Spack CONSULTING
ENGINEERING TRAFFIC FORWARD

Traffic Impact Study

TWIN CITIES GERMAN IMMERSION SCHOOL

SAINT PAUL, MINNESOTA

I hereby certify this report was prepared by me or under my direct supervision, and I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

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Date: January 15, 2019

Executive Summary

Background:

The Twin Cities German Immersion School (TCGIS) is proposing building renovations to update their facilities and accommodate expected student growth. The purpose of this study is to review the traffic operations around the TCGIS site now and with the proposed renovations and recommend and improvements that are needed with the goal of improving operations and safety around the site.

Results:

The principal findings of this study are:

- The study intersections currently operate acceptably in all three peak hours in the existing and year 2023 scenarios with the exception of the Lexington Parkway & Wynne Avenue/Como Avenue intersection in the a.m. peak hour in the existing and year 2023 scenarios.
- None of the study intersections have a crash issue based on the latest three years of available crash data.
- Traffic is expected to increase both from expansion of the school's population and generic growth the area.
- Parking demands from the TCGIS can be accommodated on-street on the surrounding roadways.
- Current issues around the TCGIS during the pick-up/drop-off times include large amounts vehicle stacking at the school building, vehicle stacking on westbound Como Avenue at Lexington Parkway, large number of pedestrian crossings at multiple locations on Como Avenue, and a general mixing of pedestrians, buses, moving cars, parked cars and pick-up/drop-off cars.
- With the recommended alternatives in place, the Lexington Parkway & Wynne Avenue/Como Avenue intersection is forecast to operate acceptably in all peak hours in the year 2023.

Recommendations:

The following items are recommended based on the analyses contained in this study:

- Add a marked pedestrian crossing on Como Avenue on the west side of the intersection with Oxford Street. Everyone going to/from the TCGIS needing to cross Como Avenue should be directed to this crossing. Crossing guards should be utilized before and after school as needed.
- Continually monitor and update the signal timing plans at the Lexington Parkway & Wynne Avenue/Como Avenue intersection around the school start and end times as growth occurs at the TCGIS.
- Investigate and research staggered release times for the end of the school day with 15 minutes between each half of the school being released.
- Investigate the use of the TCGIS parking lot as a pick-up/drop-off location.
- Instruct staff of the TCGIS to not park on-street on Como Avenue or on Churchill Street, Oxford Street or Argyle Street within 200 feet south of Como Avenue.
- Extend the time-of-day parking restrictions on the north side of Como Avenue from in front of the TCGIS building to the Van Slyke Avenue intersection.
- Implement TDM strategies at the TCGIS.

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1. Introduction

a. Purpose of Study

The Twin Cities German Immersion School (TCGIS) is proposing building renovations to update their facilities and accommodate expected student growth in their K–8 classes. The purpose of this study is to review the traffic operations around the TCGIS site, both existing and with the proposed renovations, and recommend improvements that are needed with the goal of improving operations and safety around the site. For those not familiar with the general concepts and terms associated with traffic engineering, *The Language of Traffic Engineering* guide is included in the Appendix.

Spack Consulting completed an "Existing Conditions" memorandum for the TCGIS in November 2018. That document is referenced in this report and is included for review in the Appendix.

b. Study Objectives

The objectives of this study are:

- Review how the study intersections and roadways currently operate.
- Forecast the amount of traffic expected to be generated in the future by the school as well as non-school traffic.
- Determine the parking needs for the site based on City code and compare that to the surrounding availability.
- Recommend short-term and long-term improvements, if applicable, that can be made to the school's traffic operations.

For the purposes of this traffic study, the intersections closest to the proposed development and where the greatest impact is expected were chosen for initial review and include:

1. Lexington Parkway & Como Avenue/Horton Avenue
2. Horton Avenue & Van Slyke Avenue
3. Van Slyke Avenue & Churchill Street
4. Como Avenue & Chatsworth Street
5. Lexington Parkway & Wynne Avenue/Como Avenue
6. Churchill Street & Como Avenue
7. Como Avenue & West Parking Lot
8. Como Avenue & Oxford Street
9. Como Avenue & East Parking Lot

It should be noted traffic expected from the proposed development will have minor impacts on other intersections beyond those studied here. Furthermore, this study does not account for the existing roadway conditions such as pavement quality or appropriate drainage.

2. Existing Conditions Summary

As mentioned, Spack Consulting previously completed an Existing Conditions memorandum, which can be referenced in the Appendix for further details about the existing network.

The primary conclusions from the Existing Conditions analysis are:

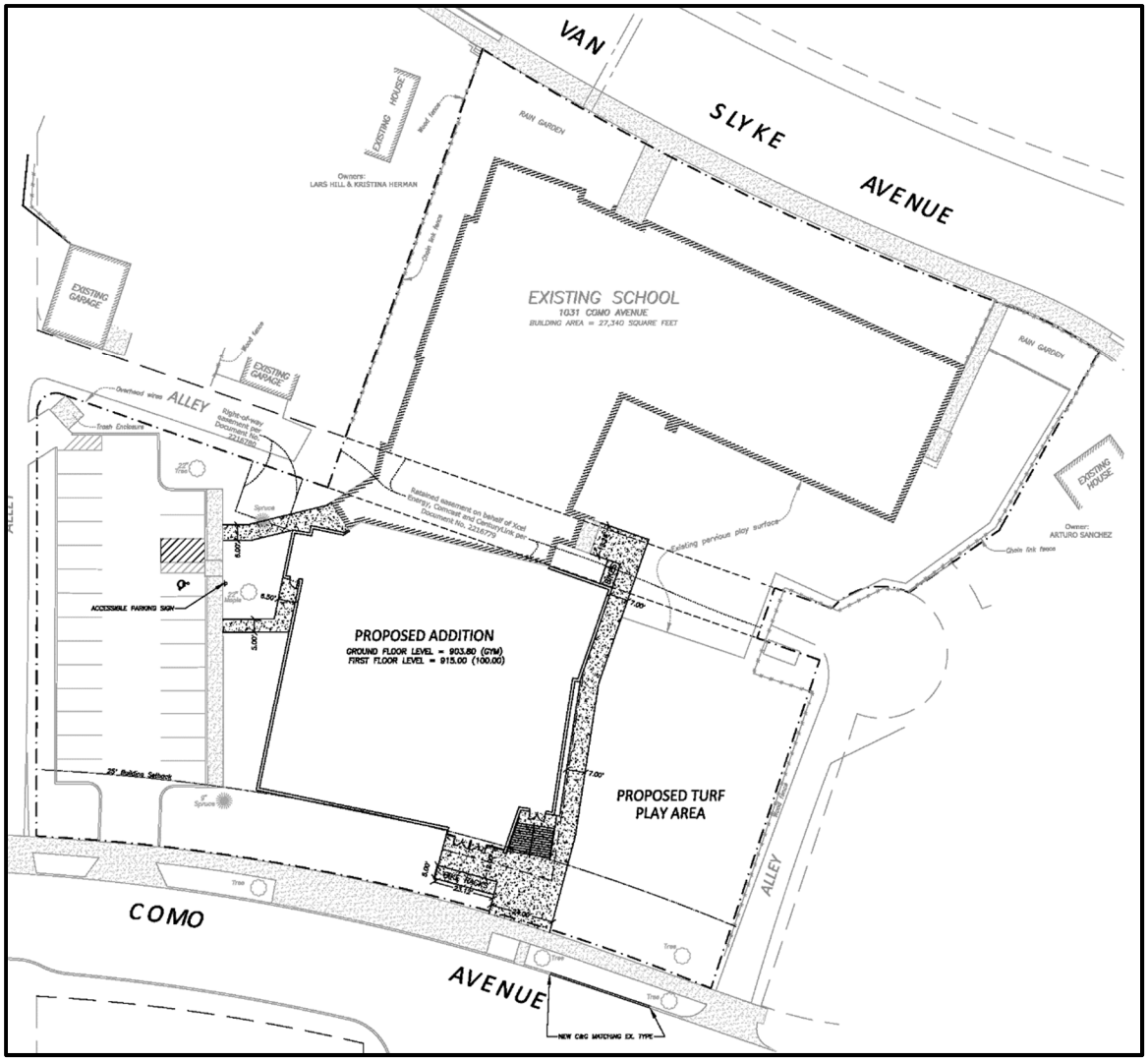
- Study peak hours of operations occurred from 7:30 – 8:30 a.m., 3:00 – 4:00 p.m., and 4:15 – 5:15 p.m.
- Acceptable operations at the study intersections except for Lexington Parkway/Wynne Avenue/Como Avenue which sees significant stacking on the westbound approach coming from the TCGIS in the a.m. peak hour.
- School drop-off operations in the morning lasts for about 25 minutes and school pick-up operations in the afternoon last for about 15 minutes. This is slightly shorter in duration than expected for an elementary school.
- There were a large number of pedestrian crossings at intersections around the TCGIS in the a.m. and school p.m. peak hours.
- Disordered feel on Como Avenue in front of the TCGIS during the pick-up time with pedestrians, buses, cars, vehicles picking up and parked vehicles all mixed together.
- On-street parking spaces on Como Avenue and Churchill Avenue near the site are heavily parked during the school day, especially around pick-up time.
- Crash history at the study intersections is below the critical crash rate threshold, suggesting the crashes do not represent a systemic safety concern. No fatal or serious injury crashes occurred at the study intersections within the most recent three years of data (2013 to 2015).

