City of Saskatoon

In-Service Road Safety Review

College Drive and Wiggins Avenue

Reference-0379

CIMA+file number: SA0127A
January 2024

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Prepared by:

Ellen McLaughlin, P.Eng.

Jeffrey Suggett, M.Sc.

Reviewed by:

Paul Steel, M.Eng., P.Eng., RSP1

4th Floor – 333 3rd Avenue North Saskatoon Saskatchewan
Canada S7K 2M2

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Confidentiality and ownership

Review and submission register			
Issue No.	**Reviewed by**	**Date**	**Description of the review**
1	J. Suggett	Nov 21, 2023	Review of draft report
2	P. Steel	Nov 28, 2023	Review of draft report
3	P. Steel	Jan 8, 2024	Address comments to finalize report
4	E. McLaughlin	Jan 25, 2024	Address supplemental comments to finalize report

Executive Summary

The intersection of College Drive and Wiggins Avenue is a critical link between Saskatoon's eastern residential neighborhoods and the central business district, a key gateway to the University of Saskatchewan, supports the second highest volume of crossing pedestrians, and the highest volume of crossing cyclists recorded in the City. It is a traditional signalized intersection with complex and often competing needs.

The existing intersection displays a history of collisions resulting in injury, and vehicles on the minor street experience long delays due to high pedestrian crossing volumes. A proposed Bus Rapid Transit (BRT) corridor is planned along College Drive and both vehicle and pedestrian travel patterns are expected to shift in response.

Mitigation measures are identified over short-, medium-, and long-term phases – for immediate implementation, opportunities to fast-track portions of larger designs, or to be included with the corridor reconstruction accompanying the proposed Bus Rapid Transit.

COLLEGE DRIVE AND WIGGINS AVENUE IS THE MOST BIKED AND SECOND MOST WALKED INTERSECTION RECORDED IN THE CITY. MITIGATION MEASURES ARE DESIGNED TO REFLECT THIS.

The solutions developed in this report prioritize the safety of vulnerable road users such as pedestrians and cyclists by separating their movements from vehicles in either time or space. Recommendations include changes to signal timing (pedestrian exclusive phase or leading pedestrian intervals), bike boxes or geometric changes to Wiggins Avenue to provide dedicated space to cyclists, and fast-tracking portions of the physical infrastructure associated with the BRT.

The costs associated with this these recommendations are estimated to be $59,015 for short-term improvements and range from $84,030 to $89,290 for medium-term improvements. Long-term improvements can generally be accomplished within the general operating and maintenance budget for the City.

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1. Introduction

The City of Saskatoon (City) engaged CIMA+ Canada Inc. (CIMA+) to complete an in-service road safety review at the intersection of College Drive and Wiggins Avenue. The road safety review explicitly considers the needs of drivers, pedestrians with diverse mobility needs, cyclists, and transit users / operators. The study intersection is illustrated in **Figure 1.1**.

Figure 1.1: Study Intersection

The intersection of College Drive and Wiggins Avenue serves multiple purposes as a link to Saskatoon's central business district and a major gateway to the University of Saskatchewan. This intersection supports a large volume of traffic, multiple transit routes, has the second highest volume of crossing pedestrians, and the highest volume of crossing cyclists recorded in the City. The corridor is anticipated to undergo significant transformation with the introduction of a Bus Rapid Transit system along College Drive in the near future.

1.1 Impetus for Review

On May 24, 2023 a cyclist died in a fatal collision with a heavy truck at the intersection of College Drive and Wiggins Avenue, the memorial ghost bike is captured in **Photo 1**. On June 28, 2023 Council unanimously passed the following:

1. The Administration commission a third-party road safety review at the intersection of College Drive and Wiggins Avenue.
2. That the 2023 operating budget transfer to the Reserve for Capital Expenditures be reduced by $30,000 and reallocated to Transportation to complete a third-party road safety review at the intersection of College Drive and Wiggins Avenue and report back with the results and any recommendations.
3. That Administration provide an update on the implementation of the Active Transportation Plan, including but not limited to the status of any planned connections in the area bound by College Drive, Preston Avenue, 12th Street, and Clarence Avenue and in the interim report on the opportunity of rapidly deploying safety improvements on an access to the University of Saskatchewan campus from the South as well as other key areas where comparable safety benefits could be expected and where planning for permanent solutions is not yet underway.
4. That Administration provide a budget option for an annual Road Safety Audit program through the 2024-2025 Multi-Year Budget Process.

Photo 1 Ghost Bike Honoring Natasha Fox

1.2 Study Process

An in-service road safety review is a formal and independent safety performance review conducted by safety professionals, planners, and engineers to review an intersection or corridor for operational and safety issues of all road users. This study consisted of the following steps:

- Review background documents, as-built drawings, collision history, etc.
- Multi-modal operational analysis,
- Multi-modal site investigation during the day and night,
- Meet with Saskatoon Transit,
- Review functional plans for proposed Bus Rapid Transit,
- Develop mitigation measures,
- Hold a findings meeting with City team.

This project focuses on a single intersection within a broader systemic road safety conversation along the College Drive corridor. The fatal collision in 2023 could have occurred at any number of similar intersections along College Drive where high volumes of passenger cars, heavy vehicles, busses, cyclists, and pedestrians mix with limited protection. For example, there was a serious injury collision between a pedestrian and transit vehicle just east of the study intersection earlier this year. It is our intention to develop solutions at the intersection of College Drive and Wiggins Avenue that are unique to this location while also noting safety countermeasures that may be considered at other nearby intersections to reduce the risk of fatal and injury collisions along the entire corridor.

1.3 Reference Material

A list of reference material that was consulted in preparing this report includes:

- Transportation Association of Canada (TAC) In-Service Road Safety Review Guide (ISRSR)
- TAC Geometric Design Guide (GDG)
- TAC Manual of Uniform Traffic Control Devices for Canada (MUTCDC)
- TAC Vision Zero and Safe System Approach primer:

  "**Vision Zero** is a philosophy that positions deaths and serious injuries as an unacceptable result of crashes and sets the ultimate goal of eliminating them.

  The **Safe System Approach** explains how we can dramatically improve road safety through an integrated, comprehensive process that recognizes the fallibility and vulnerability of human beings.
- Gender Based Analysis + (GBA+) tools

  From the TAC Safe Systems primer "Equity in road safety requires the fair distribution of safety benefits and costs, and vertical equity requires that disadvantaged groups enjoy a disproportionately greater share of resources".
- City of Saskatoon Design Standards, Transportation Master Plan, Active Transportation Plan, Active Transportation Data Collection Report, functional drawings for the Bus Rapid Transit corridor, Service Requests, and City Council meeting minutes
- Highway Capacity Manual (HCM), 2000
- The Ontario Traffic Council Multi-Modal Level of Service Guide
- City of Ottawa Protected Intersection Design Guide
- Ontario Traffic Manual (OTM) Book 12 Traffic Signals
- OTM Book 15 Pedestrian Crossing Treatments
- Federal Highway Administration (FHWA) Signalized Intersections: Informational Guide

2. Background

2.1 Surrounding Land Use

The University of Saskatchewan campus is located immediately north of the study intersection. Wiggins Avenue is one of three major passenger vehicle gateways into the centre of campus. Key destinations near the intersection include the Royal University Hospital, the Jim Pattison Children's Hospital, the Health Sciences buildings, the student centre, on-campus residence halls, and various parking lots.

The Varsity View neighborhood lies south of the study intersection. While it is broadly comprised of low-density housing, the lands nearest the study intersection are medium density including off-campus student residence halls, hotels, and mixed commercial / residential units.

College Drive is access controlled on the north side but there are frequent residential and hotel driveways on the south side.

2.2 Intersection Configuration

College Drive is classified as a major arterial roadway and provides a direct east-west route between Saskatoon's eastern-most residential neighborhoods and the central business district. Speeds are posted at 50 km/h on the east and west approaches and parking is prohibited. Both approaches include three through lanes and dedicated left turn lanes, right turns are made from the curb through lane. A sidewalk is provided on the south side while a 2.0 m multi-use path is provided on the north side. A typical College Drive cross section is illustrated in **Figure 2.1**.

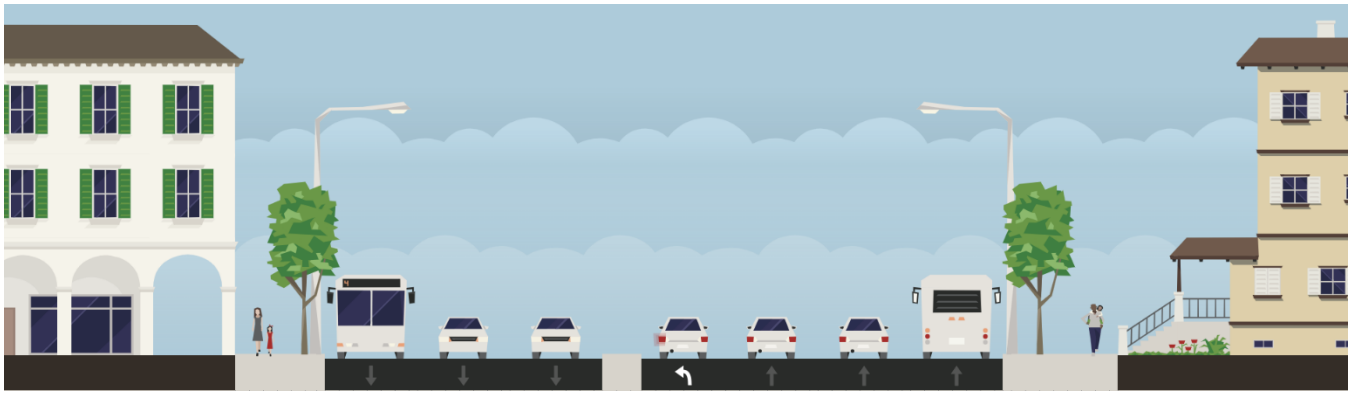


Figure 2.1: College Drive Cross Section (Looking East)

Wiggins Avenue is classified as a minor collector and is a central access to the University of Saskatchewan, Royal University Hospital, and the Jim Pattison Children's Hospital. Speeds are posted at 50 km/h south of College Drive and 40 km/h on campus. Parking is prohibited for four blocks south of the intersection, but becomes permitted further south. The south approach is comprised of a single lane, approximately 4.5 m wide, from which all turns are made. The north approach includes a dedicated lane for each movement as well as a channelized right turn island with an estimated 25 m radius. Sidewalks are provided on both sides of the street. A typical Wiggins Avenue cross section is illustrated in **Figure 2.2**.

Figure 2.2: Wiggins Avenue Cross Section (Looking North)

2.3 Transportation Master Plan

The Saskatoon Transportation Master Plan (TMP) was published in 2021 and outlines long-range strategies, policies, and priorities to support multi-modal travel for growth to a half-million population. The TMP identifies the following criteria to prioritize future transportation projects:

- Improves Equity
- Improves Accessibility
- Improves Safety
- Optimizes Traffic Flow
- Addresses Network Gaps
- Optimizes Parking
- Facilitates Infill Development

The plan shows that this intersection is not on a truck route, will continue to support the multiuse path along its northern edge, and will support the Red and Green lines for the proposed Bus Rapid Transit (BRT) project. There are no specific improvements identified in the TMP at the intersection of College Drive and Wiggins Avenue.

2.4 Transit Planning

Transit along College Drive changed in 2019 when stops were moved from Place Riel on the University of Saskatchewan campus to the curb lane of College Drive. College Drive supports a number of transit lines to the University of Saskatchewan and the community at large. There is now a far side bus stop on the southeast corner of the intersection that serves six routes – 17, 43, 44, 45, 46, and 81 – with stops every 5 to 10 minutes during peak periods. Route 81 runs along Wiggins Avenue at 30-minute intervals. The City of Saskatoon is currently undertaking the functional design to transform College Drive into a BRT corridor, discussed further in **Section 4**.

2.5 Active Transportation Plan

Saskatoon's Active Transportation Plan (ATP) was published in 2016. The five goals of the ATP, depicted in **Photo 2**, are meant to guide the development of new infrastructure and policy. While this document is superseded by the TMP, it offers more detailed active transportation network mapping in the project area.

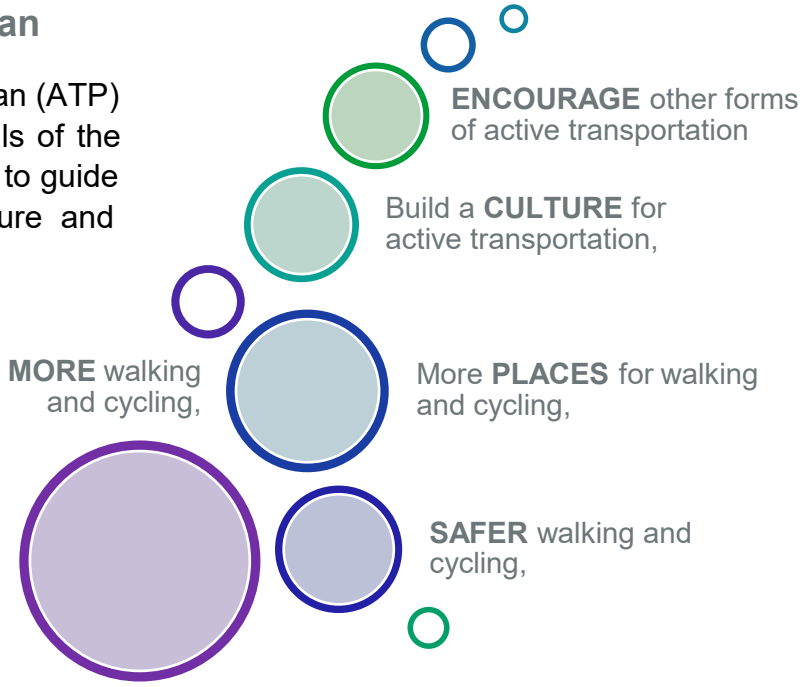


Photo 2 ATP Objectives

An excerpt from the ATP Appendix A is illustrated in **Figure 2.3**. College Drive is identified as an existing multi-modal corridor from the University Bridge to Preston Avenue, comprised of a 2.0 m concrete multi-use path along the north side of College Drive. There is no cycling network planned on Wiggins Avenue at this time. Cycling routes are planned two blocks east and west of Wiggins Drive along Cumberland Drive and McKinnon Avenue.

