Multi-use Trail Hard - Medicine to Prescribe and Swallow

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1. Abstract

This project consisted of the upgrade of South Ridge Drive, a residential collector roadway in the City's south side, to an arterial standard due to increased volumes and congestion driven by growth. The client (City of Medicine Hat) wanted to provide an upgrade that also accommodated active transportation modes.

The challenge was to provide the right active transportation facility within the corridor and especially within the much narrower right of way (~25 m) that existed in one third of the corridor. A public process was developed for the project as a whole.

Several active transportation (AT)-related issues arose during this process. The objective became to design an AT facility that met the needs of non-motorized users and encouraged new users, all while balancing the competing demands of property owners, available ROW, cost-effectiveness, safety, drainage, parking, maintenance, environmental impacts and the requirements of the roadway geometric upgrade.

A backgrounder document was provided to the client that summarized the pros and cons, design characteristics and associated signage and pavement markings of on-street vs. off-street facilities. Four facility types were considered: (a) shared on-street bike lanes, (b) exclusive on-street bike lanes, (c) 3.0 m off-street multi-use trail (MUT) and (d) 4.0 m segregated, signed, marked, MUT. Numerous iterations (16) of cross sections showing the various alternatives that were developed and analyzed. As the project was a retrofit in an established neighborhood, the decision on which facility type to incorporate into the project was to be made by City Council.

In order to provide a higher degree of objectiveness, and provide Council with as much information as possible on the various alternatives and allow them to make a more objective and informed decision, an evaluation matrix was developed to rank the alternatives to facilitate the decision making process. This quasi-"Triple Bottom Line" analysis considered 32 criteria categorized into three different groups – social, environmental and economic.

Based on the outcome of the analysis, Council decided that a 3.0 m off-street facility was the best solution. This preferred design, which incorporated concerns raised by the public process where possible, was presented at a final open house. It incorporated TAC's new "elephant feet" crossings at intersections and a 1.0 m boulevard between the roadway and the MUT which were both subsequently removed for various reasons.

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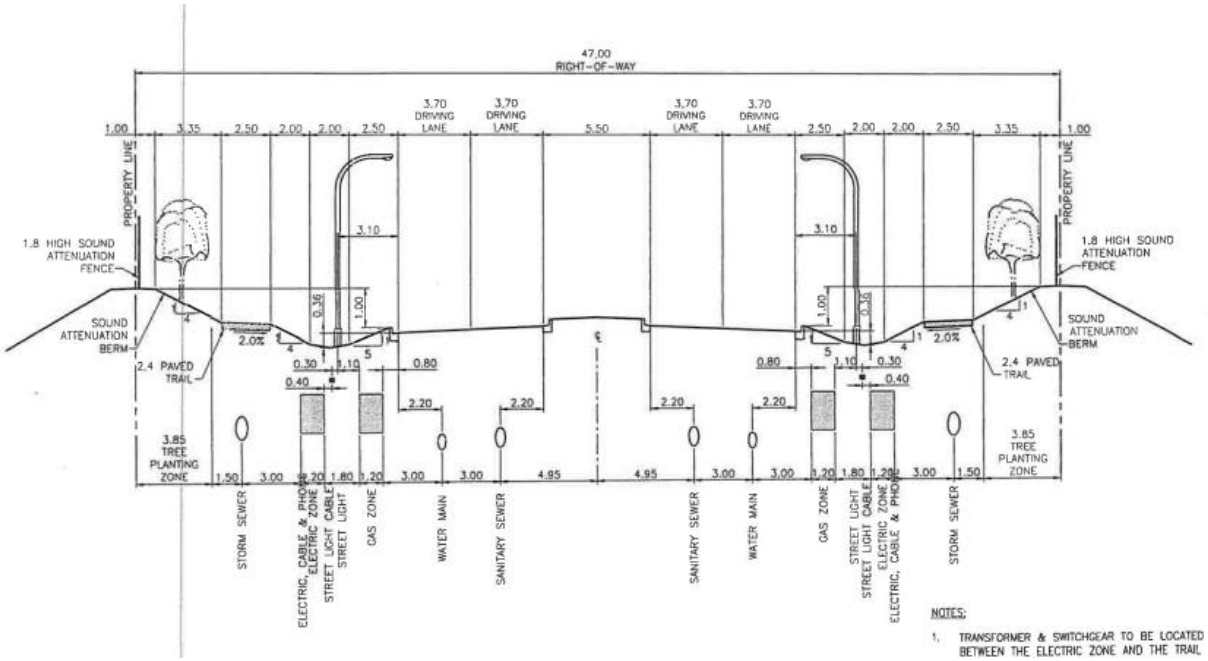
3. Background