3. Proposed Development

The TCGIS is proposing to remodel the southern portion of their site. The TCGIS is forecasting that with the remodeling of the site, K–8 student enrollment can grow from the current number of 585 students to 648 students, an increase of 63. Staff members are also expected to grow with the student body, from 81 to 87 employees.

As part of this work, the eastern parking lot with access to Como Avenue will be removed to provide for a new play area. It is noted that the removal of one site access will improve operations around the Como Avenue side of the site for pedestrians and vehicles by removing conflict points.

The western parking lot is expected to remain the same with some likely striping revisions for an accessible stall. Based on the current plan, a total of 25 parking spaces will be available for the school after the proposed changes. The graphic below shows the proposed plans. This graphic is also available in the Appendix.



4. Forecasted Traffic

Any changes to the transportation system must be able to accommodate existing as well as projected future traffic. For the purposes of this study, the year 2023 is used as the future scenario, which assumes completion of the proposed changes and the expected growth in students and staff. Forecasting 2023 volumes requires examining both school growth and general growth in the surrounding area.

a. School Traffic Forecasting

The TCGIS currently has an enrollment of 585 students and is projecting a future enrollment of 648 students after the proposed renovations. This is a growth in students of approximately 11 percent. Traffic growth for the volumes related to the school are also expected to grow by a similar amount. Thus, all school traffic movements in the study network were increased by 11 percent to reflect the expected growth.

b. Non-school Traffic Forecasting

The remaining vehicle volumes are not considered school traffic but reflects the area resident travel as well as through traffic from commuters and other travelers in the general area. For this area of Saint Paul, the current zoning designations suggest little room for additional development around the study area. To account for some general growth in the study area, a growth rate of 0.5 percent per year was assumed to capture future growth. For the future year 2023, a total of three percent growth was applied to the existing traffic volumes at the study intersections.

c. Total Traffic

The total 2023 projected volumes are the sum of the existing school traffic with 11 percent growth and the existing general traffic with 3 percent growth. The volumes for the three different peak hours can be seen in the capacity analysis section of the Appendix for different scenarios.

5. Future Analyses

a. 2023 No Change Analysis

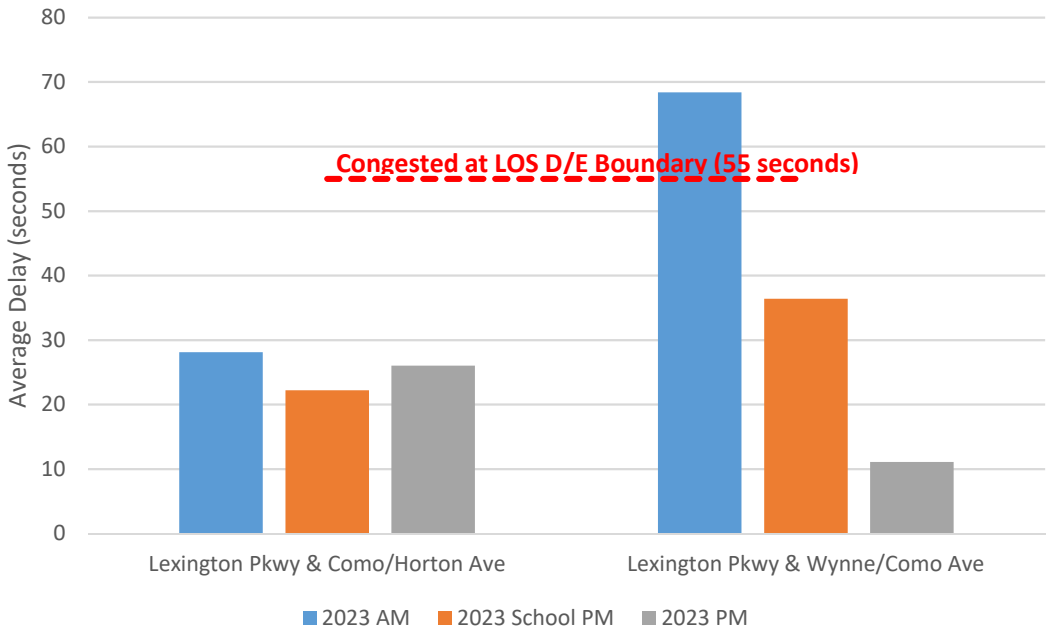
To determine where poor operations are or may be occurring, capacity analyses were performed for the study intersections using the forecasted volumes. This capacity analyses and the associated delay calculations were done in accordance with the *Highway Capacity Manual, 6th Edition* using the Vistro software package.

The Vistro model used in these analyses utilized a copy the Existing Conditions model with increased volumes, which were calibrated to match observations of each intersection made in the field. The signal timing for the a.m. and school p.m. peak hours at the Lexington Parkway & Wynne Avenue/Como Avenue intersection has been updated since the Existing Conditions memorandum was completed. The new signal timing for those scenarios is utilized in this analysis.

The capacity analyses were conducted for the study intersections during the a.m., school p.m. and p.m. peak hours. Signal timing for the signalized intersections was provided by the City of Saint Paul.

Chart 1 shows the average peak hour delay per traffic signal controlled intersections for the three peak hours. The LOS D/E boundary of 55 seconds of delay per vehicle is considered the threshold between acceptable and unacceptable traffic signal operation in Minnesota. The full calculations for each study scenario, including Level of Service (LOS) grades and queue lengths, are included in the Appendix. Also, included in the Appendix is a guide explaining the Level of Service grade concept.