'Connecting Campus' is an upcoming functional planning study arising from the ATP to select and design one north-south active transportation corridor from College Drive to Wilson Crescent set to be released in 2026–2027. Results from this study may change the recommended network into the University area. The City may wish to consider designing and constructing more than one new cycling route. The provision of additional north-south network options beyond those identified in current planning documents would provide the cycling community with route selection choices if disruptions to the single planning route occur.

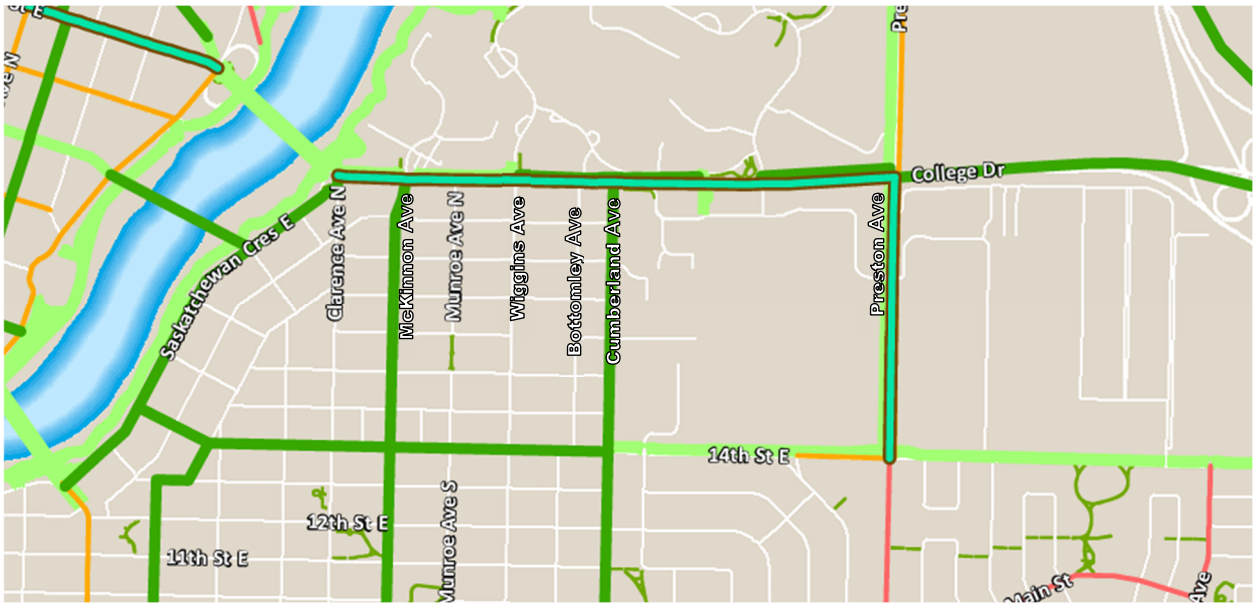


Figure 2.3: Planned Cycling Network near Study Intersection (ATP Appendix A)

2.6 Multi-Modal Traffic Data

The City of Saskatoon provided the audit team with 24-hour multi-modal traffic counts collected Tuesday September 12, 2023 following the start of the University of Saskatchewan fall semester. Traffic counts for vehicles, bicycles, and pedestrians are illustrated in **Figure 2.4** through **Figure 2.6** for the AM Peak, PM Peak, and daily periods. The AM peak for vehicles occurred from 8:00 am to 9:00 am and the PM peak occurred from 4:00 pm to 5:00 pm. The AM peak hour for pedestrians occurred from 9:00 am to 10:00 am with approximately 830 pedestrians. Cyclists travelling in mixed street traffic are noted using grey left / through / right turn arrows while cyclists using the sidewalk or multi-use path are noted directionally using red arrows.

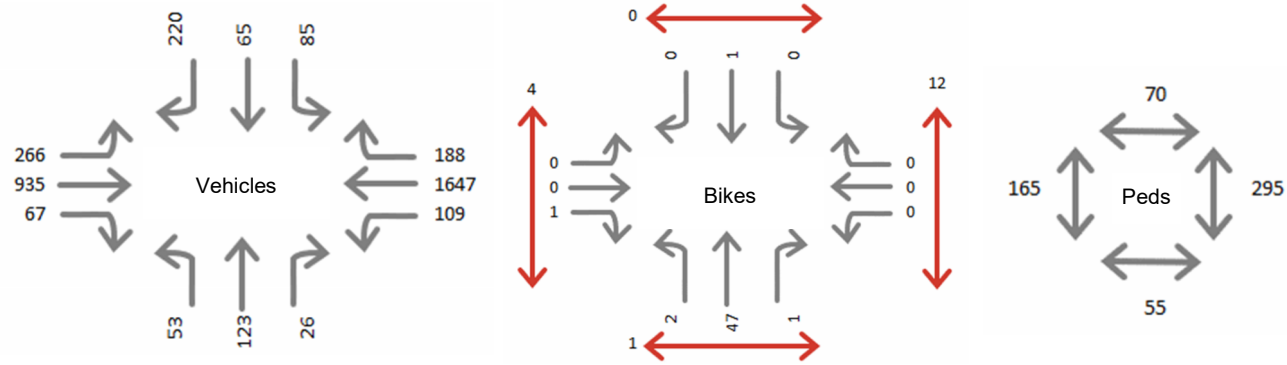


Figure 2.4: AM Peak Traffic Counts (8:00 am – 9:00 am)

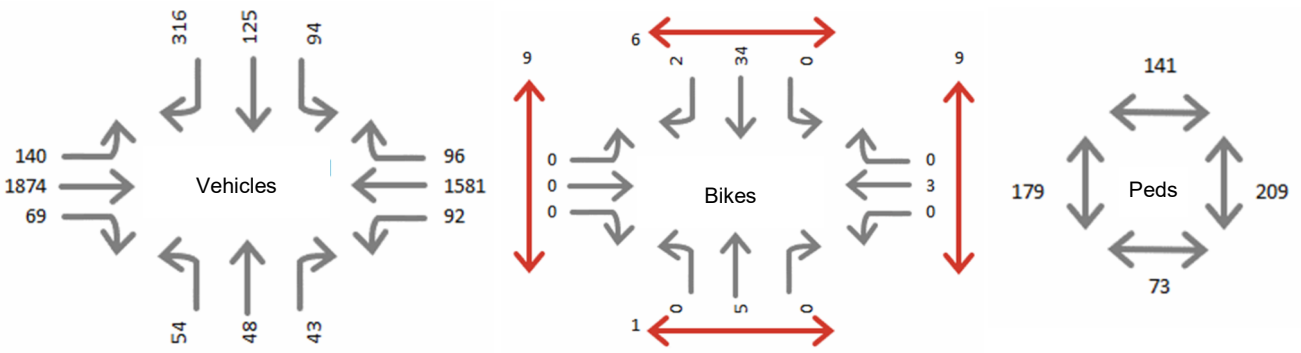


Figure 2.5: PM Peak Traffic Counts (4:00 pm – 5:00 pm)

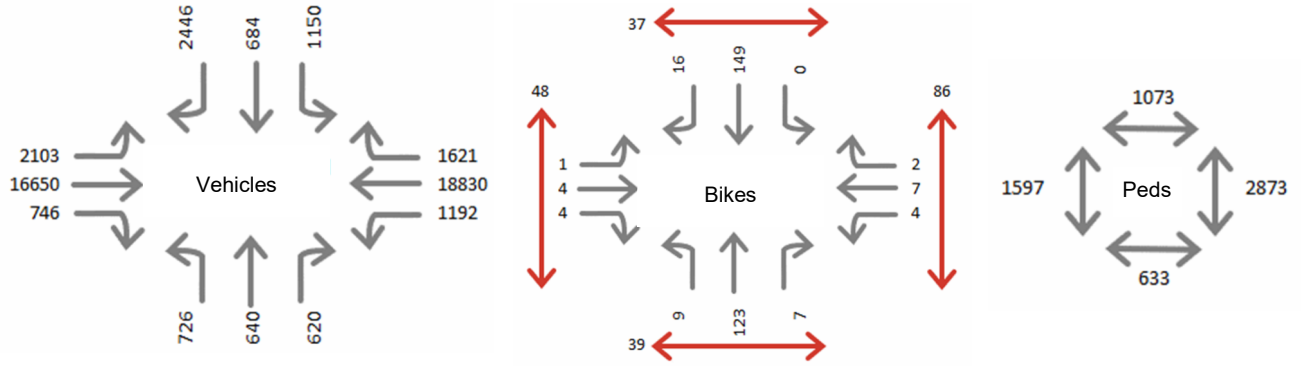


Figure 2.6: Daily Traffic Counts

Trucks represent approximately 1% of vehicle traffic on all legs.

Most cyclists travelling east-west did so on the multi-use path. Cyclists travelling north-south typically did so on the road in mixed traffic. Cyclists make up between 21% to 28% of all on-street through traffic on Wiggins Avenue. This is a significant percentage considering there is no dedicated cycling facility on Wiggins Avenue.

Data from the Active Transportation Benchmarking Program (2019) was also considered. This program counted pedestrians and cyclists at 80 locations throughout Saskatoon prior to the Covid-19 pandemic. The intersection of College Drive and Wiggins Avenue had the highest volume of crossing cyclists and the second highest volume of crossing pedestrians in the City; surpassed only by College Drive at Cumberland Avenue two blocks to the east. Daily cyclist data from the benchmarking report is reproduced here as **Figure 2.7**.

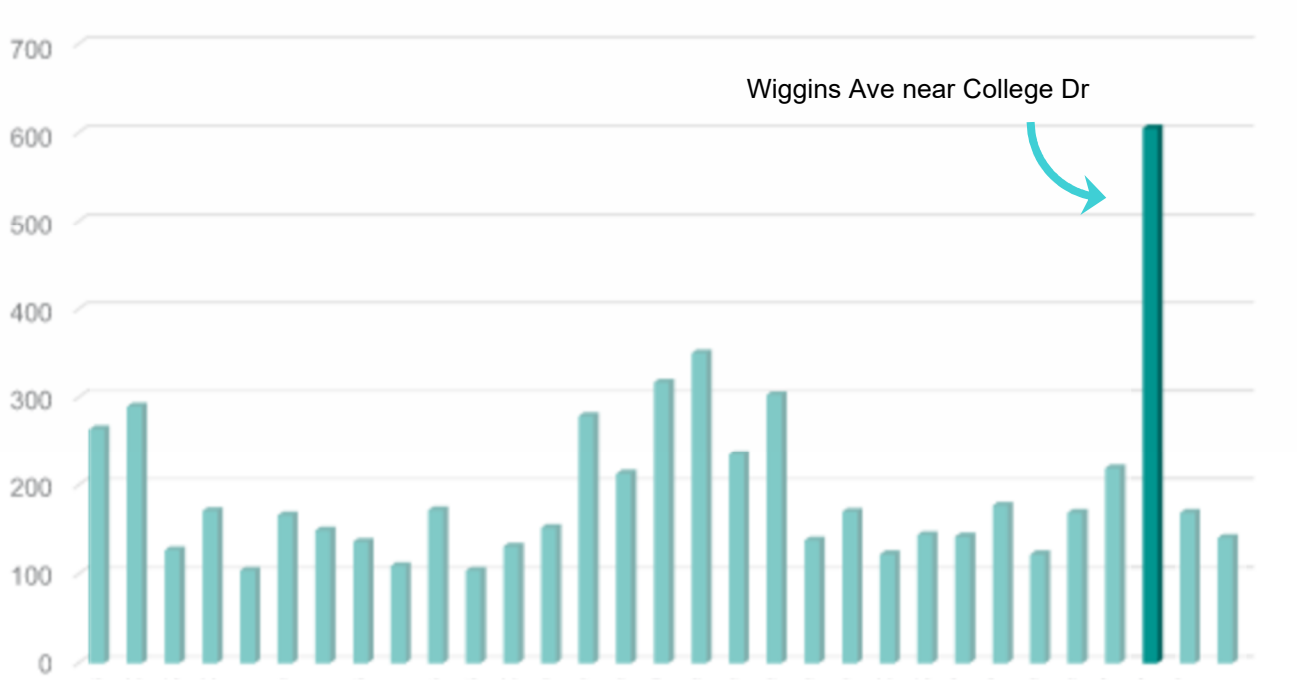


Figure 2.7: Locations with Higher than Average Daily Cyclist Volumes (Active Transportation Benchmarking Program Figure 5)

2.7 Operational Review

The intersection of College Drive and Wiggins Avenue is controlled by a traffic signal. The signal operates in coordination along College Drive and Pedestrian Recall is in use between 6:00 AM and 10:00 PM. Intersection operations were assessed in Synchro 11 using Highway Capacity Manual 2000 methodologies of estimating vehicle delay. Results for the AM and PM peak periods are summarized in **Table 2.1** and **Table 2.2** on the following page. Synchro reports are provided in **Appendix A**.

Both approaches on College Drive currently operate within acceptable ranges during the AM and PM peak periods. Both approaches on Wiggins Avenue operate below acceptable ranges – represented by the yellow highlighted cells in the tables – during the AM and PM peak periods. The minor road green time is predominantly used by crossing pedestrians, leaving little to no green time for left turning vehicles to complete their maneuvers. Eastbound left turn bay storage is occasionally exceeded in the AM Peak and northbound queues come close to spilling back through Elliot Street 100 m to the south in both peak periods.

While an assessment in Synchro based on HCM methodologies is an industry standard approach to assessing the performance of an intersection, this methodology risks prioritizing the delay of vehicles over the safety and comfort of vulnerable road users. We recommend using multi-model level of service (MMLOS) as a more robust approach to intersection operations when evaluating operational improvements. Our team often relies on the Ontario Traffic Council (OTC) MMLOS guide in the absence of local guidance.

