



A Sustainable Transportation Study for Calgary: A Multimodal Approach

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ABSTRACT

Cities in Canada are adopting new transportation policies that define the relative importance of travel modes by corridor. Calgary, through its newly adopted transportation plan, has identified new road cross sections that help define the desired roadway character and mode hierarchy. Also new to the Calgary Transportation Plan (CTP) are a series of maps that create logical networks for primary transit, cycling, high occupancy vehicle and goods movement. These new plans and road templates are part of the bigger “Plan It Calgary” approach of integrating land use and transportation decisions. The 17 Avenue SE corridor study is the first opportunity since adoption of Plan It Calgary to determine the long term plans for a specific area in terms of both land use and transportation.

The 17 Avenue SE corridor plays many important roles. It is the original main street of the Forest Lawn community, a secondary highway with regional connections, a culturally diverse hub dubbed International Avenue, and has recently been made part of Calgary’s envisioned primary transit and cycling networks.

Today, 17 Avenue SE is auto-centred with a four, and sometimes six-lane cross section with significant congestion during peak periods. Sidewalks along 17 Avenue SE are discontinuous and have a narrow clear path due to road signs and amenities. No dedicated cycling infrastructure exists, and connecting with Calgary’s downtown involves sharing a narrow pathway with pedestrians over several bridge structures. Transit service is frequent and experiences some of the highest ridership city-wide, despite the many passenger access deficiencies. Promoting a more sustainable transportation can often be achieved by influencing a mode shift from single occupancy vehicles (SOV) to more sustainable modes, such as public transit, carpooling, walking and biking. The objectives of this project included dedicating road space for transit, walking and cycling.

Three alternatives for a long term cross section were developed and integrated with the land use plans to support the different character zones along the corridor. The preferred concept:

- includes median transit lanes to provide the greatest travel speed, reliability and station integration opportunities
- has wide sidewalks and boulevards to establish an urban character and allow inclusion of historic elements, including angle parking
- includes on-street bike lanes to clearly define cycling as a legitimate mode and to appeal to less confident cyclists
- accommodates an auto capacity that is equivalent to today’s capacity
- locates transit stations near higher density development according to the land use concept.

Developing a multi-modal cross section in close collaboration with land use visioning will make sustainable travel choices convenient. The result is expected to be increased

person-capacity of the transportation network while realizing the social benefits associated with reduced reliance on the private automobile.

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1.0 Introduction

Transportation demand in Calgary, as in many other cities in Canada, is experiencing continued and accelerated growth. The rate at which it is growing is already to some extent higher than the rate at which capacity is being added. Consequences of this can be observed through longer travel times, greater driver frustration, and more congestion. These consequences are in line with the study done by Thompstone, L., et al. (2006) where the authors observed that the traditional methods of traffic management tended to accommodate congestion problems through road widening and building, rather than seeking to reduce the actual problems themselves, i.e., traffic volume leading to congestion [1]. One approach to lessen these effects and to maximize the use of existing infrastructure is to decrease the number of vehicle trips [2, 3]. This can often be achieved by influencing a mode shift from single occupancy vehicles (SOV) to more efficient alternative modes, such as public transit, carpooling, walking, biking, etc. [3]

Against the backdrop of increasing traffic congestion and the resulting diminishing level of service, the City of Calgary has been changing transportation policies from auto-oriented to transit-oriented since 2007. In particular, the Calgary Transportation Plan (CTP) [4] is focusing on developing a public transit network with the aim of encouraging modal shift to more sustainable transportation options. Within Calgary's transportation network, 17 Avenue SE is an important arterial that connects Southeast Calgary and the surrounding regions, particularly the Town of Chestermere to the east, to the downtown. This road is referred to as International Avenue due to the many backgrounds and cultures of nearby businesses and residents.

1.1 Study Area

17 Avenue SE corridor plays many important roles. It is the original main street of the Forest Lawn community, a secondary highway with regional connections, a culturally diverse hub being dubbed International Avenue, and has recently been made part of Calgary's envisioned primary transit and cycling networks. **Figure 1** shows the study area in relationship to the City of Calgary.

1.2 Project Goals and Objectives

The purpose of the Transportation Planning Study was to provide dedicated road space for transit, cycling and walking that is consistent with the community and the City vision and complements the proposed land use concept plan for this corridor. The new

Calgary Transportation Plan (CTP) and Municipal Development Plan (MDP) identify 17 Avenue as a combination of Urban Boulevard and Parkway corridor classifications. In keeping with the City’s Triple Bottom Line targets, as well as their sustainability principles, the objectives of the study were to influence a mode shift by:

- building upon the existing attributes of the area;
- improving deficient aspects of the sidewalk, bicycle, transit and road network;
- promoting active modes of transportation along the corridor;
- designing for the safe and efficient movement of people in the area;
- establishing a dedicated transit-way; and
- enhancing the aesthetic features of the corridor

2.0 Background

In June 2007, The City of Calgary’s Land Use Planning and Policy (LUPP) initiated a land use planning study for the 17 Avenue SE Corridor to establish a vision and long-term sustainable policy framework for land use, urban design and mobility to realize the potential of the Southeast 17 Corridor. The Concept Plan is in alignment with Council’s “Sustainability Principles”, the Municipal Development Plan (MDP) and the Calgary Transportation Plan (CTP).

In May 2009, AECOM began conducting this transportation planning study on behalf of the City of Calgary (City) to determine the feasibility of a multi-modal corridor consistent with the community and City vision that complements the proposed land use concept plan prepared for this corridor by the City of Calgary’s Land Use Planning and Policy (LUPP), to identify the ultimate preferred cross-section for the corridor, and to identify the required right-of-way to accommodate the cross-section. As part of the study, issues such as safety, parking, access management, environmental and utility impacts and stormwater management were identified and addressed in the ultimate preferred concept. Additionally, a proposed alignment for the transit route through Inglewood was identified.