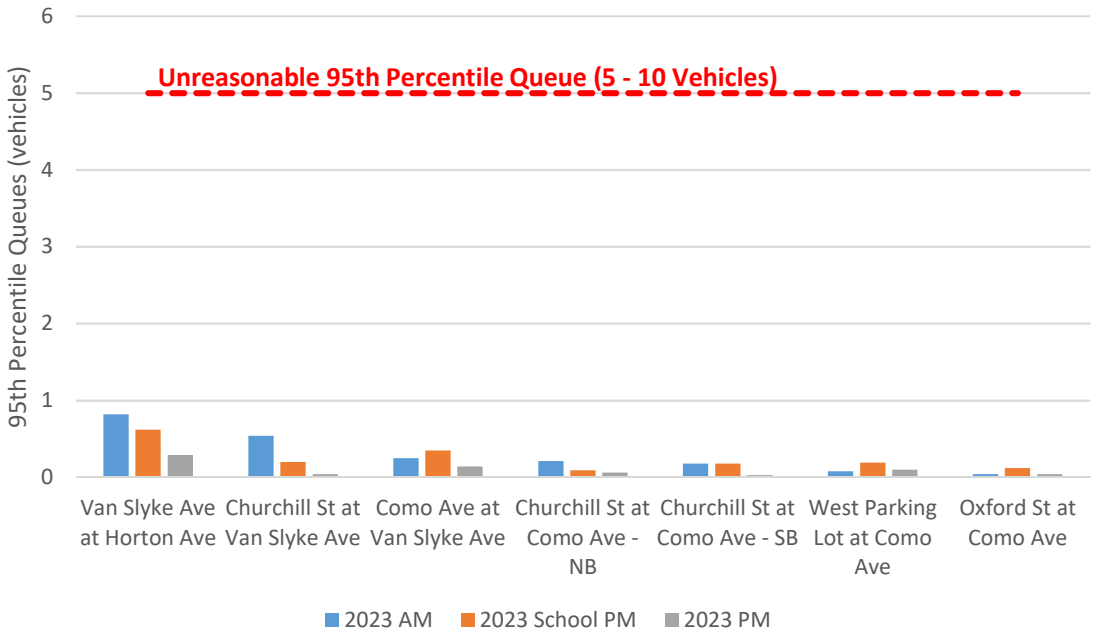
Chart 1 – Peak Hour Delays: Signal Controlled Intersections



Average delays for side-street stop-controlled intersections, while calculated and included in the Appendix, can be misleading for intersections with side-street stop sign control because the vast majority of vehicles are through movements on the main roadway and have zero delay, skewing the overall average delays. At side-street stop sign controlled approaches to busy roadways, the average delay for all vehicles on the approach can often exceeds 60 seconds. This result can be the case for a few vehicles waiting at the stop sign where improvements would not be justified due to the low traffic volume.

Instead of reporting average approach delays as in the previous charts, Chart 2 shows the 95th percentile queue as the measure of effectiveness at intersections with side-street stop sign control. Based on our experience, improvements are not warranted at these types of intersections until the 95th percentile queue at a stop sign is in the five to ten vehicle range.

Chart 2 – Peak Hour Queues: Side-Street Stop-Controlled Intersections



As shown in Charts 1 and 2, most intersections and movements are forecasted to operate within the typical range of acceptability throughout the three peak hours in the year 2023. The exception to this is the Lexington Parkway & Wynne Avenue/Como Avenue intersection which is forecast to have high delays in the a.m. peak hour. This result is due to the westbound approach operations at the intersection seeing high delays and long queues in the a.m. peak hour and school p.m. peak hour. The other three approaches at the intersection are forecast to operate with acceptable delays.

b. Parking Analysis

The City of Saint Paul's Code of Ordinances states in Section 63.207 that for elementary schools, the minimum number of parking spaces required to be provided is equivalent to one space per employee. With 87 staff proposed with the building remodel, 87 parking stalls are needed for the site.

The site is proposing a parking lot with 26 parking spaces, 24 standard stalls with two ADA stalls. This striping design meets the accessible parking requirements according to Saint Paul Ordinance Section 63.213 for parking lots with between 26 and 50 spaces. However, this lot falls 61 stalls short of the overall City requirement.

The TCGIS has an approved agreement with the Mission Orthodox Presbyterian Church (OPC) on the south side of Como Avenue for 15 shared use parking spaces in the OPC lot. Located to the south of the TCGIS, this lot is used by staff and easily accessible by the adjacent sidewalk and a crossing of Como Avenue. With these spaces, the school's parking shortfall is reduced to 46 spaces.

The City allows a reduction in the minimum parking requirement when an equivalent amount of secure bicycle parking is provided. Four spaces in a secure bicycle rack are the equivalent of one vehicle parking space. If the TCGIS provided 36 bicycle spaces, in nine racks, the vehicle parking requirement would be reduced by nine spaces. This reduction would further decrease the school's shortfall to 37 spaces.

The TCGIS has indicated that of the current 81 staff members, 16 of them do not drive to school but get to the school via bicycle, transit or walking. This information reinforces that the parking requirement can be reduced with the provided bicycle racks.

To be able to determine the availability of on-street parking around the TCIGS open to use by school staff, the parking counts from the Existing Conditions memorandum are used. Those parking counts included on-street parking demand counts at 9:30 p.m. For residential land uses, the overnight hours are the time of peak parking demand. Because of that, it is assumed the counts conducted at 9:30 p.m. represent the peak parking demand for the residents. Comparing those counts to the number of available on-street parking spaces, the number of spaces not being used for residential use can be determined. Figure 1 shows the availability of on-street parking spaces around the TCGIS.

Figure 1 – Available On-Street Parking Spaces Not Being Used by Residential Uses

As shown in Figure 1, there is ample on-street parking availability of over 200 spaces immediately around the TCGIS building to accommodate 37 vehicles from the TCGIS.

It is noted that there is a surge of on-street parking demand in the study network before and after school due to pick-up/drop-offs for the school occurring on surrounding roads. This surge can be seen in Table 1 of the Existing Conditions memorandum. Accounting for the available on-street parking spaces not being used by residential uses as shown in Figure 1, there are more than enough spaces to accommodate the up to 80 vehicles parking around the TCGIS building during the a.m. peak hour and 130 vehicles in the school p.m. peak hour.

6. Improvement Options

a. Issues

From the Existing Conditions memorandum as well as the 2023 analysis, the issues surfaced in the study area around the TCGIS include:

- Pedestrian crossings, including many school children, occurring at multiple locations along Como Avenue near pick-up/drop-off vehicle operations.
- Unassisted pedestrian crossings at all intersections surrounding the TCGIS.
- Vehicle stacking for pick-ups on the north side of the TCGIS building currently extending all the way to Lexington Parkway. With an 11% increase in students, that queue will extend beyond/onto Lexington Parkway.
- Vehicle stacking for pick-ups on the south side of the TCGIS building extending to Van Slyke Avenue and conflicting with bus loading zones. With an 11% increase in students, these conflicts will become more regular.
- Vehicle queues on westbound Como Avenue at Lexington Parkway extending to Oxford Street at the start of the school day and past Churchill Street at the end of the school day. With an 11% increase in students, this queue will increase.
- Disordered mix of pedestrians, buses, parked vehicles, through vehicles and pick-up vehicles around the TCGIS, especially on the Como Avenue side of the building, at the end of the school day.
- Significant amount of on-street parking being occupied by vehicles related to the TCGIS, both for staff and pick-ups/drop-offs, on surrounding residential roadways around school start and end times.

