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ENGINEERING TRAFFIC FORWARD

Chanhassen Panera Development Site

Chanhassen, 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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Executive Summary

Background:
The existing Chanhassen Inn is proposed for redevelopment into Panera Bread sit-down restaurant with a drive-thru is proposed at the existing Chanhassen Inn site. The purpose of this study is to determine the traffic impacts associated with the build out of the proposed development on the study intersections where significant impact is anticipated.

Results:
The principal findings of this traffic study are:

- The proposed redevelopment is expected to generate approximately 1,068 new daily trips, approximately 92 new trips during the AM peak hour and approximately 74 new trips during the PM peak hour.
- This new traffic associated with the proposed redevelopment represents an approximate three to nine time increase beyond what the site currently generates today.
- Within the last three years, 28 crashes occurred within the study area. The most significant in terms of traffic operations outside normal expectations, are the five of six total crashes at the W 79th Street/Great Plains Boulevard intersection designated as left turn/right angle crashes.
- The existing conditions show queues along Great Plains Boulevard at the Arboretum Boulevard intersection stretch back to the W 79th Street intersection, impeding normal operations at the latter intersection. These queueing conditions occur during approximately five hours of a typical weekday.
- All intersections are projected to operate with acceptable overall delays and queueing through all scenarios, except for the Arboretum Boulevard/Great Plains Boulevard intersection.
- The eastbound left turn movement at W 79th Street experiences long delays during the PM peak No-Build and Build scenarios, occasionally blocking the adjacent gas station access.
- Negligible queue lengths are expected at the site accesses.
- The proposed parking stalls exceed both the City requirements and the expected peak demand.
- The drive-thru has sufficient space to accommodate the expected peak stacking based on data of fast food restaurants.
- Pedestrians connections to the north and bicycle facilities are not shown in the current site plan.

Recommendations:
The following items are recommended based on the analyses and results:

- Reevaluate the signal timing at the Arboretum Boulevard/Great Plains Boulevard intersection.
- Begin planning for the restriction of the W 79th Street/Great Plain Boulevard to 3/4-access, eliminating the W 79th Street left turn and through movements.
- Add signage directing drivers on W 79th Street to use Market Boulevard for travel to the north.
- Encourage/schedule truck deliveries and trash pickup outside of the weekday peak periods.
- Provide additional pedestrian connections to the existing northern pedestrian facilities along W 79th Street.
- Provide short term bicycle parking facilities for restaurant customers to help encourage multimodal travel to and from the development.

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i. Introduction

a. Proposed Development

The existing Chanhassen Inn site is proposed for redevelopment into a Panera Bread restaurant with a drive-thru. Located south of W 79th Street and west of the newly constructed Chick-fil-A site in Chanhassen, Minnesota, this redevelopment will include a 4,450 square feet building with 60 parking stalls and 110 seats (88 interior and 22 outside patio).

b. Purpose of Study

The purpose of this study is to determine the traffic impacts associated with the build out of the proposed redevelopment. The traffic impacts are studied on the roads and intersections where significant impact is anticipated, and improvements are recommended where mitigation is needed. The primary concern is the impact of traffic operations at the Great Plains Boulevard/W 79th Street intersection. 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.

c. Study Objectives

The objectives of this study are:

i. Document how the study intersections and roadways currently operate including a review of the most recent crash data.
ii. Forecast the amount of traffic expected to be generated by the proposed development and compare that expectation to the existing hotel traffic.
iii. Determine how the study intersections and roadways will operate in the future with and without the proposed development.
iv. Review the site circulation and multi-modal aspect.
v. Recommend appropriate mitigation measures if poor operations or areas of concern are identified.
vi. Compare the study results with the from previous studies within the area, such as the Chick-fil-A Traffic Impact Study and the Great Plains Boulevard Traffic Study.

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

i. Arboretum Boulevard (MN 5)/Great Plains Boulevard
ii. W 79th Street/Great Plains Boulevard
iii. W 79th Street/Eastern Gas Station Access
iv. W 79th Street/Western Gas Station Access
v. W 79th Street/Eastern Site Access
vi. W 79th Street/Western Site Access

The full build year of 2019 was chosen for this study representing the first full year of operation after completion of the redevelopment.

ii. Existing Conditions

a. Corridor Characteristics

As mentioned, the proposed site is located south of W 79th Street and west of the newly constructed Chick-fil-A site. Figure 1 shows the vicinity of the site and the study area, while Figure 2 shows the proposed site's Concept Plan. Table 1 shows the characteristics of the key roadway corridors around this site and within the study area.

Table 1 – Study Corridor Characteristics

Name	Designation[1]	Classification[2]	Speed Limit	Lanes	Transit	Peds/ Bicycles
Arboretum Boulevard	TH 5	A Minor Arterial	55 mph	4 divided	4 Routes	Sidewalk on north side
Great Plains Boulevard	MSA 119	Minor Collector	30 mph	4 undivided	4 Routes	Sidewalk on both sides
W 79th Street	-	Local Road	30 mph	2 undivided	-	Sidewalk on north side

[1]TH = Trunk Highway, MSA = Municipal State Aid Route.
[2] Met Council Functional Classification.

b. Traffic Volumes

Intersection videos were collected at the study intersections under normal weekday conditions in October 2017. Using these videos, 48-hour turning movement counts were collected at the study intersections. Counts for the two days were averaged together to smooth out possible irregularities in the data.

The AM and PM peak hours for the project area intersections along the W 79th Street are from 7:45 to 8:45 AM and 6:30 to 7:30 PM. These peaks correspond with the peak use of restaurants in the area. The peak hours of the Arboretum Boulevard/Great Plains Boulevard intersection vary slightly, 7:15 to 8:15 AM and 4:45 to 5:45 PM, based on commuter traffic on the highway. For the purposes of this evaluation, the peak hour volumes for each were used. The W 79th Street corridor volumes show relatively little change between the corridor peak hours and the Arboretum Boulevard/Great Plains Boulevard intersection peak hour volumes. In addition, using the commuter peak hour volumes allow for review when the impact of the signalized intersection's southbound queues is greatest. The turning movement count data from the counts are contained in 15-minute intervals in the Appendix.

c. Existing Observations

All study area intersections were observed during the peak hours to better understand the area operations. The key observations are:

- During the AM peak hour, the southbound left queue along Great Plains Boulevard at the Arboretum Boulevard intersection extends back into the W 79th Street/Great Plains Boulevard intersection. We observed several

signal cycles during this peak hour where the southbound left turn queue blocked the southbound through and eastbound right turn movements.

