ATTACHMENT 1

2013

Central Avenue and Attridge Drive Functional Plan

City of Saskatoon
Transportation Branch

2013/07/24

EXECUTIVE SUMMARY

The *Central Avenue and Attridge Drive Functional Design Study* was commissioned by the City of Saskatoon in 2010 to assess short-term and long-term intersection needs. The study identified that at-grade modifications would be insufficient to address traffic demand as the City nears 300,000 population and an interchange was recommended for an estimated cost of $22.4 Million (excluding land acquisition).

Since the 2010 study, the City of Saskatoon has assigned a higher priority to the construction of the North Commuter Parkway Project in recognition the growing northeast area of the city. Completion of the North Commuter Parkway Project is anticipated for 2016.

Traffic patterns at the Central Avenue and Attridge Drive intersection are expected to change as some commuter traffic shifts from Circle Drive to the North Commuter Parkway river crossing and its shorter connection to the Marquis Industrial Area. The anticipated change in traffic patterns has brought to question whether alternatives which did not suit the original forecast conditions may, in fact, be well-suited to the revised forecast conditions considering the North Commuter Parkway Project. As such, the *Central Avenue and Attridge Drive Functional Plan* was reviewed to identify alternatives suitable to the modified forecast traffic patterns.

The *Central Avenue and Attridge Drive Functional Plan* assessed alternate intersection configurations for forecast traffic operations at 300,000 population and addressed issues noted in the 2010 in-service safety audit performed for the study intersection.

A total of three alternate intersection configurations were developed in consideration of input from existing intersection capacity issues, projected forecast traffic demand, the 2010 in-service safety review and public engagement. The alternatives assessed in this plan included:

1. Existing Configuration

2. Alternative 1:
   (a) Fully-protected east/west left-turns with dual eastbound left-turn bays;
   (b) Southbound right-turn bay with dedicated receiving lane on Attridge Drive;
   (c) Removal of north/south signal split-phasing and modification of the northbound lane assignment to function with one left-turn bay; and,
   (d) Realignment of the Circle Drive northbound to Attridge Drive eastbound off-ramp.

3. Alternative 2: same as Alternative 1, but with:
   (a) Southbound right-turn bay with yield entry onto Attridge Drive;
   (b) Added westbound lane beginning at Rever Road and terminating at the Circle Drive northbound on-ramp; and.
   (c) Added eastbound lane beginning prior to Central Avenue and terminating at Berini Drive.

Assessment of forecast traffic operations identified that:

- Maintaining the existing intersection configuration is likely to result in unacceptable operations for several intersection traffic movements;
- Constructing Alternative 1 improves the overall intersection and traffic movement operation to acceptable standards; and,
- Construction of Alternative 2 provides benefit to the eastbound through movement during the afternoon peak hour.

A summary of the evaluation of alternatives is provided below:

Table A. Summary of Alternative Evaluation

EVALUATION CRITERIA	EXISTING CONFIGURATION	ALTERNATIVE 1	ALTERNATIVE 2
Does the alternative address intersection capacity needs?	○	◎	●
Does the alternative improve pedestrian accommodations?	○	●	◎
Doe the alternative improve cycling accommodations?	○	●	●
Does the alternative improve transit accommodations?	○	●	●
Does the alternative address issues outlined in the safety review and/or by the public?	○	◎	●
Overall cost	Lowest Cost	Moderate Cost	Highest Cost

○ = least benefit ◎ = moderate benefit ● = most benefit

A high level construction cost estimate (excluding land acquisition) identified that Alternative 1 may cost approximately $4.0 Million to design and construct. Construction of additional through lanes for Alternative 2 will add a minimum of $2.0 Million to construction costs.

The additional operational benefit realized with the extra east-west through lanes in Alternative 2 is mostly confined to the afternoon peak hour for a single movement. The configuration outlined in Alternative 1 meets minimal acceptable operational service for the forecast horizon and addresses the majority of issues communicated by the public. As such, it is recommended that Alternative 1, outlined in Figure 1, be taken to the detailed design stage.

Alternative 1 was presented at an open house on March 6th, 2013 and a total of 24 comments were received. Most comments identified overall agreement with maintaining the intersection at-grade, while some expressed the need for an interchange at this location and/or immediate need for additional through lanes to address existing capacity concerns.

If required for funding purposes, implementation of Alternative 1 may be staged, and may involve:

- Construction of the dedicated southbound right-turn bay and receiving lane on Attridge Drive westbound first, followed by;
- Construction of dual eastbound left-turn bays with protected left-turn signal; and,
- Significant changes to traffic signal operation (i.e. removal of north/south split phasing) are not recommended until the North Commuter Parkway Project is functional and traffic patterns have stabilized.

Realignment of the Circle Drive northbound off-ramp to Attridge Drive eastbound may occur any time after the southbound right-turn measures have been constructed.

