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**MUNICIPALITY OF RED LAKE**

# TRAILS ENGINEERING STUDY – PRELIMINARY DESIGN REPORT

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SUBMITTED BY:


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HMM353111

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## EXECUTIVE SUMMARY

The Municipality of Red Lake has made it a priority to develop a network of trails that will link the communities of Red Lake, Balmertown, Cochenour, Madsen and Starratt Olsen. This goal is reinforced by various plans published by the Municipality including the Strategic Plan (2012), the Sustainable Community Plan (2011) and the Cultural Plan (2011).

A proposed trail network was developed using data gathered from available existing background information, field reviews and two public meetings. Various design constraints were recognized including the confinement of the trail within the Ministry of Transportation's (MTO) Right-of-Way (ROW), Chukuni River Bridge crossing, existing user groups, overhead and underground utilities and existing soil conditions and terrain.

The proposed trail network design along Highway 105 and 125 includes a separated gravel surface throughout the majority of the system, with select areas including a paved surface and trail illumination. The typical cross-section of the trail consists of a 3.0 m surface with a 0.5 m rounding on both sides. The proposed trail network design along Highway 618 includes a 1.2 m paved shoulder along the existing highway on both sides. In areas where unsuitable soil has been identified, a 3.0 m board walk structure complete with handrail system has been proposed. For the Chukuni River crossing, a stand-alone 3.0 m pedestrian suspended bridge has been proposed as the option to expand the existing Chukuni River Bridge was deemed unattainable due to existing design constraints. The trail has been designed for pedestrian activities only as motorized vehicles will not be permitted on the trail.

A Class "B" Cost Estimate (estimate variance of +/- 15 %) was prepared after site investigations and studies have been completed and the major systems defined. The construction cost estimate variances for each Phase are as follows: Phase 1 – Red Lake to Balmertown = $3,584,937 to $4,850,209, Phase 2 – Balmertown to Cochenour = $2,329,277 to $3,151,375, Phase 3 – Red Lake to Madsen = $499,760 to $676,146 and Phase 4 – Madsen to Starratt-Olsen = $129,335 to $174,983.

To protect the Municipality of Red Lake against liability, a number of provisions were considered to address trail safety related issues and concerns. These provisions included trail alignment considerations that minimize user crossings, pavement markings for delineation, warning signage, trail illumination and the removal of vegetation to improve sightlines of users. The Municipality of Red Lake would be required to establish a legal agreement with the MTO for liability, insurance, and maintenance of the proposed trail.

To assist in reducing taxpayer costs associated with the development of trail network, outside funding opportunities were reviewed and summarized in this report. Funding sources made available for Active

Transportation, cycling, pedestrian and trail projects have been increasing in popularity. It is expected that this trend will continue.

The proposed trail network will require ongoing and annual maintenance. Maintenance activities would include pavement markings re-application, replacement of signage, asphalt repairs, sweeping, culvert cleanouts, vegetation management, snow removal (if desired) and garbage removal. The proposed trail network will require allocated maintenance dollars to ensure its implementation. Maintenance costs are estimated in the range of ***$2,500-$5,000 per km*** for the trail section along Highway 618 (paved shoulder). The off-road trail sections have varying degrees of maintenance costs ranging from ***$500 - $1000*** in rural areas and ***$2,500 - $5,000 per km*** for more urbanized areas.

# 1.0 INTRODUCTION AND BACKGROUND

The Municipality of Red Lake has retained the services of Hatch Mott MacDonald Ltd (HMM) to undertake a Trails Engineering Study whose primary objective is to link the communities of Red Lake, Balmertown, Cochenour, Madsen, and Starratt-Olsen by a pedestrian trail system (known hereinafter as the Active Trail).

## 1.1 Study Area

The Trails Engineering Study area is mainly focused along the Ministry of Transportation's Right-of-Way at:

- Highway 618 from Starratt-Olsen northerly for 11.6 km to 10.3 km north of Main Street (Madsen);
- Red Lake from the Junction of Hwy 105 and Hwy 618 easterly along Highway 105 for 2.8 km to 1.2 km east of Hughes Crescent west and;
- From the Junction of Highway 125 and Highway 105 northerly along Highway 125 for 13.0 km to Cochenour (7.4 km north of Dickenson Road, Balmertown).

The study area also encompasses the Chukuni River and areas as shown on the ***Figure 1 – Study Area.***

## 1.2 Objective

The purpose of this Trails Engineering Study is as follows:

- To provide a quantity and quality assessment to an Active Trail to reinforce its importance to the community;
- To compile and sort background information and present it in a usable format;
- To summarize design criterion;
- To evaluate feedback and input obtained from the public meetings;
- To serve as a best practices guide for the purpose of design and construction;
- To list the legalities and property issues associated with the Active Trail;
- To investigate, analyze and evaluate the existing conditions and constraints and recommend a feasible route alignment;
- To provide a project related cost estimate broken into prioritized stages;
- To recommend funding avenues for the Municipality;
- To provide display options for interpretive signage;
- To detail the Environmental Assessment requirements and;
- To detail the cost of maintenance.