- During the PM peak hour, the southbound left queue along Great Plains Boulevard at the Arboretum Boulevard intersection stretches beyond the W 79th Street/Great Plains Boulevard intersection. This southbound left turn queue blocks southbound through and eastbound right vehicles from completing their movement and results with additional queueing that blocks the eastern gas station exit on W 79th Street. When the southbound approach on Great Plains Boulevard at the Arboretum Boulevard intersection receives a green light, these queues are able to clear on all approaches.
- During both peak periods, operation of the W 79th Street/Great Plains Boulevard intersection becomes complicated. Drivers in the southbound queue, cognizant of this side-street stop-controlled intersection, generally provide a gap for the eastbound motorist left turn movements to head north on Great Plains Boulevard. This results in the intersection working more like an all-way stop intersection with drivers using eye contact and waving for when to proceed. This continues until the southbound queue clears and vehicles along the cross street at W 79th Street/Great Plains Boulevard complete their movements. This operation, while generally allowing motorists to proceed faster than otherwise would be expected, is not ideal and represents a safety concern.

d. Crash History Review

Using the Minnesota Crash Mapping Analysis Tool (MnCMAT), as developed by the Minnesota Department of Transportation (MnDOT), we obtained the study intersection crash reports for the most recent three-year timeframe, years 2013 to 2015. Analyzing these reports can help show potential areas of concern within a roadway system due to high crash rates, or patterns in type of crashes. Table 2 shows a summary of the crashes in the study area by year and severity.

Table 2 – Study Area Crash History Summary

	Severity Type					
Year	Fatal	A injury	B Injury	C Injury	PD[1]	Total
2013	0	0	1	1	8	10
2014	0	0	2	3	9	14
2015	0	0	0	1	3	4
Totals	0	0	3	5	20	28

[1] PD stands for Property Damage Only.

Of the 28 crashes in this three-year period, six occurred at or near the Great Plains Boulevard intersection with W 79th Street West (western leg). Five of these crashes were designated as left turn/right angle crashes and one as sideswipe passing. These crashes are likely the result of drivers taking chances when turning due to a lack of gaps during the peak periods. There is a potential for drivers to be confused

by the continuous southbound left turn lane or the wide northbound pavement area which transitions from one to two lanes.

The remaining 22 crashes occurred at the Arboretum Boulevard/Great Plains Boulevard intersection. 16 of these crashes were classified as rear end crashes, four as left turn/right angle crashes, and two as sideswipe crashes. These crashes are most likely due to the traffic signal at the intersection, where rear end collisions are more common.

The crashes and trends match our expectations based on observations of the study area. The crash detail information is attached in the appendix.

iii. Forecasted Traffic

a. Site Traffic Forecasting

The Institute of Transportation Engineers' (ITE) *Trip Generation Manual, 10th Edition*, is the standard document for determining expected traffic for proposed land uses. ITE compiles studies from across the Country to determine the expected traffic associated with various land uses. Using this ITE information, trip generation forecasts can be made for this proposed development site.

The proposed development most closely fits the new ITE land use of Fast Casual Restaurants. Unfortunately, this data set contains only one study for determining trip generation. Also, the corresponding trip rates do not appear to accurately represent the expected trip generation of the proposed development based on general knowledge of the incoming restaurant. For this reason, the ITE land use of Fast-Food Restaurant with Drive-Thru Window was chosen for the trip generation calculations. This land use is similar to the proposed development, contains many data points for a quality average rate, and results with a trip generation that more closely represents what we would expected from the proposed redevelopment.

For the analysis, the raw trip generation was divided among two types of trips – new and pass-by. Pass-by trips are those vehicles already on the roads which will stop at the development site in the future. New trips represent traffic increasing the overall number of vehicles at the intersections. All pass-by percentages used in this study were based on the values published in the *ITE Trip Generation Manual, 10th Edition*. The breakdown between these types of trip generation for this land use is:

- 49 percent Pass-By Trips.
- 51 percent New Trips.

The resultant new trips generated by the proposed development are shown in Table 3. It is noted while pass-by trips are not new to the system, they are new to the site and are included at the driveways. A detailed trip generation table showing the exact breakdowns is provided in the Appendix.

Table 3 – Net New Trip Generation

Land Use Code – Source	Description & Size	Daily		AM Peak Hour		PM Peak Hour	
		In	Out	In	Out	In	Out
934 - ITE	Fast-Food Restaurant with Drive-Thru Window (4,500 sq. ft.)	534	534	66	65	48	48
TOTAL NEW TRIPS GENERATED		**534**	**534**	**66**	**65**	**48**	**48**

A trip distribution pattern was then developed for the generated traffic going to and from the site. This pattern is based on the existing traffic volumes and access to the regional transportation system. The general trip distribution pattern assumed for this study is:

i. 40% of the generated traffic to/from the west on Arboretum Boulevard and W 79th Street.
ii. 44% of the generated traffic to/from the east on Arboretum Boulevard.
iii. 8% of the generated traffic to/from the south on Great Plains Boulevard.
iv. 8% of the generated traffic to/from the north on Great Plains Boulevard.

Traffic generated by the site development was assigned to the area roadways per this distribution pattern.

b. Non-site Traffic Forecasting

To account for non-specific development in the area, background growth rates were determined based on the MnDOT's County growth factors. Carver County has a 20-year growth factor of 1.8, resulting in a 3.0% annual growth rate. This rate does account for potential developments within the region and for that reason, the traffic rates were only applied to through traffic on Great Plains Boulevard and Arboretum Boulevard, not all individual turning movements.