Table 2.1 AM Peak Capacity Analysis Results

Traffic Control	Measure of Effectiveness	Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Signal (Coordinated) LOS: C Delay: 33.8 v/c: 0.93	Volume	266	935	67	109	1647	188	53	123	26	85	65	220
	Approach LOS	C			C			E			D		
	Movement LOS	E	B		B	C		E			F	D	B
	Delay (s)	74.6	13.5		12.0	34.5		79.6			93.5	47.4	13.5
	v/c Ratio	0.93	0.40		0.41	0.88		0.86			0.81	0.22	0.62
	95th % Queue (m)	#103.2	62.9		15.1	197.9		#95.9			#53.0	31.0	20.9
	Queue>Storage?	Y	-		N	-		Y			Y	-	N

Table 2.2 PM Peak Capacity Analysis Results

Traffic Control	Measure of Effectiveness	Eastbound			Westbound			Northbound			Southbound		
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Signal (Coordinated) LOS: C Delay: 30.8 v/c: 1.14	Volume	140	1874	69	92	1581	96	54	48	43	94	125	316
	Approach LOS	B			B			E			F		
	Movement LOS	C	B		D	B		E			E	D	F
	Delay (s)	34.9	18.9		36.9	18.3		69.9			71.4	53.1	127.1
	v/c Ratio	0.69	0.69		0.58	0.62		0.74			0.64	0.39	1.14
	95th % Queue (m)	40	160.7		32.4	142.0		#75.6			#53.5	57.0	#150.7
	Queue>Storage?	N	-		N	-		Y			Y	-	Y

2.8 Collision Assessment

The City of Saskatoon provided the audit team with SGI's Traffic Accident Information System (TAIS) six years of collision history from 2017 to 2022 at the study intersection. Overall, 62 collisions were recorded over the six-year period resulting in 54 property-damage-only collisions, 8 injury collisions, and 0 fatal collisions. This data does not include any collisions from 2023. Collisions by configuration are presented in **Table 2.3**.

Table 2.3 Collision Configurations

Configuration	2017	2018	2019	2020	2021	2022	Grand Total
Rear End	9	11	8	3		8	**39**
Right Angle (Left vs. Through)	2	2	3			2	**9**
Right Angle (Through vs. Through)	1	1	1	1			**4**
Other	2	1	1		1		**5**
Fixed / Movable Object	1			1			**2**
Side Swipe			2				**2**
Right Turn (Merging)						1	**1**
Grand Total	**15**	**15**	**15**	**5**	**1**	**11**	**62**

Only one collision was recorded in 2021, well below the intersection average. The rapid reduction in collisions beginning in 2020 may be attributed to the shift to virtual work and education during the Covid-19 pandemic, drastically reducing the volume of vehicles travelling during this period.

Revisions to transit routing occurred during the collision assessment period. Transit stops moved from Place Riel on campus to College Drive resulted in an increase to crossing pedestrian volumes at the study intersection. This does not appear to have effected collision outcomes; however, concurrent changes to our travel patterns resulting from Covid-19 may obfuscate underlying issues.

Rear end collisions were the most frequent collision type and are typically the most common type of collision at signalized intersections. Right angle collisions were the second most common configuration. Of this collision type, 31% occurred between two through vehicles travelling in conflicting directions while 69% occurred between vehicles travelling left and through. The most common configuration occurred between westbound through and eastbound left turning vehicles entering the University.

Of the major contributing factors noted in the TAIS database, 26 collisions cited some combination of distracted / inattentive driving and following too closely while 13 collisions cited road or weather conditions.

Each year, SGI releases the Traffic Collisions Report documenting collision trends and patterns in the province. Among the data presented, SGI publishes the 15 intersections with the highest collision frequency in Saskatoon, Regina, and Prince Albert and releases their associated collision rate. Collision rates are generally considered more indicative of an unusual traffic safety issue because the data is normalized by the volume of vehicles passing through the intersection. The collision rates in SGI's 2021 report for Saskatoon ranged from 49.5 collisions / 10 M vehicles at Circle Drive and Preston Avenue South to 6.3 collisions / 10 M vehicles at 8th Street East and McKercher Drive. The 2022 collision rate at College Drive and Wiggins Avenue is estimated to be 6.4 collisions / 10 M vehicles based on the 24-hour count conducted earlier this year. A broader shift to collision rates is recommended to understand if this intersection displays above average collision tendencies.

Many current safety initiatives focus on reducing and preventing serious collisions (i.e., those resulting in an injury or fatality). Of the 62 collisions reported over six years, 13% resulted in an injury or fatality. **Figure 2.8** illustrates the collision diagram for serious collisions.

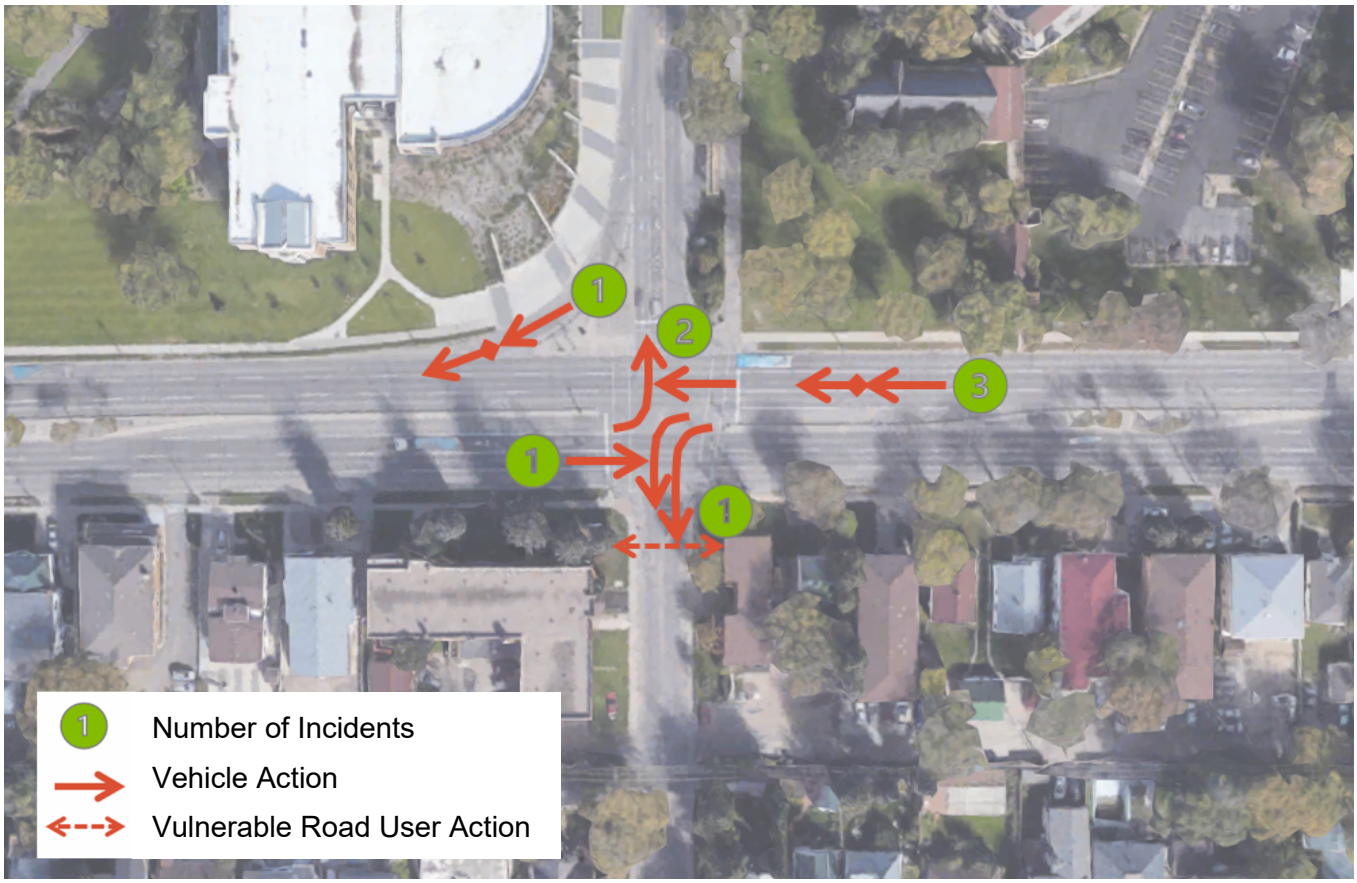


Figure 2.8: Serious Collision Diagram

2.9 Public Enquiries and Letters to Council

The audit team was provided with six Service Requests – communication from the public requesting that the City address a perceived concern – regarding the intersection of College Drive and Wiggins Avenue, as well as seven verbal and 100+ written submissions to City Council regarding cyclist safety.

Service Requests include:

- Advanced left turn phases for southbound left traffic due to the volume of crossing pedestrians.
- Removal of transit services from Wiggins Avenue. Auditor Note: this route is crucial to maintaining accessible transit for a large seniors' centre on Wiggins Avenue. Other route options were deemed too far away to really be considered accessible for the senior centre residents, requiring that Wiggins Avenue remain a transit services route.
- Advance left turn phase for eastbound left traffic regardless of demand. Auditor Note: a protected-permitted left turn phase is provided but the detector is setback 28 m from the stop bar, requiring at least five queued cars to place a call for the advanced phase.
- Implement methods to clear pedestrians through the intersection independent of vehicle traffic, for example, an exclusive pedestrian phase / pedestrian scramble.
- Increase split time allocated to the minor street (suggested 20 seconds). Auditor Note: The frustration expressed in this service request might be addressed by clearing conflicts between pedestrians and left turning vehicles.
- Reduce cycle lengths to within a comfortable range for pedestrians, typically 60 to 120 seconds.

The written and verbal reports to Council focused more broadly on cyclist safety, calls for rapid deployment of dedicated cyclist facilities, better driver education, and safer speeds. Many members of the public that worked on Campus noted that Wiggins Avenue provides the only route to the center of campus that does not involve riding on a sidewalk, hopping a curb, or riding on a narrow pedestrian filled path.

A note on the perspectives and experiences heard: While demographics data was not explicitly collected, many letters volunteered heartfelt experiences from Saskatoon's cycling-oriented community. Letters to City Council were submitted from people of all ages – from a class of eighth graders to senior citizens. An estimated 30% of submission were made by women and 1% were gender diverse. Many submissions referenced living in Saskatoon or the University Heights neighbourhood. The experiences of current University students and new residents may be under-represented.

3. Site Observations

Site observations were completed on October 17 and 18 in the morning, afternoon and evening period as well as after sunset. In addition to observing the site, auditors drove through all approaches and movements, and navigated the intersection as a pedestrian and cyclist. Weather on October 17 reached a high of 18ºC with clouds, weather on October 18 was 1°C and foggy.

3.1 Geometry

- No drainage issues observed.
- The intersection is well illuminated.
- Horizontal and vertical alignments are not expected to contribute to conflicts, i.e. there are no sight line issues.
- Lane widths on College Drive are adequate at 3.3 m. Lane widths on Wiggins Avenue northbound are 4.5 m, which is generally considered too wide for a single lane and may encourage the mixing of turning movements (as some drivers attempt to use the extra space as a right turn lane) and travel modes (as some cyclists attempt to use the extra space as a bike lane).
- The intersection radii on the southeast corner may be too small for transit – occasionally, northbound right turning buses graze the curb cut. Saskatoon Transit does not receive complaints from their operators about this location.
- East and westbound left turn lanes are not offset, and queued vehicles can block the view of opposing through traffic.
- The intersection radii on the northeast corner is very wide and it is unclear whether such a large radii is required for heavy vehicle deliveries to the University or hospitals.

3.2 Signs and Pavement Markings

- Pavement markings are well maintained, potholes have been patched, and there is no debris collecting in the gutter.
- Speeds are posted at 50 km/h along College Drive and 40 km/h on campus. Speeds signs on College Drive would normally contribute to sign clutter but are needed to remind drivers exiting the University of the posted speed.

Photo 3 Pavement and Paint Condition

Photo 4 Breakaway Bases

3.3 Vehicle and Transit Operations

- Eastbound left turn demand is not met in each cycle during the AM peak hour and spills back past the left turn bay impacting through movements.
- The minor road green time is dictated by the pedestrian walk and Flashing Don't Walk (FDW) time, leaving little to no time for conflicting left turning vehicles to complete their movement. Many left turning vehicles (north and south) completed their maneuvers through the amber, all red, and beginning of the eastbound advanced left turn phase.
- While right turns on red are permitted, they are nearly impossible to complete due to the volume of crossing and queueing pedestrians at each corner.
- Parking is prohibited on College Drive (entire length) and Wiggins Ave (within 4 blocks south of intersection). However, drivers stopped in traffic during the red light were observed, permitting pedestrians to disembark on College Drive as though the outer lane was a loading zone.
- The far side bus stop (eastbound) does not disrupt through traffic. The outer lane is mostly used as a right turn lane, so vehicles are not held up behind the bus.
- Reasonably good eastbound vehicle progression was observed in the PM peak hour. The start of green typically begins immediately before the platoon of vehicles arrives from the upstream intersection. There appears to be enough underserved green time on College Drive in the PM peak that cycle lengths could be shortened or redistributed to other movements / modes.
- Northbound queued vehicles block alley access on Wiggins Avenue causing southbound queues to develop.

- Northbound queues on campus develop as vehicles wait to enter parking lot 1 just south of Place Riel or make drop-offs in front of the Health Sciences / Dental buildings. These queues can spill back to College Drive.

Photo 5 Northbound Pedestrian Platoon

Photo 6 Far Side Bus Stop

3.4 Pedestrian and Cyclist Operations

- Signal cycle lengths exceed comfortable pedestrian wait times (135 seconds in the AM and 140 seconds in the PM). No pedestrian violations were observed during the site visit.
- The northwest channelized right turn supports a high volume of southbound right turns in the PM peak hour. The size of the channelized island may have less to do with vehicle turning paths and more to do with functioning as a pedestrian refuge area as there is a high volume of pedestrians crossing at this location.
- The crosswalk between the channelized island and the northwest sidewalk is painted along a pedestrian desire line rather than at a right angle to the vehicle travelled path, requiring pedestrians to complete a shoulder check before crossing.
- There are no pedestrian crossing signs at the channelized right turn crosswalk.
- There are consistently pedestrians and cyclists crossing north/south each cycle. Crossing activity surges following a transit stop and near class start times.
- Significant pedestrian queuing is noted at each corner.
- The MUP on the north side is generally undersized (2.0 m) to meet pedestrian demands, as illustrated by the desire lines spilling over both sides of the path.
- Northbound cyclists use the half-lane space between vehicles and the curb to jump the queue. This places cyclists beside through and left turning traffic or in conflict with right turning traffic. Right turning traffic that turns from the left edge of the lane – such as heavy trucks or buses – would not be able to see the cyclist and the cyclist may not be able to see the turn signal of the vehicle. This increases the risk of right hook collisions.