Many of these are existing issues that will remain whether or not the school expands as proposed. It is in the best interest of both the City and the school to continue cooperatively working on solutions as they have down in the past.

b. Potential Alternatives

To deal with the different issues identified, different alternatives can be explored which can address one or multiple issues. However, any alternative is likely to present a trade-off compared to the existing conditions. Various potential alternatives are explored below, noting both positive and negative impacts.

Marked Pedestrian Crossing/Crossing Guards

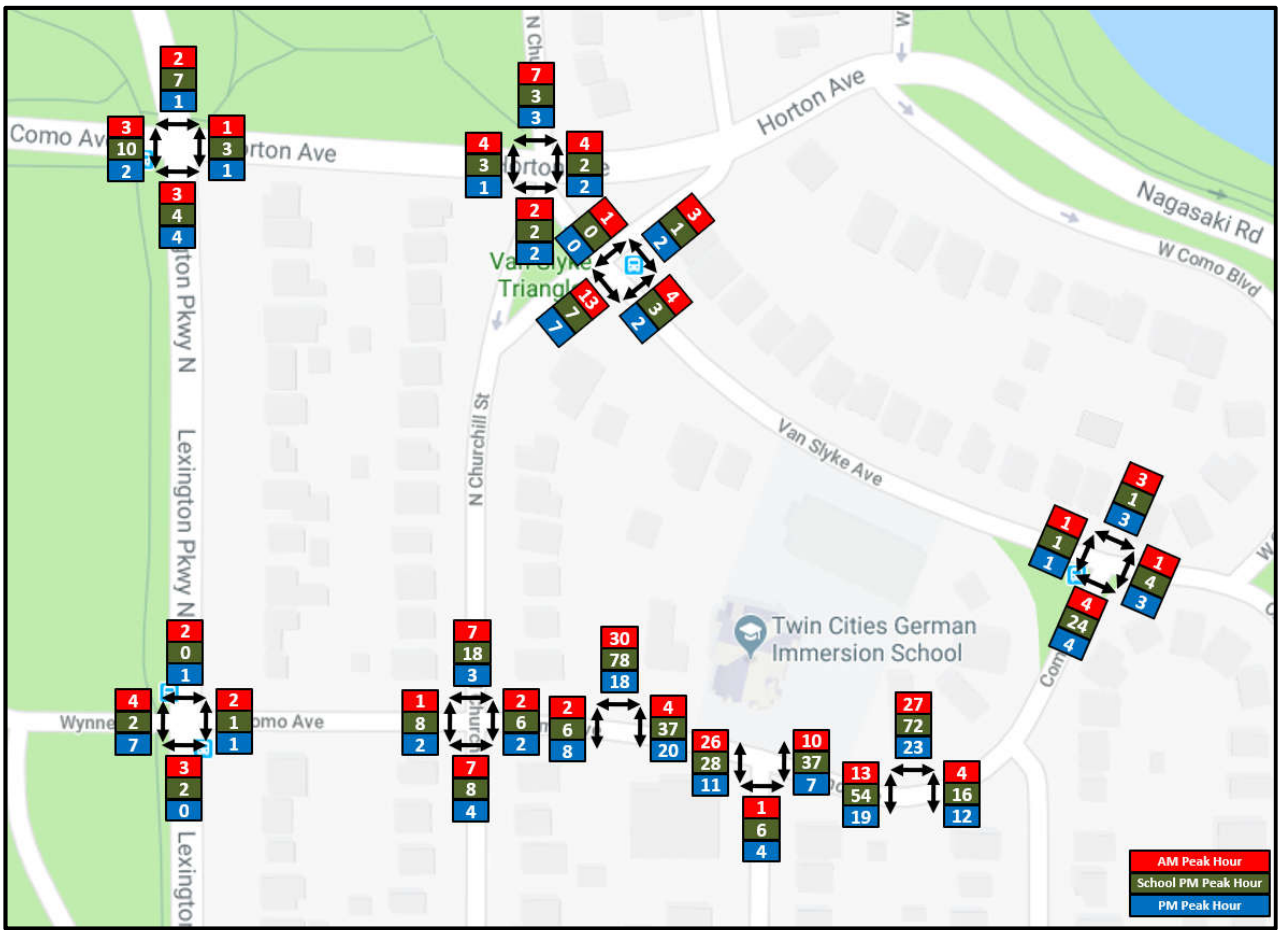
As previously mentioned, there is a large amount of pedestrian activity around the TCGIS building, especially around Como Avenue. Figure 2 below shows the peak hour pedestrian/bicycle crossing volumes at each leg of the study intersections adjusted for the future scenario where the TCGIS sees an 11% increase in students.

As seen in Figure 2, there are large numbers of pedestrians/bicycles crossing Como Avenue near the TCGIS during all three peak hours. It is noted that nearly all of these are pedestrians with a small number of bicycles. Between Churchill Street and

Argyle Street, the total number of pedestrian crossings on Como Avenue is 61 in the a.m. peak hour, 184 in the school p.m. peak hour and 79 in the p.m. peak hour.

According to the Local Road Research Board's (LRRB) *Pedestrian Crossings: Uncontrolled Locations*, marked crossings on roadways with speeds of 35 mph or less can be placed at locations with a minimum of 20 pedestrian crossings during at least one hour of the day. With the high pedestrian crossings on Como Avenue, a marked crossing would be able to be justified.

Figure 2 – Peak Hour Pedestrian/Bicycle Crossing Volumes with TCGIS Renovations



Currently, as seen in Figure 2, the pedestrian crossings across Como Avenue are spread from Churchill Street to Argyle Street with many of them occurring around the parking lot accesses and Oxford Street. However, there is not a set crossing location which means that crossings are occurring in a number of different locations. Pedestrians going to/from the TCGIS are encouraged to cross on the east side of the Como Avenue & Oxford Street intersection, but, as seen in Figure 2, while some crossings occur here, the majority do not. Having one location where the heavy majority of pedestrians are crossing will improve safety on Como Avenue by setting clearer expectations for drivers and pedestrians.

Pedestrian crossings are best placed where pedestrians have a clear view of traffic from either direction and where drivers can easily see pedestrians from far enough away to be able to come to a stop. At 30 mph, a vehicle needs 200 feet to see an object in the road and come to a full stop. With the curve on Como Avenue east of Oxford Street, placing the marked crosswalk on the west side of the Como Avenue & Oxford Street intersection would provide the needed 200 feet stopping sight distance for vehicles on either side of the crossing. Curb ramps already exist at this location. Marking the crossing would help keep loading vehicles from parking in the crosswalk.

If a marked crosswalk is included on the west side of the Como Avenue & Oxford Street intersection, the TCGIS should guide all pedestrian crossings, students and parents/guardians, to use this crosswalk to get across Como Avenue. Having crossing guards at this one location for peak periods before and after school would also reinforce that this is the location to cross at.

This location is right where the pick-up/drop-off operations occur on the south side of the TCGIS meaning pedestrians and vehicles will be intermixed. Having staff guide vehicles and having crossing guards guide pedestrians will help aid in safety.

Looking at Figure 2 for other busy crossing locations, the northbound approach on Como Avenue at Van Slyke Avenue and the northeast bound approach on Churchill Street at Van Slyke Avenue stand out due to their higher volumes. The crossings on Como Avenue at Van Slyke see an increase in the school p.m. peak hour due to a bus loading location east of Como Avenue. The students that make this crossing to get to the bus are already accompanied by a staff member. The Churchill Street crossing location sees low enough traffic volumes that mitigation may not be necessary but crossing guards could be helpful.