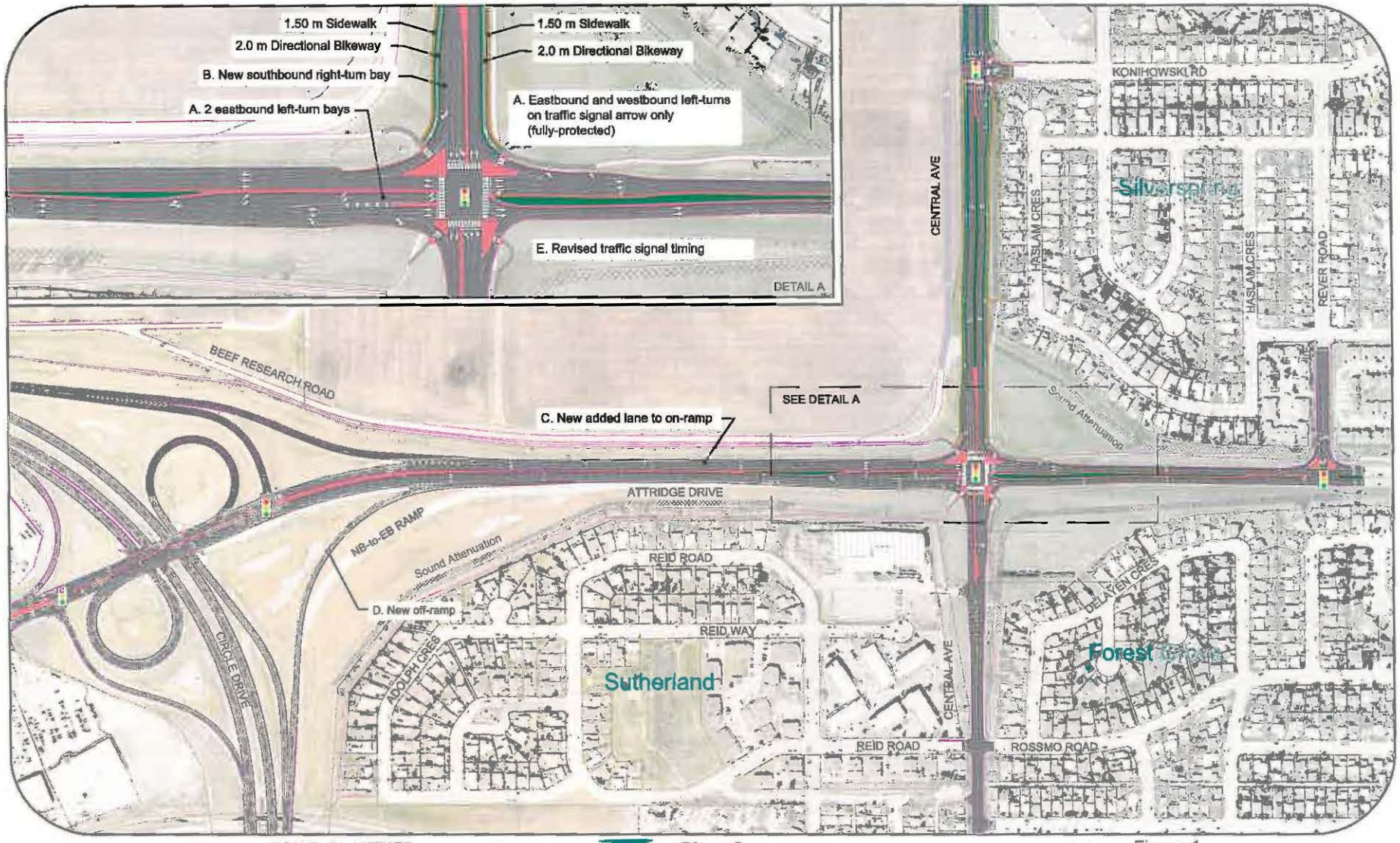

Figure 1
Proposed Central Avenue
& Attridge Drive Modifications

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1 STUDY PURPOSE

The *Central Avenue and Attridge Drive Functional Design Study* was commissioned by the City of Saskatoon in 2010 to assess the immediate (i.e. short-term) needs of the Central Avenue and Attridge Drive intersection and develop a long-term plan addressing traffic demand as the City grows to 300,000 residents.

The intersection review identified that at-grade modifications would be insufficient to address traffic demand as the City nears its 300,000 population forecast horizon. Construction of an interchange was recommended, incorporating a loop ramp to accommodate the eastbound-to-northbound movement. The total estimated construction cost of the interchange was $22.4Million, excluding land acquisition.

Since the 2010 study, the City of Saskatoon has assigned a higher priority to the construction of the North Commuter Parkway Project in recognition of growth expected in the northeast area of the city. The North Commuter Parkway Project is now anticipated to be completed by 2016.

Traffic patterns at the Central Avenue and Attridge Drive intersection are expected to change as some commuter traffic shifts from Circle Drive to the North Commuter Parkway river crossing and its shorter connection to the Marquis Industrial Area. Currently, all potential geometric modifications at the Central Avenue and Attridge Drive intersection are controlled by the service requirements of the northbound left-turn and eastbound left-turn peak hour traffic movements. The success of any intersection modifications is limited by how well they accommodate these peak hour left-turn movements. Operation of the North Commuter Parkway Project is expected to lessen the impact of these left-turn movements as more emphasis, or traffic demand, is shifted towards northbound and southbound through-movements along Central Avenue.

The anticipated shift in traffic patterns at the Central Avenue and Attridge Drive intersection due to the North Commuter Parkway Project has brought to question whether alternatives which did not suit the original forecast conditions may, in fact, be well-suited to the revised forecast conditions considering the North Commuter Parkway Project. As such, an updated review was completed to identify alternatives suitable to the modified forecast traffic patterns.

The *Central Avenue and Attridge Drive Functional Plan* assesses alternate intersection configurations for current and forecast traffic operations at 300,000 population. The functional plan will also attempt to address issues noted in the 2010 in-service safety audit performed for the study intersection.

2 TRAFFIC VOLUMES

Traffic volumes have been assessed based on current trends and projected patterns with the North Commuter Parkway Project in operation.

2010 peak hour traffic volumes are illustrated in Figure 1 and have been adjusted to account for seasonal variations using Average Annual Daily Traffic (AADT) factors from local permanent count stations. Forecast traffic volumes, illustrated in Figure 2, represent a City population of 300,000 with the North Commuter Parkway operational. At the current population growth rate of 2.5 percent, the 300,000 population target may be reached as soon as 2022.

Forecast traffic volumes from the 300,000 population Transportation Model are based on the old suburban growth plan and represent completion of the following:

- Circle Drive South;
- Hampton Village and Kensington;
- Stonebridge;
- Rosewood;
- Evergreen, Aspen Ridge (northeast of Evergreen) and Willowgrove;
- The first neighbourhood in the Holmwood Sector; and,
- Elk Point (north of 33rd Street in Blairmore).

Confidence in the 300,000 population scenario is relatively high, as it assumes that Saskatoon's current growth trends will continue. However, this scenario does not include impacts from significant infill, nor changes to growth patterns based on implementation of *The Strategic Plan* or policies from the *Integrated Growth Plan (IGP)*.

Confidence in the 400,000 population scenario is much lower because it does not reflect growth policies currently in development through the *IGP* nor potential for significant infill. The 400,000 population scenario may be available in late 2015 pending input from the *IGP* and Council-mandated growth plan. As such, traffic projections for this forecast scenario were not utilized in this analysis.