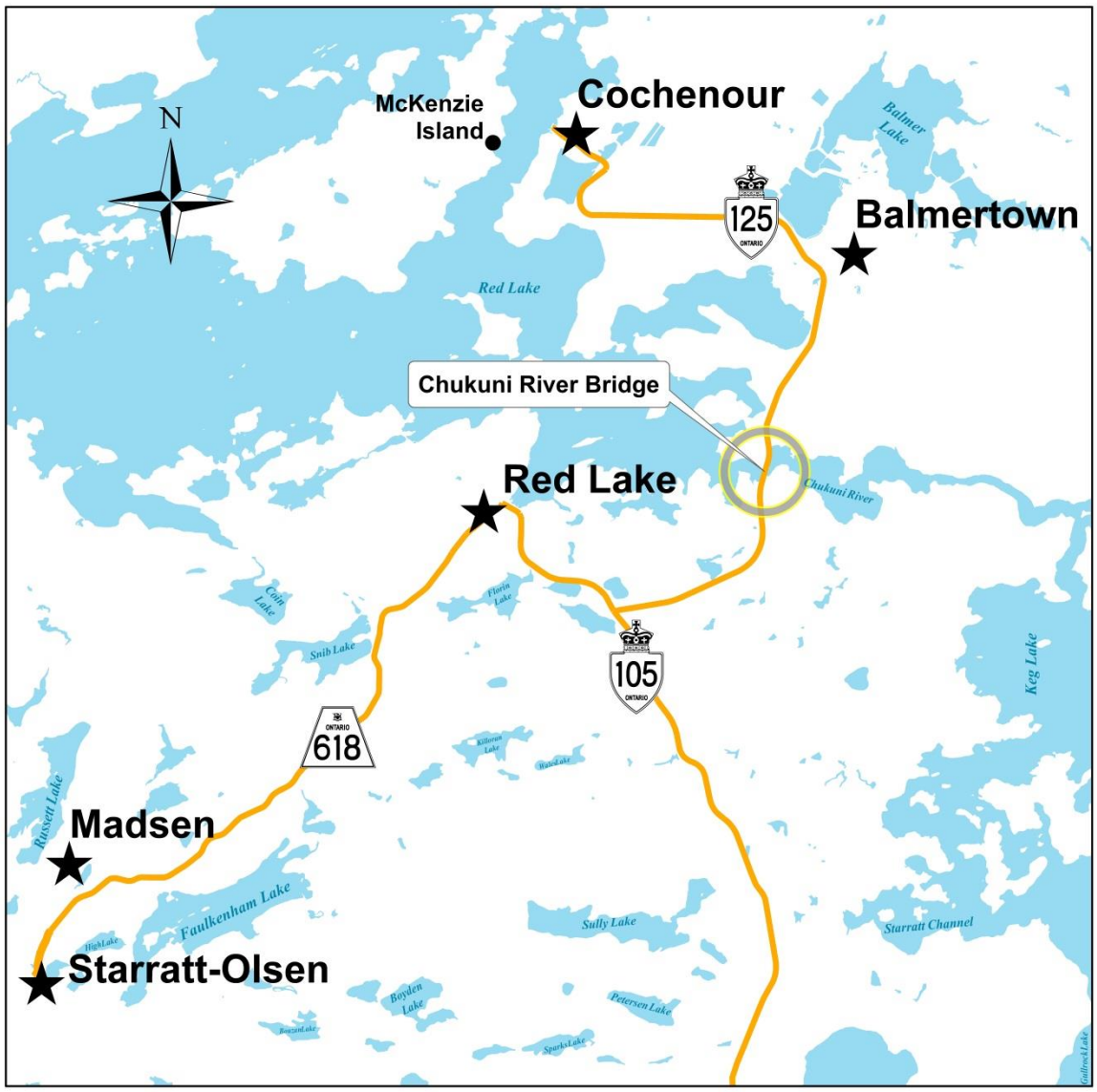


**Figure 1 - Study Area Map**

## 1.3 Report Justification

The Municipality of Red Lake has made it a priority to develop a network of trails to connect the surrounding communities. This goal is reinforced by the following plans:

### *Red Lake Strategic Plan – 2012*

*Excerpts from:*

- *Vision Statement - 'The Municipality of Red Lake in five years will have created or have a plan for: a medical clinic, recreation center, and a* ***trail system.'***

- *Sector One - Social and Cultural - Goal 2 - A Connected Community - Objective A - Promote and* ***Create an Integrated Municipal Wide Trail System.***

- *Sector Three - Operations and Communications - Goal 2 - Well Maintained and Expanded Infrastructure - Objective C - Improve the Quality of the Roads and Sidewalks with a Focus on Accessibility - Implementation Strategies -* ***Create a Trail System.***

### *Municipality of Red Lake Sustainable Community Plan – 2011*

*Excerpts from:*

- *Themes and Strategies - Theme 2 - Green Energy Community - Strategies for the Next Five Years - Incorporate Green Energy Considerations into the Official Plan and Subsequent Development Planning for Residential, Commercial and Industrial Activity - 'The Official Plan is a policy document that sets out the general guidelines for growth and development. Options for urban design can reduce energy consumption and fuel use, including reducing travel distances and* ***incorporating walking and biking trails to reduce use of fossil fuels,*** *incorporating passive resources, living systems and urban ecology to reduce energy consumption. The Official Plan may also include building code considerations that require energy efficient design.'*

- *Themes and Strategies – Theme 6 – Accessible Housing – Strategies for the Next Five Years – Develop Land Use Plan Applying Principles of Smart Growth – The Municipality will prepare a land use plan that will expand on the Official Plan to further implement the goals of the Sustainable Community Plan. This plan will incorporate principles of Smart Growth, which include:* ***'Active Transportation Systems (Walking, Bike Trails).'***

### *Red Lake Cultural Plan – 2011*

*Excerpts from:*

- *Our Shared Values - Value - Connectivity Between and Within Communities with a* ***Trail System***

- *Recommendations - Strategy #1 – Build on Our Unique Sense of Place - Recommendation #15 - Develop a Public Transportation System That Reflects Residents' Needs, is Cost-Effective, and Reflects the Long-Term Sustainable Community Plan - 'A walking/hiking trail is an important way to connect the communities that make up the Municipality of Red Lake and to promote a healthy lifestyle. The Municipality should continue to* ***focus effort on making a trail system a reality.'***

The Trails Engineering Study report is justified as the next step in realizing the Municipality's goals, completing their objectives whilst focusing on their shared values.

## 1.4 Supplied Information

The following information was supplied to assist in the evaluation of the Active Trail:

Municipality of Red Lake

- Arc Geographic Information System (GIS) Shapefiles
    - Municipal Infrastructure (Roads, Sewers, Water)
    - Imagery
    - Terrestrial and Wetland Eco-sites

Ministry of Transportation (MTO)

- AutoCAD Survey and Plan Sections from the Right of Way (ROW) Office

# 2.0 EXISTING CONDITIONS & CONSTRAINTS

## 2.1 Field Investigation

Field reviews were undertaken by HMM on May 13th and July 27th, 2015. At the time of the field review, photographs and video of the entire 27.4 km length of roadway were taken. Stops were also made at Rahill Beach, Kinsmen Beach and the towns of Starratt-Olsen, Madsen, Red Lake, Balmertown and Cochenour. A separate stop was also made at the site of the plane crash on the north side of Highway 125 west of Cochenour.

Observations made during the review are summarized in the following sections.

## 2.2 Ministry of Transporation Right-of-Way

The MTO's corridor section outlined their concerns with being able to develop an Active Trail within their ROW: These concerns are highlighted in the following points:

- Ensure items such as bridges are engineered;
- Ensure that the Active Trail has minimal impacts to the environment;
- Ensure that the existing drainage for the highway is maintained – culverts, ditches, etc.;
- Ensure all affected property owners, First Nations, utilities, etc. are consulted with;
- Ensure all approvals and permits are obtained;
- Establish a legal agreement for liability, insurance, and maintenance with the Ministry;
- Ensure that the Active Trail is kept to the outer edge of the ROW (where possible) to maintain an adequate clear zone;
- Ensure that the trail does not interfere with highway maintenance operations, i.e. snow removal;
- Establish an Emergency Management Plan;
- Ensure proper signage is erected and meets the requirements of the appropriate Ontario Traffic Manual;
- During Construction maintain the safe, efficient flow of traffic;
- Ensure that any proponent working on the Active Trail be qualified and certified by the RAQ's (Registry Appraisal and Qualification System) and holds the appropriate level of liability insurance.

