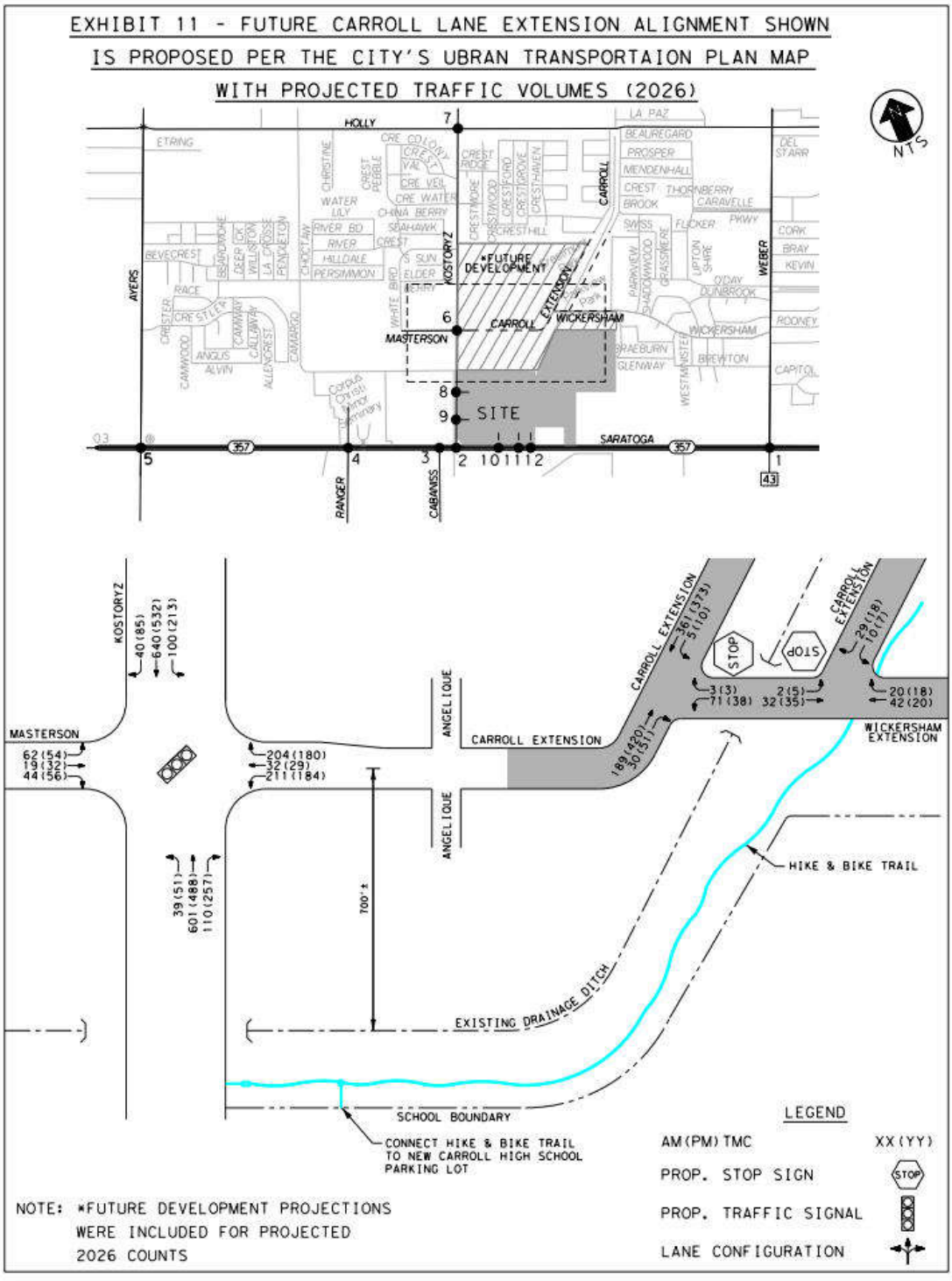


EXHIBIT 11 - FUTURE CARROLL LANE EXTENSION ALIGNMENT SHOWN IS PROPOSED PER THE CITY'S UBRAN TRANSPORTAION PLAN MAP WITH PROJECTED TRAFFIC VOLUMES (2026)



Tables

TABLE 1
TRAFFIC DISTRIBUTION

TRIP DISTRIBUTION % (AM)						
DRIVEWAY	INBOUND			OUTBOUND		
	LEFT (←)	STRAIGHT (↑)	RIGHT (→)	LEFT (←)	STRAIGHT (↑)	RIGHT (→)
DW8	60%	-	40%	40%	-	60%
DW9	40%	-	60%	40%	-	60%
DW10	-	-	100%	-	-	100%
DW11	-	-	-	-	-	100%
DW12	-	-	100%	-	-	-