The projected increases and/or decreases to traffic volumes at the study intersection result from shifting traffic patterns due to the North Commuter Parkway Project, new developments in the northeast and east areas of Saskatoon, and the proposed interchange at McOrmond Drive and College Drive.

General traffic trends noted in Figures 1 and 2 include:

MORNING PEAK HOUR

Morning peak hour traffic demand for northbound left-turn and southbound right-turn movements is currently very large, but is projected to decrease substantially as traffic patterns shift with the opening of the North Commuter Parkway Project.

AFTERNOON PEAK HOUR

Afternoon peak hour northbound and southbound through movements are projected to increase (with the North Commuter Parkway Project) as demand shifts from the eastbound right-turn and northbound left-turn movements.

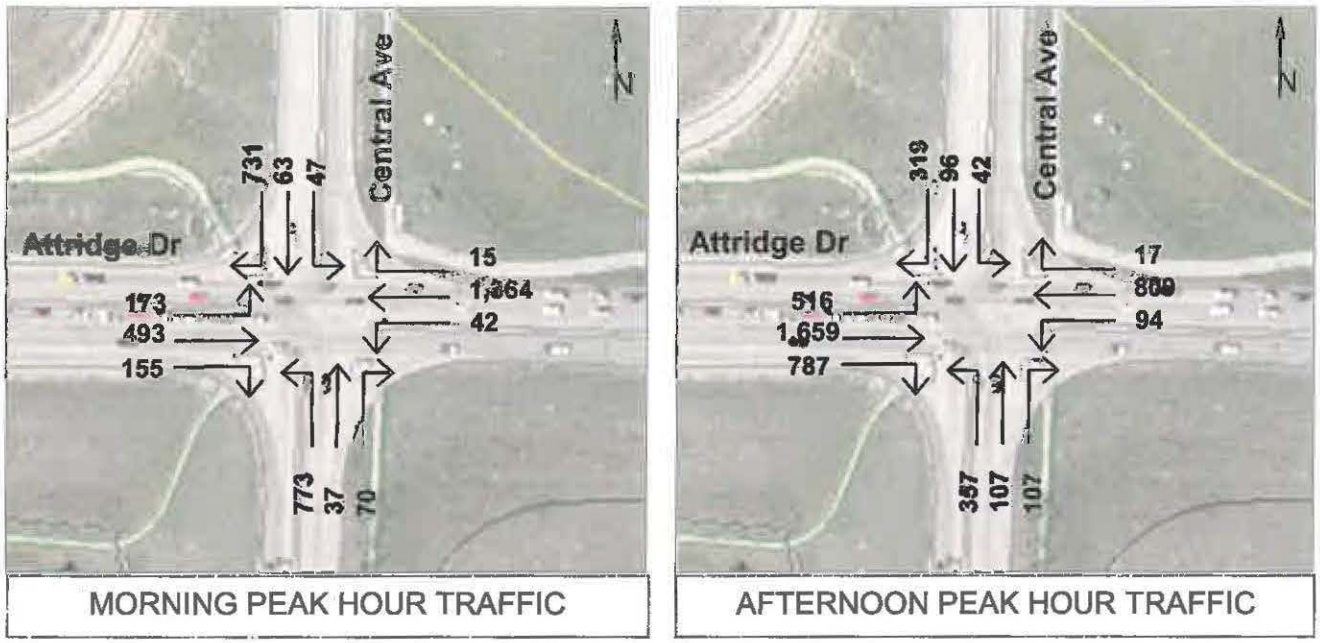

Figure 1. Existing 2010 Peak Hour Traffic Volumes

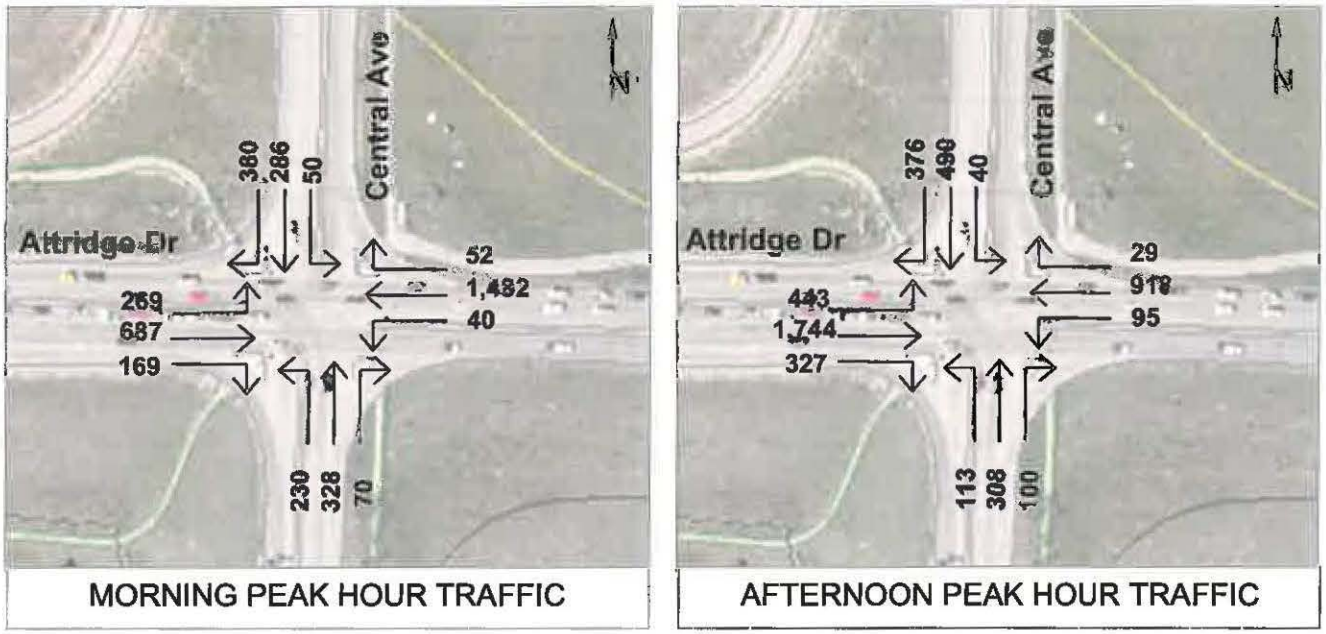

Figure 2. Forecast Peak Hour Traffic Volumes at 300,000 Population with North Commuter Parkway Project Complete

3 ALTERNATIVES

3.1 Development of Alternatives

The alternative intersection configurations assessed in this plan were developed in consideration of input from existing intersection capacity issues, projected traffic demand, the 2010 in-service safety review and public engagement.