The CTP acknowledges that despite walking, cycling and transit being more sustainable modes of transportation, the majority of daily trips are still expected to continue to be made by private vehicles. However, achieving sustainability will require significant mode shift. Keeping these in mind, the CTP lays out the following goals for mode shift for the next 60 years [4]:

Table 1: CTP Goals for Modal Shift

Mode	Current	Desired
Walking/Cycling	14%	20-25%
Transit	9%	15-20%
Vehicles	77%	65-55%

The CTP emphasises that *increasing variety of transportation choices made by Calgarians in the future can be effectively accommodated by putting the right type of infrastructure in the right place [4].*

17 Avenue SE corridor plays many important roles. It is the original main street of the Forest Lawn community, a secondary highway with regional connections, a culturally diverse hub being dubbed International Avenue, and has recently been made part of Calgary's envisioned primary transit (with two primary transit hubs at the intersections of 17 Avenue SE with 36 Street SE and 52 Street SE) and cycling networks.

In line with the CTP's goals for mode shift and the aims of the Primary Transit Network (PTN), the Southeast 17 Corridor Study (LUPP) includes a vision that *"17 Avenue SE functions as a multi-modal urban boulevard where walking, cycling and transit are the priorities, though it continues to accommodate moderately high volumes of traffic serving the needs of both local residents and businesses and the needs of those commuting through the area to the Downtown and connecting to Deerfoot Trail."* The land use study further lays out the following guidelines for creating an urban boulevard [5]:

- Ensure connectivity between pedestrian, bicycle, transit and road facilities
- Encourage safe movement along the Corridor, within the area, and amongst the various transportation modes
- Add transit priority measures to make transit services faster and more reliable
- Accommodate the needs of both local and regional transit
- Provide adequate short term parking facilities
- Provide safe and high quality bicycle storage facilities
- Improve sidewalks along the Corridor and at other key places within the surrounding areas
- Create a tree-lined boulevard along the length of the Corridor

The CTP identifies 17 Avenue SE as having Urban Boulevard and Parkway segments. An Urban Boulevard is identified as a corridor that promotes walking, cycling and transit, and accommodates reasonably high volumes of vehicular traffic. A Parkway focuses on pedestrian and cyclist movements (both recreational and commuting) but accommodates all modes of transportation [4]. The CTP explains that multi-modal streets provide choices for people who want to walk, cycle or take transit and this in turn increases capacity of the overall transportation system by reducing the number of unnecessary automobile trips on the streets. This study, therefore, attempts to achieve/establish, through innovative planning and future development goals, a distinctive and character based community in the Greater Forest Lawn area that complements the diversity and values of the residents and supports the long term goal of modal shift, accompanied by improved safety.

The goal of the Transportation Planning Study (TPS) for 17 Avenue SE is to design a transportation corridor that promotes alternative and active modes of transportation and complements the land use concept. As part of the study, issues such as safety,

parking, access management, environmental and utility impacts and stormwater management were identified and addressed in the ultimate preferred concept.

3.0 Existing Conditions

Today, 17 Avenue SE is auto-centred with a four, and sometimes six-lane cross section with significant congestion during peak periods. Sidewalks along 17 Avenue SE are discontinuous and have a narrow clear path due to road signs and amenities. No dedicated cycling infrastructure exists, and connecting with Calgary’s downtown involves sharing a narrow pathway with pedestrians over several bridge structures. Transit service is frequent and experiences some of the highest ridership city-wide, despite the many passenger access deficiencies.

3.1 Existing Cross-section

The length of the study corridor is approximately 6 km between 26 Street SE and 84 Street SE. The geometric features of the cross section and existing right-of-way vary along this corridor, as per **Table 2**:

Table 2: Existing Roadway Features

Segment	Right-of-Way (m)	Posted Speed Limit (km/h)	# / Type of Lanes
26 – 36 St SE	38.4 – 51.1	50	<ul style="list-style-type: none"> • 4 – 6 lanes • 3.7 m inner (median), 4.3 m outer • Left turn bays at all intersections
36 – 52 St SE	20.1 – 51.3	50	<ul style="list-style-type: none"> • 4 lanes • 3.0 m through lanes, 2.6 m turn lanes • Left turn bays at most intersections
52 – 68 St SE	28.8 – 38.4	60	<ul style="list-style-type: none"> • 4 lanes • 3.7 m through lanes, 3.5 m turn lanes • Left turn bays at most intersections
68 – 84 St SE	46.5 – 49.0	60	<ul style="list-style-type: none"> • 4 lanes • 3.7 m lanes • Auxiliary lanes at most intersection

3.2 Existing Transit Mode Share

Using the 17 Avenue SE bridge across Deerfoot Trail and the Bow River as the entry/exit point of the 17 Avenue SE corridor, mode share was estimated for AM trips out of the corridor and PM trips into the corridor. The transit on-off counts obtained from the City of Calgary do not reflect transfers from or to other routes. The mode shares of trips that take place within the corridor were therefore estimated using alternative forms of data.

The data suggests that fewer cars are currently traveling eastbound on the bridge in the PM peak period than westbound in the AM peak period. In contrast, it is assumed that

the current transit loads across the bridge are balanced in the AM and PM peaks. As a result, the transit mode share estimate for 2009 is larger in the PM peak (23%) into the corridor than in the AM peak (17%) out of the corridor. It would be expected that the transit mode share of trips to work in the peak periods from this area would be higher than the city-wide average, given the higher level of transit service, and the downtown orientation of trips leaving this corridor would be another factor that would suggest that the transit mode share of trips leaving this corridor should be higher than average.

The following charts summarize the mode share estimates and assumptions used in their calculation.