TRIP DISTRIBUTION % (PM)						
DRIVEWAY	INBOUND			OUTBOUND		
	LEFT (←)	STRAIGHT (↑)	RIGHT (→)	LEFT (←)	STRAIGHT (↑)	RIGHT (→)
DW8	60%	-	40%	60%	-	40%
DW9	40%	-	60%	60%	-	40%
DW10	-	-	100%	-	-	100%
DW11	-	-	-	-	-	100%
DW12	-	-	100%	-	-	-

DRIVEWAY DISTRIBUTION % (AM)		
DRIVEWAY	INBOUND	OUTBOUND
DW8	27%	20%
DW9	28%	20%
DW10	30%	50%
DW11	-	10%
DW12	15%	-
TOTAL	100%	100%

DRIVEWAY DISTRIBUTION % (PM)		
DRIVEWAY	INBOUND	OUTBOUND
DW8	22.5%	25%
DW9	22.5%	25%
DW10	45%	45%
DW11	-	5%
DW12	10%	-
TOTAL	100%	100%

Table 2
Definition of Level of Service for Signalized Intersections

Level of Service	Average Control Delay per Vehicle (sec/veh)	Description
A	≤ 10	LOS A describes operations with a control delay of 10 s/veh or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If it is due to favorable progression, most vehicles arrive during the green indication and travel through the intersections without stopping.
B	> 10 and ≤ 20	LOS B describes operations with control delay between 10 and 20 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with LOS A.
C	> 20 and ≤ 35	LOS C describes operations with control delay between 20 and 35 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual *cycle failures* (i.e., one or more queued vehicles are not able to depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.
D	> 35 and ≤ 55	LOS D describes operations with control delay between 35 and 55 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.
E	> 55 and ≤ 80	LOS E describes operations with control delay between 55 and 80 s/veh and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.
F	> 80	LOS F describes operations with control delay exceeding 80 s/veh or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycle fail to clear the queue.

Source: 2010 Highway Capacity Manual

TABLE 3
LOS FOR SIGNALIZED INTERSECTIONS
EXISTING

Intersection #	Intersection Delay (HCM)	AM		PM	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Intersection 1: SARATOGA BLVD/ WEBER RD	Overall	15	B	16	B
Intersection 2: SARATOGA BLVD/ KOSTORYZ RD	Overall	10	A	10	A
Intersection 4: SARATOGA BLVD/ RANGER AVE	Overall	11	B	12	B
Intersection 5: SARATOGA BLVD/ AYERS ST	Overall	11	B	12	B
Intersection 7: KOSTORYZ RD/ HOLLY RD	Overall	10	A	14	B

LOS results are without signal coordination

TABLE 4
LOS FOR SIGNALIZED INTERSECTIONS
BACKGROUND (OPENING DAY 2021)

Intersection #	Intersection Delay (HCM)	AM		PM	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Intersection 1: SARATOGA BLVD/ WEBER RD	Overall	36	D	24	C
Intersection 2: SARATOGA BLVD/ KOSTORYZ RD	Overall	10	A	10	A
Intersection 4: SARATOGA BLVD/ RANGER AVE	Overall	12	B	14	B
Intersection 5: SARATOGA BLVD/ AYERS ST	Overall	11	B	13	B
Intersection 7: KOSTORYZ RD/ HOLLY RD	Overall	11	B	16	B

LOS results are without signal coordination

TABLE 5
LOS FOR SIGNALIZED INTERSECTIONS
PROJECTED (2026)

Intersection #	Intersection Delay (HCM)	AM		PM	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Intersection 1: SARATOGA BLVD/ WEBER RD	Overall	52	D	43	D
Intersection 2: SARATOGA BLVD/ KOSTORYZ RD	Overall	11	B	10	A
Intersection 4: SARATOGA BLVD/ RANGER AVE	Overall	15	B	19	B
Intersection 5: SARATOGA BLVD/ AYERS ST	Overall	11	B	16	B
Intersection 6: KOSTORYZ RD/ MASTERSON DR	Overall	8	A	8	A
Intersection 7: KOSTORYZ RD/ HOLLY RD	Overall	12	B	19	B

LOS results are without signal coordination

Table 6: LOS Criteria for Stop Sign Controlled Intersections

LEVEL OF SERVICE	DELAY RANGE (seconds)
A	≤ 10 SEC.
B	> 10 and ≤ 15 sec.
C	> 15 and ≤ 25 sec.
D	> 25 and ≤ 35 sec.
E	> 35 and ≤ 50 sec.
F	> 50 sec.