Peak hour capacity issues identified in the 2010 study are summarized below.

CURRENT MORNING PEAK HOUR CAPACITY

- Northbound, southbound right-turn and westbound through/right-turn movements operate at LOS[(a)] F.
- The eastbound left-turn operates at LOS E with extended delays.
- The intersection exceeds its available capacity.

CURRENT AFTERNOON PEAK HOUR CAPACITY

- Eastbound left-turn and through movements operate at LOS D.
- Westbound through/right-turn movements operate at LOS F.
- The intersection operates at LOS E and nears its available capacity.

The 2010 in-service safety review identified issues which may be primarily attributed to inadequate intersection capacity during the peak hour. A potential need for measures addressing conflict at the northbound off-ramp from Circle Drive onto eastbound Attridge Drive was also noted, where much of the ramp traffic was observed to weave across two lanes to gain access to the left-turn bay onto Central Avenue northbound.

Engagement completed for the 2010 study identified concern with the safety of the eastbound and westbound left-turns, ability of the northbound off-ramp movement to turn left onto Central Avenue and congestion at the Circle Drive on-ramp.

3.2 Alternatives

Alternative intersection configurations assessed herein include:

1. Fully-protected eastbound and westbound left-turns to address concerns noted regarding safety of these movements:
   - Fully-protecting the eastbound left-turn movement would necessitate the construction of a second lane in the left-turn bay to accommodate peak traffic demand for this movement. Dual left-turn bays should be constructed with sufficient length to accommodate peak queuing and deceleration from the mainline, resulting in upwards of four-times the existing left-turn bay capacity.

(a) Level of service (LOS) assesses traffic operations based on alphabetical ranking, where LOS A equates to the best service and LOS F indicates movement or intersection failure. LOS D is typically considered the limit of acceptable service since unacceptable delays

2. Measures to address southbound right-turn demand should be explored, including:
   - Construction of a right-turn bay.
   - Construction of a dedicated receiving lane on Attridge Drive westbound; and/or,
   - Revised right-of-way control at the intersection.

3. Greater weave distance between the Circle Drive ramp and the Attridge Drive intersection:
   - The northbound off-ramp from Circle Drive to Attridge Drive eastbound may be realigned to merge onto Attridge Drive at a location 220 metres west of its existing merge. Ramp realignment would maintain the existing 60 km/h ramp advisory speed and increase the length available for the weaving manoeuvre from 230 metres to approximately 450 metres.

4. Modified north/south lane assignment to address delays from traffic signal split-phasing:
   - The existing northbound left-turn bay configuration combines the outside left-turn bay with the through movement, illustrated in Figure 3, which in turn necessitates traffic signal split-phasing and increases overall intersection delay.
   - Forecast peak hour traffic volumes identify decreased northbound left-turn demand which may be adequately accommodated in a single turn bay. This will allow modified northbound lane assignment to operate with a single-lane left-turn bay and two through-lanes, negating the need for signal split-phasing.

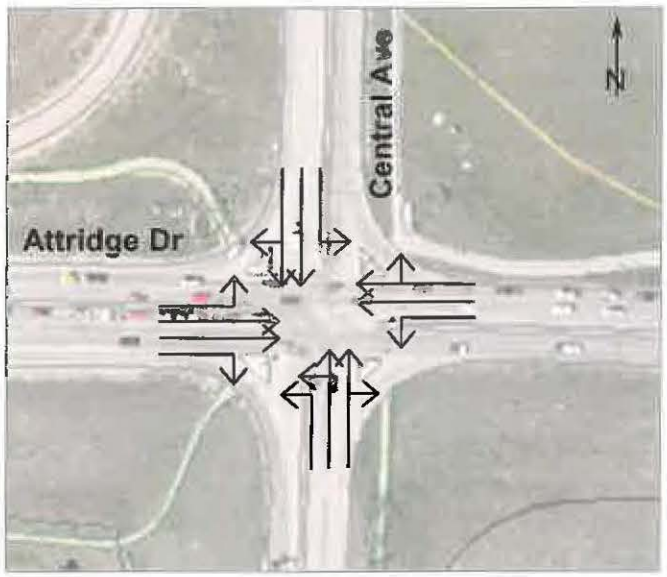

Figure 3. Existing Intersection Configuration

5. Additional east/west through movement capacity:
   - An additional westbound lane may be added along Attridge Drive beginning at Rever Road (introduced as a dedicated lane for the southbound right-turn movement from Rever Road) and ending at the Circle Drive northbound on-ramp as an exit lane.
   - An additional eastbound lane may be introduced along Attridge Drive through the Central Avenue intersection by converting the existing outside lane from a forced right-turn into a through lane and construction a right-turn bay. The earliest opportunity to safely terminate the third lane is Berini Drive, which is located 1.3 km east of Central Avenue.

6. Relocation of the Beef Research Road access intersection:
   - The existing Beef Research Road intersection is located 40 metres north of the Central Avenue and Attridge Drive intersection area (where turning bays are introduced). The preferred intersection spacing along arterial roadways is 450 metres, with a minimum spacing of 250 metres accepted in some circumstances.
   - The Central Avenue and Konihowski Road intersection is located 285 metres north of Attridge Drive. As such, the closest location to provide access to Beef Research Road is at the Konihowski Road intersection. Aligning both roadways will eliminate an intersection along Central Avenue and is preferred.

7. Adoption of the *Central Avenue Functional Plan* widening and roadway cross-section:
   - Modifications to the Central Avenue and Attridge Drive intersection should align with the roadway widening and cross-section outlined in the *Central Avenue Functional Plan*. Construction of the roadway cross-section outlined in the *Central Avenue Functional Plan* will encompass the extension of Central Avenue from Konihowski Road to McOrmond Drive and will be completed prior to the opening of the North Commuter Parkway in 2016.