Signal Timing Updates

As noted in field observations and shown in Chart 1, the Lexington Parkway & Wynne Avenue/Como Avenue intersection sees poor operations in the a.m. and school p.m. peak hours. This is due entirely to the westbound approach at the intersection; the other three approaches operate acceptably. With a majority of the TCGIS traffic occurring in highly concentrated time periods in the a.m. and school p.m. peak hours, there is more demand at the Lexington Parkway & Wynne Avenue/Como Avenue signal during those periods than the existing timing is programmed for.

The signal timing was recently updated in late 2018 during the a.m. and school p.m. peak periods to shift five seconds away from the north-south approaches and to the east-west approaches. This change did show an improvement in the operations of the westbound approach. However, with an 11% growth in students reflected in the 2023 analysis, the westbound queues are still forecast to extend beyond Churchill Street for brief periods in the school p.m. peak hour and to Oxford Street for brief periods in the a.m. peak hour.

Updating the signal timing at this intersection to allow for even more green time for the westbound approach during the peak 15-minute periods of the a.m. and school p.m. peak hours, will reduce the queues and delays for vehicles leaving the TCGIS. Reducing long delays for vehicles is a safety benefit at the signalized intersection as drivers that have been waiting longer to get through an intersection are more likely to take risks to get through the intersection, such as proceeding on a red. The reduced queue lengths will also benefit pedestrian crossings on Como Avenue in front of the TCGIS.

Any signal timing changes that give more time to Como Avenue will negatively impact operations on Lexington Parkway which serves significantly more vehicles than Como Avenue/Wynne Avenue. Because of that, it is only recommended that the signal timing changes be for the brief periods that see high concentrations of vehicles leaving the TCGIS.

The City of St. Paul has a 20-minute period before the start of school and a 40-minute period after the end of school where they have implemented the updated timing plans to accommodate the TCGIS traffic at this intersection. It is recommended that this intersection continue to be monitored as growth occurs at the TCGIS and that the signal timing continue to be modified as needed.

Staggered Release Times

Currently, the start and end time for all students at the TCGIS is the same. That means that all pick-ups and drop-offs for the school are occurring at the same time. This is common at schools, as having multiple starting and ending times can bring logistical challenges. However, some schools have staggered start and/or end times which helps to spread out the period of pick-ups and drop-offs. Spreading out those periods means they will take longer, but the number of vehicles and pedestrians around the school is not as high at any one time. In the case of the TCGIS, that would mean the pick-up/drop-off vehicle queues, as well as the queues on Como Avenue and Lexington Parkway, would be shorter.

If half of the school, grades 4-8 for example purposes, were to start 15 minutes later than the other half of the school, grades K-3, the pick-up and drop-off periods would be half as busy as they currently are. However, with some students taking buses, the simple staggering time may not work without doubling the number of buses the school uses.

While the a.m. peak hour is busy around the TCGIS, it experiences smoother operation than the school p.m. peak hour because it is easier, and quicker, to drop students off than to pick them up. There is still large queueing on Como Avenue at Lexington Parkway, but the operations around the TCGIS building are less disordered. Because of that, staggered release times may be more prudent for the TCGIS than staggered start times.

Staggered release times could operate a number of different ways. One way would be to release all students in grades K-3 as well as all students that ride the bus at one time. The non-bussing students in grades 4-8 could then be released 15 minutes later. This spreads the pick-up times out so that the first round of pick-ups and bus departures are completed before the second round starts.

Pick-up queues will also be reduced meaning the queues will no longer extend to Lexington Parkway from Van Slyke Avenue. Vehicles waiting to pick-up on Como Avenue would also not extend into the bus loading zone removing blockages on Van Slyke Avenue as buses wait to get into their loading zones. On-street parking demands around the TCGIS would also be lowered during the pick-up period as the pick-up times are spread out.

Again, additional logistics would need to be worked out within the school to be able to accomplish this. Bussing, how to accommodate parents with children in each grouping, and impacts to daily schedules are among many elements beyond traffic that need to be evaluated before implementation. This option could be a long-term solution implemented in the future after other recommendations have been adopted.

At this time, it is recommended the TCGIS complete an investigation and research into the impacts of staggered release times.

Revise Pick-up/Drop-off Layouts

One of the issues identified for the TCGIS is the mixing of bus and car traffic. Having cars in the pick-up line stacking into the bus loading zones results in students walking around cars to get to their bus. Also, buses cannot enter their loading area thereby blocking a through lane on Van Slyke Avenue causing vehicles to weave around buses into oncoming traffic.

Fully separating the bus and car loading areas will remove this mixing issue. If buses were located on Oxford Street, Argyle Street or Churchill Street, separation from the car pick-up/drop-off lines on Como Avenue and Van Slyke Avenue would be provided. However, all students riding buses would need to cross at least one roadway to reach the new bus location. A marked crossing and crossing guards would provide some mitigation for these safety implications.

For bus operations to consistently use those roads, general parking restrictions would need to be put in place and enforced. The restrictions and enforcement ensure the buses can always pull curbside for safe student loading/unloading and that the buses do not block a lane of traffic. Residents would be restricted from using the parking in front of their homes for some period of time under this scenario.

A less complicated option to separate cars and buses would be to restrict each of their operations to one side of the school or the other. Como Avenue would be appropriate for bus operations due to the limited stacking on the south side of the

school. Six buses could easily park on Como Avenue adjacent to the school (north side) between the TCGIS parking lot and Argyle Street.

The current operations split some student pick-ups on the north side and some on the south side. The north side queue already extends to Lexington Parkway, so adding more pick-ups to this side would increase this queue. Having all of the staff helping with pick-ups located on the same side would help decrease wait time. A staggered release time would also be beneficial with this layout to reduce queues on Van Slyke Avenue.

When using this layout without a staggered release, vehicles picking up students on Van Slyke Avenue could be routed to use northbound Churchill Street to get to Van Slyke Avenue rather than using Horton Avenue. This would give additional stacking room before reaching Lexington Parkway. However, this stretch of Churchill Street would be occupied with queued vehicles during the drop-off/pick-up period, limiting its usability by non-school traffic during those times.

Another option for re-orienting the pick-ups/drop-offs is using the existing and future western parking lot, assuming a connection constructed to link the parking lot to the adjacent alley. Pick-ups/drop-offs could occur within the parking lot where vehicles would enter the lot, pick-up/drop-off students, and then continue to the alley. Drivers could go either north or south in the alley, pulling some volumes away from the long queues at the Lexington Parkway & Wynne Avenue/Como Avenue intersection and up towards Horton Avenue instead.

This change in procedure would result in approximately 75 vehicles using the alley in the morning peak and about 45 vehicles using it in the school p.m. peak (note, some school p.m. peak pick-ups utilize the side streets around the school to park and walk rather than waiting in a vehicle queue). During these peaks, other operations in the alley would be impacted, such as:

- Garage and recycling pick-ups
- Operations to and from seven residential garages

In addition, the parking lot would have limit use at best during these peaks due to the flow of vehicles.

With these operations pulled into the parking lot, the buses could in theory operate more freely on Como Avenue. Adjacent to the school, Como Avenue provides parking area on the north and south sides. Splitting the buses to three on each side keeps them in close proximity to the school and would make good use of the proposed crosswalk.

While the actual pick-up/drop-off activity would occur in the lot off the public roadway system, it is likely vehicle queues would extend back onto Como Avenue. The vehicle queue would then interfere with bus activity on the north side of Como Avenue. Alternatively, if buses could be restricted to the south side of Como Avenue,

the north side could then be used for vehicle pick-up/drop-off queuing. One or two buses would likely need to park to the east of the Oxford Street intersection to allow for sufficient parking space of six vehicles.