The City of Medicine Hat is familiar with the need for sustainable solutions. Their Council has been aggressive with the "green" attitude. The City has experimented with geothermal heat, wind energy, solar energy, ways to reduce water consumption and encourage yard recycling. So when it came time to upgrade South Ridge Drive, a high volume residential roadway to an arterial standard, incorporating active transportation in the design process was something they were keen on investigating.

On new arterial roadway construction projects, the City has a current standard that calls for a 3.0 m asphalt multi-use trail (MUT) **(Figure 1)**. The existing right of way (ROW) was constrained to approximately 24 m **(Figures 2A and 2B)** for the northern third of the corridor which was within an established neighborhood **(Figure 3)**. The City's standard called for a 47 m ROW.

Figure 1 – City of Medicine Hat Minor Arterial Standard



As a result of these realities and constraints, two challenges arose:

1. How to best accommodate active transportation modes in the corridor when the standard doesn't quite fit within approximately 30% of it.

2. What *type* of facility would be best for the people of Medicine Hat?

A context-sensitive approach was required.

Figure 2A – Existing Cross Section in Narrow ROW

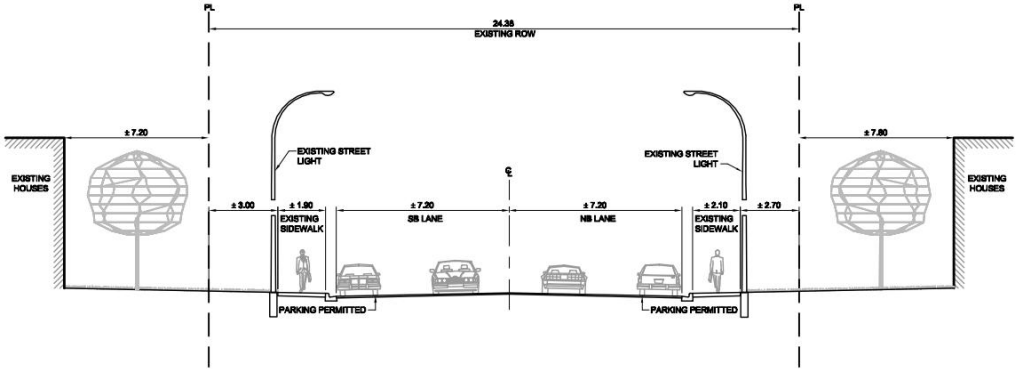


Figure 2B – Plan View of Corridor showing Limits of Narrow ROW

4. Methodology

With the objective of designing a facility that (a) met the needs of current AT users, (b) encouraged new ones and (c) fit within the constrained ROW, consideration prior to and during the public and design processes had to be given to several competing needs / demands / concerns / constraints. Specifically:

a. The roadway geometric upgrade
b. Proximity to private property
c. Available ROW
d. Environmental impacts
e. Acceptance with users and residents
f. Cost-effectiveness
g. The safety of all users
h. Resident concerns over noise
i. AT linkages to existing trails and trip generators i.e. college to the north
j. On-street parking
k. Traffic operations (especially the widest cross sections where left turn lanes were necessary to improve congestion and queues)
l. Maintenance issues i.e. snow removal and/or storage

Figure 3 – Typical Streetview of Narrow Corridor

4.1 Public Process

A style of public process new to the City of Medicine Hat was adopted for the project. The City wanted to experiment with a type of forum new to them: a Community Advisory Group (CAG).