The background volume was added to the existing traffic to establish the 2019 No Build Scenario volumes. The resultant 2019 No Build peak hour forecasts are shown in the Appendix under the capacity analysis section for each scenario.

c. Total Traffic

Traffic forecasts were developed for the 2019 Build scenarios by removing the existing hotel traffic and adding the traffic generated by the proposed development to the No-Build forecast volumes. As there are some users the access both the hotel and Chick-fil-A, only 90% of the existing hotel traffic was removed from the development site accesses. This reduction assumes a more conservative reduction in traffic for the 2019 Build scenarios. Peak hour forecasts are shown in the Appendix.

iv. Analyses

a. Trip Generation Comparison

A trip generation comparison for the existing and proposed redevelopment of the site helps to show the magnitude of impact expected on the study roadways and intersections. The existing parking lot layout provides access to both the hotel and the adjacent Chick-Fil-A. The raw turning movement counts do not discern between the two adjacent land uses.

To differentiate the trips between the two existing land uses, observations of the turning movements and ITE information were used. Observations revealed a very high percentage of trips are destined for the Chick-Fil-A. ITE information suggests the approximately 15% to 25% of the driveway traffic is for the hotel with the majority for the restaurant. Due to older nature of the hotel and our observations, only 15% of the driveway trips were assigned to the Chanhassen Inn and 85% of the driveway trips assigned to the Chick-Fil-A.

Using the driveway counts and the assumed percentage of hotel traffic with the proposed redevelopment trip generation presented earlier, Table 4 shows the trip generation comparison.

Table 4 – Trip Generation Comparison

Case	Land Use	Daily		AM Peak Hour		PM Peak Hour	
		In	Out	In	Out	In	Out
Existing Land Use	Hotel (Chanhassen Inn)	204	204	10	10	26	25
Proposed Land Use	Fast Food Restaurant with Drive-Thru Window (4,500 sq. ft.)	1,048	1,048	91	88	73	73
TOTAL INCREASE IN GENERATED TRIPS		**844**	**844**	**81**	**78**	**47**	**48**

As Table 4 shows, the proposed restaurant is expected to generate more traffic than the existing hotel. Depending upon the time frame, the increase is three to nine times over the existing.

b. Corridor Vehicular Analysis

While many factors contribute to a road feeling congested, the two biggest factors are volume, how many vehicles are using the road, and capacity, how many vehicles the road can accommodate a day. Transportation professionals use these pieces of information to create a ratio of volume to capacity. For example, a road with a volume to capacity ratio of 1.0, where the traffic demand is nearly equal to the traffic supply, will feel congested to motorists.

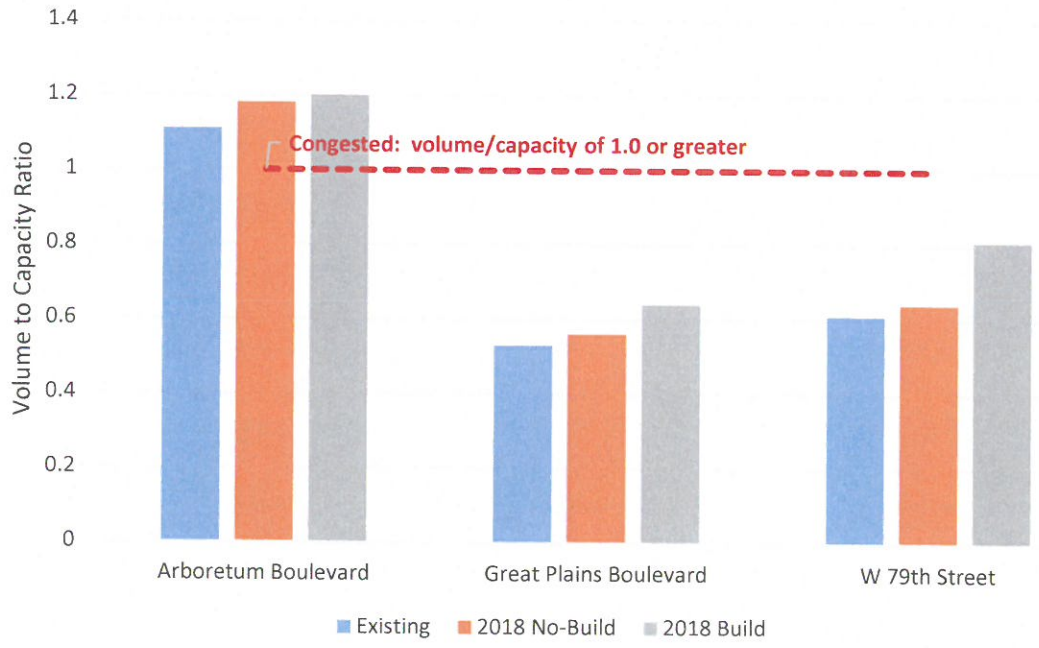
Below is a rough guide of the daily traffic volumes different types of roads can accommodate based on the *Highway Capacity Manual, 6th Edition* Exhibit 16-16. If the Average Daily Traffic (ADT) volume on a roadway is below the threshold, then it is considered un-congested. If the daily volume falls inside the range, the road is almost congested, and if the daily volume is over the threshold the road is congested.

- 2-Lane, undivided street (one in each direction with left turn lanes at busy intersections and coordinated signals), – 8,900 to 18,300 vehicles per day.
- 4-Lane street (two in each direction with left turn lanes at busy intersections and coordinated signals), – 18,600 to 36,800 vehicles per day.

The above capacities represent physical capacity in ideal roadway conditions. Research from UC Berkley, for example, indicates quality of life along a residential street is negatively impacted when the ADT exceeds 1,000 vehicles per day. Therefore, the 1,000 vehicle per day threshold is used for the capacity along neighborhood two lane roads even though its physical capacity is approximately ten times larger.

To provide an initial planning level screening, Chart 1 provides the daily volume to capacity ratios of the study corridors during each of the study full build out study year to determine if any of the roadway corridors are candidates for additional through lanes. As shown, Great Plains Boulevard and W 79th Street are below the planning level capacity thresholds. The data further suggests Arboretum Boulevard is over-capacity with congestion. These results are consistent with observations of the study area, particularly congestion on Arboretum Boulevard during the peak periods. In all cases, the proposed development adds to the daily volumes, but does not significantly impact the results.