Table 3: Mode Share for WB Trips (2009, AM Peak)

Mode	Mode Share	Passengers Over Two Hours
drivers	75%	4,934
passengers	8%	493
transit	17%	1,140
bicycle	0%	0
pedestrian	0%	0
TOTAL	100%	6,568

Assumptions:

- Average bus load of 40 people crossing the bridge in the westbound direction in the peak hour
- 30 buses travelling westbound over the two-hour peak period
- Traffic volume estimates for peak hour, with an applied factor of 1.9 for two-hour peak period
- 1.1 people per car
- No one walks or bikes across the bridge because there is no infrastructure for safely doing so

Table 4: Mode Share for EB Trips (2009, PM Peak)

Mode	Mode Share	Passengers Over Two Hours
drivers	70%	3,435
passengers	7%	344
transit	23%	1,140
bicycle	0%	0
pedestrian	0%	0
TOTAL	100%	4,919

Assumptions:

- Average bus load of 40 people crossing the bridge in the eastbound direction in the peak hour
- 30 buses travelling eastbound over two hour peak period
- Traffic volume estimates for peak hour, with an applied factor of 1.9 for two-hour peak period
- 1.1 people per car
- Express buses are included in the calculation
- No one walks or bikes across the bridge because there is no infrastructure for safely doing so

3.3 Existing Pedestrian & Cyclist Facilities

The diverse mix of land uses along the 17 Avenue SE corridor generates significant local travel demand, with short trips of this nature being most practical for sustainable travel modes. An assessment of existing infrastructure for sustainable modes of

transportation along 17 Avenue SE confirmed that most sections of the corridor are not an attractive environment for pedestrians, cyclists, and other users.

The Transportation Association of Canada (TAC) recommends 2.0 m width for sidewalks against curb, 1.5 m for sidewalks not against curb, and at least 2.4 m in commercial areas [6]. Within the study area, however, sidewalks against curbs were observed to be approximately 1.5 m, while sidewalks separated from the roadside were 1.3 m to 1.4 m wide, even in commercial areas. Narrow sidewalk widths make it difficult for pedestrians to pass or walk side by side comfortably, and reduce the width available for vulnerable users such as elderly pedestrians and persons in wheelchairs. The sidewalk on the north side of 17 Avenue SE is relatively continuous from Deerfoot Trail to 68 Street SE, while the sidewalk on the south side of the street runs more disjointedly from 26 Street SE terminating at Hubalta Road.

There are six signalized pedestrian crossings along 17 Avenue SE east of 26 Street SE, although pedestrians were still observed to cross in non-designated mid-block locations, often waiting in the narrow median. Aside from the limited pedestrian facilities, there was no other infrastructure for sustainable modes (e.g. cyclist facilities) along 17 Avenue SE, with the exception of four pathway connections to parks.



Figure 2: Pedestrians cross roadway mid-block; waiting in median



Figure 3: Sidewalk ends abruptly; no continuation on other side of intersection

3.4 Safety Issues/Concerns: Existing Facilities

A field investigation was undertaken to identify safety issues and user design problems. A lack of design, alignment, and treatment consistency was noted throughout the study area with discrepancies often observed between adjacent blocks. The following issues were noted:

- Vehicles diverging from 17 Avenue to parallel service roads, retail complexes, and parking area created conflicts. Through traffic would have to slow or evade

vehicles exiting 17 Avenue, an issue that appears to be exacerbated by the number of access points along the corridor.

- Rapid lane changes and departures from 17 Avenue SE were witnessed. Interactions between buses navigating designated stops and joining/existing traffic in the curb lane were seen, which may have been affected due to proximity of access points and stops.
- Additionally, a number of business's street-front parking facilities are very shallow resulting in patron parking on the sidewalk, which in turn caused further conflict points for vulnerable road users (VRUs) and main road traffic.
- Active mode travel on sidewalks revealed a number of challenges and deficiencies as well. Most prominent were conflicts resulting from the number and variety of users using the same limited path, such as in-line skaters and elderly pedestrians. A large number of cyclists were seen to travel along the pedestrian sidewalk and areas of grass, and only a few were observed on the roadway.
- Other identified issues included lack of a continuous path across intersections, bus benches and shelters on the sidewalk, control devices and light standards install within the pedestrian path, abrupt sidewalk terminations, and retail food drive-thrus that exist directly onto pedestrian areas.

Overall, the following issues represent potential safety hazards along the 17 Avenue SE study area:

- Lack of consistent alignment for roadway and sidewalks
- Diverse range of road users without optimal design or accommodation for any given mode
- Often only a single narrow sidewalk is provided to accommodate the variety of active modes users
- Sidewalk or path absent from several areas
- 17 Avenue SE access management issues (location and frequency)

4.0 Proposed Plan

4.1 Preliminary Alternatives

Three preliminary alternatives were developed. For each alternative, one cross-section at a mid-block location and one at an intersection were developed, for both the Urban Boulevard and Parkway street concepts. The main features of the roadway are the same for both concepts with the difference being in the slightly wider green boulevards for the Parkway section. Another difference is the existence of a multi-use pathway in the Parkway section instead of the sidewalks included in the Urban Boulevard section. The design speed for the Parkway is 70 km/hr and is 60 km/h for the Urban Boulevard but the same traffic lane widths (3.5 m) are used for both concepts. All alternatives include adequate width for the potential future upgrade of the transit system to a Light Rail Transit (LRT) system when warranted. The transit stations are situated at the far side of intersections at specified locations. In general, left turn lanes were provided only at intersections where transit stations are proposed. This feature was adopted to

minimize the need for wider rights-of-way and to reduce impacts on existing properties. Although limiting the number of left turning opportunities restricts motorists, it will enhance operation of the median transit system. Street parking (within the boulevard) was suggested in certain areas for Alternatives 1 and 3 to offset the loss of parking spaces due to the road widening.

Alternative 1

Alternative 1 consists of four lanes of vehicular traffic and two dedicated transit lanes in the median. The ultimate cross-section also includes dedicated on-street bike lanes, boulevards and sidewalks. The transit stations are provided along the median transit lanes at predetermined locations. Two typical cross sections are presented in each figure, one represents an area with a transit station (representing the highest width of the roadway) while the other is for locations where no stations exist (representing a mid-block cross-section).