- The signal timing plan relies on minor street detection during the evening period. Set-back induction loops are not set up to detect the smaller frame of a bike at the stop bar.
- The University of Saskatchewan is a 'no ride zone' for shared e-scooters.
- The driver side A-pillar obscures southbound pedestrians from northbound left turning vehicles.

Photo 7 Potential Truck x Cyclist Blind Spot

Photo 8 Crosswalk at Channelized Island

Photo 9 Shared Northbound Lane

Photo 10 Shared Northbound Lane

3.5 Accessibility

- Curb cuts are missing on the channelized right turn island. The remaining corners have been constructed with a single curb cut that directs pedestrians into the intersection at a 45° angle. This location has a high enough volume of pedestrians to consider the installation of bi-directional curb cuts.

- Auditory Pedestrian Signals currently use the same tone for east/west and north/south crossing phases, additionally the tone is obscured by the noise of passing vehicles. Municipalities typically use the cuckoo sound to indicate that a pedestrian can cross north/south and the chirp (or Canadian melody) to indicate pedestrians can cross east/west. **NOTE:** This has been addressed between the Draft and Final Report.
- The signal operates using pedestrian recall from 6:00 AM to 10:00 PM. The pedestrian actuation within the northwest channelized island is not located within an accessible distance to either the south or eastbound crosswalks, at least 6 m from the nearest crossing.

Photo 11 Missing Curb Cuts

Photo 12 Single Direction Curb Cut

3.6 Human Factors

- Frequent residential driveway access on the south side of College Drive west of the intersection could cause issues but are low volume due to land use (residential). No operational issues were observed while on site, but it is unusual to have private accesses onto a major arterial roadway.
- Private signs advertising nearby services (hotels, optometrist etc.) can be distracting to road users.
- Signs for residential parking permits posted on southeast corner, facing eastbound traffic, does not provide vital information to drivers given that parking is not permitted along College Drive.
- Shrubs on the northeast corner can obscure sight lines between westbound and southbound traffic prior to the stop bar but do not infringe on views from the stop bar.

3.7 Observed Near Misses

While on site, auditors observed the following near misses:

- An eastbound left turning vehicle failed to yield the right-of-way to a westbound through cyclist using the curb lane. The drivers use of their horn leaves the impression that they expected to receive the right-of-way during this interaction.
- A westbound left turning vehicle failed to yield the right-of-way to a pedestrian crossing the south crosswalk. This mirrors a collision in 2017 resulting in the injury of a pedestrian.
- A vehicle making a southbound through movement veered suddenly to make a southbound right turn. The driver honked and behaved aggressively towards the vehicle queued in front waiting for a gap in the westbound traffic. The driver proceeded to merge into westbound traffic at an unsafe (fast) speed and wove through numerous lanes, nearly colliding with through traffic on two occasions.
- Northbound queues into the parking lot on campus occasionally spilled back to the study intersection. An eastbound left turning vehicle completed their maneuver but was unable to fully clear the intersection due to the queue spillback. The rear portion of the vehicle was left exposed to westbound through traffic.

Additionally, the Double Arrow (WA-17) sign on the channelized island shows clear sign of having been struck by a vehicle and a hub cap remains on the island.

Photo 13 Damaged Double Arrow Sign

4. Review of Bus Rapid Transit

The City provided the audit team with functional drawings for the proposed Bus Rapid Transit corridor at the intersection of College Drive and Wiggins Avenue. It is our intention to integrate mitigation measures developed throughout this study with long-term plans to rehabilitate the College Drive corridor.

The BRT plan is not finalized yet and is still subject to change. At the time of this study, the corridor improvements include:

- Centre running transit lanes.
- Vehicle through lanes are to be reduced from three to two along College Drive.
- The removal of the southbound channelized right turn island.
- The prohibition of westbound left turns. This removal is expected to affect a small volume of vehicles. Less than 1,500 vpd made this turn during a typical weekday in 2023.
- Bi-directional curb cuts on the south side and uni-directional curb cuts on the north side. Crosswalks are better aligned through the intersection.
- A multi-use path on the north side of the corridor.

Though not specifically part of the scope of this safety review, we have noted a number of opportunities for improvements that should be considered as the BRT design progresses:

Left turn hardening should be considered to deter the newly prohibited turn westbound left turn. We do not have sufficient information to understand how displaced left turns will be accommodated. The nearest intersections that currently accommodate this movement are Cumberland Avenue, 290 m to the east, and Clarence Avenue, 515 m to the west.

The removal of the southbound channelized island is expected to help control vehicle speeds and sightlines exiting the University and move the northwest pedestrian actuation adjacent to the pedestrian queueing area. However, the total exposed pedestrian crossing distance is expected to increase from 21 m to an estimated 29 m due to proposed intersection radii. The City may wish to review the proposed intersection radii at the north approach to shorten exposed pedestrian crossing distances.

We have assumed that the eastbound left turn phase will operate on a protected-prohibited phase to eliminate conflicts with the centre-running BRT lanes. Increased storage length is likely required at the eastbound left turn bay to mitigate lane blockage for the remaining eastbound through lanes.

Additional pedestrian queueing area should be considered on the south side.

The eastbound curb lane is currently used as a pseudo transit lane, right turn lane, and merge lane for vehicles accessing private driveways. The City may wish to remove private driveways on the south side of College Drive to increase the perceived capacity of the curb lane to through traffic.

5. Solutions Development

Through the desktop review and site investigation, a list of findings/issues and their potential countermeasures were summarized in **Table 5.1**. The tables indicate the findings/issues identified in either the office review or the field investigation, suggested treatment, benefits and disbenefits, and a recommendation for implementation with an associated time frame.

For issues at all other locations, consideration was given to:

- Whether the City is planning on implementing treatments that will likely mitigate the issue noted (such as the BRT);
- The feasibility of the treatment (benefit and disbenefits); and
- The timing of the implementation of the treatment with low-cost treatments being recommended in the short term (this year), medium-cost treatments being recommended in the medium term (1 – 5 years or related to the BRT implementation) and significant-cost treatments or treatments requiring coordination with other parties being recommended in the long-term (>5 years).

Table 5.1 Issues and Potential Solutions

Finding / Issue	Potential Countermeasure	Benefits and Drawbacks	Recommendation
The volume of crossing pedestrians leaves little time for vehicles making left turns from the minor street resulting in driver impatience, near misses with vulnerable road users, and amber/red light violations. In the peak hour of pedestrian traffic, there are an estimated 830 crossing pedestrians and the intersection LOS for vehicles is LOS C.	Incorporate Leading Pedestrian Intervals (LPI) allow pedestrians to establish their presence in the crosswalk before vehicles turn right or left. Preliminary operational results are shown in **Table 5.2** and **Table 5.3** for the AM and PM peak respectively. Overall intersection performance is relatively stable compared to existing conditions.	**BENEFITS** – Lower impact on signal timing and cycle lengths than an exclusive pedestrian phase. Crash Reduction Factor (CRF) of 13% for vehicle-pedestrian collisions. **DRAWBACKS** – LPIs will not necessarily improve turning opportunities for minor street traffic, addressing half of the issue.	**SHORT TERM** – Recommend an LPI of ~5 seconds for a pilot project prior to the implementation of an exclusive pedestrian phase. Repurpose underused green time on the major street to offset changes.
	Consider repurposing underserved green time on College Drive and install an exclusive pedestrian phase at the study intersection while the University is in session. Preliminary operational results are shown in **Table 5.2** and **Table 5.3** for the AM and PM peak respectively. Volume to capacity ratios exceed 1.0 in the AM peak. The City of Toronto employs a variety of exclusive pedestrian phase timing plans, two of which are illustrated in **Figure 5.1** following this table. The second option allows pedestrians to continue to cross with traffic in situations were there is insufficient queueing space for pedestrians. If queueing space becomes an issue at the study intersection prior to the BRT reconstruction, this option may be necessary. The exclusive pedestrian phases should be called prior to the minor street phase to clear as many conflicting pedestrians as possible from the path of left turning vehicles.	**BENEFITS** – Separates vulnerable road user movements from vehicle movements by prioritizing the significant volume of pedestrians. CRF of 51% for vehicle-pedestrian collisions. **DRAWBACKS** – Introduces additional delay to vehicles and may interrupt signal coordination on College Drive. There are no national warrants for an exclusive pedestrian phase. Most jurisdictions offer some variation of the following: There is heavy pedestrian traffic. Delay for vehicular turning traffic is excessive due to the heavy pedestrian traffic. There are a large number of vehicle-pedestrian conflicts involving all movements. The study intersection meets all of these qualitative descriptions. Some large metropolitan areas used volume-based thresholds for exclusive pedestrian signals in their pilot projects ranging from 1,000 to 3,000 crossing pedestrians in the peak hour (City of Beverly Hills and the City of Toronto). Additionally, the City of Beverly Hills recommends an intersection LOS C or better for vehicles prior to implementation.	**MEDIUM TERM** – Recommend an exclusive pedestrian phase of ~25 seconds **only if** an LPI does not address vehicle-pedestrian conflicts. Repurpose underused green time and update corridor coordination to include exclusive pedestrian phase.
	Incorporate north and southbound protected left turn phases.	**BENEFITS** – Provides dedicated green time to left turning vehicles. **DRAWBACKS** – Prioritizes a small number of turning vehicles over a large volume of pedestrians. Phasing will have limited impact for northbound left traffic without a dedicated left turn lane.	Not recommended for implementation at this time.
The northeast corner radius is estimated to be 13 m, which may be larger than needed.	We recommend reducing the corner radii at this location. Consider temporary curb extensions or bollards **(Photo 14**) for short-term improvements before permanently reducing the radius.	**BENEFITS** – Shortens pedestrian crossing time, slows turning vehicle traffic, and increases pedestrian visibility. **DRAWBACKS** – Bollards are more difficult for winter maintenance crews than temporary curb extensions.	**SHORT TERM** – Consider temporary curb extensions. **MEDIUM TERM** –Permanently reduce the curb radii during BRT construction.

Finding / Issue	Potential Countermeasure	Benefits and Drawbacks	Recommendation
	If the radius must be maintained for heavy trucks or emergency vehicles, consider short term solutions such as turn calming wedges (**Photo 15**) or a mountable truck apron.	**BENEFITS –** Maintains truck turning radius while slowing passenger vehicles. **DRAWBACKS –** The safety of pedestrians with vision impairments can be compromised and care needs to be taken to clearly designate a safe queueing area outside of the truck apron.	**SHORT TERM –** Determine University needs and appropriate radius. **MEDIUM TERM** – Modify curb with truck apron if needed.
The channelized right turn island is missing curb cuts and ground mounted pedestrian crossing signs. The crosswalk between the channelized island and the northwest sidewalk is not painted at a right angle to the vehicle travelled path. And the pedestrian push button is at least 6 m from the nearest crossing point.	Install curb cuts and ground mounted pedestrian crossings signs at the channelized right turn island (sketched in **Photo 16**). Repaint crosswalk at a right angle to vehicular travel. Relocate the pedestrian push button closer to crossing locations.	**BENEFITS** – Improves the accessibility of the sidewalk for those using mobility devices. **DRAWBACKS** – Short term improvements will be removed with the implementation of the BRT. Relocating the pedestrian push button will have minimal benefits as the intersection currently operates using Pedestrian Recall from 6:00 AM to 10:00 PM.	Not recommended for implementation at this time. Improvements related to the BRT supersede these counter-measures.
	The channelized island is identified for removal as part of the BRT corridor improvements.	**BENEFITS** – Depending on the design radius, the island removal could reduce exposed pedestrian crossing distances and walk times. **DRAWBACKS** – Removal of the island will decrease LOS for southbound right turning traffic, a heavy movement in the PM peak hour. Has the impact been documented in the BRT study report?	**MEDIUM TERM** – Recommended for implementation. Review intersection radius following channelization removal.
Pedestrian crossing areas on the northeast, southeast, and southwest corners have been constructed with a uni-directional curb cut that directs vulnerable road users into the intersection at a 45° angle.	Bi-directional curb cuts are proposed at the south approach as part of the BRT construction. Bi-directional curb cuts should also be installed at the north approach to support the high volume of crossing pedestrians and path users.	**BENEFITS** – The City may be able to fast-track portions of the BRT corridor improvements. **DRAWBACKS** – Early implementation relies on maintaining the proposed curb location which may be subject to change as the BRT design continues to evolve.	**SHORT TERM** – Recommended for implementation. Install bi-directional curb cuts on all four corners. Catch basins and retaining walls may require relocation / regrading.
The multi-use path on the north side of College Drive is undersized (estimated width of 2 m) and does not provide sufficient space to meet pedestrian / cyclist capacity demands.	Widen the multi-use path to meet design standards for a high-volume active transportation facility. This is planned as part of the BRT construction.	**BENEFITS** – The City may be able to fast-track portions of the BRT corridor improvements. **DRAWBACKS** – Early implementation relies on maintaining the proposed curb location which may be subject to change as the BRT design continues to evolve.	**SHORT TERM** – Recommended for implementation. Widen the existing multi-use path.
Northbound cyclists using wide lane (4.5 m) to navigate between queued vehicles and the curb are exposed to right-hook collisions. This corridor is the most biked location recorded in the City.	Install bike box pavement markings and a northbound painted bike lane on Wiggins Avenue between College Drive and Elliott Street to clearly establish cyclist right-of-way approaching the intersection and reduce the likelihood of right-hook collisions. Consider a bike box on the north approach as well.	**BENEFITS** – This treatment can be rapidly implemented with low costs. Transit vehicles and heavy trucks can still use the entire lane to complete a right turn. **DRAWBACKS** – The interim solution does not provide physical separation between cyclists and vehicles, leaving room for non-compliance. Bike lane width would be smaller than the 1.8 m City standard and the northbound vehicle lane would be offset from its receiving lane.	**SHORT TERM** – Recommended for temporary implementation. Install bike boxes, a northbound painted bike lane, “No Right Turn on Red” and ‘Turning Vehicles Yield to Bicycles’ signs.