Chart 1 – Study Corridor Volume to Capacity



c. *Intersection Analysis*

The traffic operation analyses are based on delay calculations done in accordance with the methodology of the *Highway Capacity Manual, 6th Edition.* For this analysis, we used the Vistro software package, which utilizes the HCM procedures. The existing, 2019 No-Build, and 2019 Build scenarios were initially analyzed for both the AM and PM peak hours. Full calculations for each study scenario, including traffic operational 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 2 (AM peak hour) and Chart 3 (PM peak hour) show the average peak hour delay for signal controlled intersections for each study scenario. The only intersection with traffic signal control is Arboretum Boulevard/Great Plains Boulevard. 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 initial signal timing for the existing conditions was estimated based on traffic observations.

Chart 2 – AM Peak Hour Delays: Signal Controlled Intersection

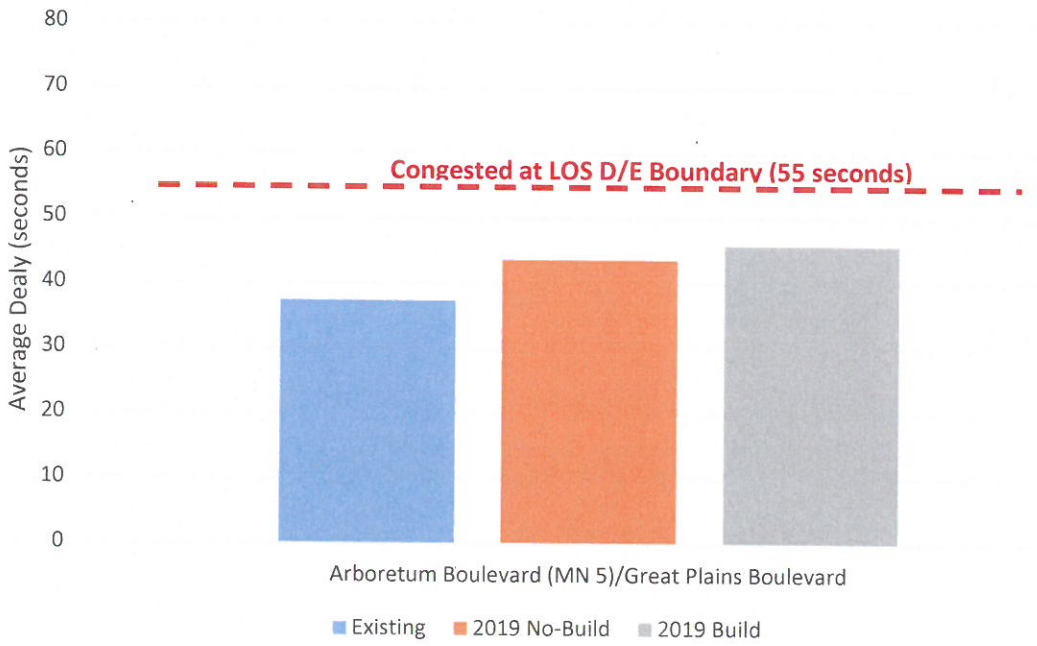
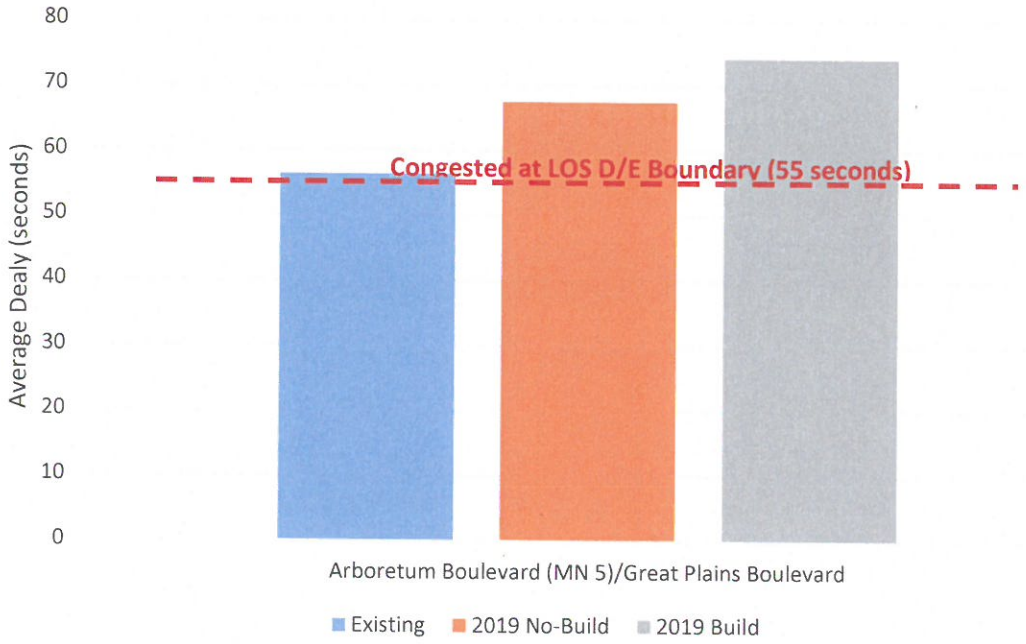


Chart 3 – PM Peak Hour Delays: Signal Controlled Intersection



Due to the extended southbound queue observed in the existing conditions at the Arboretum Boulevard/Great Plains Boulevard intersection, the vehicles queues as provided by the analyses were also examined. Chart 4 (AM peak hour) and Chart 5 (PM peak hour) show the 95th percentile vehicle queue lengths as the measures of effectiveness at the signalized intersection.