Another impact of this option is an increase of vehicle traffic to Van Slyke Avenue and the northern study roadways. Drivers headed back to Lexington Parkway would likely reach an equilibrium between the two signalized intersections, balancing the westbound approach traffic. With continued updating of the signal timing, this option could benefit overall operations in the area.

This option has potential merits from a traffic perspective, and is recommended for further investigation by both the City and the TCGIS. Other items in need of evaluation include:

- Condition of the alley pavement and its ability to accommodate more traffic.
- Review of sight distance within the alley considering the existing structures including a fence close to the pavement.
- Turning movements to ensure vehicles can safely navigate the alley from the parking lot.
- The connection between the alley and the parking lot.

Curb Bump-Outs

Curb bump-outs move the curb or use large physical objects (like planters) to reduce the width of the road at intersections or mid-block locations. These elements, if installed around the site, could clearly define the loading zones for cars and/or buses. Bump-outs also reduce the width of the street for pedestrian crossings if used in conjunction with a crossing.

To provide a bump-out on the Van Slyke Avenue side of the building, the location is complicated by the Metro Transit bus stop. Avoiding impacts to that bus stop pushes a potential bump-out over 100 feet from the Como Avenue intersection to allow for Metro Transit as well as school bus loading. Student pedestrian crossings were not observed to occur across Van Slyke Avenue, so a bump-out here would not have much impact in aiding pedestrian crossings. Given the potential confusion to drivers and limited impact for pedestrian improvements, a bump-out is of limited value in this location.

Como Avenue has two potential locations for a bump-out at the front of the car loading area; one on the east side of the TCGIS parking lot and one on the west side of the Como Avenue & Oxford Street intersection. Next to the TCGIS parking lot, a bump-out would remove space for one vehicle in the loading zone but provide a shorter crossing to the OPC building and its curb ramp in front of the building. However, the existing legal crossing of Como Avenue on the west side of Oxford Street results in two crossings within 100 feet of each other. This short distance is not ideal as it goes against general driver expectations.

Next to Oxford Street a bump-out would eliminate space for about three vehicles in the loading zone. It is not recommended to split the loading zone in two as that will create stacking and blocking issues. Therefore, the car loading zone would be shifted east increasing the potential for cars to spill back to Van Slyke Avenue and into the bus loading areas. For these reasons, a curb bump-out is not recommended at this location.

On both Como Avenue and Van Slyke Avenue, putting a bump-out to mark the end of the vehicle loading zone is not recommended as there is the potential for the pick-up lines to extend beyond the designated zone, as there is currently seen today. A bump-out would be an impediment in those locations for vehicles in the pick-up line resulting in a higher chance of the traffic lane to be blocked.

Curb bump-outs are not an option for consideration as part of this report.

Move Pick-up/Drop-off Operations

The main reason the pick-up/drop-off operations at the TCGIS see any issues is that all operations are occurring on public roadways. If the TCGIS had a large lot to accommodate these operations, it would be easier to control many of the factors.

About a quarter mile west of the TCGIS building is a large parking lot for the Como Regional Park Pool and McMurray Fields. If pick-ups were to be moved to this parking lot, queues and parked vehicles could be removed from the neighborhood streets and everything would occur in this lot. This would, of course, need to be worked out with the other uses at the parking lot.

The biggest challenge to this is getting students to/from the parking lot. In good weather, staff could walk students over in large groups, but for much of the time buses would need to be utilized to move students. Close coordination would need to occur for getting students off of the buses and into the car that is picking them up. Utilization of the PikMyKid app would help. Students may end up waiting outside for a time after getting off the buses.

Signal timing updates may need to occur at the Lexington Parkway & Wynne Avenue/Como Avenue intersection since a majority of the school traffic is utilizing the west leg of this intersection rather than on the east leg.

Guide Staff Parking Locations

Depending on the layout used for pick-up and drop-off operations, the TCGIS should instruct staff members to not park in areas that will conflict with these operations. For example, when there are vehicles parked on the north side of Como Avenue east of Oxford Street during the pick-up period, vehicles in the pick-up line must weave around these parked vehicles, essentially blocking the through lane.

It is recommended staff using on-street parking not park in the following locations:

- Anywhere on Como Avenue. This will reduce conflicts/weaving between pick-up/drop-off vehicles and parked vehicles and will aid in reducing parking near a marked pedestrian crossing to give better sight lines of the crossing. It will also reduce parking on the curve on Como Avenue which sees a mix of cars, buses and pedestrians in the peak periods
- On Churchill Street, Oxford Street and Argyle Street about 200 feet south of Como Avenue.

Per observations of parking, plenty of space is also available on Jessamine Avenue, one block south of the school. Staff can be educated about this through a staff handbook or other internal school methods.

Move Staff Parking Off-Site

Taking the staff parking locations one step further, any staff that are not able to park in the lot adjacent to the TCGIS building could be required to park at an off-site lot and either walk or be bussed in. This option would remove a number of vehicles from parking on-street in the surrounding neighborhood.

While a benefit from a parking in the neighborhood perspective, this option does little to impact traffic operations during the school peak periods.

Time of Day Parking Restrictions

Similar to guiding staff parking locations, extending the time-of-day parking restrictions on the north side of Como Avenue from the front of the TCGIS building to the Van Slyke Avenue intersection would remove conflicts between parked vehicles and vehicles in the drop-off/pick-up lines. This stretch of Como Avenue is in front of several residences and may impact the residents' ability to park in front of their homes, however these residences can utilize off-street parking or park on the other side of Como Avenue.

Travel Demand Management Strategies

Travel demand management (TDM) strategies are ways that the TCGIS could get its staff and students to travel to/from school using methods other than single occupancy vehicles or single car drop-offs/pick-ups. There are a variety of TDM strategies that could be implemented, such as:

- Encouraging carpooling among staff as well as for parents/guardians students. A carpool matching program could be set up by the TCGIS to make it easier for staff and students to connect with others willing to carpool.
- Investigating the Metropass or Student Pass options with Metro Transit for students and staff to be able to use Metro Transit buses.
- Encouraging staff/students to bicycle or walk to school or to utilize existing buses. Incentives could be implemented to encourage this behavior.
- Installing extra bicycle parking spaces, a bicycle maintenance station and shower/locker facilities for staff will encourage bicycle use to the site.