Alternative 2

Alternative 2 consists of four lanes of vehicular traffic and two curb side dedicated transit lanes. The ultimate cross-section also includes dedicated on-street bike lanes, boulevards and sidewalks. The transit stations are provided along the curb side transit lanes at predetermined locations. Two typical cross sections are presented in each figure, one represents an area with a transit station (representing the highest width of the roadway) while the other is for locations where no stations exist (representing a mid-block cross-section).

Alternative 3

Alternative 3 is similar to Alternative 1 but with two lanes (instead of four) of vehicular traffic. All other features are the same as in Alternative 1. Two typical cross sections are presented in each figure, one represents an area with a transit station (representing the highest width of the roadway) while the other is for locations where no stations exist (representing a mid-block cross-section).

4.2 Proposed Concept

Evaluation

In order to evaluate each alternative and identify a preferred, a set of evaluation criteria was created. A weighted comparative analysis of the three alternatives was carried out using five main criteria: *safety, operations, sustainable modes, cost, and social and environmental impact*. Each criterion was independently rated and then weighted using the relative importance of each criterion to identify the preferred alternative.

Recommended Roadway Concept

The recommended concept promotes a mode shift by providing:

- median transit lanes with transit priority at signalized intersections to provide uninterrupted operation, reliability and station integration opportunities;
- wide sidewalks and boulevards to establish an urban character and allow inclusion of historic elements, including diagonal parking;
- on-street bike lanes to clearly define cycling as a legitimate mode and to appeal to less confident cyclists;
- an enhanced auto capacity due to the removal of transit operations from vehicular lanes and potential bus-bike and bus-car conflicts at intersections; and
- transit stations located near higher density development according to the land use concept

The proposed roadway concept met the stated objectives of the study:

Table 5: Proposed Roadway Attributes

Objectives	Roadway Attribute
Build upon the existing attributes of the area	A modified cross-section is proposed between 33 Street SE and 45 Street to include angled parking, one of the lasting features of the original Main Street of the Town of Forest Lawn. Enhanced walking and cycling facilities will also support the Main Street feel.
Improve the deficient aspects of the sidewalk, bicycle, transit and road network	<p>The current sidewalks are discontinuous and inconsistently in width and location. The proposed roadway concept provides sidewalks on both sides of the roadway, of consistent width and location, with multi-use pathways along the Parkway segment.</p> <p>Currently, there is no dedicated cycling infrastructure along the roadway. Cyclists must use the sidewalk network, which is incomplete. The proposed roadway concept will provide on-street dedicated bike lanes along the entire length of the corridor, as well as multi-use pathways along the Parkway segment.</p> <p>The current transit routes are shared with vehicular traffic, with no priority provided. The proposed roadway concept will provide dedicated transit lanes with priority at signalized intersections.</p>
Promote active modes of transportation along the corridor	The corridor is currently an inhospitable area for pedestrians and cyclists, with little to no infrastructure provided for safe and efficient movement, and an unpleasant environment. The proposed roadway concept will result in the provision of pedestrian and cyclists facilities, and the associated land use plan will encourage the redevelopment of the area to enhance the public realm through open and green spaces and street-level retail.

Objectives	Roadway Attribute
Design for the safe and efficient movement of people in the area	<p>This was accommodated in a number of ways:</p> <ul style="list-style-type: none"> • Dedicated median transit lanes will reduce conflicts between buses and other vehicles • Continuous and wide sidewalks will provide a safe environment for walking for all pedestrians, including seniors • Dedicated bike lanes provide a suitable environment for cyclists and will reduce conflicts with pedestrians • Reduction in the number of driveways and access points is expected to reduce potential conflict points • Wider lanes (through and auxiliary) will enhance vehicular commutes along the corridor • Reduced design speed (50 km/h) for a portion of the Urban Boulevard will provide traffic calming
Establish a dedicated transit-way between the east-city limit and the downtown core.	The proposed roadway plan recommends dedicated median transit lanes along the 17 Avenue corridor, with a dedicated right-of-way through Inglewood and into the downtown core.
Enhance the aesthetic features of the corridor.	The proposed roadway plan recommends green boulevards on both sides that separate sidewalks from traffic lanes. In addition, available width along the central median will also be used as green areas.

Modifications to Recommended Roadway Concept

Specific modifications were made to the typical cross-section within a portion of the Urban Boulevard (between 33 Street and 45 Street) to address individual needs along the corridor. These included:

- Angled parking on the south side of 17 Avenue SE between 33 Street SE and 35 Street SE. This is accommodated by eliminating the green boulevard and moving the sidewalk further back to the edge of the existing buildings to create a parking area that will accommodate one row of 45° stalls aligned along the sidewalk. The parking area has a one-way driving lane that is separated from the main traffic lanes by a 2.0 m wide raised median.
- Slight alignment shifts to reduce the impact on existing buildings.
- Slight narrowing of the cross-section, accompanied by a reduction in design speed from 60 km/h to 50 km/h, to reduce impacts on existing properties and buildings between 36 Street SE and 45 Street SE by revising:
 - The vehicle lane widths as follows:
 - 3.3 m for regular traffic lanes instead of 3.5 m

- 3.1 m for left turn lanes instead of 3.35 m
- The dedicated transit lane width at the station area: 3.5 m instead of 3.75 m for both directions
- The width of the transit stations: 3.0 m instead of 4.0 m
- The cyclist lane width: 1.3 m instead of 1.5 m
- The green boulevard widths: 2.65 m instead of 3.15 m
- The width of the separate sidewalk: 2.5 m instead of 3.0 m

The recommended cross-sections are shown in **Figures 4 to 6**; **Figure 7** displays a sample segment of the proposed roadway.

5.0 Expected Impacts on Mode Share

One of the primary goals of the project was the encouragement of travel mode choice modifications, from single-occupancy vehicles to transit, cycling and walking.