Chart 4 – AM Peak Hour Queues: Arboretum Boulevard/Great Plains Boulevard

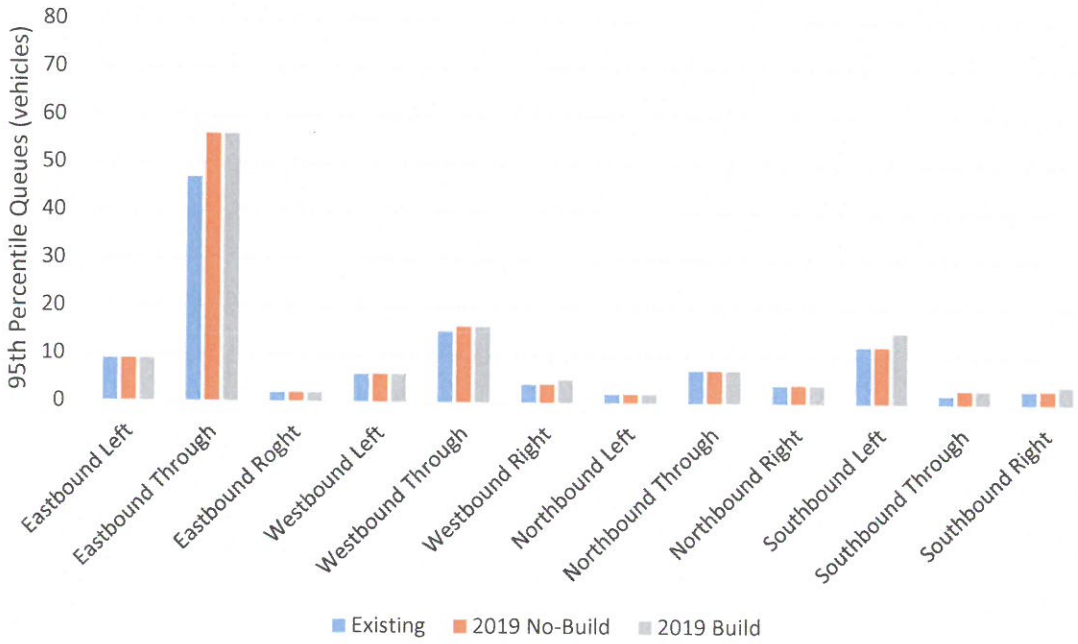


Chart 5 – PM Peak Hour Queues: Arboretum Boulevard/Great Plains Boulevard

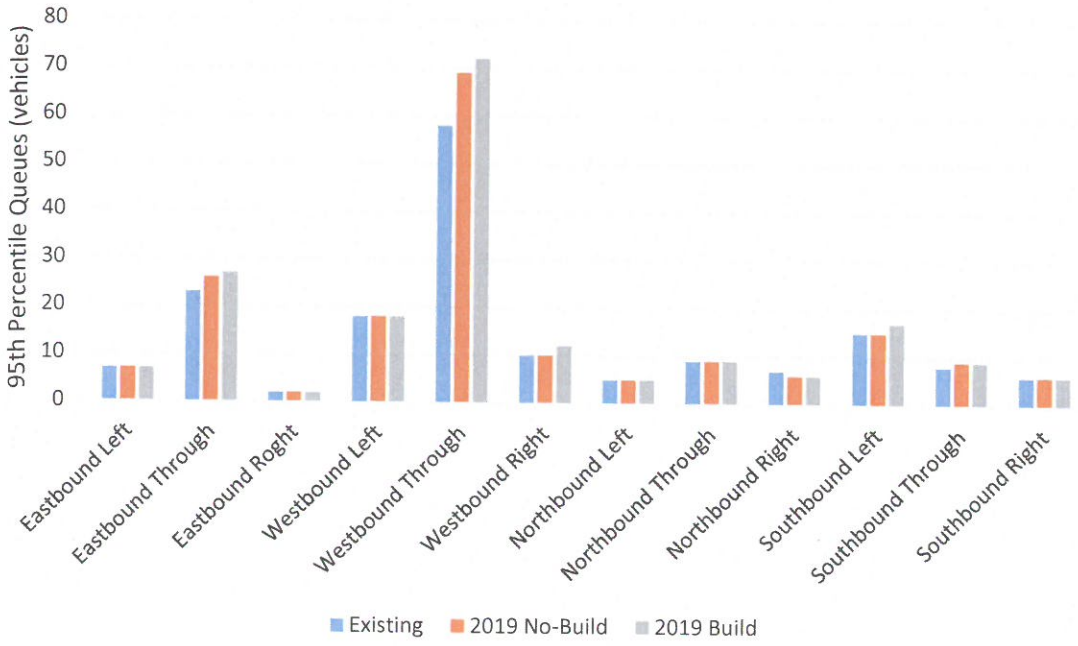


Chart 6 (AM peak hour) and Chart 7 (PM peak hour) show the 95th percentile vehicle queue lengths as the measures of effectiveness at intersections with side street stop sign control. For this type of control, vehicle queues are a better measure than LOS or delay, which can be poor with even one or two vehicles where mitigation would not be appropriate. Vehicle queues are presented for the longest queue experienced at the intersection. Based on our experience, improvements are not warranted until the 95th percentile queue at a stop sign is in the five to ten vehicle range. The stop controlled intersections in this study include:

i. W 79th Street/Great Plains Boulevard.
ii. W 79th Street/Eastern Gas Station Access.
iii. W 79th Street/Western Gas Station Access.
iv. W 79th Street/Eastern Site Access.
v. W 79th Street/Western Site Access.