This group consisted of 12 members; among them local residents, residents-at-large, local business owners, a school principle, a condo association president, a developer and an advocate for active and alternate modes. The active modes advocate presented to the CAG during meeting 2 on the benefits of active and alternate transportation. The group met in the pre- and early design stages and was given the opportunity to express their concerns. Four CAG meetings were held over 11 months. Following these CAG meetings, a general public open house was held.

Among the AT and pedestrian safety-related issues that arose during the public process, that subsequently informed the design, were the following:

a. Cycling and walking should be promoted as part of the upgrade
b. The AT facility should be something people would actually use and feel safe using
c. Adjacent properties owners expressed opposition to the encroachment of a MUT closer to their property
d. Snow removal /storage concerns
e. Mature tree loss
f. Residents' preferred use of an existing trail that veered away from the corridor behind residences and would have added an additional 750 m to what would otherwise have been a shorter and more direct route

g. Residents' concerns over the potential conflicts between pedestrians and cyclists on the MUT
h. Safety concerns of pedestrians walking adjacent to the busy roadway and the desire for separation via a boulevard
i. Safety concerns relative to pedestrian crossings used by school children

4.2 Design Process

4.2.1 Backgrounder Document

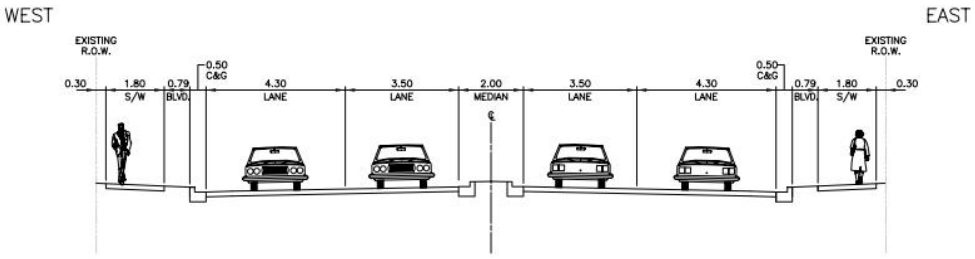
The first step was to determine whether to accommodate cyclists on- or off-street. In order to begin to accomplish this step, a 14 page backgrounder document (based primarily on TAC's *2009 Bikeway Traffic Control Guidelines* with some input from City of Calgary policy documents) was provided to the client summarizing the pros and cons, design characteristics and associated signage and pavement markings of on-street vs. off-street facilities. This form of tutorial allowed us to educate both ourselves and the client and allowed us to better communicate with each other regarding the impacts each type of facility would have, positive or negative, on the upgraded roadway operations and private property.

Four facility types were considered: (a) Shared on-street bike lane, (b) Exclusive on-street bike lane, (c) a 3.0 m off-street MUT and (d) a 4.0 m off-street MUT.

4.2.2 Cross Section Development

The *2005 South Ridge Drive Functional Planning Study* completed by Earth Tech had originally proposed 1.8 m sidewalks on both sides separated from the road by 0.8 m boulevards and included 4.3 m outside lanes for shared on-street cycling and 3.5 m inside lanes separated by a 1.8 m median. AECOM proposed revisiting the use of a median and shared on-street bike lanes and considering instead a 3.0 m off-street multi-use trail which, it was felt, would benefit more non-motorized users.

Figure 4 - 2005 Functional Study Recommended Cross Section



As a follow up to the backgrounder document and to further explore how the various facility types could be incorporated into the ROW along with a 3.0 m MUT, sixteen cross sections showing various design iterations and variations for the various facility types were eventually developed, analyzed, considered and presented to the client for discussions.