Source: 2010 Highway Capacity Manual

TABLE 7 - LOS For Un-Signalized Intersections
EXISTING

Intersection #	Approach Delay	AM				PM			
		EAST BOUND	WEST BOUND	SOUTH BOUND	NORTH BOUND	EAST BOUND	WEST BOUND	SOUTH BOUND	NORTH BOUND
Intersection 3: SARATOGA BLVD/ CABANISS PKWY	LOS	FREE	FREE	N/A	B	FREE	FREE	N/A	C
	(s/veh)	FREE	FREE	N/A	12	FREE	FREE	N/A	25
Intersection 6: KOSTORYZ RD/ MASTERSON DR	LOS	B	B	FREE	FREE	C	B	FREE	FREE
	(s/veh)	15	10	FREE	FREE	16	13	FREE	FREE

TABLE 8 - LOS For Un-Signalized Intersections
BACKGROUND (OPENING DAY)

Intersection #	Approach Delay	AM				PM			
		EAST BOUND	WEST BOUND	SOUTH BOUND	NORTH BOUND	EAST BOUND	WEST BOUND	SOUTH BOUND	NORTH BOUND
Intersection 3: SARATOGA BLVD/ CABANISS PKWY	LOS	FREE	FREE	N/A	B	FREE	FREE	N/A	D
	(s/veh)	FREE	FREE	N/A	12	FREE	FREE	N/A	28
Intersection 6: KOSTORYZ RD/ MASTERSON DR	LOS	D	B	FREE	FREE	C	B	FREE	FREE
	(s/veh)	26	12	FREE	FREE	18	14	FREE	FREE
Intersection 8: KOSTORYZ RD/ DW8	LOS	N/A	C	FREE	FREE	N/A	B	FREE	FREE
	(s/veh)	N/A	18	FREE	FREE	N/A	13	FREE	FREE
Intersection 9: KOSTORYZ RD/ DW9	LOS	N/A	C	FREE	FREE	N/A	B	FREE	FREE
	(s/veh)	N/A	17	FREE	FREE	N/A	13	FREE	FREE
Intersection 10: SARATOGA BLVD/ DW10	LOS	FREE	FREE	A	N/A	FREE	FREE	A	N/A
	(s/veh)	FREE	FREE	0	N/A	FREE	FREE	0	N/A
Intersection 11: SARATOGA BLVD/ DW11	LOS	FREE	FREE	A	N/A	FREE	FREE	A	N/A
	(s/veh)	FREE	FREE	0	N/A	FREE	FREE	0	N/A
Intersection 12: SARATOGA BLVD/ DW12	LOS	FREE	FREE	N/A	N/A	FREE	FREE	N/A	N/A
	(s/veh)	FREE	FREE	N/A	N/A	FREE	FREE	N/A	N/A

TABLE 9 - LOS For Un-Signalized Intersections
PROJECTED (2026)

Intersection #	Approach Delay	AM				PM			
		EAST BOUND	WEST BOUND	SOUTH BOUND	NORTH BOUND	EAST BOUND	WEST BOUND	SOUTH BOUND	NORTH BOUND
Intersection 3: SARATOGA BLVD/ CABANISS PKWY	LOS	FREE	FREE	N/A	B	FREE	FREE	N/A	E
	(s/veh)	FREE	FREE	N/A	13	FREE	FREE	N/A	38
Intersection 8: KOSTORYZ RD/ DW8	LOS	N/A	C	FREE	FREE	N/A	B	FREE	FREE
	(s/veh)	N/A	19	FREE	FREE	N/A	13	FREE	FREE
Intersection 9: KOSTORYZ RD/ DW9	LOS	N/A	C	FREE	FREE	N/A	B	FREE	FREE
	(s/veh)	N/A	18	FREE	FREE	N/A	13	FREE	FREE
Intersection 10: SARATOGA BLVD/ DW10	LOS	FREE	FREE	A	N/A	FREE	FREE	A	N/A
	(s/veh)	FREE	FREE	0	N/A	FREE	FREE	0	N/A
Intersection 11: SARATOGA BLVD/ DW11	LOS	FREE	FREE	A	N/A	FREE	FREE	A	N/A
	(s/veh)	FREE	FREE	0	N/A	FREE	FREE	0	N/A
Intersection 12: SARATOGA BLVD/ DW12	LOS	FREE	FREE	N/A	N/A	FREE	FREE	N/A	N/A
	(s/veh)	FREE	FREE	N/A	N/A	FREE	FREE	N/A	N/A