Finding / Issue	Potential Countermeasure	Benefits and Drawbacks	Recommendation
	Modify lane assignment to create a one-way street northbound, double left turn lanes southbound, and bike lanes on Wiggins Avenue. Preliminary operational results are shown in **Table 5.2** and **Table 5.3** for the AM and PM peak respectively. Volume to capacity ratios exceed 1.0 in the AM peak.	**BENEFITS –** Provides protected space for cyclists. Bike lane widths meet or exceed City standards. A signalized bike phase could overlap with the protected phase of the dual southbound left if a bi-directional bike lane is constructed to the west. **DRAWBACKS –** Transit routes on Wiggins Avenue would be diverted. Additional infrastructure would be needed on campus and at Elliot Street to transition cyclists from one-way to two-way travel.	**MEDIUM TERM –** Recommend that the City explore design and timing options for a quick build bike lane and associated geometric changes.
	Assess the feasibility of implementing a permanent, protected cycling facility along Wiggins Avenue in addition to the routes proposed in the ATP and TMP.	**BENEFITS** – Building bike infrastructure along existing cyclist routes can be critical in immediate infrastructure use. **DRAWBACKS** – Transit routes on Wiggins Avenue may require relocation based on remaining vehicular travelled lane widths.	**SHORT TERM** – Consider fast-tracking the 'Connecting Campus' study to determine appropriate, permanent cycling connections to the University.
Auditory Pedestrian Signals (APS) are too quiet and do not use the appropriate cuckoo and chirp tones.	Ensure that the cuckoo sound is used to indicate that a pedestrian can cross north/south and the chirp (or Canadian melody) is used to indicate pedestrians can cross east/west. Confirm that the APS can be heard above passing vehicles.	**BENEFITS** – APS can help those with no or low-vision navigate an intersection. Auditory Pedestrian Signals are required at exclusive pedestrian phases because visually impaired pedestrians can no longer rely on the auditory queues from adjacent street traffic.	**SHORT TERM** –Ensure that APS are working. (City has already begun to address this within current operational budget)
Residential parking permit sign posted on southeast corner, facing eastbound traffic, does not provide vital information to drivers given that parking is not permitted along College Drive. A ghost bike is attached to this sign post.	Remove or relocate the neighborhood parking permit sign to reduce driver workload at the intersection.	**BENEFITS** – Relocating the sign removes non-vital information from the driver workload at the intersection. **DRAWBACKS** – The ghost bike attached to this sign post should not be entirely removed at this time. Consider relocated to a nearby sign post or structure.	**SHORT TERM** –Remove the residential parking permit sign.
Private signs advertising nearby services (hotels, optometrist, etc.) can be distracting to eastbound road users approaching the intersection.	The City may wish to review private sign bylaws and seek to eliminate sign clutter and unnecessary driver distractions.	**BENEFITS** – Reduces driver workload through numerous pedestrian crossing locations. **DRAWBACKS** – All signs currently comply with Zoning Bylaw 8770, an update to the Bylaw would be required.	**LONG TERM** – Review private sign permit process during next zoning bylaw update.
Private driveways on the south side of College Drive can result in a perceived reduction in capacity of the eastbound curb lane resulting in motorists using the eastbound median lane.	The City may wish to remove private driveways on the south side of College Drive to increase the perceived capacity of the curb lane following the removal of a through lane to accommodate the BRT.	**BENEFITS** – All properties along College Drive have alley access and most use the alley as their primary driveway / parking lot. Corridor construction associated with BRT presents a great opportunity to make changes to access control. **DRAWBACKS** – Residents and landowners may be resistant to changes in property access.	**LONG TERM** – Couple future corridor projects with stricter access management control along College Drive.
Northbound queues develop on campus as vehicles wait to enter Parking Lot 1 just south of Place Riel or make drop-offs in front of the Health Sciences / Dental buildings. These queues can spill back to College Drive.	The University may wish to explore queue management solutions such as park-and-rides, additional drop-off loops, or electronic systems to notify drivers of lot vacancy to reduce vehicle queues (when the lot is at capacity).	**DRAWBACKS** – Countermeasures on University lands are outside of the direct influence of the City.	**SHORT TERM** – City to pass along concerns to the University of Saskatchewan.

Table 5.2 Alternative AM Peak Capacity Analysis Results

Scenario	Traffic Control	Measure of Effectiveness	Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Existing Conditions (150 s Cycle)	Signal (Coordinated) LOS: C Delay: 33.8 v/c: 0.93	Volume	266	935	67	109	1647	188	53	123	26	85	65	220
		Approach LOS	C			C			E			D		
		Movement LOS	E	B		B	C		E			F	D	B
		Delay (s)	74.6	13.5		12.0	34.5		79.6			93.5	47.4	13.5
		v/c Ratio	0.93	0.40		0.41	0.88		0.86			0.81	0.22	0.62
		95th % Queue (m)	#103.2	62.9		15.1	197.9		#95.9			#53.0	31.0	20.9
		Queue>Storage?	Y	-		N	-		Y			Y	-	N
Exclusive Pedestrian Phase (150 s Cycle)	Signal LOS: E Delay: 69.5 v/c: 1.09	Volume	266	935	67	109	1647	188	53	123	26	85	65	220
		Approach LOS	D			F			F			E		
		Movement LOS	F	C		C	F		F			F	E	B
		Delay (s)	122.7	26.4		21.7	84.8		123			167.2	57.1	14.6
		v/c Ratio	1.09	0.50		0.50	1.08		1.02			1.06	0.26	0.66
		95th % Queue (m)	#139.0	96.0		25.3	#265.8		#120.6			#67.2	35.2	19.2
		Queue>Storage?	Y	-		N	-		Y			Y	-	N
Leading Pedestrian Interval (135 s Cycle)	Signal LOS: D Delay: 40.7 v/c: 0.97	Volume	266	935	67	109	1647	188	53	123	26	85	65	220
		Approach LOS	C			D			E			C		
		Movement LOS	E	B		B	D		E			E	D	B
		Delay (s)	77.8	17.9		15.6	47.4		72.4			79.7	44.0	11.3
		v/c Ratio	0.95	0.43		0.43	0.97		0.83			0.74	0.21	0.61
		95th % Queue (m)	#106.5	81.3		21.2	#256.9		81.9			42.5	28.6	15.8
		Queue>Storage?	Y	-		N	-		Y			N	-	N
Modified Geometry –One-Way Northbound, Dual Southbound Left (Protected – Prohibited) (150 s Cycle)	Signal LOS: E Delay: 56.8 v/c: 1.06	Volume	266	1002	-	-	1702	188	53	123	26	140	-	230
		Approach LOS	C			E			F			D		
		Movement LOS	E	B			E		F			E		B
		Delay (s)	78.4	13			77.2		92.4			78.7		10.2
		v/c Ratio	0.93	0.37			1.06		0.89			0.65		0.53
		95th % Queue (m)	#105.6	67.8			#305.3		#108.9			35.9		19.5
		Queue>Storage?	Y	-			-		Y			N		N

Table 5.3 Alternative PM Peak Capacity Analysis Results

Scenario	Traffic Control	Measure of Effectiveness	Eastbound			Westbound			Northbound			Southbound		
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Existing Conditions (140 s Cycle)	Signal (Coordinated) LOS: C Delay: 30.8 v/c: 1.14	Volume	140	1874	69	92	1581	96	54	48	43	94	125	316
		Approach LOS	B			B			E			F		
		Movement LOS	C	B		D	B		E			E	D	F
		Delay (s)	34.9	18.9		36.9	18.3		69.9			71.4	53.1	127.1
		v/c Ratio	0.69	0.69		0.58	0.62		0.74			0.64	0.39	1.14
		95th % Queue (m)	40	160.7		32.4	142.0		#75.6			#53.5	57.0	#150.7
		Queue>Storage?	N	-		N	-		Y			Y	-	Y
Exclusive Pedestrian Phase (140 s Cycle)	Signal LOS: D Delay: 43.6 v/c: 0.94	Volume	140	1874	69	92	1581	96	54	48	43	94	125	316
		Approach LOS	D			D			E			C		
		Movement LOS	E	D		D	D		E			E	D	B
		Delay (s)	58.9	45.8		40.7	40.1		74.9			75.5	54.4	14.5
		v/c Ratio	0.79	0.94		0.62	0.85		0.78			0.67	0.40	0.72
		95th % Queue (m)	#59.1	237.5		#35.7	199.2		#78.9			#55.7	57.5	35.9
		Queue>Storage?	N	-		N	-		Y			Y	-	Y
Leading Pedestrian Interval (140 s Cycle)	Signal LOS: C Delay: 32.0 v/c: 0.93	Volume	140	1874	69	92	1581	96	54	48	43	94	125	316
		Approach LOS	C			C			F			E		
		Movement LOS	C	C		D	C		F			F	E	E
		Delay (s)	33.0	21.0		40.9	22.1		88.1			84.1	55.8	72.9
		v/c Ratio	0.63	0.71		0.60	0.66		0.85			0.74	0.43	0.93
		95th % Queue (m)	44.9	177.7		33.9	155.7		#78.5			#54.8	57.0	#127.0
		Queue>Storage?	N	-		N	-		N			Y	-	Y
Modified Geometry –One-Way Northbound, Dual Southbound Left (Protected – Prohibited) (140 s Cycle)	Signal LOS: C Delay: 30.8 v/c: 0.84	Volume	140	1943	-	-	1627	96	54	48	43	209	-	326
		Approach LOS	C			C			E			D		
		Movement LOS	E	B			C		E			E		C
		Delay (s)	56.5	19.5			33.0		63.0			78.2		31.6
		v/c Ratio	0.76	0.68			0.78		0.63			0.73		0.84
		95th % Queue (m)	53.6	171.9			#216.3		67.3			49.8		46.3
		Queue>Storage?	N	-			-		N			Y		N

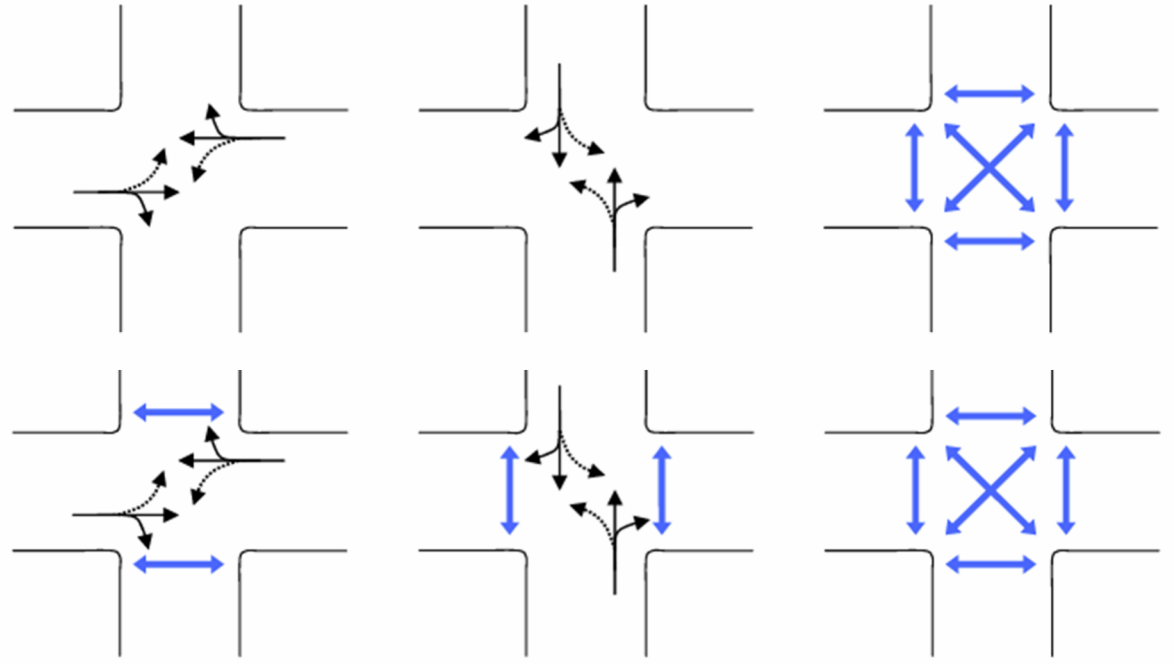


Figure 5.1: Exclusive Pedestrian Phases (City of Toronto)