## 2.3 Highway Cross-Section

The typical highway cross-section along Highway 105, 125 and 618 consists of 3.25 m lanes and a 1.0 m paved shoulders. There are some urban sections containing pre-existing sidewalks. These are located:

- Along sections of Highway 105 from the Red Lake District High School Entrance (north side) to the northern terminus at Highway 618 and;
- Along Highway 618 from eastern terminus of Highway 618 at Highway 105 westerly for approximately 1.9 km.

## 2.4 Alignment

The Active Trail will not be developed through the urban sections of Red Lake. Users will be made to rely on the existing sidewalk network and the highway where speeds are 50 km/hr through much of the urbanized area. The existing sidewalk is to be extended from the High School to the sidewalk length at the north leg of Hughes Crescent. The Active Trail will commence again at the south terminus of that sidewalk length.

The alignment of the Active Trail is constrained to the MTO's ROW for areas along Highways 105, 125 and 618 and areas owned by the Municipality. No additional property will be acquired at this stage.

The alignment will assume the geometrics, profiles and super-elevations for sections of the Active Trail shared with the Highway, i.e. in a paved shoulder scenario. In the case of stand-alone pathway, the Active Trail will meet the design criteria outlined in the MTO's Bikeways Design Manual (2014) and address their aforementioned concerns identified in Section 2.2.

Between Red Lake and Cochenour, the Active Trial is tied horizontally and vertically to the south side of the Red Lake District High School entrance and the pre-existing sidewalk network along Hughes Crescent. The Active Trail will commence from the south side of the Hughes Crescent sidewalk, continue on the north side of Highway 125 and terminate at approximately 50 m west of Lakeview Avenue, Cochenour. The sections will be only be constrained to the vertical grade of the existing intersections and entrances along the path.

## 2.5 Drainage

Typical for rural roadways, drainage for the existing highways in areas where the Active Trail is proposed, are provided by open drainage ditches and cross culverts. Numerous cross-culverts were reviewed for adequate sizing. A number of entrance culverts were also reviewed during the field review.

## 2.6 User Groups

The ***Ontario Federation Snowmobile Club*** (OFSC) has existing agreements in place with MTO for use of the existing MTO ROW for snowmobiling purposes. With these agreements already in place these areas cannot cross or be disturbed by, and must maintain a buffer with the proposed Active Trail alignment.

The existing OFSC trail network was reviewed along the length of the active trail study area. A summary of the review is outlined below:

- Existing OFSC trails exist within the Active Trail study area (along Highway 105, 125 and 618.)
- Existing OFSC trails do not cross the proposed Active Trail route;
- Approximately 1,300 m length of existing OFSC trail section along Highway 125 conflicts with the Active Trail route in terms of proximity; a buffer is maintained to eliminate the conflict.

## 2.7 Intersections

There are a number of intersections and private entrances within the study area. As previously noted, the vertical alignment will be constrained by these intersections. Because the Active Trail is kept solely to the east side of Highway 105 and the north side of Highway 125, only the side roads and private entrances on those sides will be affected. These include:

- Highway 105 - Hughes Crescent

- Highway 125 - Private Entrance (6+350), Private Entrance (6+575), McManus Street, Sandy Beach Road, Private Entrance (8+800), McNeely Road and Rahill Beach Entrance

## 2.8 Utilities

A full review of the existing utilities within the Active Trail study area was undertaken. Shaw Communications, Bell Canada, Hydro One and Union Gas all have utility plants within area; their respective services have been summarized below:

- ***Shaw Communications*** has an aerial line that runs along Highway 105 from Howey Street to the Intersect of Highway 105 and 125; an underground dip pole is located at the intersection of Highway 105 and Howey Street;

- ***Bell Canada*** and ***Hydro One*** share an aerial pole line that runs along Highway 105, 125 and 618. A number of dips are present at intersections and driveways along the highway network;

- ***Union Gas*** installed a new gas line in 2012 throughout much of the proposed active trail study area. Through discussion with MTO it was revealed that the majority of rock and boulders that Union Gas encountered during construction were left within the MTO's ROW.

## 2.9 Structures

### *Chukini River Bridge*

The Chukuni River Bridge, spanning the Chukuni River on Highway 125, was reviewed with MTO to discuss the modification of the existing structure to accommodate a new sidewalk/pathway. MTO structural staff completed a review and concluded that the original design of the existing bridge structure did not factor the addition of a sidewalk/pathway; the 3 m overhang required for a new sidewalk/pathway would exceed the loading of the existing girders. Therefore, a new sidewalk would only be considered if the bridge was replaced. As indicated by the MTO, the structure is not in their five (5) year plan for major rehabilitation/reconstruction.

Because the Chukuni River crossing is a major hurdle for the development of the Active Trail between Red Lake and Balmertown, a new stand-alone suspended pedestrian bridge was considered for the purposes of this study.

## 2.10 Soils and Wetlands

A review of the main 'Terrestrial and Wetland Eco-sites' GIS layer was completed to better understand the soil types that exist along the MTO ROW.

The soil types encountered, like in most of Northwestern Ontario, vary greatly. These as classified below:

- Loamy, silty and clayey soils of various depths consisting of reworked materials that are poorly sorted;
- Dry to moderately fresh soils usually associated with eskers, outwash plains, sand dunes complexes and kame fields, usually deep soils;
- Silty to fine loamy and clayey soils of various depths, often associated with depressions, bedrock plateaus and lower slopes;
- Loamy, silty and clayey soils of various depths, often enriched by weathering of nutrient rich bedrock;
- Margin of open peatlands, shores of lakes and poorly drained depressions on bedrock or tills and;
- Silty to fine loamy and clayey soils of various depths; often associated with glaciolacustrine deposits, having crest, level and mid-slope positions.

Accompanying these soil types are the following typical tree types: black spruce; jack pine; white birch; trembling aspen; white spruce; balsam fir; balsam poplar; tamarack; white cedar; and black ash.

Each of these individual soil types pose their own individual challenges for construction and were taken into account in later sections of the report.

Although not a requirement of this Study, a comprehensive Geotechnical Investigation is recommended to help better understand the soil conditions in critical areas of the route, i.e. for proposed structures. Recommendations received from the Investigation would aid the designer to adequately design for earthworks, base materials, surface treatments and foundations.

## 2.11 Vegetation

Trees and brush have grown up overtime within the MTO ROW. Substantial clearing and grubbing along the 27.4 km length of the Active Trail Network will be required to improve sightlines and horizontal clearances.

# 3.0 DESIGN CRITERIA

The design criterion for the Active Trail was established and largely developed from the following publications:

- MTO *Bikeways Design Manual (2014);*
- Transportation Association of Canada's (TAC) *Geometric Design for Canadian Roads (1999, Updated 2011)*

Other publications, guidelines, and reports that helped serve the basis of the design include:

- MTO's *Ontario Traffic Manual (OTM) Book 18 – Cycling Facilities (2013);*
- American Association of State Highway and Transportation Officials (AASHTO)'s *Guide for the Development of Bicycle Facilities (2012);*
- Transport Canada's *Active Transportation in Canada – A Resource and Planning Guide (2011);*
- Trails for All Ontarians Collaborative's *Ontario's Best Trails – Guideline and Best Practices for the Design, Construction and Maintenance of Sustainable Trails for All Ontarians (2006)*

Feedback from Public Consultation Meetings was also considered during the design of the Active Trail. A summary of comments received from the public and how the comments were considered during preliminary design is included in **Appendix A**.