Chart 6 – AM Peak Hour Queues: Side Street Stop Sign Controlled Intersection

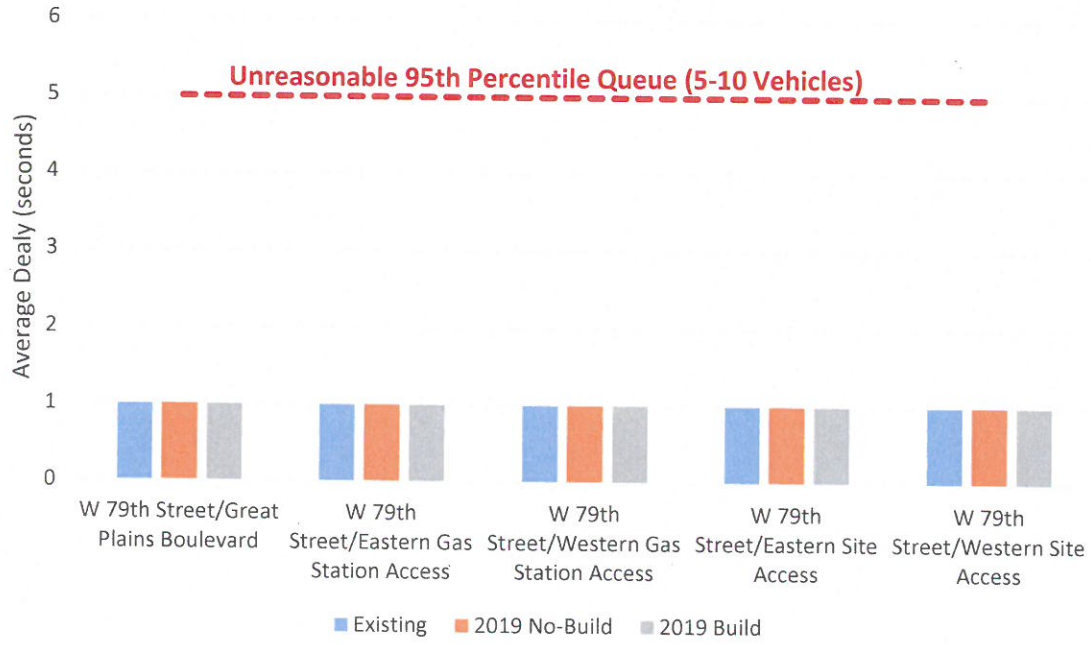
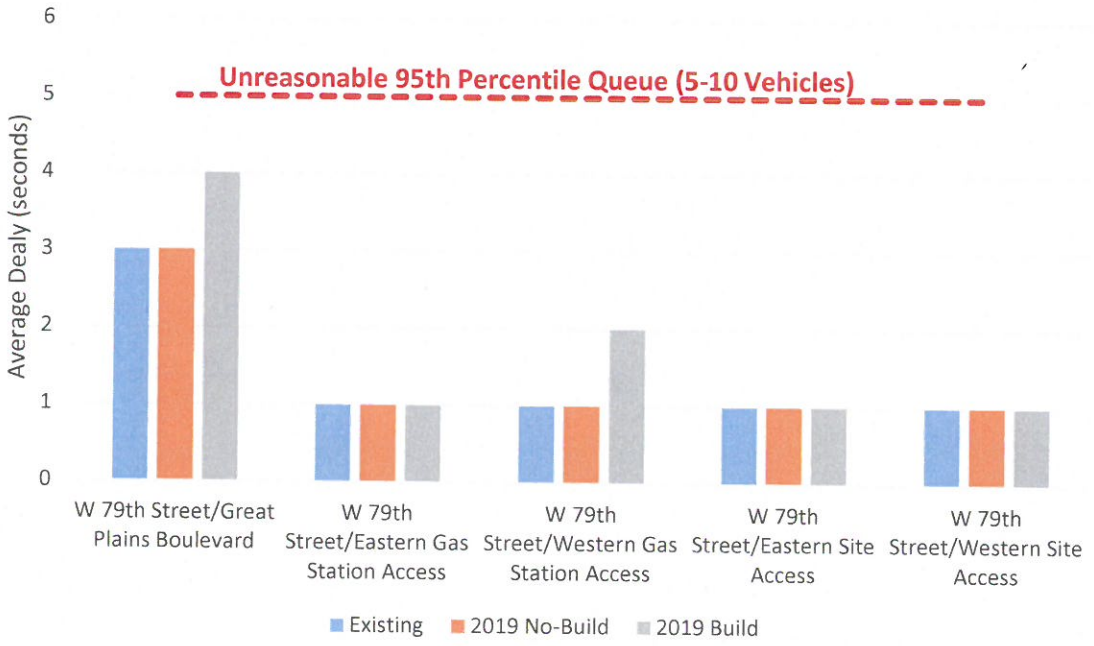


Chart 7 – PM Peak Hour Queues: Side Street Stop Sign Controlled Intersection



A Level of Service of the side street stop controlled intersections were also reviewed to determine if any movements were undergoing significant delays caused by heavier mainline traffic despite the acceptable queuing. Table 5 shows the resulting intersection level of service results as well as the highest delayed movement level of service at each side street stop controlled intersection.

Table 5 – Trip Generation Comparison

Intersection	Existing		No-Build		Build	
	AM PEAK	PM PEAK	AM PEAK	PM PEAK	AM PEAK	PM PEAK
W 79th Street/Great Plains Boulevard	A (c)	A (f)	A (c)	A (f)	A (c)	A (f)
W 79th Street/Eastern Gas Station Access	A (b)	A (a)	A (b)	A (a)	A (b)	A (b)
W 79th Street/Western Gas Station Access	A (b)	A (b)	A (b)	A (b)	A (b)	A (c)
W 79th Street/Eastern Site Access	A (b)	A (c)	A (b)	A (c)	A (b)	A (c)
W 79th Street/Western Site Access	A (b)	A (b)	A (b)	A (b)	A (b)	A (b)

As table 5 shows, all intersections, except W 79th Street/Great Plains Boulevard, operate with an overall intersection Level of Service (LOS) of A with worst movements at LOS C or better. The W 79th Street/Great Plains Boulevard intersection operates with a LOS A, however the worst movement delay, the eastbound left, experiences delays at LOS F with delays around 77 seconds in the build PM peak hour. This delay is longer than desired and raises concern of left turning vehicles becoming impatient and attempting to complete a movement without sufficient gap. The result is supported by five of the six accidents at that intersection being right angle/left turning accidents.

Overall, the results of the capacity analysis show acceptable vehicle operations at most study intersections. With traffic from the proposed redevelopment being distributed amongst the study corridors and intersections, operations are expected to remain similar overall. The additional vehicles generated by the redevelopment of the Chanhassen Inn to restaurant use are not expected to significantly impact the surrounding roadway system. This is evidenced by the relatively similar delay and queuing results between the No-Build and Build scenarios.