4 ANALYSIS OF ALTERNATIVES

Alternatives developed for this study were assessed based on projected traffic operations, pedestrian, cycling and transit accommodations, as well as estimated project cost.

4.1 Traffic Operations Assessment

Using the forecast turning movement volumes for the 300,000 population horizon, projected traffic operations were simulated using VISSIM 5.30 (industry-standard microsimulation software) for the following scenarios:

1. Existing Intersection Configuration and Traffic Signal Operation.

2. Alternative 1:
   - Fully-protected eastbound and westbound left-turns;
   - Dual eastbound left-turn bays;
   - Southbound right-turn bay with dedicated receiving lane on Attridge Drive westbound; and,
   - Significant changes to traffic signal operation (i.e. removal of north/south traffic signal split-phasing) and modification of the northbound lane assignment to function with one left-turn bay.

3. Alternative 2: same as Alternative 1, except:
   - Southbound right-turn bay with yield entry onto Attridge Drive;
   - Additional westbound lane beginning at Rever Road and terminating at the Circle Drive northbound on-ramp; and,
   - Additional eastbound lane terminating at Berini Drive.

Traffic operations for each scenario were assessed based on movement delay and level of service. Due to the variable nature of traffic flow, several simulations were completed for each scenario and an average of the results utilized to represent anticipated operations. Similar to what is observed at all other intersections, the simulated peak hour movement operation of LOS D may, in fact, sometimes operate at LOS C or LOS E.

A summary of the traffic operations analysis for each scenario is presented below for morning and afternoon peak hours of operation.

Morning peak hour operations are summarized in Table 1 for all analysis scenarios.

Table 1. Morning Peak Hour Forecast Traffic Operations

	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			OVERALL
	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT	INTERSECTION
Volume (vph)	380	286	50	52	1,482	40	70	328	230	169	687	269	4,043
Existing Configuration													
Delay (s)	14	51	43	40	52	33	1	49	41	0	22	38	39
LOS	B	D	D	D	D	C	A	D	D	A	C	D	D
Alternative 1													
Delay (s)	3	45	39	16	26	66	9	37	38	0	15	50	26
LOS	A	D	D	B	C	E	A	D	D	A	B	D	C
Alternative 2													
Delay (s)	6	45	39	7	23	63	10	37	38	1	15	47	24
LOS	A	D	D	A	C	E	A	D	D	A	B	D	C

Alternative 1 is expected to decrease delay to most of the morning peak hour motorized intersection movements with the exception of the westbound left-turn. The westbound left-turn represents 2 percent of all motorized intersection traffic and is expected to, experience additional delay due to the fully-protected east/west left-turn traffic signal operation implemented to address concerns noted regarding safety of these movements.

Alternative 2 is expected to produce the same decreases in overall vehicle movement delay as noted in the analysis of Alternative 1.

Afternoon peak hour operations are summarized in Table 2 for all analysis scenarios.

Table 2. Afternoon Peak Hour Forecast Traffic Operations

	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			OVERALL
	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT	INTERSECTION
Volume (vph)	376	490	40	29	918	95	100	308	113	327	1,744	443	4,983
Existing Configuration													
Delay (s)	42	75	59	33	44	46	6	76	65	7	49	45	48
LOS	D	E	E	C	D	D	A	E	E	A	D	D	D
Alternative 1													
Delay (s)	4	42	37	7	23	58	11	37	37	12	43	65	35
LOS	A	D	D	A	C	E	A	D	D	B	D	E	C
Alternative 2													
Delay (s)	6	42	38	3	21	58	9	36	36	2	21	55	25
LOS	A	D	D	A	C	E	A	D	D	A	C	E	C

Alternative 1 is expected to decrease delay to most of the motorized intersection movements in the afternoon peak hour. The westbound left-turn is expected to experience additional delay due to the fully-protected east/west left-turn traffic signal operation. The added east/west through lanes of Alternative 2 will be needed to realize improvement of the eastbound through vehicle movement during the afternoon peak hour.

4.2 Circle Drive Ramp Analysis

CIRCLE DRIVE ENTRANCE RAMP

Attridge Drive westbound currently has two lanes with the outer lane providing an entrance ramp to the Circle Drive northbound on-ramp and permitting continued westbound travel towards Preston Avenue. This ramp entrance is congested during peak hours, particularly in the morning when available capacity is exceeded and the ramp entrance operates at LOS F. Construction of a third westbound lane terminating directly into the ramp (i.e. a dedicated ramp entrance from the outer westbound lane) allows approximately 500 metres for a lane change manoeuvres to access the ramp and improves the ramp entrance function to LOS C in the forecast scenario.

Capacity at the Attridge Drive westbound to Circle Drive northbound on-ramp is often constrained due to congestion along Circle Drive. The measures outlined herein only address capacity deficiencies along the Attridge Drive study corridor and do not address operational constraints along Circle Drive.

CIRCLE DRIVE EXIT RAMP

The 2010 in-service safety review discussed the potential need for measures addressing risk of conflict at the northbound off-ramp from Circle Drive onto eastbound Attridge Drive where a large amount of ramp traffic was observed to immediately weave across two lanes to turn left onto Central Avenue northbound. Public consultation also highlighted a misconception that the ramp directly enters its own lane on Attridge Drive, rather than merging into traffic in an existing lane.

The Circle Drive northbound off-ramp onto eastbound Attridge Drive was originally designed as a highway-to-highway connection. Since construction of the interchange, the speed limit along Attridge Drive has been lowered due to increasing traffic volumes and the Attridge Drive corridor has become a fully-urbanized roadway accommodating large traffic volumes. As traffic increases along Attridge Drive, opportunity for vehicles to enter Attridge Drive eastbound from the ramp will become more restricted and ability for ramp traffic to manoeuvre will become increasingly difficult during peak hours. As such, ramp realignment will provide operational benefit to address these difficulties.