5.1 Transit Ridership

The preferred cross-section for the 17 Avenue SE corridor includes two median transit lanes, four auto lanes and on-street bike lanes. Before finalizing the preferred cross-section, the City modeled and tested traffic operations to confirm the effectiveness of the proposed transit-way for the design year (2035). The model assumed that the exclusive transit-way would continue from the 17 Avenue SE corridor to the downtown. The model indicated that there will be a significant increase in transit ridership on 17 Avenue SE, which will impact the auto traffic in this corridor.

The modal shift is attributed to:

- a reduction in the level of service for vehicular traffic along the corridor as no additional traffic lanes are being provided to accommodate growth; and
- the provision of exclusive transit lanes ensuring timely and reliable access to and from downtown core

It is estimated that by horizon year the proposed transit-way will almost double the transit ridership for the 17 Avenue SE corridor.

5.2 Cyclist & Pedestrian Environment

The Calgary Transportation Plan identifies 17 Avenue as a link in the primary cycling network [4]. A regional pathway also connects this corridor with other parts of the City. The segment of 17 Avenue SE east of 52 Street SE will serve as a Parkway which promotes public realm by giving priority to pedestrians, bicyclists and transit and discourages goods movement.

The proposed transportation plan complements the land use concept prepared by the City for this corridor. The land use concept promotes public realm and identifies various character areas like main street retail, mixed land use and parkway for the study corridor. Exclusive on or off-street bike lanes and pedestrian sidewalks with boulevards

to support the 'green street' network will encourage road users to use these active modes of transportation for short and long commutes.

The existing corridor west of 36 Street SE has been identified as main street retail. This area has a unique heritage to which the local community is strongly attached. LUPP and Transportation Planning tried to protect various aspects of the local heritage. This segment of the corridor has a wide right-of-way available as service roads and off-street parking is provided in various blocks of this corridor. An effort was made to protect the local heritage by retaining angle parking that will be served through a service/frontage road. The protection of local heritage will draw auto and pedestrian traffic to this segment of the corridor.

Linear parks, street parks and pocket parks along the corridor will provide year round access to the public, which will help reduce greenhouse gas emissions by shifting public from auto to transit and other active modes of transportation.

6.0 Conclusion

Recent growth in Calgary has increased pressures on the current transportation infrastructure, leading to increased congestion and travel times, decreased levels of service, and frustrated road users. Solving these problems requires innovative solutions that provide sustainable results. An attempt to create a multi-modal environment is presented in this paper, in which an expected shift away from the car to other, more sustainable transportation modes (transit, cycling, and walking) will reduce dependency on the private vehicle. The recommended 17 Avenue SE transportation corridor, which includes dedicated transit lanes, continuous bike lanes, separated sidewalks, and continuous green boulevards, is expected to encourage the use of transit, cycling and walking along this corridor. The result will be a decreased level of reliance on private vehicles, enhanced safety and health of road users, environmental preservation, and a shift to more sustainable modes of transportation.

7.0 References

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- [6] Transportation Association of Canada, 2007. Geometric Design Guide for Canadian Roads, Section 2.2.6.1.



City of Calgary

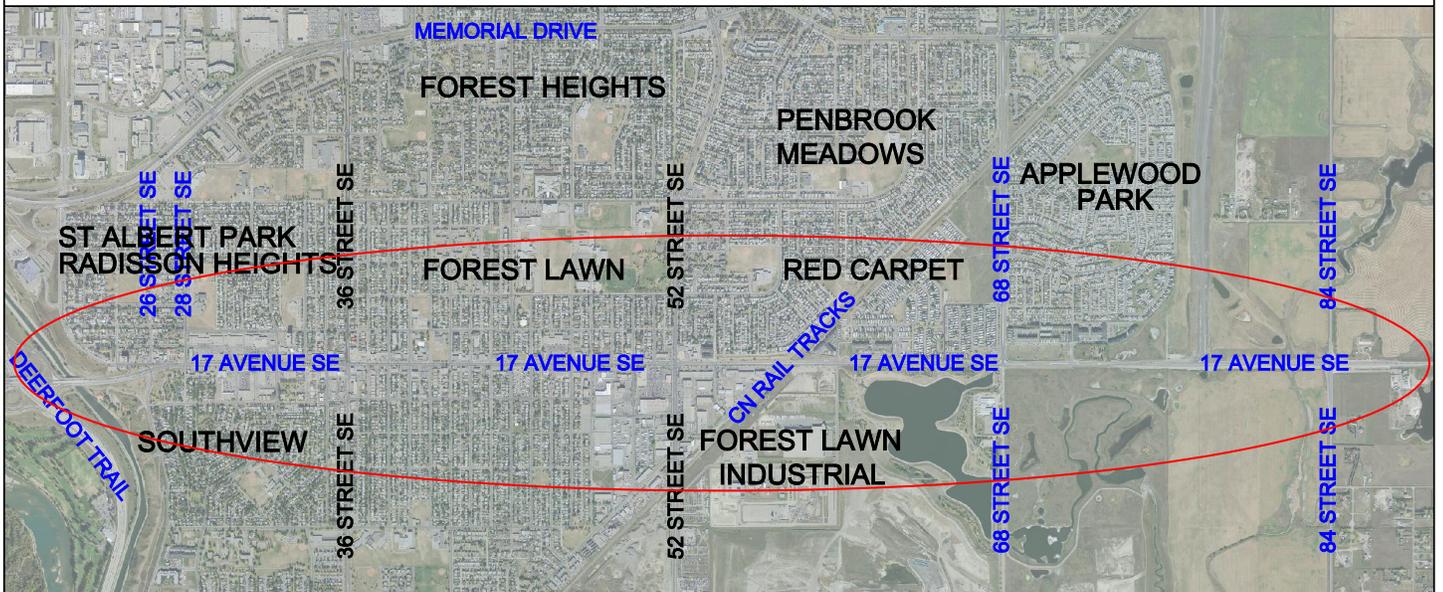
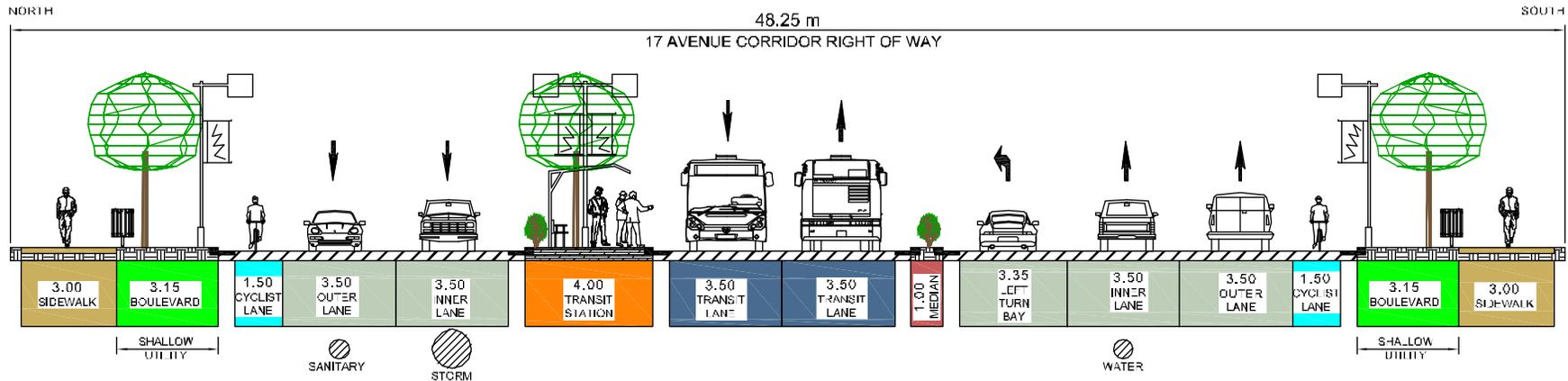