## 3.1 Design Controls

The appropriate trail type must fit its user and their needs. Feedback from the public meetings served as the basis for identifying the following **user characteristics**:

### *User Groups*

Potential users of the Active Trail would be predominantly characterized as:

- Runners;
- Walkers/Hikers and;
- Cyclists

Interest was also generated by the following user groups:

- Cross-Country Skiers;
- Snowshoers;
- In-Line Skaters/Skateboarders/Scootees;
- Those using powered mobility aids or electric scooters

### *Age*

All age groups were represented at the Public Consultation Meetings. A young user would typically be confined to short trips without adult supervision and are not likely to travel beyond 1 – 5 km for recreational purposes. The young are also more likely to use a recreational trail as opposed to sharing the roadway with vehicular traffic. An adult user may take longer trips, however, the length would vary greatly by the purpose; be that utilitarian or recreational. The type of trail an adult would use would depend on their skill and comfort level.

### *Skill and Comfort Level*

Potential users of the Active Trail vary in their abilities and comfort level. Typically those who gave feedback could be characterized as being *"Enthused and Confident"* to *"Interested and Concerned".* The **Enthused and Confident** users would be comfortable sharing the roadway with vehicular traffic but would prefer to do so within their own designated area marked by pavement marking and appropriate signage; whereas the **Interested but Concerned** users would avoid an area with medium to high traffic volumes and are by dissuaded by high-speed traffic and adverse topography. These users would be best served by an in-boulevard or off-road trail.

### *Trip Purpose*

The purpose of one's trip can generally be divided into the following three categories:

| | ***Utilitarian*** | ***Touring*** | ***Recreational*** |
|---|---|---|---|
| ***Purpose*** | *Destination oriented* | *Generally between points of interest* | *Fitness, sport, fun* |
| ***Directness*** | *Very important* | *Somewhat important* | *Not as important* |
| ***Distance*** | *1 km to 5 km* | *Very long* | *1 km to 100 km* |
| ***Constraints*** | *Lack of amenities, shared lanes, high traffic* | *Lack of facilities between points of interest* | *Routes not as scenic* |
| ***Attractiveness/Scenery*** | *More concerned about directness, flat topography is desired* | *Prefer route with interesting scenery and varied topography* | *Primary concern is ride and scenery, varied topography may be desired.* |
| ***Safety and Comfort*** | *May use roads and highways, few stops* | *Low motor vehicle volume* | *Prefer to avoid routes with high traffic volume* |

Comments gathered from the Public Consultation Meetings have the majority of the potential users utilizing the trail for **recreational trips.**

## 3.2 Operational Requirements

Because the majority of the users identified themselves as cyclists, bicycle operating space was considered an important factor is the design of the Active Trail because the operating space is governed by this fastest user group. Figure 2 illustrates the operating space required for most cyclists and is based on a source of Information adapted from the AASHTO Guide of for the Planning, Design and Operation of Bicycle Facilities, 2012.

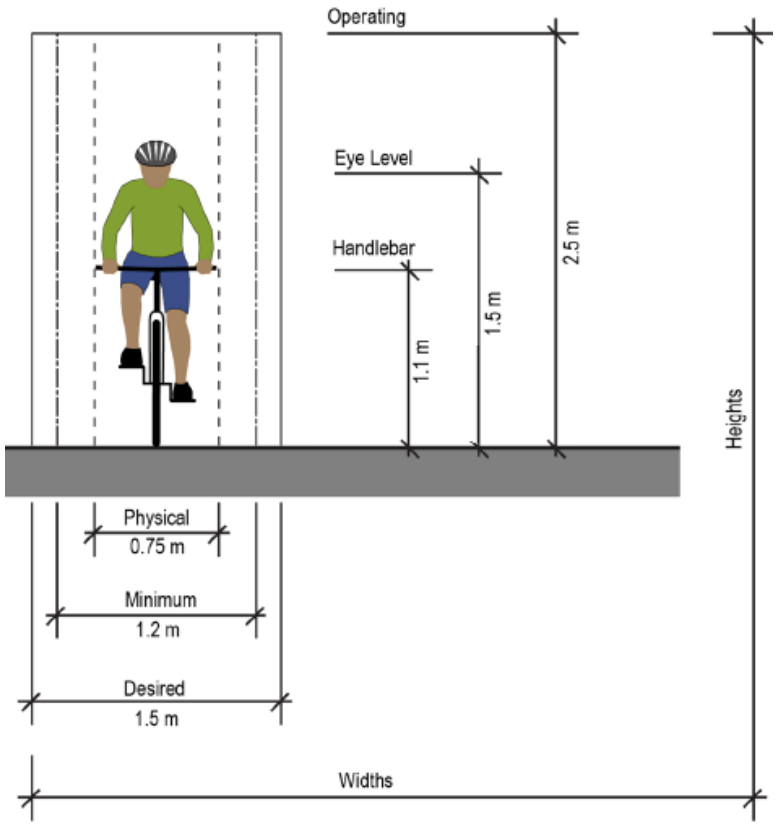


**Figure 2 - Cyclist Operating Space**

An operating width of 1.2 m is considered a minimum; 1.5 m is desired. An operating height of 2.5 m can accommodate most users while standing upright. The length of bicycle is varying; an average width is 0.75 m.

## 3.3 Surface Type Selection

Below is comparison of common surface treatments material characteristics:

### *Asphalt*

- Comfort of ride, skid resistance and resistance to weather are all excellent
- Lane marking will adhere
- Initial cost is medium to high
- Maintenance is minimal (rout and seal every 3 – 5 years)
- High life cycle

### *Surface Treatment/Chip Seal*

- Comfort of ride is fair
- Weather resistance is good
- Skid resistance is excellent
- Lane marking will adhere
- Annual maintenance required
- Life cycle 3 – 5 years

### *Concrete*

- Comfort of ride is good (joints can cause discomfort)
- Weather resistance and skid resistance is excellent
- Lane markings will adhere
- Initial cost is very high
- Minimal maintenance

### *Boardwalk*

- Comfort of ride is fair
- Weather resistance and skid resistance is good
- Lane markings will adhere
- Initial cost is high
- Seasonal maintenance (due to frost action) may be required
- Recommended where soil is unsuitable (silt, loam, tailings, wet or in water)
- Minimal impacts for sensitive terrain

### *Limestone/Granular Surfaces*

- Comfort of ride is fair
- Skid resistance is poor
- Weather resistance is good
- Lane marking will not adhere
- Low initial cost and easy to maintain
- Recommended for recreational paths
- Natural settings where terrain is flat

A concrete surface was selected for the section of the Active Trail between the Red Lake District High School and Hughes Crescent in order to be consistent with existing concrete sidewalk sections on both ends.