Alternatives 1 and 2 outline realignment of the northbound off-ramp to merge onto Attridge Drive at a location 220 metres west of its existing merge while maintaining the 60 km/h ramp advisory speed. Forecast afternoon peak capacity analysis has identified that ramp realignment could help to accommodate a little more weave capacity, but that the ramp merge would ultimately operate at LOS D regardless of realignment.

If the off-ramp is not realigned, channelization to prohibit weaving of ramp traffic to the eastbound left-turn bay onto Central Avenue northbound may be necessary.

4.3 Pedestrian and Cycling Accommodations

All alternatives identified in this plan will include the construction of accessibility ramps at all channelization islands and intersection approaches. In addition, modification of traffic signal operations to function without north/south split phasing, as outlined in Alternatives 1 and 2, will help to reduce delay to pedestrians waiting to cross the intersection. However, the additional lanes proposed in Alternative 2 will increase the crossing distance and time for north/south pedestrians at the intersection.

To maintain consistency with the *Central Avenue Functional Plan*, the bikeway will terminate at intersections and cyclists will be expected to cross as pedestrians.

4.4 Transit Accommodations

Route 4 vehicle movements at the study intersection include:

- Northbound left-turn for inbound routes (i.e. destined for Place Riel Hub); and,
- Eastbound right-turn for outbound routes (i.e. into Sutherland, Forest Grove, Erindale and Arbor Creek neighbourhoods).

Transit stops nearest to the study intersection include:

- The Central Avenue and Reid Road / Rossmo Road intersection (inbound stop 4432 and outbound stop 4351); and,
- At the Preston Crossing (inbound stop 3993 and outbound stop 3992).

Some impact to transit operations is expected resulting from delay associated with each alternative. In particular, maintaining the existing configuration is expected to impose the highest delay to inbound transit vehicles.

No additional measures are proposed to accommodate transit, nor are additional impacts expected at either of the aforementioned stop areas.

4.5 Cost Estimate

The estimated design and construction cost for Alternative 1 is approximately $4.0 Million, excluding land acquisition costs.

A high level review was completed to estimate the additional construction costs associated with the extra through lanes presented in Alternative 2. The cursory cost review indicates that construction of the additional two through lanes requires a minimum of $2.0 Million in addition to the base cost for Alternative 1.

4.6 Other Alternatives Considered

1 Alternatives to the relocation of the northbound ramp:

A. Complete removal of the ramp and diversion of traffic to the existing loop; construction of a full intersection at the top of the loop. Rejected – displacement of existing volumes to the loop would likely cause the loop and intersection to fail. The existing PM demand is at the threshold for a dual left-turn; to provide this the entire loop would have to be re-built.

B. Install a raised median and create a collector-distributor road through Central Avenue, this would completely prevent the weave of eastbound vehicles into the northbound left turn bays. Rejected – this would displace the weave and left turn demand to the intersection at Rever Road. The additional arterial demand on a neighbourhood collector is not acceptable.

C. Maintain existing ramp (i.e. do nothing). Not recommended – the ramp-related conflict identified in the 2010 Safety Review will likely worsen as traffic volumes continue to increase. This may require a re-examination of alternative treatments to address the ramp-related conflict, including the potential prohibition of ramp access to eastbound left-turning traffic (Option 1.B). However, cost savings for not relocating the ramp is estimated as $550,000.

2 Attridge Dr westbound 3rd Lane:

Alternative 2 identified in the attachment evaluates:

- Changing the southbound right-turn bay into a yield condition (instead of free-flow);
- Adds a westbound through-lane starting at Rever Road and terminating at the Circle Dr northbound ramp;
- Continues the eastbound outside lane through Central Avenue to the first intersection east of Central Avenue with a right turn (Berini Dr).

As shown in the attachment, the additional through lanes provide no additional benefit during the morning peak hour for westbound traffic when compared to Alternative 1; however, the additional eastbound lane would reduce overall delay and improve operation of the intersection for the evening peak hour.

3 Alternatives to the proposed modifications:

Unconventional intersection designs were also considered – a continuous flow intersection, in particular the displaced left turn (DLT) was considered. The DLT has the ability to process much higher intersection volumes, especially left turns; however, the unbalanced flows on approaches would reduce the effectiveness of the intersection.

5 STAKEHOLDER AND PUBLIC CONSULTATION

Key stakeholders for this project were identified as:

- The University of Saskatchewan (U of S) due to their large land-holding in the northwest quadrant of the intersection; and,
- Dutch Growers due to their land-holding in the southwest quadrant of the intersection.

The U of S was presented the proposed functional plan on February 14, 2013 for review; the U of S noted the following concerns:

- Relocation of the Beef Research Road access from its current location to align with Konihowski Road, would require a sizeable amount of agricultural research land; and,
- The suitability of the realigned Beef Research Road may not support future development plans.

The City will continue discussions with the U of S and will develop right-of-way drawings to determine how much land will be required to accommodate the roadway realignment once agreement is reached and how that realigned road may work with future development.

Dutch Growers was presented the functional plan on February 19, 2013 for review and comment. During the review, Dutch Growers noted some concerns:

- They believe that a northbound dual left-turn will still be required, despite the projected changes to traffic due to the North Commuter Parkway Project;
- The northbound-to-eastbound ramp from Circle Drive to Attridge Drive is too tight and will still require traffic to merge. They have requested consideration for a fourth outside lane to assist with the merge.
- They have requested consideration of wider medians to accommodate slotted eastbound/westbound left-turn bays.
- They have requested consideration for relocated business access to align with Reid Terrace due to difficulty turning left out of property onto Central Avenue.

The stakeholder's concerns have been noted and incorporated into the design. However, relocation of the Dutch Growers driveway is not included in the intersection design in this functional plan. If the landowner is seeking alternative property access, they may do so independently of the intersection revisions identified herein.

An open house was held on March 6, 2013 at the Sutherland Hall to present the revised functional plan. A total of 24 comments were received during from the open house and are summarized in Table 1. Most comments identified overall agreement with maintaining the intersection at-grade; however some concern was expressed for an ultimate need for an interchange at this location.