Figure 1: Study Area

URBAN BLVD. SECTION (EAST OF 28 ST. TO WEST OF 36 ST. & EAST OF 45 ST. TO 54 ST)
TYPICAL CROSS SECTION AT STATION AREA



URBAN BLVD. SECTION (EAST OF 28 ST. TO WEST OF 36 ST. & EAST OF 45 ST. TO 54 ST)
TYPICAL CROSS SECTION OUTSIDE STATION AREA

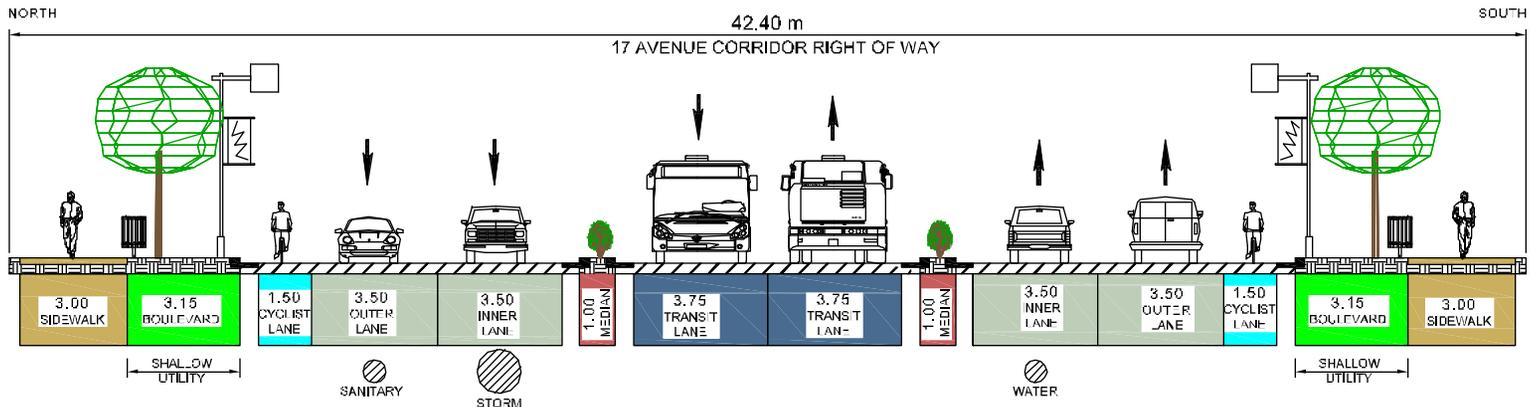
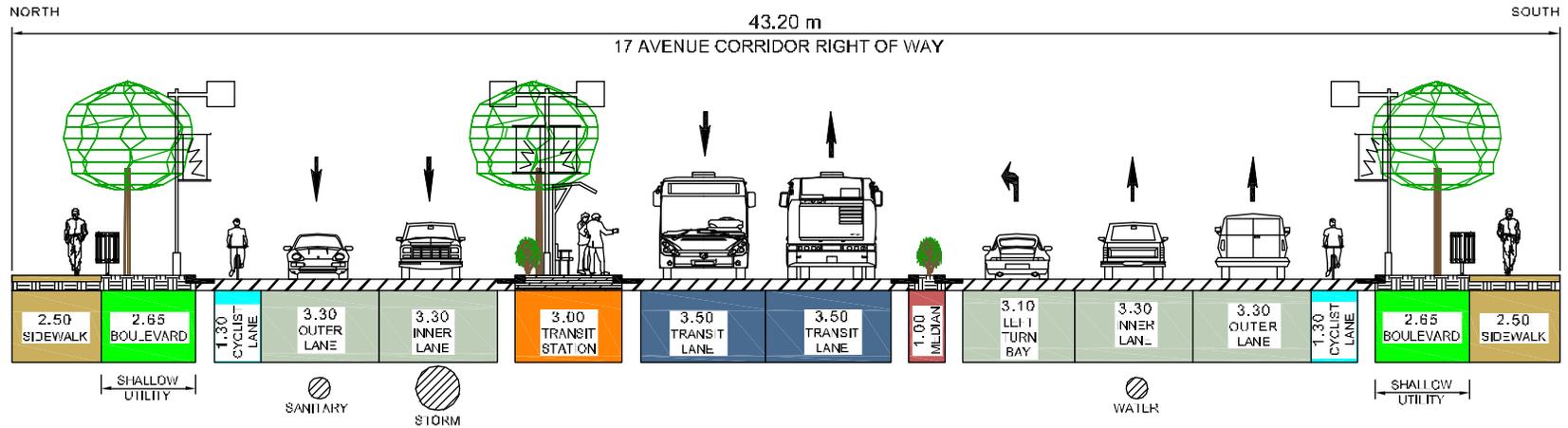