An asphalt surface was selected for the more popularized sections of the Active Trail. These sections include:

- Highway 105 from the south entrance to Hughes Crescent to the intersection of Highway 105
- Highway 125 along the Red Lake Golf and Country Club from Dickenson Road easterly for 2.0 km

A boardwalk surface was selected for the Active Trail in sections leading into and away from the wet, open muskeg sections, adjacent to Culvert 8, Culvert 17 adjacent to Dickenson Road and over the existing tailings pond on the shore of Red Lake adjacent to Culvert 25.

A granular surface was selected for all remaining areas, because of the low initial cost, lower anticipated usage volumes, ease of maintenance and its compatibility with the existing conditions.

## 3.4 Trail Type Selection

The Pre-Selection Nomograph (refer to Figure 3) was used as the first step in selecting a trail type. The graph considers two (2) safety risk factors: vehicle speed and volume. The following Average Annual Daily Traffic (AADT) values from the year 2010, were obtained from the MTO's publication website:

- 4,300 - Highway 105 from the intersection of Highway 618/105 to the junction of Highway 105/125;
- 3,900 - Highway 125 from the junction of Highway 105/125 to Balmertown;
- 1,650 - Highway 125 from Balmertown to Cochenour;
- 600 - Highway 618 from the intersection of Highway 618/105 to Starratt-Olsen.

The 85$^{th}$ percentile of the Motor Vehicle Operating Speed (km/hr) was assumed to be **80 km/hr** for Highways 105, 125 and 618.

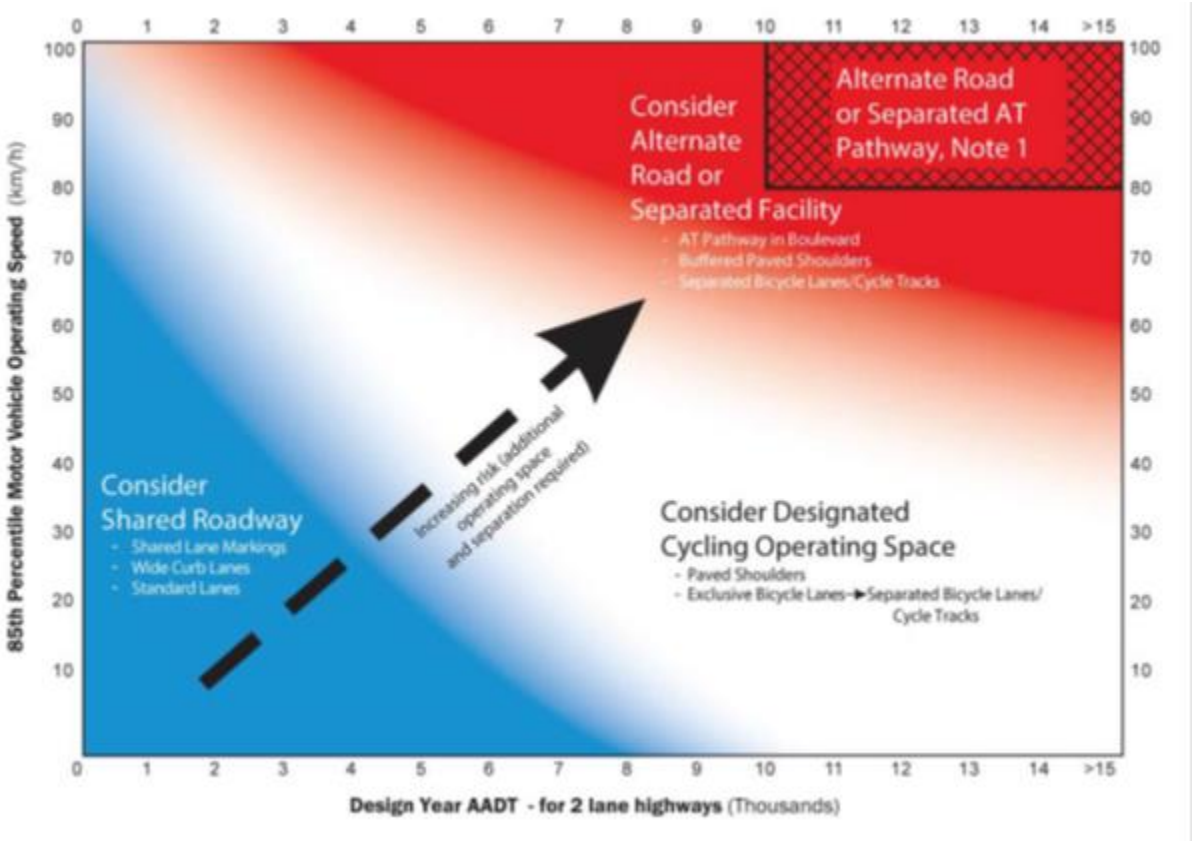


**Figure 3 - Trail Type Pre-Selection Nomograph**

For the lower volume Highway 618, the optimal trail type would be considered a *'Designated Operation'* spaces i.e. paved shoulder and bicycle lanes.

For the higher volume areas of Highway 105 and Highway 125, the optimal trail would be considered 'Alternate Road/Separate Facility' spaces, i.e., separated lanes, cycle tracks, in-boulevard facilities, and off-road pathways.

It is important to note that when the nomograph is applied to provincial highways, particularly in rural settings, speed tends to drive the trail selection type towards one with a greater separation between users and motor vehicles.

As a second step to the trail type selection process, it is important to acknowledge that the Pre-Selection Nomograph is not applicable to all scenarios due to physical, environmental and cost constraints.

The application of the MTO's knowledge-based rules was completed. Only the applicable design considerations were reviewed. The application results are summarized below:

- When the speed differential is greater than 40 km/hr, a physical separation of the two modes of transportation (active user and motor vehicles) i.e. buffered paved shoulders is suggested;
- When the AADT is between 2,000 and 10,000, some level of formal means (signed bike route with paved shoulders) is recommended;
- When the function of the highway is characterized as a mobility or motor vehicle commuter route, some form of separated cycling facility shoulder be considered;
- When more than 30 trucks per hour are present in an outside lane, a separated pathway may be preferred by the user;
- To overcome physical barriers such as steep grades, rivers, narrow bridges, etc., separated pathways should be considered;
- When the anticipated user (skill, trip purpose) is characterized as recreation, preference is given to a paved shoulder, buffered paved shoulder or separated facility. For the young user, a separated means of transport need be considered near schools, parks and neighborhoods;
- When the type of Roadway Improvement Project is retrofit, affordable solutions may be limited to redistributing existing road space;
- In a reconstruction roadway improvement project, opportunities exist to improve provisions such as roadway widths or off-road space with considerable cost savings.