Table 3. Summary of Comments from Public Consultation

Comment	Count
Agree with maintaining intersection (rather than interchange)	7
Want to see functional plan implemented soon, potentially before North Commuter Parkway Project	5
Concerned that interchange will be needed	4
Request construction of dedicated lane for Circle Dr northbound-to-eastbound off-ramp, or longer merge lane	2
Request improved accommodate of active modes at grade-crossings	2
Disagree that North Commuter Parkway Project will alter traffic patterns at intersection	1
Request that dual northbound left-turn lanes are maintained	1
Request multilane roundabout in lieu of intersection	1
Request all funds be reallocated to Victoria Bridge reconstruction	1
Request for sound attenuation due to higher traffic volumes	1
Concern for traffic issues in other areas of northeast due to growth	1
Concern that traffic on Attridge Dr westbound will not be able to merge into Circle Dr North on-ramp lane	1
Request to make left-turn bays 750 to 1,000 metres long	1
Disagree that relocation of Circle Dr northbound-to-eastbound off-ramp is necessary	1
Request construction of 3 lanes on Attridge Dr from Lowe Rd to Central Ave	1
Request for dual westbound left-turn lanes	1
Request for longer southbound right-turn bay	1
Request for revision of right-of-way assignment on Attridge Dr to Circle Dr northbound on-ramp	1
Request that southbound right-turn movements be allowed from outside through lane (akin to Circle Dr westbound off-ramp at Warman Rd)	1
Request for second lane on eastbound-to-northbound loop to have dedicated entry (rather than yield entry) to Attridge Dr	1
Request for traffic signals at Central Ave and Konihowski Rd	1
Request for turning lanes at Beef Research Rd intersection	1
Request for commercial use of unused portions of right-of-way	1
Request for additional speeding enforcement along Attridge Dr	1

6 SUMMARY AND RECOMMENDATIONS

6.1 Summary

Traffic analyses for the Central Avenue and Attridge Drive intersection were completed for a 300,000 population scenario with the North Commuter Parkway Project operational. There is less confidence in forecast models extending beyond the 300,000 population scenario due to ongoing policy revisions impacting future growth and development patterns. As such, analysis may not be completed for forecast horizons beyond the 300,000 population scenario with any reasonable amount of certainty.

Key results from this study are presented below with the evaluation of alternatives summarized in Table 4.

CONSTRAINED OPERATIONS

Regardless of the intersection configuration, many movements are likely to continue to be constrained during peak hours as a result of conflicting traffic demand and provision for protected (signalized) turning movements. Several movements may be expected to operate at the limit of acceptable operations (LOS D) during afternoon peak hour, including the northbound and southbound through and left-turn movements.

While incorporating fully-protected eastbound and westbound left-turn signal operations will address safety concerns expressed by the public and the 2010 safety audit, it will also increase peak hour delay for these movements from LOS D to LOS E.

ADDITIONAL LANES

Maintaining the existing number of through lanes on Attridge Drive and revising traffic signal operations to omit the north-south split phasing (Alternatives 1 and 2) is anticipated to improve east-west through movement operations throughout most of the day. The additional benefit realized from the construction of new (3rd) east-west through lanes on Attridge Drive, as outlined in Alternative 2, is limited to the eastbound through movement during the afternoon peak hour and will require construction of approximately 2.6 km of new lanes at a minimum additional cost of $2.0 Million.

FORECAST UNCERTAINTY

The potential impact of additional development beyond the 300,000 forecast horizon is unknown at this time and may not be estimated with reasonable certainty due to ongoing review of development and intensification policies.

PEDESTRIAN AND CYCLING ACCOMMODATIONS

Alternatives 1 and 2 will provide for improved pedestrian accommodations through the addition of accessibility ramps at all channelization islands, as well as reduced crossing delay compared to existing conditions. However, the additional east-west through lanes included in Alternative 2 will increase north/south pedestrian crossing distance and time.

The bikeway proposed for the Central Avenue extension is incorporated into Alternatives 1 and 2, but will end at the intersection and cyclists will be required to cross as pedestrians. This approach maintains consistency with the bikeway treatment per the *Central Avenue Functional Plan*.

TRANSIT ACCOMMODATIONS
Alternatives 1 and 2 will reduce intersection delay for inbound buses on Route 4.

ISSUES IDENTIFIED IN 2010 SAFETY REVIEW AND PUBLIC ENGAGEMENT
The existing configuration does not address issues identified in the 2010 review, whereas Alternative 1 addresses several of these issues. However, the supplementary measure of constructing additional east-west through lanes in Alternative 2 addresses more of the issues identified in the prior study.

Table 4. Summary of Alternative Evaluation

EVALUATION CRITERIA	EXISTING CONFIGURATION	ALTERNATIVE 1	ALTERNATIVE 2
Does the alternative address intersection capacity needs?	○	◎	●
Does the alternative improve pedestrian accommodations?	○	●	◎
Doe the alternative improve cycling accommodations?	○	●	●
Does the alternative improve transit accommodations?	○	●	●
Does the alternative address issues outlined in the safety review and/or by the public?	○	◎	●
Overall cost	Lowest Cost	Moderate Cost	Highest Cost

○ = least benefit ◎ = moderate benefit ● = most benefit

6.2 Recommendations

The configuration outlined in Alternative 1 meets the minimal acceptable operational service for the forecast horizon and addresses safety concerns expressed by the public. The additional benefit realized through the construction of additional east-west through lanes in Alternative 2 may not be sufficient to justify the increased costs. As such, it is recommended that Alternative 1, illustrated in Figure 1, be taken to the detailed design stage, including the design of:

- Fully-protected eastbound and westbound left-turns;
- Dual eastbound left-turn bays;
- Southbound right-turn bay with dedicated receiving lane on Attridge Drive westbound;
- Removal of north/south signal split-phasing and modification of the northbound lane assignment to function with one left-turn bay; and,
- Realignment of the Circle Drive northbound off-ramp to Attridge Drive eastbound to merge into Attridge Drive at a location approximately 220 metres west of its existing merge.

Implementation of the measures presented in Alternative 1 may be staged as funding permits. Staging may involve:

- Construction of the dedicated southbound right-turn bay and receiving lane on Attridge Drive westbound first, followed by;
- Construction of the dual eastbound left-turn bays with fully-protected left-turn signal function; and,
- Significant changes to traffic signal operation (i.e. removal of north/south split phasing) are not recommended until the North Commuter Parkway Project is functional and the resulting shift in traffic patterns has stabilized.