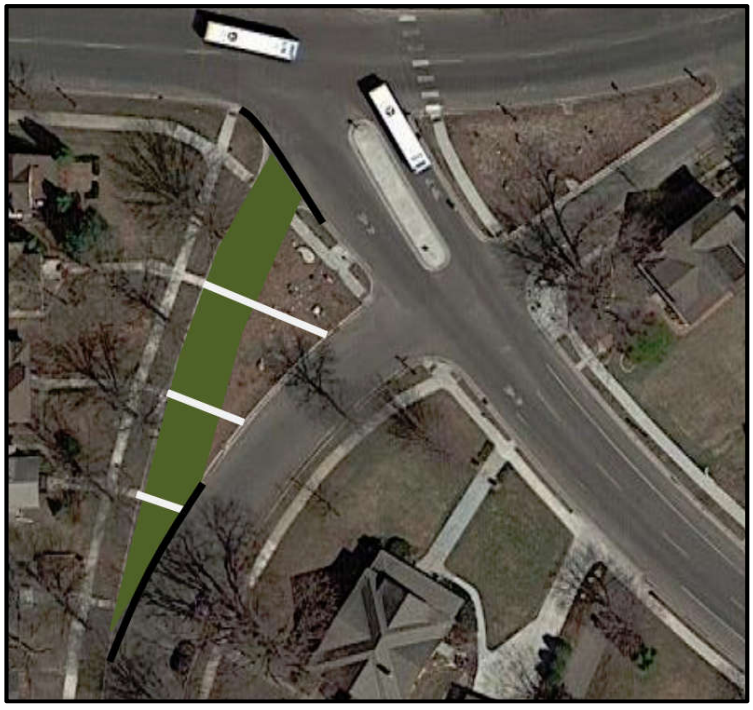
- Continue to hold bicycle safety events, such as the current 4th Grade Bicycle Safety Class. The TCGIS provides education and information about bicycling safely to 4th graders, giving them a 'license' once they complete the training which includes practice with staff. Added features such as bicycle tune-up services and helmet giveaways could also be included at this event or separately to increase awareness and excitement about bicycling.

Any of these, or other, TDM strategies could be implemented to encourage alternatives to commuting by single occupant vehicle. Staff can be educated about these items through a staff handbook. Parents/guardians/students can be notified about these items at the beginning of the school year and they can also be posted on the school website.

Close Van Slyke Triangle

Within the study area, the Van Slyke Triangle does not specifically relate to the TCGIS but does impact users of the TCGIS. This portion of land located on the southwest side of the Van Slyke Avenue & Churchill Street intersection functions as a channelized right turn onto Churchill Street. With the low volumes in the area, a separated right turn movement is not needed from an operational standpoint. Similar to the nearby Leroy Triangle at Como Avenue & Chatsworth Street, the Van Slyke Triangle could be closed with the intersection reconfigured. This change would reduce the number of crossings for pedestrians along Van Slyke Avenue as well as remove the conflict point located on the curve of Churchill Street. Besides cost, the on-street vehicle parking supply would be reduced by about four spaces. Sidewalks would also need to be reconfigured, with one option to extend the house connections to the street. Figure 3 shows an illustration of this potential alternative.

Figure 3 – Alternative: Close Van Slyke Triangle



Different stakeholders would need to be involved to complete this road closure. The City of Saint Paul would need to lead the project, involving residents of the area. Although a good idea from an overall transportation standpoint, this change has a minimal impact on the specific school operations. Given the City needs to lead this type of improvement and the minimal impact on school operations, closing the Van Slyke Triangle is outside of the recommendations for the TCGIS.

Through additional discussions with the City, changes to this area are not an option at this time and are not considered further in this report.

c. Potential Alternative Analysis

Table 1 summarizes some of the positive and negative impacts of the different alternatives.

Table 1 – Potential Alternative Impacts

Potential Alternative	Positive Impact		Negative Impact	
A Marked Pedestrian Crossing	Move pedestrian crossings to one location	Clarify driver and pedestrian expectations	Pedestrian crossings located at pick-up/drop-off area	
B Crossing Guards	Aid in safety of pedestrian crossings			
C Continual Signal Timing Updates	Reduce queues on Como Avenue	Improves safety for pedestrians crossing Como Avenue	Increase delay on Lexington Parkway	
D Staggered Release	Lower intensity of pickup period	Reduced queues and congestion	Extend pickup period	Additional in-school logistics
E Re-Orient Pick-up/Drop-off Layout	Separate cars and buses		Extended queue on Van Slyke Avenue	
F Utilize Parking Lot for Pick-up/Drop-off	Increase queue storage area	Allow for greater exiting traffic split at signals	Temporarily limit usability of parking lot	Increase traffic in alley
G Move Pick-up/Drop-off Operations	Pickups occur in more controlled area	Remove queues and parking from neighborhood streets	Need to get students to/from lot	Students potentially more exposed to the weather
H Guide Staff Parking Locations	Reduce impact to pick-up/drop-off operations			
I Move Staff Parking Off-Site	Remove on-street parked vehicles around the TCGIS		Inconvenient for staff	
J Time-of-Day Parking Restrictions	Remove conflicts in pick-up/drop-off line on Como Avenue		Impact parking for adjacent residents	
K TDM Strategies	Aid in reducing vehicle trips to the site			

Based on this, the recommended alternatives to be implemented, along with the estimated order of impact (Impact 1 being the highest impact and Impact 7 being the lowest impact), are:

- A – Marked Pedestrian Crossing (Impact 5)
- B – Crossing Guards (Impact 4)
- C – Continual Signal Timing Updates (Impact 2)
- D – Investigate Staggered Release (Impact 1)
- F – Utilize Parking Lot for Pick-Up/Drop-Off (Impact 3)
- H – Guide Staff Parking Locations (Impact 7)
- J – Time-of-Day Parking Restrictions (Impact 6)
- K – TDM Strategies (Impact 8)

In terms of timing, alternatives B, H and K could be implemented at any point. The other alternatives would take longer to implement, with the TCGIS needing to work with the City of Saint Paul on alternatives A, C and K and the City of Saint Paul needing to implement alternative M.

Regarding cost of each alternative, alternative I would have no cost and alternatives B and K would have minimal to no cost. All other alternatives would have some cost to them in terms of the TCGIS staff time, City of Saint Paul staff time and materials. Alternative J would likely have the highest cost for the City to implement.

To see the impacts to the roadway network with a combination of these alternatives, the study intersections were analyzed in each of the three peak hours. The following describes how each alternative impacts the analysis:

- Alternative A shifts the pedestrian crossings on Como Avenue in front of the TCGIS to all be at one location.
- Alternative B is similar to Alternative A.
- Alternative C involves modifying signal timing to allow for additional green time devoted to the westbound approach at the Lexington Parkway & Wynne Avenue/Como Avenue intersection.
- Alternative D spreads out the school related traffic from occurring during one period to during two different periods resulting in lower peaks in traffic volumes during the school p.m. peak hour only.
- Alternative F shifts the traffic volumes for pick-ups and drop-offs through the network.
- Alternative H does not impact intersection operations.
- Alternative J does not impact intersection operations.
- Alternative K would result in a slight decrease in school related traffic volumes. Conservatively, this is not included in the analysis.

Charts 3 and 4 show the delay and queueing results at the study intersections with year 2023 volumes and all of these alternatives.

Chart 3 – Peak Hour Delays: Signal Controlled Intersections – With Recommended Alternatives