Figure 4: Cross - Section for Urban Boulevard Segment

URBAN BLVD. REDUCED SECTION (WEST OF 36 ST. TO EAST OF 45 ST.)
TYPICAL CROSS SECTION AT STATION AREA



URBAN BLVD. REDUCED SECTION (WEST OF 36 ST. TO EAST OF 45 ST.)
TYPICAL CROSS SECTION OUTSIDE STATION AREA

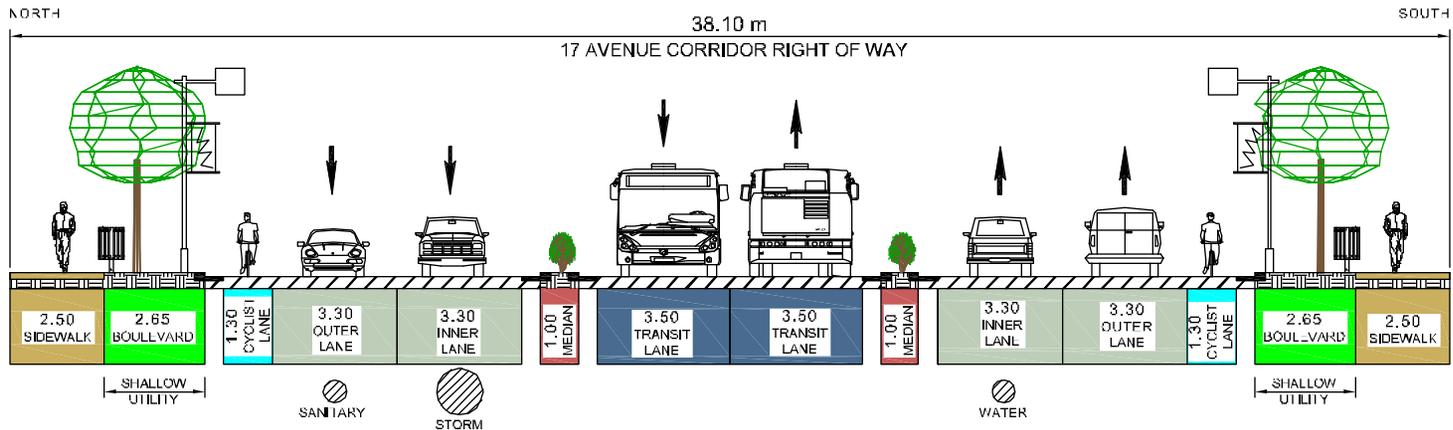


Figure 5: Cross - Section for Reduced Urban Boulevard Segment

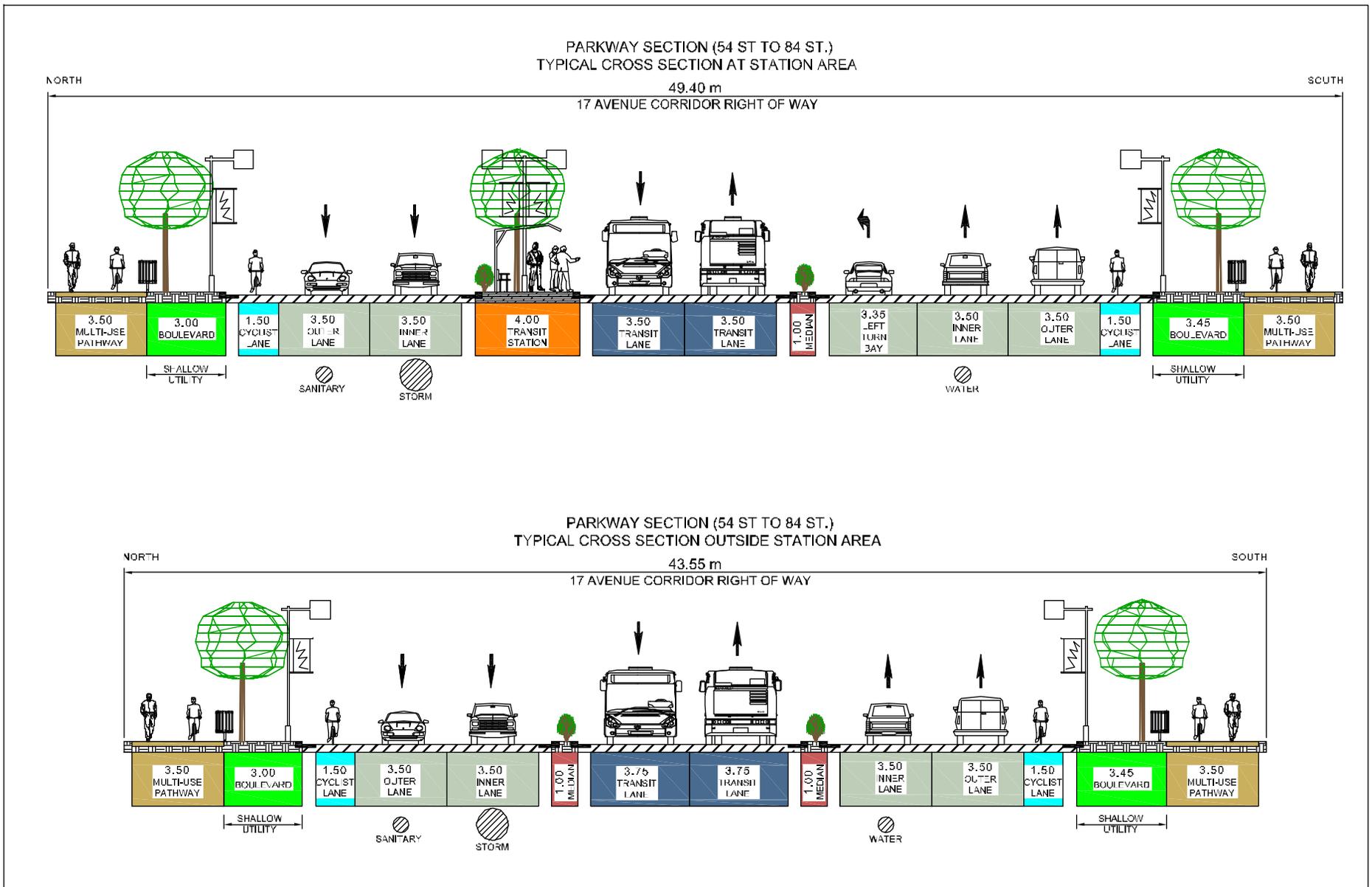
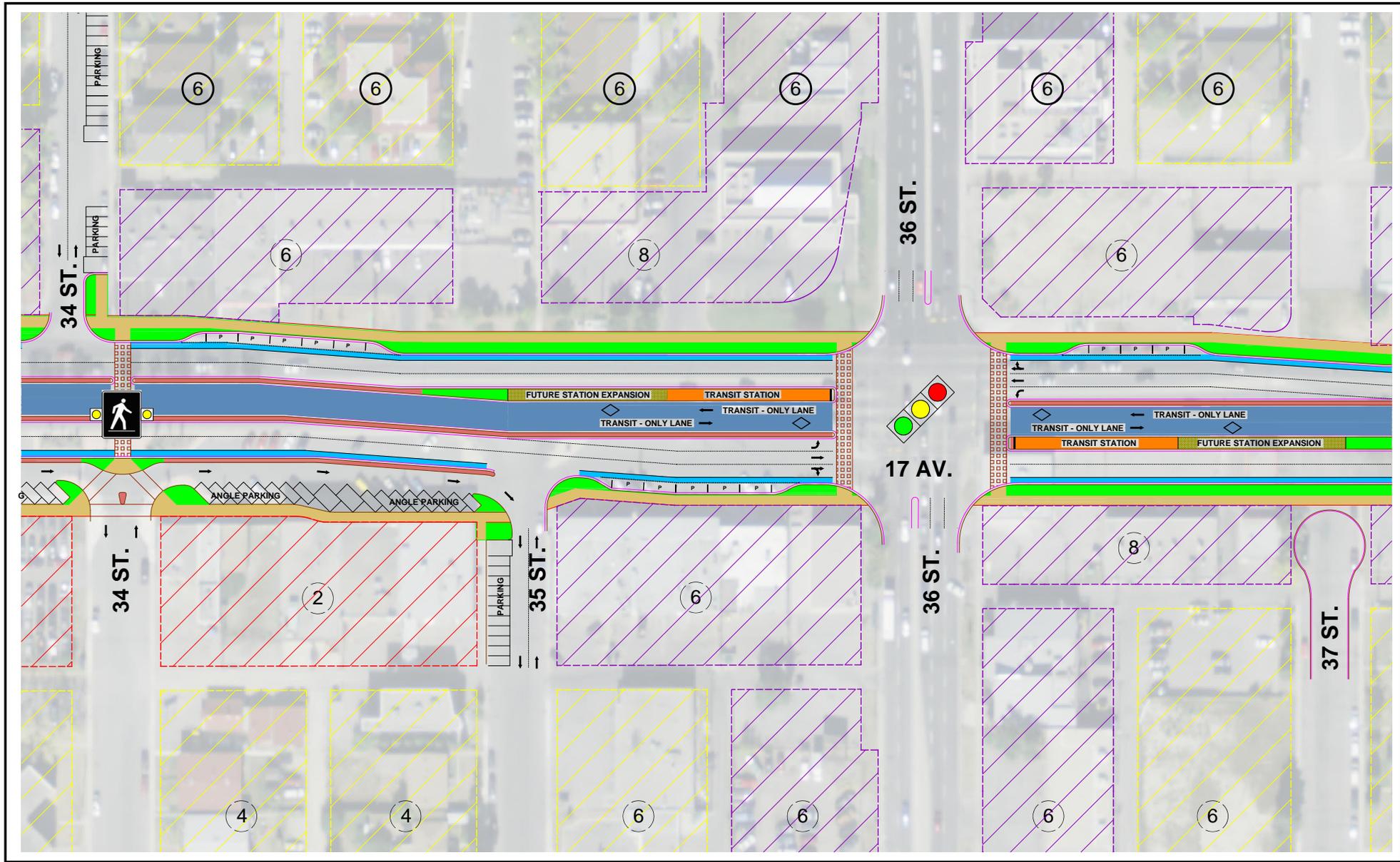


Figure 6: Cross - Section for Parkway Segment



LEGEND

- | | | | | | |
|--------------------|---------------------|----------------------------------|--------------|--------------------------|---------------------------------|
| Corridor Mixed Use | Main Street Retail | Transit Station | Cyclist Lane | Green Boulevard & Median | Crosswalk |
| Multi-Residential | Transit - Only Lane | Future Transit Station Expansion | Sidewalk | Median | Max. Building Height (# Storey) |



Figure 7: Segment of Proposed Roadway Plan