The key differences that contributed to the large number of options within and between the various facility types included variations on the following components of the cross section:

a. Vehicle lane width
b. Inclusion or exclusion (and varying widths of) of a median
c. Sidewalk, boulevard and MUT width
d. MUT alignment
e. Inclusion of noise barrier
f. Presence of left turn lanes at intersections

Additional property was not an option the client was interested in.

Following the iterative cross section development process for the various alternatives, a growing body of information had been created. AECOM was still of the opinion that a 3.0 m MUT would be the most appropriate and cost-effective investment in AT. However, a decision on which facility to select was now to be made by City Council.

4.2.3 Evaluation Matrix

In order to provide a higher degree of objectiveness and provide Council with as much information as possible on the various alternatives, thereby helping them make the most informed decision possible, an evaluation matrix was developed to score and rank the alternatives and facilitate Council's decision-making process. This quasi-"Triple Bottom Line" analysis considered 32 criteria categorized into three different groups – social, environmental and economic.

Each facility type was scored initially by AECOM on a scale of 1 to 5. Following our rankings, the City Project Manager and AECOM reviewed, discussed and made some changes to better incorporate the City's perspective.

Scores for the rankings were tallied by adding the number of Xs in each column, multiplying by the value of each column i.e. 1, 2, 3, 4 or 5 and then dividing by the number of criteria (or rows i.e. in the case of environmental or economic, 4). The criteria and scoring applied in the environmental category are shown in Figure 5.

Figure 5 – Evaluation Matrix – Environmental Criteria Ranking

Ranking rationale: 1 least positive, 5 most positive	ON-STREET 1.5 m LANE					WIDE CURB LANE					3.0 m MULTI-USE TRAIL					4.0 m MULTI-USE TRAIL (signs & mrkngs)				
ENVIRONMENTAL	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Decreased emissions / energy consumnption			x					x						x						x
Impact on open areas / green space / trees			x						x				x				x			
Reduce "Environmental Footprint" (Note 2)			x					x							x					x
Reduce Automobile Dependence			x					x						x						x
	3.00					3.25					4.00					4.25				**AVG. SCORES**

The 4.0 m MUT scored the highest in the environmental category even though it had the most negative impact on open areas and trees. The criteria and scoring applied in the economic category are shown in Figure 6.

Figure 6 – Evaluation Matrix – Economic Criteria Ranking

Ranking rationale: 1 least positive, 5 most positive	ON-STREET 1.5 m LANE					WIDE CURB LANE					3.0 m MULTI-USE TRAIL					4.0 m MULTI-USE TRAIL (signs & mrkngs)				
ECONOMIC	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Complexity of design		x					x							x				x		
Capital cost	x						x							x				x		
Maintenance cost		x					x							x			x			
Will use of infrastructure be optimized?		x					x							x						x
	1.75					2.00					4.00					3.25				AVG. SCORES

The 3.0 MUT scored the highest in the economic category. The criteria and scoring applied in the social category are shown in Figure 7.