Photo 14 City of Honolulu Quick Build Projects

Photo 15 Turn Calming 'Wedge' in New York

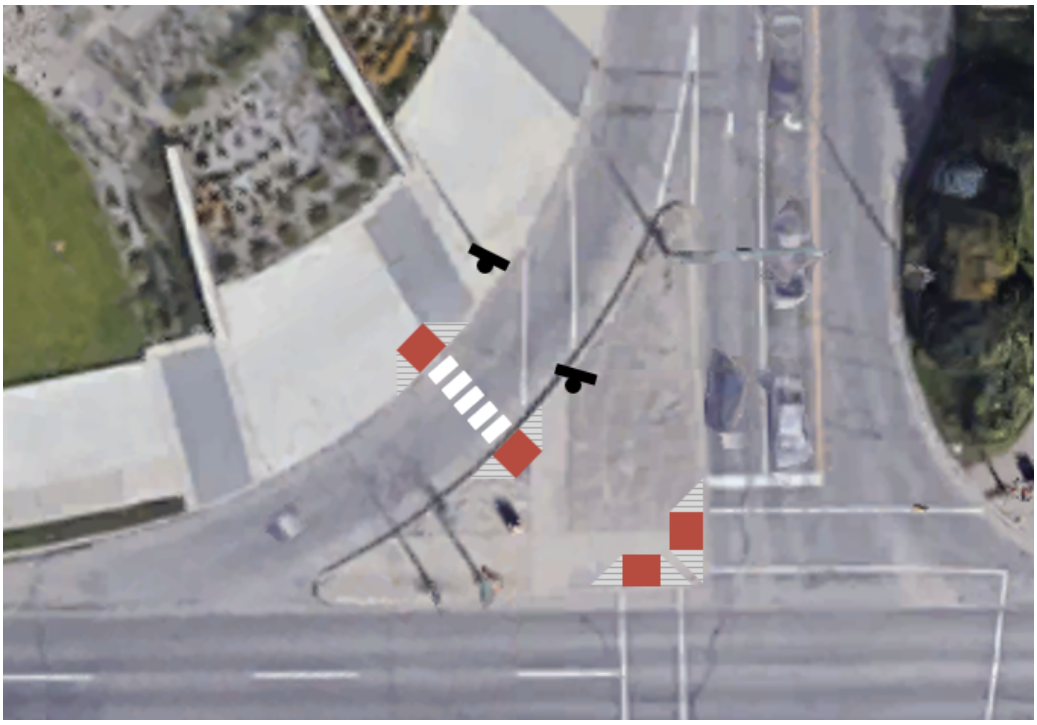


Photo 16 Sketch of Channelized Island

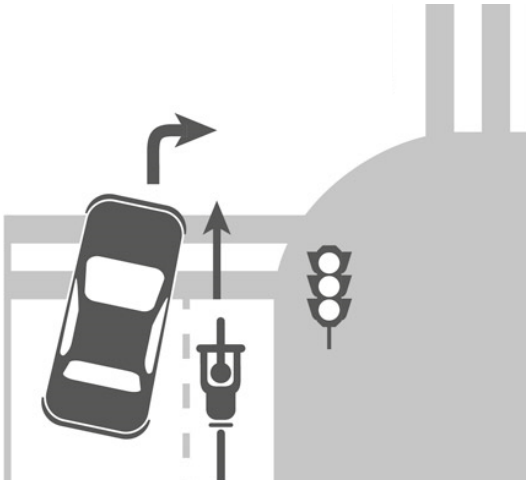


Photo 17 Right Hook Collision

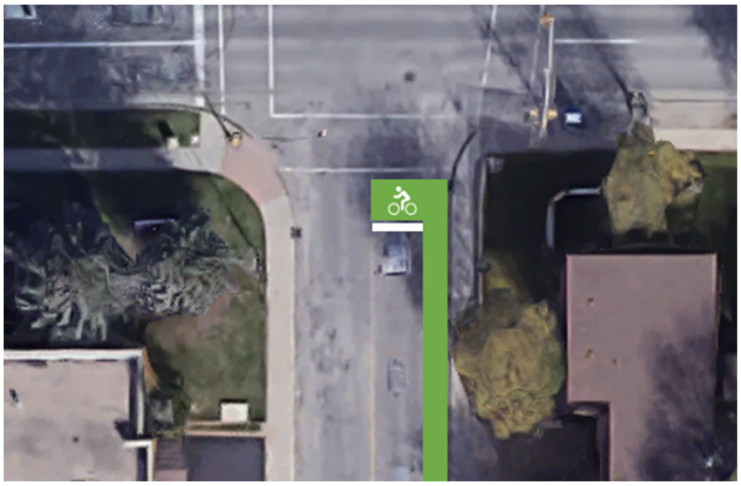


Photo 18 Bike Box and Painted Bike Lane

6. Cost Estimates

In preparation of the cost estimate, unit pricing was taken from recent tender closings for projects undertaken by the City of Saskatoon, City of Regina, Alberta Transportation and Economic Corridors, and the report “Costing of Bicycle Infrastructure and Programs in Canada” by the Clean Air Partnership. These unit prices were averaged and adjusted in effort to reflect local market conditions.

An overall project cost estimate has been prepared with a summary shown in **Table 6.1** below. A detailed breakdown of costs are shown in **Appendix B**. Routine City operational and maintenance (O&M) costs and original BRT implementation costs are not documented in the estimate. Incremental costs to the BRT are included where recommendations propose changes to the current design.

The cost estimate is a Class D, which is historically considered to be +/- 30% at the feasibility design stage. Given the uncertainty of inflation and market volatility over the past year, the above estimate has been based on current market trends and should be considered +40%/-20%.

Table 6.1 Preliminary Cost Estimate

Recommendation			Cost		
			Short Term	Medium Term	Long Term
Leading Pedestrian Interval			Incl. O&M	-	-
Exclusive Pedestrian Phase			-	$2,100	-
Temporary Curb Extension at Northeast Corner			$6,300	-	-
Modify Northeast Corner Radius[1]					
A)	Permanently Reduce Radius (Incremental Cost to BRT Project)	OR	-	$16,170	-
B)	Reduce and Modify Curb with Truck Apron (Incremental Cost to BRT Project)		-	$21,430	-
Remove Northwest Channelized Island. Review and Reduce Curb Radius.			Incl. BRT	-	-
Bi-Directional Curb Cuts, Grading, Drainage, and Retaining Walls (Incremental Cost to the BRT Project)			$27,000	-	-
Widen Existing Multi-Use Path			Incl. BRT	-	-
Cycling Intersection Treatment					
A)	Bike Box and Painted Bike Lane	AND	$25,600	-	-
B)	Bi-Directional Bike Lane and Restrict Wiggins Avenue to Northbound Traffic Only		-	$65,760	-
Fast Track 'Connecting Campus' Study			Incl. O&M	-	-
Ensure Auditory Pedestrian Signals are Working			Incl. O&M	-	-
Remove Residential Parking Permit Sign			$115	-	-
Review Private Sign Permit Process			-	-	Incl. O&M
Implement Strict Access Management Practices on College Drive			-	-	Incl. O&M
Communicate Queue Issues to University of Saskatchewan			Incl. O&M	-	-
Project Total			**$59,015**	**$84,030 - $89,290[1]**	**-**

Note: 1 – contingency added to one option not both

A

Appendix A
Synchro Reports

Existing Signal Timing – Existing Geometry

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Future Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4900	0	1750	4801	0	0	1704	0	1750	1842	1566
Flt Permitted	0.053			0.221				0.885		0.426		
Satd. Flow (perm)	98	4900	0	390	4801	0	0	1431	0	653	1842	1136
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			21			5				254
Link Speed (k/h)		50			50			50			41	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			19.5	
Confl. Peds. (#/hr)	70		55	55		70	165		295	295		165
Confl. Bikes (#/hr)			4			12			48			1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	320	1208	0	131	2211	0	0	243	0	102	78	265
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	30.0	87.0		15.0	72.0		33.0	33.0		33.0	33.0	33.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	97.7	83.3		79.5	70.1			26.2		26.2	26.2	26.2
Actuated g/C Ratio	0.72	0.62		0.59	0.52			0.19		0.19	0.19	0.19
v/c Ratio	0.93	0.40		0.41	0.88			0.86		0.81	0.22	0.62
Control Delay	74.6	13.5		12.0	34.5			79.6		93.5	47.4	13.5
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	74.6	13.5		12.0	34.5			79.6		93.5	47.4	13.5
LOS	E	B		B	C			E		F	D	B
Approach Delay		26.3			33.2			79.6			37.8	
Approach LOS		C			C			E			D	
Queue Length 50th (m)	71.3	59.4		10.1	205.7			65.0		27.5	18.5	2.5
Queue Length 95th (m)	#103.2	62.9		15.1	197.9			#95.9		#53.0	31.0	20.9
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	376	3029		333	2503			289		130	367	429
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.85	0.40		0.39	0.88			0.84		0.78	0.21	0.62

Intersection Summary			
Area Type:	Other		
Cycle Length: 135			
Actuated Cycle Length: 135			
Offset: 94 (70%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.93			
Intersection Signal Delay: 33.8		Intersection LOS: C	
Intersection Capacity Utilization 92.9%		ICU Level of Service F	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Wiggins Avenue & College Drive

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Future Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4947	0	1750	4833	0	0	1573	0	1750	1842	1566
Flt Permitted	0.075			0.050				0.730		0.569		
Satd. Flow (perm)	138	4947	0	92	4833	0	0	1068	0	838	1842	1050
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			11			13				127
Link Speed (k/h)		50			50			50			40	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			20.0	
Confl. Peds. (#/hr)	141		73	73		141	179		209	209		179
Confl. Bikes (#/hr)			9			12			6			40
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	2135	0	101	1842	0	0	159	0	103	137	347
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	20.0	92.0		15.0	87.0		33.0	33.0		33.0	33.0	33.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	98.6	87.3		95.4	85.7			26.9		26.9	26.9	26.9
Actuated g/C Ratio	0.70	0.62		0.68	0.61			0.19		0.19	0.19	0.19
v/c Ratio	0.69	0.69		0.58	0.62			0.74		0.64	0.39	1.14
Control Delay	34.9	18.9		36.9	18.3			69.9		71.4	53.1	127.1
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	34.9	18.9		36.9	18.3			69.9		71.4	53.1	127.1
LOS	C	B		D	B			E		E	D	F
Approach Delay		20.0			19.3			69.9			100.1	
Approach LOS		B			B			E			F	
Queue Length 50th (m)	17.1	141.0		10.8	113.2			40.6		28.0	35.2	~86.3
Queue Length 95th (m)	40.0	160.7		32.4	142.0			#75.6		#53.5	57.0	#150.7
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	273	3087		181	2961			215		161	353	304
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.56	0.69		0.56	0.62			0.74		0.64	0.39	1.14

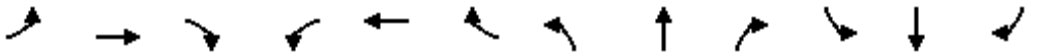
Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 55 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.14			
Intersection Signal Delay: 30.8		Intersection LOS: C	
Intersection Capacity Utilization 105.8%		ICU Level of Service G	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Wiggins Avenue & College Drive

Optimized Signal Timing – Existing Geometry



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Future Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4900	0	1750	4801	0	0	1704	0	1750	1842	1566
Flt Permitted	0.053			0.221				0.885		0.431		
Satd. Flow (perm)	98	4900	0	390	4801	0	0	1432	0	660	1842	1136
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			21			5				231
Link Speed (k/h)		50			50			50			41	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			19.5	
Confl. Peds. (#/hr)	70		55	55		70	165		295	295		165
Confl. Bikes (#/hr)			4			12			48			1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	320	1208	0	131	2211	0	0	243	0	102	78	265
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	28.0	87.0		14.0	73.0		34.0	34.0		34.0	34.0	34.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	97.2	82.9		79.4	70.1			26.7		26.7	26.7	26.7
Actuated g/C Ratio	0.72	0.61		0.59	0.52			0.20		0.20	0.20	0.20
v/c Ratio	0.95	0.40		0.41	0.88			0.85		0.78	0.21	0.65
Control Delay	79.4	13.8		12.0	34.3			76.6		88.4	46.7	16.9
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	79.4	13.8		12.0	34.3			76.6		88.4	46.7	16.9
LOS	E	B		B	C			E		F	D	B
Approach Delay		27.5			33.0			76.6			38.5	
Approach LOS		C			C			E			D	
Queue Length 50th (m)	72.8	60.8		10.4	202.4			64.4		27.1	18.3	7.9
Queue Length 95th (m)	#110.5	63.5		15.6	194.8			#92.7		#51.1	30.7	28.4
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	352	3013		320	2504			299		136	380	418
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.91	0.40		0.41	0.88			0.81		0.75	0.21	0.63

Intersection Summary	
Area Type:	Other
Cycle Length: 135	
Actuated Cycle Length: 135	
Offset: 94 (70%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 34.0	Intersection LOS: C
Intersection Capacity Utilization 92.9%	ICU Level of Service F
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 3: Wiggins Avenue & College Drive

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Future Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4947	0	1750	4833	0	0	1573	0	1750	1842	1566
Flt Permitted	0.058			0.055				0.834		0.613		
Satd. Flow (perm)	107	4947	0	101	4833	0	0	1217	0	886	1842	1066
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			9			16				137
Link Speed (k/h)		50			50			50			40	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			20.0	
Confl. Peds. (#/hr)	141		73	73		141	179		209	209		179
Confl. Bikes (#/hr)			9			12			6			40
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	2135	0	101	1842	0	0	159	0	103	137	347
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	18.0	73.0		14.0	69.0		53.0	53.0		53.0	53.0	53.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	86.8	75.4		82.5	73.2			39.2		39.2	39.2	39.2
Actuated g/C Ratio	0.62	0.54		0.59	0.52			0.28		0.28	0.28	0.28
v/c Ratio	0.78	0.80		0.61	0.73			0.45		0.42	0.27	0.87
Control Delay	56.5	30.5		41.5	29.4			39.7		44.4	38.6	50.4
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	56.5	30.5		41.5	29.4			39.7		44.4	38.6	50.4
LOS	E	C		D	C			D		D	D	D
Approach Delay		32.3			30.1			39.7			46.6	
Approach LOS		C			C			D			D	
Queue Length 50th (m)	27.0	188.0		13.1	155.0			33.3		23.8	30.2	60.8
Queue Length 95th (m)	#59.4	225.3		#38.7	191.1			53.2		40.4	46.4	#104.8
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	220	2664		165	2531			418		296	617	448
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.70	0.80		0.61	0.73			0.38		0.35	0.22	0.77

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 55 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 33.3		Intersection LOS: C	
Intersection Capacity Utilization 105.8%		ICU Level of Service G	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Wiggins Avenue & College Drive