Considering the results of the nomograph and the guidance provided in the application of the MTO's knowledge-based rules, only the following two (2) trail types (and variations thereof) will be considered hereafter:

- On-Road - Signed Bike Route with a Paved/Buffered Paved Shoulders
- Off-Road - Shared Use Active Transportation Pathway in Boulevard

Figures 4 through 7 are examples of: A Signed Bike Route with a Paved Shoulder; A Signed Bike Route with a Buffered Paved Shoulder; A Shared Use Active Transportation Trail in Boulevard and; A Shared Use Active Transportation Trail in Boulevard Separated by Roadside Ditch respectively.

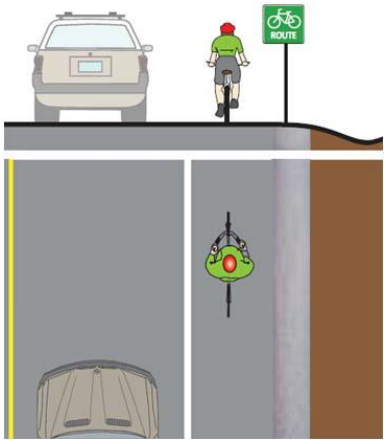


Figure 4 - Signed Bike Route with Paved Shoulder

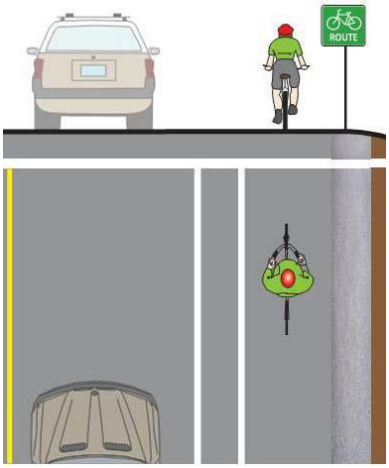


Figure 5- Signed Bike Route with Buffered Paved Shoulder

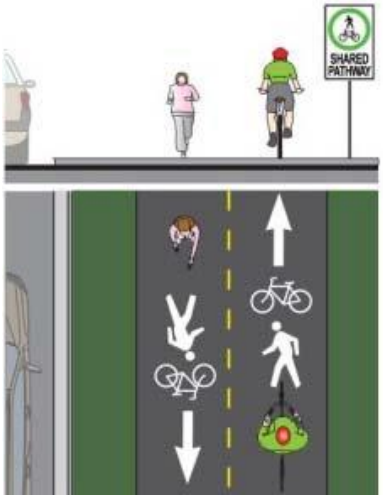


Figure 6 - Shared Use A.T.T. in Boulevard

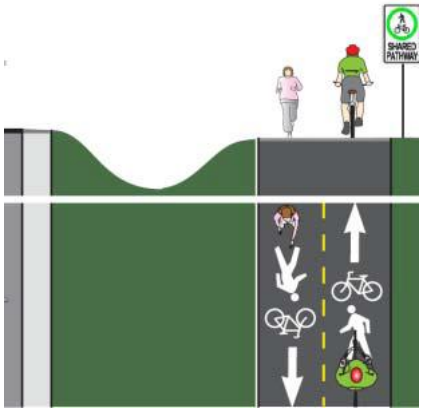


Figure 7 - Shared Use A.T.T. Separated by Roadside Ditch

A **Signed Bike Route with Paved/Buffered Paved Shoulder** will be considered for the section of Highway 618 between Starratt-Olsen and Highway 105 on the basis of low traffic volumes.

A **Shared Use Active Transportation Trail in Boulevard (and/or Separated by Roadside Ditch)** will be considered for the section of Highway 105 from Hughes Crescent to Highway 125 and for Highway 125 from Highway 105 to Cochenour. The selection is reinforced by higher volumes of motor vehicle truck traffic; the need to overcome steep grades, river and narrow bridges, and proximity to businesses, schools and hospitals/clinics.

### *On-Road Facilities*

On-Road facilities generally follow the geometric alignments, profiles and super elevations of the highway. The grade, curvature and sight distance of a highway typically exceed the minimum design requirements for bikeways and pathways. As previously noted a ***Signed Bike Route with Paved/Buffered Shoulder*** is the most appropriate facility type for provincial ROW's with moderate to high speeds and will be considered for use on Highway 618.

While other On-Road facility types exist, they are more appropriate for lower speeds and volumes or Urban Sections and will thus not be considered.

### *General Considerations*

A Signed Bike Route with a Paved Shoulder is a road with a rural cross section that is signed as a cycling route which also includes a paved shoulder (Figures 4 and 5). A designated cycling route may include a buffer zone to provide greater separation between motorists and cyclists (refer to Figure 5).

### *Geometry*

As shown in Figure 8 below, the desired width of the paved shoulder along a signed bike route with paved shoulder route is 1.5 m with 0.5 m granular shoulder. As a minimum, a 1.2 m paved and 0.5 m granular widths should be achieved. Typically, a buffer is recommended only for AADT traffic volumes greater than 4,000, with that said some considering will be given based on user characteristics.

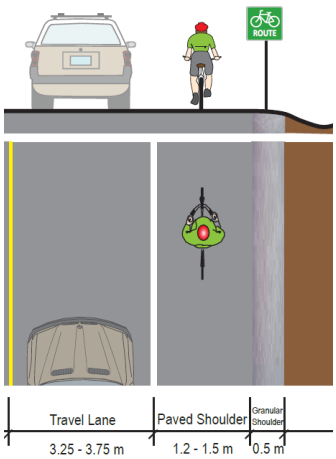


**Figure 8 - Signed Bike Route with Paved Shoulder**

### *Pavement Condition and Treatment*

It is recommended that the shoulder of the roadway be paved at the same time as re-surfacing projects to ensure a seamless joint between it and the travel lane. In the case where a bicycle lane is added after, the lane cannot be designated as a signed route until the surface type is the same as that of the shared road.

### *Pavement Markings*

Signed Bike Routes with Paved Shoulders are delineated by a 100 mm wide edge line to separate the vehicular traffic lane from the paved shoulder. No other pavement markings are generally required.

### *Signage*


A green 'Bike Route' marker (shown below) is required for Signed Bike Route with Paved Shoulders. Depending on the roadway characteristics, typically no other signs are required. The markers should be placed 20 to 30 m in advance of, and following an intersection and other decision points, as well as intervals along the route that are frequent enough to guide and inform cyclists.

### *Off-Road Facilities*

Off-Road facilities are generally separated from the vehicles by a boulevard or a roadside ditch and are implemented where higher traffic speeds and volumes exists. Because of this separation, the geometric alignment and profiles of the highway can be improved to better accommodate the user (runner, walker, cyclist, roller-blader/skateboarder, and wheel chair/motorized aid user). It is for these reasons (and as previously noted), that a **Shared Use Active Transportation Trail in Boulevard (and/or Separated by Roadside Ditch)** is the most appropriate trail type for the sections of Highway 105 and 125.