Figure 7 – Evaluation Matrix – Social Criteria Ranking

Ranking rationale: 1 least positive, 5 most positive	ON-STREET 1.5 m LANE					WIDE CURB LANE					3.0 m MULTI-USE TRAIL					4.0 m MULTI-USE TRAIL (signs & mrkngs)				
SOCIAL	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Conflicts with vehicular traffic at intersections	x					x						x					x			
Conflicts with vehicular traffic flows	x					x									x					x
Conflicts with pedestrian traffic				x					x			x						x		
Conflicts with other altermnate transportation traffic				x					x			x						x		
Conflicts with cyclists overtaking cyclists	x					x						x						x		
Understanding of how to use facility		x					x							x						x
Amount of education needed for proper usage	x					x							x					x		
Facility continuity over the TCH	x					x								x					x	
Hazard of curb and gutter	x					x								x					x	
Hazard of utility pole / light standard / signs / trees					x					x		x					x			
Delayed snow clearing impacts (Note 1)		x					x						x					x		
Use of facility for snow storage					x					x	x					x				
Usable by people of all ages and abilities		x					x								x					x
Impact on transit operations		x					x								x					x
Impact on left- and right-turning vehicles	x					x							x					x		
Recreational benefit			x					x							x					x
Health benefits			x					x							x					x
Impact on traffic speeds (Traffic Calming)		x						x			x					x				
Meets community needs (Note 2)			x					x							x					x
Pedestrian level of comfort (Note 2)					x					x			x						x	
Cyclist level of comfort (Note 2)		x					x							x						x
Consequences of accidents / collisions	x					x							x					x		
Commuter cycling				x					x				x					x		
Compliant with established design guidelines					x					x					x					x
	2.54					2.58					3.38					3.63				AVG. SCORES

Several of the criteria in the social category were able to be ranked based on information in the *2009 Leisure Trails and Alternative Transportation Report (Stantec).*

These included:

a. Meets community needs
b. Pedestrian level of comfort
c. Cyclist level of comfort

The report found that 67% of respondents had not participated in cycling activities that were not located on the leisure trail system. Of this 67%, the reasons were as follows: 49% lack of interest, 12% do not own bikes, 10% too old and 10% physically incapable. 32% had also indicated they felt unsafe cycling on roads.

The report also showed that the stated purposes (in decreasing order) for the use of on-street facilities was for pleasure, exercise, running errands, commuting and high speed training. 64% of respondents said they were unlikely to use on street facilities. 73% of respondents indicated that the continued development of the leisure trail system was most important because they would be used more and are perceived as safer.

Note 1 in the *Delayed Snow Clearing Impacts* criterion in the social category explained that this criterion considered the consequences on the facility of delayed snow removal. For the on-street facilities, this criterion scored less positively based on the assumption that any roadway snow clearing would be pushed to the edge of the roadway and stored in the bike lanes. The off-street facilities score more positively based on the assumption that pathway clearing would not result in storage on the facility.

4.2.3.1 Evaluation Matrix Outcome

The 3.0 m MUT had the highest overall score followed closely by the 4.0 m MUT. The 4.0 MUT lost points in the economic category.

4.2.4 Other influencing Factors

4.2.4.1 On-street parking

In order to provide the basics of the arterial standard (4 lanes and a median) as well as a MUT, on-street parking was eliminated from the design. This loss was mitigated by the fact that most properties fronting onto the street had parking off of the lane behind the residences.

4.2.4.2 Inclusion / Exclusion of Median

The City's arterial standard called for a 5.5 m median (from gutter lips). In the various options, several widths were considered with the most common width being 1.8 m. Ultimately, in order to minimize encroachment toward private property, provide the 3.0

MUT on the west side and permit left turn lanes at two intersections 320 m apart, a median was eliminated from the cross section. Discussions were held regarding the impact on safety of not including a median on a 4-lane roadway on an R200 (50 km/h posted) curve. As there are several other roadways within the City with such laning configurations with low collision history, its removal was deemed to have a low impact on the safety of the roadway.