N-S LPI – Existing Geometry

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Future Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4900	0	1750	4801	0	0	1700	0	1750	1842	1566
Flt Permitted	0.058			0.216				0.885		0.441		
Satd. Flow (perm)	107	4900	0	382	4801	0	0	1414	0	673	1842	1075
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			17			5				265
Link Speed (k/h)		50			50			50			41	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			19.5	
Confl. Peds. (#/hr)	70		55	55		70	165		295	295		165
Confl. Bikes (#/hr)			4			12			48			1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	320	1208	0	131	2211	0	0	243	0	102	78	265
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	30.0	74.0		15.0	59.0		41.0	41.0		41.0	41.0	41.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	91.2	76.6		73.6	64.1			27.7		27.7	27.7	27.7
Actuated g/C Ratio	0.68	0.57		0.55	0.47			0.21		0.21	0.21	0.21
v/c Ratio	0.95	0.43		0.43	0.97			0.83		0.74	0.21	0.61
Control Delay	77.8	17.9		15.6	47.4			72.4		79.7	44.0	11.3
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	77.8	17.9		15.6	47.4			72.4		79.7	44.0	11.3
LOS	E	B		B	D			E		E	D	B
Approach Delay		30.4			45.6			72.4			32.7	
Approach LOS		C			D			E			C	
Queue Length 50th (m)	71.6	67.4		12.0	~229.5			64.5		27.0	18.3	0.0
Queue Length 95th (m)	#106.5	81.3		21.2	#256.9			81.9		42.5	28.6	15.8
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	376	2787		311	2287			369		173	476	474
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	Ø3	Ø7
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (m)		
Storage Length (m)		
Storage Lanes		
Taper Length (m)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (k/h)		
Link Distance (m)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(m)		
Link Offset(m)		
Crosswalk Width(m)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (k/h)		
Turn Type		
Protected Phases	3	7
Permitted Phases		
Total Split (s)	5.0	5.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (m)		
Queue Length 95th (m)		
Internal Link Dist (m)		
Turn Bay Length (m)		
Base Capacity (vph)		
Starvation Cap Reductn		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.85	0.43		0.42	0.97			0.66		0.59	0.16	0.56

Intersection Summary			
Area Type:	Other		
Cycle Length: 135			
Actuated Cycle Length: 135			
Offset: 94 (70%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.97			
Intersection Signal Delay: 40.7		Intersection LOS: D	
Intersection Capacity Utilization 88.7%		ICU Level of Service E	
Analysis Period (min) 15			

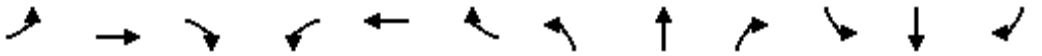
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Wiggins Avenue & College Drive

Lane Group	Ø3	Ø7
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Future Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4947	0	1750	4833	0	0	1564	0	1750	1842	1566
Flt Permitted	0.067			0.050				0.703		0.553		
Satd. Flow (perm)	123	4947	0	92	4833	0	0	1020	0	816	1842	1041
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			10			13				47
Link Speed (k/h)		50			50			50			40	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			20.0	
Confl. Peds. (#/hr)	141		73	73		141	179		209	209		179
Confl. Bikes (#/hr)			9			12			6			40
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	2135	0	101	1842	0	0	159	0	103	137	347
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2		1	6			8			4	5
Permitted Phases	2			6			8			4		4
Total Split (s)	20.0	87.0		15.0	82.0		33.0	33.0		33.0	33.0	20.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	5.0
Act Effct Green (s)	98.8	85.1		90.4	80.7			24.1		24.1	24.1	39.0
Actuated g/C Ratio	0.71	0.61		0.65	0.58			0.17		0.17	0.17	0.28
v/c Ratio	0.62	0.71		0.59	0.66			0.85		0.74	0.43	0.93
Control Delay	32.7	21.0		40.1	22.2			88.1		84.1	55.8	72.0
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	32.7	21.0		40.1	22.2			88.1		84.1	55.8	72.0
LOS	C	C		D	C			F		F	E	E
Approach Delay		21.7			23.1			88.1			70.3	
Approach LOS		C			C			F			E	
Queue Length 50th (m)	19.7	152.3		12.8	134.9			41.4		28.4	35.6	74.0
Queue Length 95th (m)	44.9	177.7		33.5	155.7			#78.5		#54.8	57.0	#127.0
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	261	3009		178	2790			206		156	353	388
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	Ø3	Ø7
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (m)		
Storage Length (m)		
Storage Lanes		
Taper Length (m)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (k/h)		
Link Distance (m)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(m)		
Link Offset(m)		
Crosswalk Width(m)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (k/h)		
Turn Type		
Protected Phases	3	7
Permitted Phases		
Total Split (s)	5.0	5.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (m)		
Queue Length 95th (m)		
Internal Link Dist (m)		
Turn Bay Length (m)		
Base Capacity (vph)		
Starvation Cap Reductn		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.59	0.71		0.57	0.66			0.77		0.66	0.39	0.89

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 55 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.93			
Intersection Signal Delay: 30.1		Intersection LOS: C	
Intersection Capacity Utilization 97.5%		ICU Level of Service F	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Wiggins Avenue & College Drive

Lane Group	Ø3	Ø7
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

AM Ped Scramble – Existing Geometry

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Future Volume (vph)	266	935	67	109	1647	188	53	123	26	85	65	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4951	0	1750	4897	0	0	1699	0	1750	1842	1566
Flt Permitted	0.065			0.175				0.885		0.360		
Satd. Flow (perm)	120	4951	0	319	4897	0	0	1414	0	560	1842	1079
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			18			5				265
Link Speed (k/h)		50			50			50			41	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			19.5	
Confl. Peds. (#/hr)	70		55	55		70	165		295	295		165
Confl. Bikes (#/hr)			4			12			48			1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	320	1208	0	131	2211	0	0	243	0	102	78	265
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	21.0	67.0		16.0	62.0		27.0	27.0		27.0	27.0	27.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	78.0	63.0		66.7	56.7			20.9		20.9	20.9	20.9
Actuated g/C Ratio	0.58	0.47		0.49	0.42			0.15		0.15	0.15	0.15
v/c Ratio	1.22	0.52		0.50	1.07			1.09		1.19	0.27	0.68
Control Delay	164.0	26.2		20.9	79.0			137.4		203.8	53.3	15.3
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	164.0	26.2		20.9	79.0			137.4		203.8	53.3	15.3
LOS	F	C		C	E			F		F	D	B
Approach Delay		55.1			75.7			137.4			65.2	
Approach LOS		E			E			F			E	
Queue Length 50th (m)	~93.9	84.2		16.1	~250.5			~75.5		~34.2	19.6	0.0
Queue Length 95th (m)	#136.5	90.4		24.1	#240.7			#115.7		#65.6	32.8	19.0
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	262	2316		277	2067			223		86	285	391
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (m)	
Storage Length (m)	
Storage Lanes	
Taper Length (m)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Turn Type	
Protected Phases	10
Permitted Phases	
Total Split (s)	25.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	1.22	0.52		0.47	1.07			1.09		1.19	0.27	0.68

Intersection Summary			
Area Type:	Other		
Cycle Length: 135			
Actuated Cycle Length: 135			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.22			
Intersection Signal Delay: 71.0		Intersection LOS: E	
Intersection Capacity Utilization 84.1%		ICU Level of Service E	
Analysis Period (min) 15			

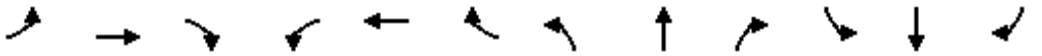
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Wiggins Avenue & College Drive

Lane Group	Ø10
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



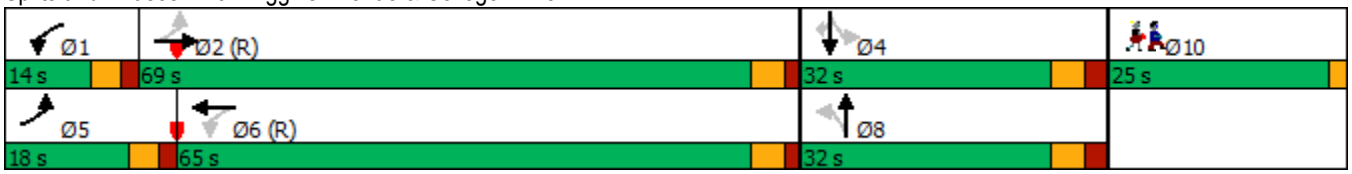
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Future Volume (vph)	140	1874	69	92	1581	96	54	48	43	94	125	316
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	1		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	4985	0	1750	4929	0	0	1574	0	1750	1842	1566
Flt Permitted	0.063			0.065				0.716		0.564		
Satd. Flow (perm)	115	4985	0	119	4929	0	0	1052	0	831	1842	1063
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			8			13				347
Link Speed (k/h)		50			50			50			40	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			20.0	
Confl. Peds. (#/hr)	141		73	73		141	179		209	209		179
Confl. Bikes (#/hr)			9			12			6			40
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	2135	0	101	1842	0	0	159	0	103	137	347
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8			4		4
Total Split (s)	18.0	69.0		14.0	65.0		32.0	32.0		32.0	32.0	32.0
Total Lost Time (s)	5.0	5.3		5.0	5.3			6.1		6.1	6.1	6.1
Act Effct Green (s)	75.3	63.7		70.7	61.4			25.9		25.9	25.9	25.9
Actuated g/C Ratio	0.54	0.46		0.50	0.44			0.18		0.18	0.18	0.18
v/c Ratio	0.79	0.94		0.62	0.85			0.78		0.67	0.40	0.72
Control Delay	58.9	45.8		40.7	40.1			74.9		75.5	54.4	14.5
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	0.0
Total Delay	58.9	45.8		40.7	40.1			74.9		75.5	54.4	14.5
LOS	E	D		D	D			E		E	D	B
Approach Delay		46.6			40.1			74.9			34.5	
Approach LOS		D			D			E			C	
Queue Length 50th (m)	27.8	213.1		13.3	174.9			41.1		28.3	35.5	0.0
Queue Length 95th (m)	#59.1	237.5		#35.7	199.2			#78.9		#55.7	57.5	35.9
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0			40.0						45.0		45.0
Base Capacity (vph)	215	2270		164	2165			205		153	340	479
Starvation Cap Reductn	0	0		0	0			0		0	0	0

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (m)	
Storage Length (m)	
Storage Lanes	
Taper Length (m)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (k/h)	
Link Distance (m)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Enter Blocked Intersection	
Lane Alignment	
Median Width(m)	
Link Offset(m)	
Crosswalk Width(m)	
Two way Left Turn Lane	
Headway Factor	
Turning Speed (k/h)	
Turn Type	
Protected Phases	10
Permitted Phases	
Total Split (s)	25.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0		0	0			0		0	0	0
Storage Cap Reductn	0	0		0	0			0		0	0	0
Reduced v/c Ratio	0.72	0.94		0.62	0.85			0.78		0.67	0.40	0.72

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 55 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.94			
Intersection Signal Delay: 43.6		Intersection LOS: D	
Intersection Capacity Utilization 85.2%		ICU Level of Service E	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

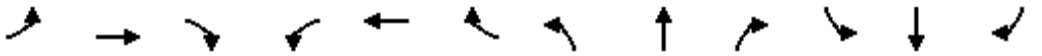
Splits and Phases: 3: Wiggins Avenue & College Drive



Lane Group	Ø10
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

Optimized Signal Timing – Revised Geometry



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	935	0	0	1702	188	53	123	26	85	0	285
Future Volume (vph)	266	935	0	0	1702	188	53	123	26	85	0	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	0		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	5029	0	0	4805	0	0	1704	0	3395	0	1566
Flt Permitted	0.061							0.987		0.950		
Satd. Flow (perm)	112	5029	0	0	4805	0	0	1584	0	2582	0	1202
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					18			5				209
Link Speed (k/h)		50			50			50			41	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			19.5	
Confl. Peds. (#/hr)	70		55	55		70	165		295	295		165
Confl. Bikes (#/hr)			4			12			48			1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	320	1127	0	0	2278	0	0	243	0	102	0	343
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			7.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA			NA		Perm	NA		Prot		pm+ov
Protected Phases	5	2			6			8		7		5
Permitted Phases	2						8					7
Total Split (s)	27.0	92.0			65.0		31.2	31.2		11.8		27.0
Total Lost Time (s)	4.5	5.3			5.3			6.1		4.5		4.5
Act Effct Green (s)	87.9	87.1			61.0			25.1		6.9		28.5
Actuated g/C Ratio	0.65	0.65			0.45			0.19		0.05		0.21
v/c Ratio	0.96	0.35			1.04			0.82		0.59		0.72
Control Delay	79.7	11.3			68.1			73.5		76.7		23.8
Queue Delay	0.0	0.0			0.0			0.0		0.0		0.0
Total Delay	79.7	11.3			68.1			73.5		76.7		23.8
LOS	E	B			E			E		E		C
Approach Delay		26.5			68.1			73.5			35.9	
Approach LOS		C			E			E			D	
Queue Length 50th (m)	72.9	50.0			~257.6			64.9		14.6		20.8
Queue Length 95th (m)	#111.9	52.6			#246.5			#93.1		22.7		40.7
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0									45.0		45.0
Base Capacity (vph)	346	3245			2182			298		183		486
Starvation Cap Reductn	0	0			0			0		0		0

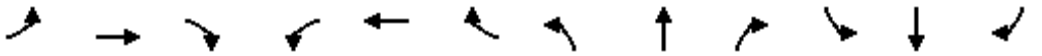
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0			0			0		0		0
Storage Cap Reductn	0	0			0			0		0		0
Reduced v/c Ratio	0.92	0.35			1.04			0.82		0.56		0.71

Intersection Summary	
Area Type:	Other
Cycle Length: 135	
Actuated Cycle Length: 135	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.04	
Intersection Signal Delay: 51.5	Intersection LOS: D
Intersection Capacity Utilization 96.6%	ICU Level of Service F
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Wiggins Avenue & College Drive