The exception is the intersection of Arboretum Boulevard/Great Plains Boulevard, currently operating at a less than ideal overall intersection LOS E during PM peak hour. The intersection continues to operate with multiple movements at LOS E or F in the No-Build and Build scenarios. The average overall delay increases by about seven seconds between the No-Build and Build scenarios. Larger delays can be expected at signalized intersections that operate with extended cycle lengths. The observed cycle length here was 180 seconds in the AM and PM peak hour. The relatively minor differences in delay between the No-Build and Build scenarios suggest that the addition of the redevelopment traffic minimally affects the intersection. Signal timing updates, which should be completed at least every three to five years to reflect current travel demands, could improve the operations.

When examining the interaction between intersection, additional issues arise with respect to queueing. As observed in the existing conditions, the southbound left turn queue at Arboretum Boulevard/Great Plains Boulevard extends to and or past the W 79th Street/Great Plains Boulevard intersection during the AM and PM peak hours for all scenarios. The proposed development is expected to increase these queues with a three vehicle increase in 95th percentile queue length in the AM Build peak hour when compared to the AM No-Build peak hour and a two vehicle increase in 95th percentile queue in the PM Build peak hour when compared to the PM No-Build peak hour results. These blockages cause queueing of the eastbound approach at W 79th Street/Great Plains Boulevard which is further exacerbated by lack of gaps for eastbound left vehicles to complete a safe movement.

The average queues were also reviewed to determine how often queues from Arboretum Boulevard/Great Plains Boulevard are expected to cause blockages of the W 79th Street/Great Plains Boulevard intersection. During the AM peak hour, the average queue lengths remain at or just less than the provided storage space between Arboretum Boulevard/Great Plains Boulevard and W 79th Street/Great Plains Boulevard through the No-Build scenario. The 2019 Build AM peak scenario shows average queues for the southbound left turn movement which stretch past this storage length. The PM peak hour analysis shows average queues which stretch beyond this storage bay for all scenarios. These results support the findings that updated signal timing would be beneficial to the study area and suggest a preexisting need for a restricted or partial restricted intersection at W 79th Street/Great Plains Boulevard to increase safety and lower the potential for left-turn related accidents.

Knowing that during the AM peak period the average southbound queue at Arboretum Boulevard/Great Plains Boulevard stretch just to the adjacent W 79th Street/Great Plains Boulevard intersection, the AM peak hour volume was used as a minimum volume threshold template. Any volume roughly at or over this hourly volume was flagged as an hour were queueing issues likely occur. Based on this assumption, the southbound queue on Great Plains Boulevard at the Arboretum Boulevard intersection stretches to or past the W 79th Street/Great Plains Boulevard intersection at least five hours of the day, further supporting the need for mitigation at this intersection.

d. Mitigation Analysis

Per the above analyses, consideration was given to improving operations regarding three issues:

- Retiming of the traffic signal at Arboretum Boulevard/Great Plains Boulevard.
- Reducing the southbound vehicle queuing on Great Plains Boulevard at Arboretum Boulevard.
- Improving operations at W 79th Street/Great Plains using partially restricted intersection layouts.

These mitigation needs match those put forth in the earlier Great Plains Boulevard Study. The options considered for reducing the vehicle queues include and improving delays include:

- Signal timing adjustments.
- Additional geometric lanes.
- Restricting allowed vehicles movements at intersections.

The signal timing is set based upon providing the most green time to the approaches with the highest volume, in this case Arboretum Boulevard. This is routine practice and should continue. However, traffic patterns often change and the signal timing should be updated to reflect the latest volumes and trends. Only a minor reduction in the vehicle queues is expected with an updated timing plan, but is recommended to occur periodically to ensure the most efficient operations are provided.

Additional vehicle lanes will allow more vehicle stacking and additional vehicles to proceed through the intersection during the limited green time provided. In terms of capacity and improving operations, additional lanes are an option. However, the surrounding land is relatively built-up with limited right-of-way or available land for added geometric lanes, particularly where this improvement would provide the most benefit such as additional eastbound or westbound through lanes. Space is available to add on the southbound approach of Arboretum Boulevard/Great Plains Boulevard where a roughly 50-foot storage bay for a second left turn lane could be added. This length of storage bay would not give a significant improvement to storage for the cost of construction and may cause other issues such as opposing left turn overlaps. Based on this, additional geometric lanes mitigation was not considered further nor analyzed.

Restriction of the eastbound left turn and through movements on W 79th Street at the Great Plains Boulevard intersection would remove the highest delayed movements and decrease the eastbound queue. This restriction would also minimize the consequences caused by blockages of the intersection by the southbound Arboretum Boulevard/Great Plains Boulevard queue and help decrease the number of right angle/left turn accidents which occur at the intersection. If the ¾-access restriction of the W 79th Street/Great Plains Boulevard Intersection is constructed, additional signage along W 79th Street will be needed to help direct drivers in the appropriate direction to proceed on their desired route. This would include directing current eastbound left turning movements destined for W 78th Street or Market Street west towards Market Boulevard.

Additional mitigation analysis was completed assuming the specified mitigation techniques were implemented. Most intersections show similar results with only a slight improvement. However, the delays and queues on W 79th Street at the Great Plains Boulevard show a significant improvement. The maximum eastbound queue is reduced from four vehicles to one, lowering the chances of blockages to the gas station accesses. As expected, this modification limits the impact of the queue

blockages caused by southbound traffic at Arboretum Boulevard/Great Plains Boulevard, while increasing safety through the intersection.

e. Parking Analysis

As with trip generation, little to no parking data is available for a fast-casual restaurant. The Chanhassen City Code for a fast food restaurant with a drive-thru specifies a ratio of one space is required per 80 square feet of gross floor area. Based on this ratio, the 4,450 square-foot building is required to provide 56 parking stalls. The proposed site plan shows 60 parking spaces, exceeding the code requirement.