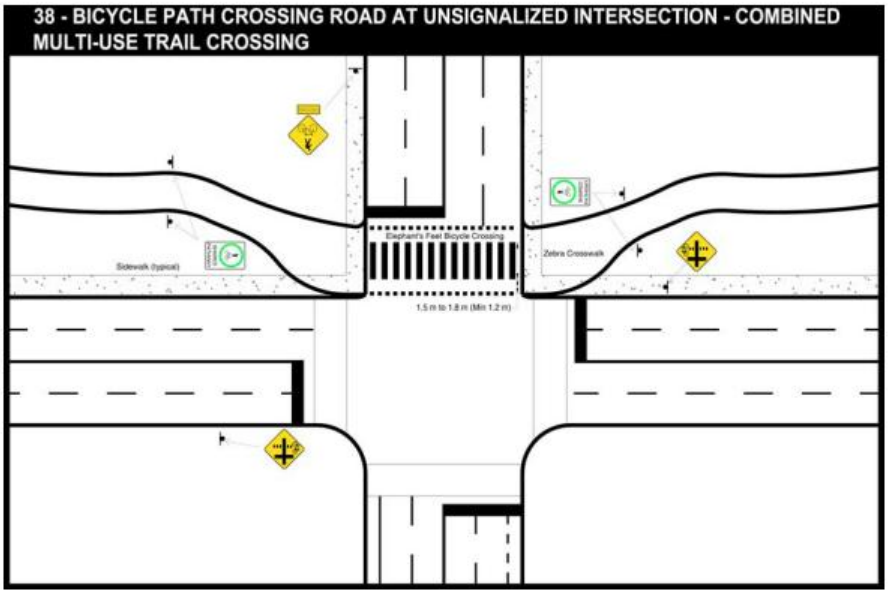
4.2.4.3 Lane Widths

The arterial standard called for 3.7 m lanes. In the various cross section options that were developed, several lane widths were considered with the most common being 3.5 m. In order to minimize encroachment toward private property, accommodate opposing left turn lanes at two intersections and in order to provide the 3.0 MUT on the west side with a boulevard, a combination of reduced lane widths were ultimately selected. Outside lanes were set at 3.5 m, inside lanes at 3.4 m and left turn lanes at 3.2 m. These widths were derived in consultation with Swanson Transportation Consultants Ltd. Reductions in lane width were made in consideration of the fact that the corridor was expected to be a truck route.

4.2.4.4 Elephant's Feet

The client was introduced to the idea of using elephant's feet **(see Figure 8)** for the MUT crossings over the side streets. Elephant's feet paint markings and their associated signs are intended to permit cyclists to ride within the crosswalk without dismounting. The client had tentatively approved their use pending further investigation of their operational, safety and any legal implications.

Figure 8 – Elephant's Feet



Source: 2009 Bikeway Traffic Control Guidelines for Canada

Further investigation involved discussions with Boulevard Transportation Group in Victoria who were instrumental in developing the elephant's feet concept.

The elephant's feet paint markings (alternating 400 mm squares and gaps adjacent to the crosswalk) and their associated signage were included in the plans shown during the public process. They did generate considerable discussion with a cycling advocate and a retired police officer at the open house.

With the further investigation came the concerns regarding the potential safety implications that may arise with their use. Specifically, it could not be determined with sufficient clarity exactly whom had the right of way – the cyclists or the vehicles. It was determined after some discussion that even if it *was* known who had the right of way, communicating this to the public may not be as successful as one would hope. As such, there could be potential for confusion and ultimately, potential vehicle – pedestrian conflicts. The question arose as to who would be at fault should a collision occur.

TAC's *2009 Bikeway Traffic Control Guidelines for Canada* states that "some signs and markings in this report may conflict with provincial legislation or with an agency's regulations and/or policies. It is up to the practitioner to use engineering judgment and maintain the current state of practice appropriate to the jurisdiction."

Should the City have chosen to implement this feature, it would have had to create or modify a bylaw as their use currently conflicts with the Alberta Traffic Safety Act. This was something they were prepared to do had they decided to support their inclusion in the design.

Unfortunately, creating a MUT that permitted commuter cyclists (for which a critical mass is nowhere near being formed in the City of Medicine Hat) to maintain a higher degree of speed and continuity within the corridor did not become more than a theoretical possibility. Ultimately, the decision was made to exclude them. The client felt that once elephant feet become more common-place, they would reconsider their implementation.

4.2.4.5 Boulevard, Private Property and Trees

One of the primary objectives in all of the cross sections was to maximize the boulevard size thereby addressing the pedestrian safety concerns expressed by the CAG. This was achieved by effectively "pushing" the east side sidewalk and west side MUT out to 0.15 m from the property line. This created a boulevard that varied from 0.0 m at intersections to up to 2.3 m on the west side.