### *General Considerations*

A Shared Use Active Transportation Trail (ATT) in Boulevard (and/or Separated by Roadside Ditch) is being used to provide both recreational and utilitarian opportunities for its users. Figures 6 and 7 (previously shown) depict the difference between an ATT in Boulevard and one Separated by Roadside Ditch.

### *Geometry*

As shown Figure 9 (below) the desired width of a Shared Use Path is 3 - 4 m. The desired width is function of the volume and mix of users. Due to anticipated low to moderate volumes and to minimize associated costs, a 3.0 m wide paved section was selected with 0.5 m wide granular shoulders. For non-paved areas, a 3.0 m wide granular platform will be provided to accommodate future development.

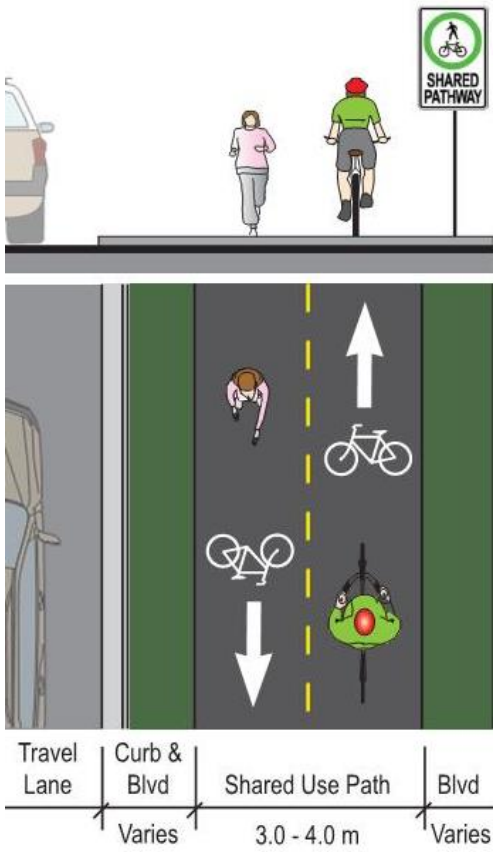


**Figure 9 – Shared Use Active Transportation Trail**

### *Design Speed*

The design speed is dependent on a number of factors, predominantly the type of wear surface, the steepness of grade and the preferred speed of the fastest users, i.e. cyclists. For an adult cyclist on flat and paved terrain, the design speed should be 35 km/hr (25 km/hr for unpaved sections). However due to grade steepness in the 6 – 8 % range over a length between 75 and 150 m, a **40 km/hr design speed was selected for unpaved** and **50 km/hr design speed was selected for paved** sections of the Active Trail.

### *Coefficient of Friction*

For paved sections a friction factor equal to 0.22 and 0.25 was assumed for a design speed of 50 km/hr and 40 km/hr respectively. For unpaved sections the coefficient of friction was assumed to be half that of the paved section.

### *Stopping Sight Distance*

Adequate stopping sight distance is required to provide a cyclist with an opportunity to see and react to unexpected conditions should they arise. Assuming a maximum grade of 8 %, the minimum stopping sight distance was calculated using the following formula:

$$S = \frac{V^2}{255(G + f)} + 0.694V$$

Where G = grade (m/m) (rise/run)

For the paved sections of the Active Trail, the Stopping Sight Distance was calculated as 67 m.
For the unpaved section of the Active Trail, the Stopping Sight Distance was calculated as 61 m.

### *Horizontal Alignment*

To maintain existing drainage patterns, the Active Trail is designed with a platform sloped towards the existing drainage ditches at 2 %. A slope of 2 % was selected as it is considered the minimum to encourage positive drainage.

### *Radius of Horizontal Curve*

The radius of Horizontal Curve was calculated using a method developed by the TAC – Geometric Design Guide for Canadian Roads and adopted by the MTO, calculated as follows:

$$R = \frac{V^2}{127(e+f)}$$

Where:
R = minimum radius of curvature (m)
V = design speed (km/hr)
E = rate of superelevation (m/m)
f = coefficient of friction

Having established the design speed, rate of super-elevation and coefficient of friction the minimum radius was calculated as 80 m for paved and 87 m for unpaved sections of the Active Trail.

### *Lateral Clearance on Horizontal Curves*

The amount of lateral clearance required on the inside of a horizontal curve is function of curvature and grade. Lateral clearance (M) is the distance between a visual obstruction and the centerline of the inside lane and calculates as follows:

$$M = R(1 - \cos(28.65\frac{S}{R})$$

For the paved sections of the Active Trail, the lateral clearance was calculated as 6.9 m.
For the unpaved sections of the Active Trail, the lateral clearance was calculated as 5.3 m.

### *Vertical Alignment*

Grades greater than 5 % are undesirable and were generally avoided where possible. Where 5 % was not achievable, grades up to 8 % were selected for short distances. On long steep upgrades in excess of 5 %, a relatively flat area less than 3 % is recommended every 100 m for rest.

A minimum grade gradient was selected as 0.6 % to provide surface run-off.

### *Crest Vertical Curve*

The minimum crest vertical curve is function of sight distance and the grades on either side of the crest. The following formula was used to determine the minimum curve length when the stopping sight distance was greater than the curve length:

$$L = 2S - \frac{274}{A}$$

When the stopping sight distances were less than the curve length the following formula was used:

$$L = \frac{AS^2}{274}$$

Where A = algebraic difference in grades (%)

### *Sag Vertical Curve*

Comfort on a sag curve (K) is function of design speed and vertical radial acceleration, taken as a maximum of 0.3 m/s$^2$ and calculated as follows:

$$K = \frac{V^2}{390}$$

The minimum length of sag curve (K) was calculated as 6 m for paved sections of the Active Trail and 4 m for unpaved sections.

### *Pavement Markings*

Pavement markings may be used to delineate the space for the various users to mitigate the chance of collisions on the pathway. A solid yellow center line should be used where active transportation traffic has reduced sightline. A broken yellow center line may be where sightlines are good.

A bicycle symbol or combination of a bicycle and pedestrian symbol may also be applied to indicate the appropriate direction of travel as shown in Figure 10.

Figure 10 - Typical Pavement Markings for AT Paths

### *Signage*

A 'Shared Pathway' marker (shown below) is required for Shared Use Active Transportation Trails. No distinction will be made for pedestrian versus cyclist space so pathway organization signs will not be considered.


Warning signs will also need to be erected to inform the users of tight, substandard conditions or hazards. Because the Active Trail will be primarily used for recreational purposes, provisions will be made for wayfinding, informational, and interpretive signage. OTM Book 18 – Cycling Facilities would serve as a guide for the current sign codes, and dimensions details.