The ITE *Parking Generation, 4th Edition*, document compiles parking demand data from different land uses, similar to the *Trip Generation Manual*. Using the same land use, Fast Food Restaurant with a Drive-Thru Window, as the trip generation, the peak parking demand is expected to be 45 occupied spaces during a typical weekday and 39 occupied spaces during a typical Saturday. Again, the proposed parking supply exceeds the expected demand.

Bicycle parking is not required by the Chanhassen City Code and none is explicitly shown in the site plan. Providing facilities for bicyclist is one method to potentially reduce vehicle demand and is recommended to allow customers and employees options to and from the proposed development.

f. Concept Site Plan & Multi-Modal Review

The concept site plan contained in the Appendix was reviewed for potential improvements to the circulation and connection of the multi-modal system. The following are the key categories reviewed and highlights of that review:

i. **Vehicle Circulation**: From the access to W 79th Street, drivers have two options to and from the parking and drive-thru areas. This provides sufficient circulation around the site and minimizes risks of one motorists or event from blocking all traffic. Autoturn movements for delivery vehicles and garbage trucks should be checked to ensure these vehicles can safely maneuver around the building. To reduce traffic impacts and conflicts with customers/parking vehicles, truck deliveries including garbage/recycling collection and food drop-offs should be scheduled during non-peak periods to the extent possible.

   The drive-thru provides space for approximately 12 to 13 vehicles stacked from the pick-up window. Spack Consulting completed analyses of drive-thru stacking needs for several land uses including fast food restaurants. That research found the 85th percentile stacking distance to be 12.0 vehicles during peak demand. True fast food restaurants would be expected to have a higher drive-thru lane use than the proposed restaurant. Thus, sufficient stacking is provided for the drive-thru operations and conflicts with parking operations are not anticipated.

ii. **Bicycle and pedestrian infrastructure:** Sidewalks are currently provided along the north side of W 79th Street and Arboretum Boulevard, and on both side of Great Plains Boulevard. Based on the provided site plan, connections are planned from the storefront to the sidewalks on Arboretum Boulevard only. Even though the sidewalk on W 79th Street is on the north side, pedestrian routes to the access intersection should be pursued. To better connect the land uses on the south side, a sidewalk could also be considered from the Great Plains Boulevard intersection to at least the proposed redevelopment.

For the pedestrian connections across the drive-thru area, signing and striping should be provided to minimize the risk of these conflicts areas.

As mentioned, the existing site plan does not show or mention bicycle parking facilities. Short-term outdoor bicycle parking should be provided, ideally located close to the front door and well-lit for safety and visibility.

iii. **Adjacent Transit:** There are bus stops within walking distance of the development site with existing transit routes available to Minneapolis. No additional transit infrastructure is recommended due to the construction of the proposed redevelopment.

v. Conclusions and Recommendations

The traffic impacts of the proposed mixed-use redevelopment were studied, and the principal findings are:

- The proposed redevelopment is expected to generate approximately 1,068 new daily trips, approximately 92 new trips during the AM peak hour and approximately 74 new trips during the PM peak hour.
- This new traffic associated with the proposed redevelopment represents an increase expected beyond what the site currently generates today, approximately three to nine times the existing traffic depending upon the timeframe.
- Within the last three years, 28 crashes occurred within the study area, six at the W 79th Street/Great Plains Boulevard intersection and the remaining 22 at the Arboretum Boulevard/Great Plains Boulevard intersection. Five of the six crashes at W 79th Street/Great Plains Boulevard were designated as left turn/right angle crashes, which is a safety concern.
- The existing conditions show queues along Great Plains Boulevard at the Arboretum Boulevard intersection that extend to the W 79th Street intersection during the peak periods. These queues block the southbound through and eastbound right turning vehicles from completing their movement. During these blockages drivers navigate the intersection similar to an all-way stop using driver queues such as eye contact and waving, which is less than ideal. This operation continues until the southbound queue clears and vehicles along the cross street at W 79th Street/Great Plains Boulevard complete their movements. Based on the traffic volumes and confirmed with observations, these queueing conditions occur during approximately five hours of a typical weekday.
- All intersections are projected to operate with acceptable overall delays and queueing through all scenarios, except for Arboretum Boulevard/Great Plains Boulevard, which begins to see southbound queues which extend past its storage length as well as less than ideal delays in the PM peak hour.
- The eastbound left at W 79th Street experiences longer delays at LOS F during the PM peak No-Build and Build scenarios. This queue creates blockages of the gas station accesses occasionally when paired with the southbound queue along Great Plains Boulevard at Arboretum Boulevard.
- Negligible queue lengths are expected at the site accesses.
- The proposed parking stalls exceed both the City requirements and the expected peak demand.
- The drive-thru has sufficient space to accommodate the expected peak stacking based on data of fast food restaurants.
- Pedestrians connections to the north and bicycle facilities are not shown in the current site plan.

The following recommendations are made based on the above findings:

- Signal timing at Arboretum Boulevard/Great Plains Boulevard should be reevaluated to reflect the current traffic and potentially improve operations from Great Plains Boulevard. It is recognized that MnDOT prioritizes the highway traffic at this intersection.
- Begin planning for the restriction of the eastbound approach on W 79th Street at Great Plains Boulevard to right-only. Turning the intersection into a 3/4-intersection (allowing left and right turns into W 79th Street, but restricting outbound movements to right turns only) will help improve safety and lower queues on the approach.
- Add signage directing customers of the businesses on W 79th Street to use Market Boulevard for travel to the north.
- Encourage/schedule truck deliveries and trash pickup outside of the weekday peak periods.
- Provide additional pedestrian connections to the existing northern pedestrian facilities along W 79th Street.
- Provide short term bicycle parking facilities for restaurant customers to help encourage multimodal travel to and from the development.

vi. Appendix

A. Figures

B. The Language of Traffic Engineering

C. Crash Detail Reports

D. Traffic Counts

E. Trip Generation Table

F. Peak Hour Volumes

G. Level of Service (LOS)

H. Capacity Analysis Backups

- AM Existing
- PM Existing
- AM 2019 No-Build
- PM 2019 No-Build
- AM 2019 Build
- PM 2019 Build
- Mitigated AM 2019 Build
- Mitigated PM 2019 Build