This maximum of 2.3 m was eventually tempered with the competing, and far more politically and emotionally charged, concerns of private property owners. The boulevard width widths eventually evolved into placing a maximum of 1.0 m in order to minimize the encroachment toward private property. Ultimately, as a result of discussions with

property owners, the boulevard width was reduced to 0.0 m. This decision was made by the City and was due primarily to the fact that one property owner, whose home was slightly closer to the roadway and who had a customized driveway layout, would have been dramatically impacted by the 3.0 MUT and had his driveway operations severely impacted.

The decision was made to accommodate this particular resident. In order to eliminate the potential perception of preferential treatment, it was decided to give all residents the same "relief" and eliminate the boulevard completely throughout the narrow segment of the corridor.

The various cross section iterations came with their own accompanying impacts on mature trees. Prior to the decision to eliminate the boulevard entirely, efforts were made to vary the MUT alignment, trail width and boulevard width to avoid impacting trees.

By ultimately eliminating the boulevard between the MUT and the roadway, the need for removing mature trees was reduced. There still remained however, due to the narrow ROW and the inability to narrow the roadway lanes any further, the need to remove 9 mature trees. Where trees were to be removed, replacement (semi-mature) trees are to be planted.

4.2.4.6 Signage and Pavement Markings

Discussions were held early on regarding how to sign and mark the trail. Several comments were received during the public process indicating that people would prefer segregated use and the accompanying signs and markings. As multi-use trails are already understood to be shared use in the City, the decision was made to install no signs or markings.

4.2.4.7 Related Active Transportation Improvements

The following related improvements were also included in the project:

1. The MUT was subsequently extended northward beyond the initial project limits by an additional 1.25 km. A portion of this extension involved a 7% grade where the trail widened to 4.5 m providing segregated lanes for uphill cyclists, downhill cyclists and up/down pedestrians.

2. Pedestrians as well as vehicles were facing challenges in finding adequate gaps in traffic in order to cross South Ridge Drive. One immediate and one future set of traffic signals at two intersections will provide safer crossing conditions for pedestrians and more gaps for vehicles.

3. Accessibility ramps will be installed at all intersections.

4. Installing improved accessibility devices at all signalized intersections

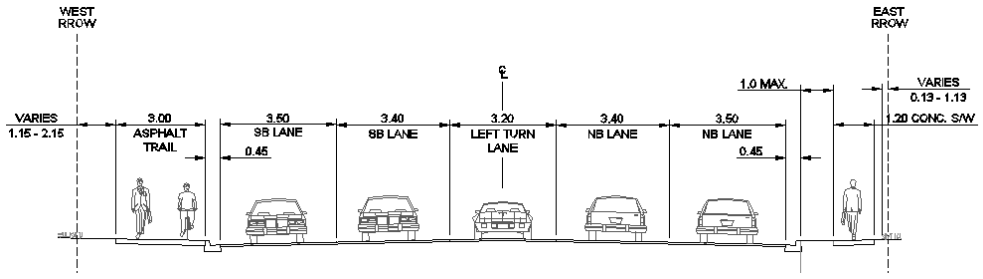
5. Conclusion

Based on the information provided them by AECOM, City of Medicine Hat Administration and Council, as elected representatives for the community, had to weigh the pros and cons and decide what was best for their City as a whole.

On the one hand there were the voices in the community pushing for a move to more substantial means of alternative transportation. On the other hand, Council also had to look at the impacts on the community like costs, environmental impacts, private property impacts, current / future levels of use and connectivity to the existing leisure trail system.

Following the submission of the evaluation matrix to City Council, the 3.0 MUT was approved and carried forward into the design of the corridor.

Figure 9 – Ultimate Cross Section



Construction is scheduled to begin in late summer / fall of 2012.