Realignment of the Circle Drive northbound off-ramp to Attridge Drive eastbound may occur any time after the southbound right-turn measures have been constructed.

Additional through lanes on Attridge Drive may be constructed at a later date should there be a demonstrated need for the additional capacity. Construction of the additional through lanes will necessitate:

- Modification of the channelization islands at the study intersection;
- Construction of an eastbound right-turn bay;
- Relocation of adjacent on-street lighting and/or traffic signal hardware and,
- Lengthening of the multi-use underpass adjacent to Rossmo Road.

Consideration for the potential future widening of Attridge Drive may be included in the detailed design of the measures presented in Alternative 1, but this will not completely eliminate the impact of the additional lane construction nor will it negate the need for revision of elements construction to meet the Alternative 1 configuration.

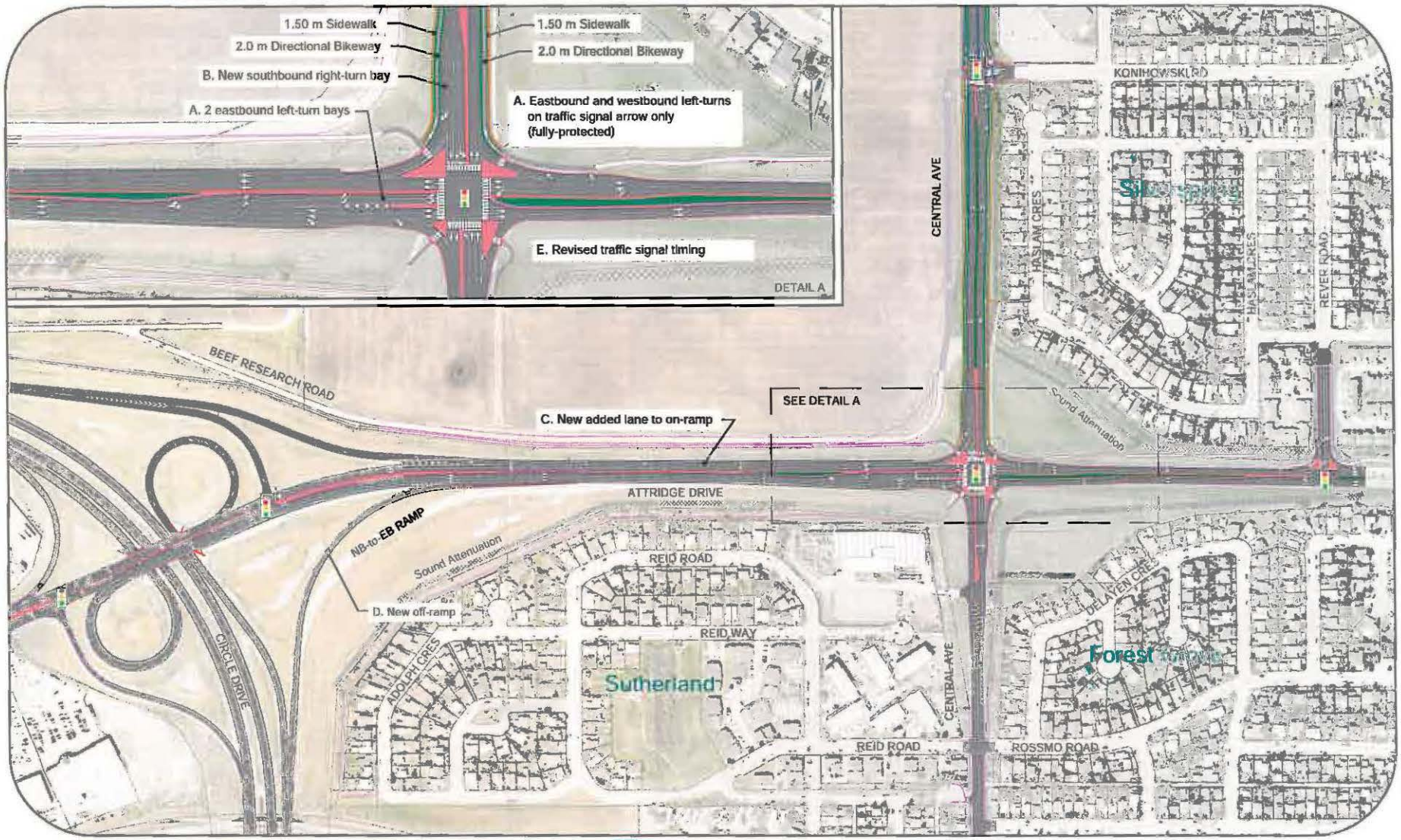

Figure 1
Proposed Central Avenue
& Attridge Drive Modifications

APPENDIX A – Level of Service Definitions

Average Control Delay (sec./veh.)	Level of Service	General Description
≤ 10	A	*Free Flow*
> 10 - 20	B	*Stable Flow* (slight delays)
> 20 - 35	C	*Stable Flow* (acceptable delays)
> 35 - 55	D	*Approaching Unstable Flow* (tolerable delay, occasional wait through more than one signal cycle before proceeding)
> 55 - 80	E	*Unstable Flow* (intolerable delay)
> 80	F	*Forced Flow* (jammed)

APPENDIX B – Existing Traffic Operations (April 2013 Traffic Volumes)

AM	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			OVERALL INTERSECTION
	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT	
Volume (vph)	477	54	33	13	1,248	38	62	47	510	184	776	126	2,792
Existing Configuration													
Delay (s)	191	178	142	14	20	20	5	45	57	1	12	28	50
LOS	F	F	F	B	B	C	A	D	E	A	B	C	D

PM	SOUTHBOUND			WESTBOUND			NORTHBOUND			EASTBOUND			OVERALL INTERSECTION
	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT	
Volume (vph)	304	74	31	21	955	63	128	104	357	969	1,811	442	3,448
Existing Configuration													
Delay (s)	6	60	56	10	19	56	11	50	56	8	19	33	22
LOS	A	F	E	A	B	E	B	D	E	A	B	C	C