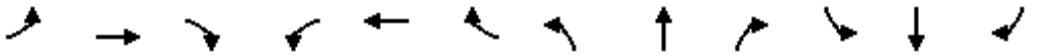
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1943	0	0	1627	96	54	48	43	209	0	326
Future Volume (vph)	140	1943	0	0	1627	96	54	48	43	209	0	326
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	0		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	5029	0	0	4840	0	0	1571	0	3395	0	1566
Flt Permitted	0.053							0.982		0.950		
Satd. Flow (perm)	98	5029	0	0	4840	0	0	1395	0	2544	0	1218
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					7			13				222
Link Speed (k/h)		50			50			50			40	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			20.0	
Confl. Peds. (#/hr)	141		73	73		141	179		209	209		179
Confl. Bikes (#/hr)			9			12			6			40
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	2135	0	0	1893	0	0	159	0	230	0	358
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			7.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA			NA		Perm	NA		Prot		pm+ov
Protected Phases	5	2			6			8		7		5
Permitted Phases	2						8					7
Total Split (s)	30.0	93.0			63.0		32.0	32.0		20.0		30.0
Total Lost Time (s)	5.0	5.3			5.3			6.1		4.5		5.0
Act Effct Green (s)	90.8	90.5			70.0			25.2		13.4		28.5
Actuated g/C Ratio	0.63	0.62			0.48			0.17		0.09		0.20
v/c Ratio	0.65	0.68			0.81			0.63		0.73		0.79
Control Delay	43.0	19.5			36.2			63.0		78.2		25.5
Queue Delay	0.0	0.0			0.0			0.0		0.0		0.0
Total Delay	43.0	19.5			36.2			63.0		78.2		25.5
LOS	D	B			D			E		E		C
Approach Delay		21.0			36.2			63.0			46.1	
Approach LOS		C			D			E			D	
Queue Length 50th (m)	28.6	147.4			173.0			41.5		35.3		25.5
Queue Length 95th (m)	51.3	171.9			#243.1			67.3		49.8		42.7
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0									45.0		45.0
Base Capacity (vph)	346	3140			2338			259		362		542
Starvation Cap Reductn	0	0			0			0		0		0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0			0			0		0		0
Storage Cap Reductn	0	0			0			0		0		0
Reduced v/c Ratio	0.45	0.68			0.81			0.61		0.64		0.66

Intersection Summary			
Area Type:	Other		
Cycle Length: 145			
Actuated Cycle Length: 145			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.81			
Intersection Signal Delay: 31.2		Intersection LOS: C	
Intersection Capacity Utilization 96.2%		ICU Level of Service F	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Wiggins Avenue & College Drive

N-S LPI – Revised Geometry



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	266	935	0	0	1702	188	53	123	26	85	0	285
Future Volume (vph)	266	935	0	0	1702	188	53	123	26	85	0	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	0		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	5029	0	0	4805	0	0	1698	0	3395	0	1566
Flt Permitted	0.072							0.987		0.284		
Satd. Flow (perm)	133	5029	0	0	4805	0	0	1560	0	872	0	1566
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					16			5				343
Link Speed (k/h)		50			50			50			41	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			19.5	
Confl. Peds. (#/hr)	70		55	55		70	165		295	295		165
Confl. Bikes (#/hr)			4			12			48			1
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	320	1127	0	0	2278	0	0	243	0	102	0	343
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			7.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA			NA		Split	NA		Perm		Over
Protected Phases	5	2			6		8	8				5
Permitted Phases	2									4		
Total Split (s)	21.0	76.4			55.4		26.1	26.1		22.5		21.0
Total Lost Time (s)	5.0	5.3			5.3			6.1		4.5		5.0
Act Effct Green (s)	71.7	71.4			50.4			20.0		17.2		16.0
Actuated g/C Ratio	0.53	0.53			0.37			0.15		0.13		0.12
v/c Ratio	1.23	0.42			1.26			0.95		0.92		0.70
Control Delay	164.7	20.0			158.9			101.1		124.4		14.1
Queue Delay	0.0	0.0			0.0			0.0		0.0		0.0
Total Delay	164.7	20.0			158.9			101.1		124.4		14.1
LOS	F	B			F			F		F		B
Approach Delay		52.0			158.9			101.1			39.4	
Approach LOS		D			F			F			D	
Queue Length 50th (m)	~94.2	68.4			~295.1			67.2		14.6		0.0
Queue Length 95th (m)	#136.8	72.0			#284.1			#105.9		#29.3		19.0
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0									45.0		45.0
Base Capacity (vph)	261	2660			1804			255		116		487
Starvation Cap Reductn	0	0			0			0		0		0

Lane Group	Ø3	Ø7
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (m)		
Storage Length (m)		
Storage Lanes		
Taper Length (m)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (k/h)		
Link Distance (m)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(m)		
Link Offset(m)		
Crosswalk Width(m)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (k/h)		
Turn Type		
Protected Phases	3	7
Permitted Phases		
Total Split (s)	5.0	5.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (m)		
Queue Length 95th (m)		
Internal Link Dist (m)		
Turn Bay Length (m)		
Base Capacity (vph)		
Starvation Cap Reductn		

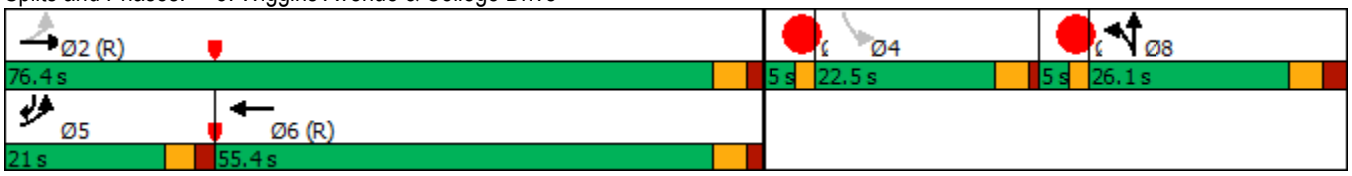
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0			0			0		0		0
Storage Cap Reductn	0	0			0			0		0		0
Reduced v/c Ratio	1.23	0.42			1.26			0.95		0.88		0.70

Intersection Summary			
Area Type:	Other		
Cycle Length: 135			
Actuated Cycle Length: 135			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.26			
Intersection Signal Delay: 108.6		Intersection LOS: F	
Intersection Capacity Utilization 92.9%		ICU Level of Service F	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

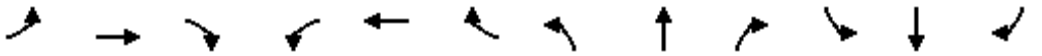
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Wiggins Avenue & College Drive



Lane Group	Ø3	Ø7
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	140	1874	0	0	1627	96	54	48	43	94	0	441
Future Volume (vph)	140	1874	0	0	1627	96	54	48	43	94	0	441
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Storage Length (m)	70.0		0.0	40.0		0.0	0.0		0.0	45.0		45.0
Storage Lanes	1		0	0		0	0		0	1		1
Taper Length (m)	20.0			20.0			7.5			7.5		
Satd. Flow (prot)	1750	5029	0	0	4842	0	0	1563	0	3395	0	1566
Flt Permitted	0.067							0.982		0.375		
Satd. Flow (perm)	123	5029	0	0	4842	0	0	1380	0	1164	0	1566
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					8			13				410
Link Speed (k/h)		50			50			50			40	
Link Distance (m)		309.1			289.8			132.4			222.5	
Travel Time (s)		22.3			20.9			9.5			20.0	
Confl. Peds. (#/hr)	141		73	73		141	179		209	209		179
Confl. Bikes (#/hr)			9			12			6			40
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	154	2059	0	0	1893	0	0	159	0	103	0	485
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		5.1			5.1			0.0			7.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA			NA		Split	NA		Perm		Over
Protected Phases	5	2			6		8	8				5
Permitted Phases	2									4		
Total Split (s)	18.0	77.8			59.8		26.1	26.1		26.1		18.0
Total Lost Time (s)	5.0	5.3			5.3			6.1		6.1		5.0
Act Effct Green (s)	72.8	72.5			54.5			20.0		20.0		13.0
Actuated g/C Ratio	0.52	0.52			0.39			0.14		0.14		0.09
v/c Ratio	0.72	0.79			1.00			0.68		0.62		0.94
Control Delay	48.5	30.4			63.5			67.7		73.7		38.2
Queue Delay	0.0	0.0			0.0			0.0		0.0		0.0
Total Delay	48.5	30.4			63.5			67.7		73.7		38.2
LOS	D	C			E			E		E		D
Approach Delay		31.7			63.5			67.7			44.4	
Approach LOS		C			E			E			D	
Queue Length 50th (m)	27.5	174.5			~200.9			41.0		14.7		21.5
Queue Length 95th (m)	#59.1	194.9			#240.2			#68.4		#26.2		#92.6
Internal Link Dist (m)		285.1			265.8			108.4			198.5	
Turn Bay Length (m)	70.0									45.0		45.0
Base Capacity (vph)	215	2604			1889			234		166		517
Starvation Cap Reductn	0	0			0			0		0		0

Lane Group	Ø3	Ø7
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (m)		
Storage Length (m)		
Storage Lanes		
Taper Length (m)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (k/h)		
Link Distance (m)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(m)		
Link Offset(m)		
Crosswalk Width(m)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (k/h)		
Turn Type		
Protected Phases	3	7
Permitted Phases		
Total Split (s)	5.0	5.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Queue Length 50th (m)		
Queue Length 95th (m)		
Internal Link Dist (m)		
Turn Bay Length (m)		
Base Capacity (vph)		
Starvation Cap Reductn		

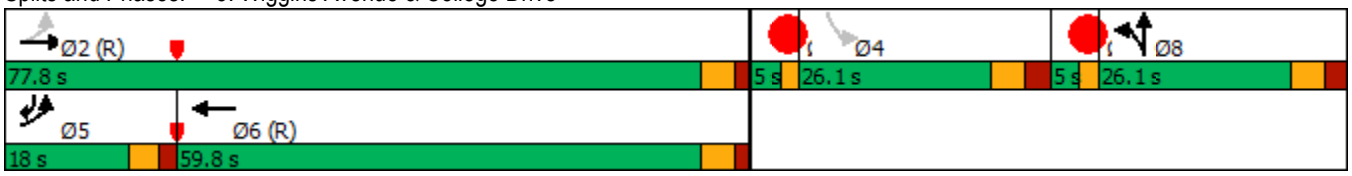
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0			0			0		0		0
Storage Cap Reductn	0	0			0			0		0		0
Reduced v/c Ratio	0.72	0.79			1.00			0.68		0.62		0.94

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.00			
Intersection Signal Delay: 46.8		Intersection LOS: D	
Intersection Capacity Utilization 99.1%		ICU Level of Service F	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Wiggins Avenue & College Drive



Lane Group	Ø3	Ø7
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

B

Appendix B
Cost Estimate

ID	Recommended Countermeasure	Items Included		Cost			
		Unit	Item	Unit Cost	Short Term	Medium Term	Long Term
1	Leading Pedestrian Interval	0	Regular O&M costs	$ -	$ -		
2	Exclusive Pedestrian Phase	0	Regular O&M costs	$ -		$ -	
		4	Signs (ped scramble)	$ 300.00		$ 1,200.00	
		3	Signs (No RTOR)	$ 300.00		$ 900.00	
3	Temporary curb extensions at northeast corner	6	Traffic Calming Curbs	$ 1,000.00	$ 6,000.00		
		1	Sign (Hazard left sign)	$ 300.00	$ 300.00		
4	Determine University needs and appropriate radius at NE corner.						
4a	Permanently reduce the curb radius during BRT construction. (Incremental cost to BRT budget)	25	m Curb and Gutter	$ 340.00		$ 8,500.00	
		13	m^2 Sidewalk	$ 360.00		$ 4,680.00	
		33	m^3 Soil and Vegetation	$ 30.00		$ 990.00	
		2	Pedestrian crosswalk marking revisions	$ 1,000.00		$ 2,000.00	
4b	Modify curb with truck apron if needed. (Incremental cost to BRT budget)	25	m Curb and Gutter	$ 340.00		$ 8,500.00	
		13	m^2 Sidewalk	$ 360.00		$ 4,680.00	
		0	m^3 Soil and Vegetation	$ 30.00		$ -	
		33	m^2 Mountable Apron	$ 250.00		$ 8,250.00	
5	Remove northwest channelized island. Review intersection radius to reduce radius.	0	Included in BRT project costs	$ -		$ -	
6	Install bi-directional curb cuts on NE and NW corners. Catch basins and retaining walls may require relocation / re-grading on SE and SW corners where bi-directional curb cuts were already identified in BRT plans.	4	Pedestrian ramps at North corners	$ 3,300.00	$ 13,200.00		
		2	Catch basin relocation at South corners	$ 2,500.00	$ 5,000.00		
		13	m Retaining wall removal at SE corner	$ 500.00	$ 6,500.00		
		23	m^2 Re-grading at SE corner	$ 100.00	$ 2,300.00		
7	Widen the existing multi-use path.	0	Included in BRT project costs	$ -	$ -		
8	Bike Lane Treatments on Wiggins Avenue						
8a	Install bike boxes, a northbound painted bike lane, "No Right Turn on Red" and 'Turning Vehicles Yield to Bicycles' signs.	1	Paint (thermoplastic, green)	$ 25,000.00	$ 25,000.00		
		2	Signs (No RTOR, Yield to Bike Lane)	$ 300.00	$ 600.00		
8b	Bi-directional bike lane on Wiggins Avenue and associated geometric changes. Includes temporary transition at Wiggins and Elliot, concept pictured below. (EXCLUDES DESIGN COSTS)	100	m Curb stops and bollards	$ 190.00		$ 19,000.00	
		150	m Paint in Bike Lane	$ 50.00		$ 7,500.00	
		50	m Paint through crossing	$ 4.00		$ 200.00	
		2	Multi-modal ramps at channelized island	$ 4,950.00		$ 9,900.00	
		2	Bike signal heads (assume use of existing poles)	$ 1,900.00		$ 3,800.00	
		4	Signs (Bike Lane)	$ 300.00		$ 1,200.00	
		4	Signs (no left, no right, DNE, double left lane)	$ 300.00		$ 1,200.00	
		12	Traffic calming curbs	$ 1,000.00		$ 12,000.00	
			Contingency (20%)	$ -		$ 10,960.00	
9	Consider fast-tracking the 'Connecting Campus' study.	0	Regular O&M costs	$ -	$ -		
10	Ensure that Auditory Pedestrian Signals are working.	0	Regular O&M costs	$ -	$ -		
11	Remove the residential parking permit sign.	1	Sign removal	$ 115.00	$ 115.00		
12	Review private sign permit process during next zoning bylaw update.	0	Regular O&M costs	$ -			$ -
13	Couple future corridor projects with stricter access management control along College Drive.	0	Regular O&M costs	$ -			$ -
14	Pass along queueing concerns to the University of Saskatchewan.	0	Regular O&M costs	$ -	$ -		
				TOTALS	**$ 59,015.00**	**$ 84,030.00** to **$ 89,290.00**	**$ -**

Conceptual transition from bi-direction bike lane to in-line bike lane