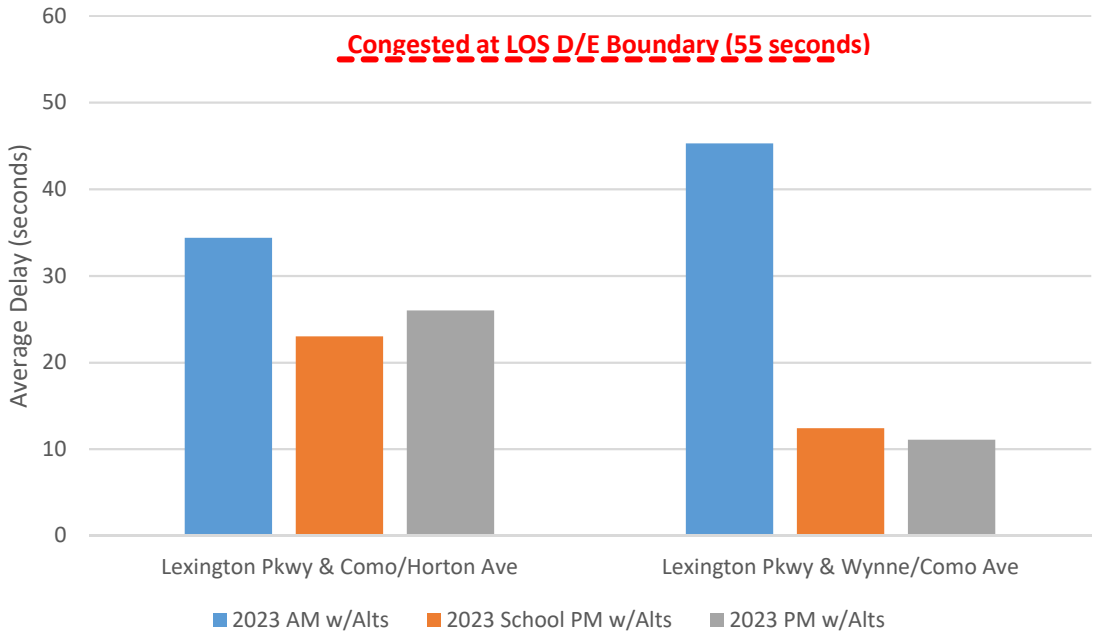
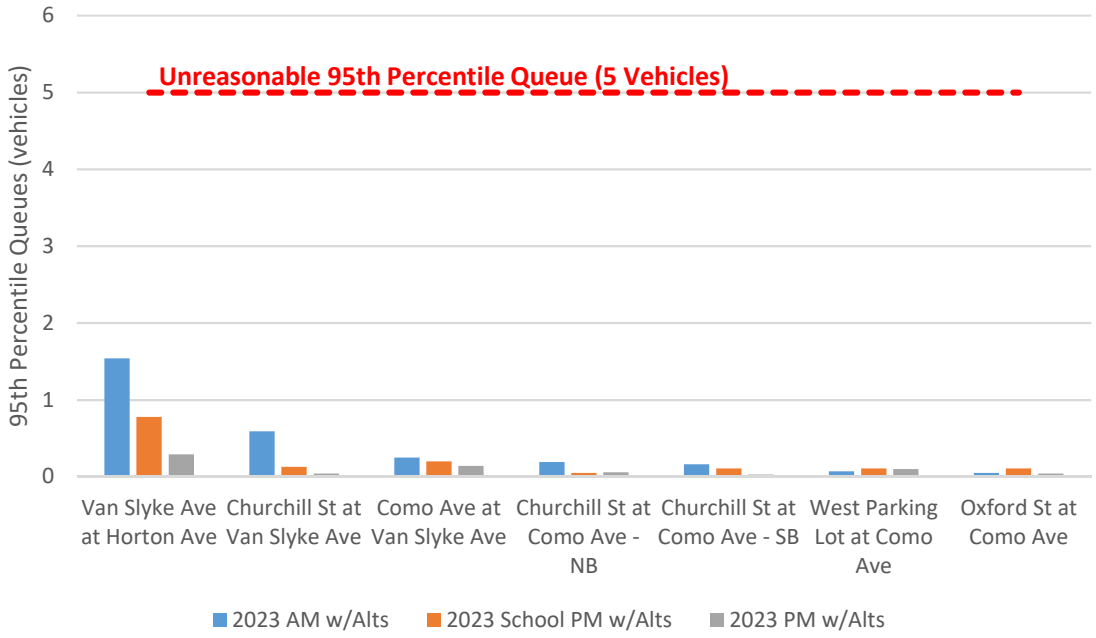


Chart 4 – Peak Hour Queues: Side-Street Stop-Controlled Intersections – With Recommended Alternatives



As seen in Charts 3 and 4, with the recommended alternatives the study intersections are forecast to operate acceptably in the 2023 peak hour scenarios.

Comparing Charts 3 and 4 to Charts 1 and 2, the most notable operational change with the addition of the recommended alternatives is at the Lexington Parkway & Wynne Avenue/Como Avenue intersection. The 95th percentile queues on Como

Avenue at the intersection with the recommended alternatives are forecast to extend beyond Churchill Street in the a.m. peak hour, but not to reach back to the recommended marked pedestrian crossing. Queues are forecast to not extend to Churchill Street in the school p.m. peak hour.

At the Lexington Parkway & Como Avenue/Horton Avenue intersection, there may be an increase in westbound volumes if pick-up/drop-off operations are moved into the TCGIS parking lot as vehicles may use the alley to go north. If the split is near 50% on vehicles heading north or south through the alley from the TCGIS parking lot, the westbound queues on Horton Avenue at Lexington Parkway will increase to extend to the Van Slyke Avenue intersection in the a.m. peak period. Because moving part of the westbound queue at Lexington Parkway from Como Avenue to Horton Avenue may result in the Horton Avenue & Van Slyke Avenue intersection being partially blocked, having the pick-up/drop-off operations in the parking lot may not be beneficial overall to the study network. Encouraging vehicles to head south in the alley to Como Avenue would not result in any impacts at the Lexington Parkway & Wynne Avenue/Como Avenue intersection but would still allow for additional queueing space for the vehicle pick-up line.

7. Conclusions and Recommendations

The traffic impacts of the TCGIS renovations were thoroughly studied and the principal findings are:

- The study intersections currently operate acceptably in all three peak hours in the existing and year 2023 scenarios with the exception of the Lexington Parkway & Wynne Avenue/Como Avenue intersection in the a.m. peak hour in the existing and year 2023 scenarios.
- None of the study intersections have a crash issue based on the latest three years of available crash data.
- Traffic is expected to increase both from expansion of the school's population and generic growth the area.
- Parking demands from the TCGIS can be accommodated on-street on the surrounding roadways.
- Current issues around the TCGIS during the pick-up/drop-off times include large amounts vehicle stacking at the school building, vehicle stacking on westbound Como Avenue at Lexington Parkway, large number of pedestrian crossings at multiple locations on Como Avenue, and a general mixing of pedestrians, buses, moving cars, parked cars and pick-up/drop-off cars.
- With the recommended alternatives in place, the Lexington Parkway & Wynne Avenue/Como Avenue intersection is forecast to operate acceptably in all peak hours in the year 2023.

The following recommendations are made based on the above findings:

- Add a marked pedestrian crossing on Como Avenue on the west side of the intersection with Oxford Street. Everyone going to/from the TCGIS needing to cross Como Avenue should be directed to this crossing. Crossing guards should be utilized before and after school as needed.
- Continually monitor and update the signal timing plans at the Lexington Parkway & Wynne Avenue/Como Avenue intersection around the school start and end times as growth occurs at the TCGIS.
- Investigate and research staggered release times for the end of the school day with 15 minutes between each half of the school being released.
- Investigate the use of the TCGIS parking lot as a pick-up/drop-off location.
- Instruct staff of the TCGIS to not park on-street on Como Avenue or on Churchill Street, Oxford Street or Argyle Street within 200 feet south of Como Avenue.
- Extend the time-of-day parking restrictions on the north side of Como Avenue from in front of the TCGIS building to the Van Slyke Avenue intersection.
- Implement TDM strategies at the TCGIS.

8. Appendix

A. The Language of Traffic Engineering

B. Concept Site Plan

C. Existing Conditions Memo without Appendices B-D

D. Level of Service (LOS)

E. Capacity Analysis Backup

- AM 2023
- School PM 2023
- PM 2023
- AM 2023 with Recommended Alternatives
- School PM 2023 with Recommended Alternatives
- PM 2023 with Recommended Alternatives