## 3.5 Horizontal Alignment

The Active Trail alignment was selected based on the existing conditions and constraints within the MTO ROW as described in Section 2.2 and designed to meet the requirement of Section 3.4.2. The final route selection was made based on the following:

- Minimizing the cost of construction;
- Feedback received from the public meetings;
- Maximizing safety and limiting cross highway pedestrian traffic and potential conflicts by keeping the Active Trail to one side of the highway;
- Consideration for access to landmarks, i.e. Red Lake Golf and Country Club, Rahill Beach, Minnow Lake, etc;
- Provision of rest stops including one at the Red Lake plane crash memorial site and;
- Avoidance of construction challenges, i.e. significant rock outcrops, steep grades and environmentally sensitive areas

One (1) alignment has been chosen for the Active Trail.

## 3.6 Vertical Alignment

The vertical alignment was generated along the established best fit horizontal alignment. In some areas along the route, the grade along the existing ground exceeded the design maximum. Additional fill will be required to flatten steep slopes and meet the design crest and sag curve length requirements.

The preliminary plans showing the horizontal and vertical alignment of the proposed Active Trail are enclosed in **Appendix B**.

## 3.7 Cross Section

It is recommended that the Active Trail consist of the 150 mm average depth Granular 'A' material overlying a variable depth of Granular B Type 1 (minimum 250 mm). These materials would be founded on native subgrade.

The cross section platform will be a total 4 m, consisting of two x 1.5 m wide lanes and two x 0.5 m wide shoulders/rounding. At barriers located along the Active Trail, an additional 0.5 m of rounding will be provided for barrier integrity.

A 3H:1V foreslope was selected to promote vegetation, minimize erosion and reduce the chance of injury.

The typical design cross-sections are enclosed in **Appendix C**.

## 3.8 Drainage

The Active Trail has been designed to maintain the existing drainage patterns for the three (3) highway sections and their respective ROW's. To achieve this, the proposed active trail has been designed above existing grade. Existing culverts will be maintained and extensions will be proposed in areas where the new active trail crosses.

## 3.9 Intersections

The proposed off-road Active Trail has been designed to match existing grades at roadway and driveway crossings. When combined with removing existing vegetation, relocating roadside furniture and providing adequate warning signage, this will improve sightlines and safety for both the travelling pedestrian and vehicular traffic.

The proposed on-road Active Trail along Highway 618 will follow the existing highway alignment which has been designed with the appropriate sightlines.

## 3.10 Proposed Structures

The Chukuni River Pedestrian Bridge is proposed as a cable suspension bridge with steel tower supports on either bank and supported on concrete foundations. The supporting cables will be anchored to cast-in-place concrete anchor blocks buried in the ground. The beams, girders and cross-bracing will all be constructed of structural steel. The pedestrian walking surface will be constructed of pressure treated wood and the posts will be constructed of HSS steel. Steel cable will be used for the horizontal pickets.

The conceptual drawings for the proposed Chukuni River Pedestrian Bridge are enclosed in **Appendix D**.

# 4.0 PROPERTY REQUIREMENTS

The entire proposed active trail has been designed all within the MTO ROW. There is no intention to purchase any additional properties as they are not required to meet project objectives.

# 5.0 ILLUMINATION

Illumination by means of an independent active trail lighting system is proposed for the two (2) paved trail sections in Red Lake and Balmertown. The active trail lighting system will consist of LED fixtures and 4.27 m square straight poles mounted to concrete bases and spaced approximately 32 m apart. The top of the concrete bases are designed to be 0.6 m above the finished active trail grade level. The proposed active trail street lighting poles are to be setback 1 m from the edge of the proposed active trail.

The section of roadway between the intersection of Highway 105/Hughes Crescent and the Super 8 Hotel is already illuminated by the existing street lighting. In this area we have proposed no changes and have designed the new active trail system to tie into this existing infrastructure.

The conceptual illumination drawings for the proposed Active Trial are enclosed in **Appendix E**.

# 6.0 ENVIRONMENTAL REQUIREMENTS

## *6.1 Municipal Class Environmental Assessment*

The development of an Active Trail can have varying impacts on the environment. A project of this nature would fall within one of the following Municipal Class Environmental Assessment (EA) schedules:

- Schedule A or A+ - generally include normal or emergency related operational and maintenance activities.
- Schedule B – generally include improvements and minor expansion to existing facilities where there is potential for some adverse environmental impacts.
- Schedule C – generally include the construction of new facilities and major expansions to existing facilities.

Because *a Schedule A or A+* type undertaking would likely have minimal environmental impacts, this type projects are typically pre-approved. With a *Schedule B* type project, there lies a potential for some adverse environmental impacts and therefore the proponent would be required to proceed through a screening process which includes consultation with those who may be affected. A *Schedule C* classified project would precede through an environmental planning process as outlined in the Class EA document which provides a more detailed classification of Class EA requirements in relation to project type.

Typically an Active Trail would not require an Environmental Assessment; however some standard project related aspects may be subject to the process. These include:

- New water crossing may require a Schedule B;
- Reconstruction of an existing water crossing may require a Schedule B.

The following works are typically pre-approved by a Schedule A or A+ or covered as part of the EA for the road (highway)

- Construction within the existing ROW;
- Culvert repair work where the capacity of the culvert is not increased;
- Where no changes are made to the drainage area;
- Reconstruction of existing water crossing where the reconstructed facility will be for the same purpose, use, capacity and at the same location;
- Where a bike lane is included as part of the road widening

Any in-water works may require approval from the Department of Fisheries and Oceans (DFO).

# 7.0 PUBLIC CONSULTATION

Two Public Meetings were held in Red Lake at the Heritage Building.

Public Meeting #1 was held on May 12, 2015 and was an open house format. The purpose of the first public meeting was to introduce the project and seek feedback regarding the proposed trail system that would link the communities of Red Lake, Balmertown, Cochenour, Madsen & Starratt Olsen. Comments and feedback from this first public meeting were used to develop the initial trail alignment.

Public Meeting #2 was held on July 27, 2015 and was also an open house format. The purpose of the second public meeting was to provide an update of the study after incorporating comments received from the first public meeting and to give the public an opportunity to review the preliminary alignment and associated preliminary costs for the proposed trail.

Summary reports for both meetings are available for review on the Municipality of Red Lake website.

# 8.0 COST ESTIMATES

## *8.1 Construction Cost Estimates*

Construction cost estimates have been prepared for the proposed Active Trail and have been broken down into four phases: Phase 1 – Red Lake to Balmertown, Phase 2 – Balmertown to Cochenour, Phase 3 – Red Lake to Madsen and Phase 4 – Madsen to Starratt-Olsen.

A Class "C" cost estimate (estimate variance of +/- 20 %) was previously presented at Public Meeting #2 which was prepared with limited site information and was based on probable conditions affecting the project. It represented the summary of all identifiable project elemental costs and was used for the purpose of presenting the initial trail alignment to the public.

A Class "B" cost estimate (estimate variance of +/- 15 %) is presented in this preliminary design report and was prepared after site investigations and studies had been completed and the major systems defined. This cost estimate can be used to obtain project approvals of for budgetary control.

The construction cost estimate variances for each phase have been summarized below:

- Phase 1 – Red Lake to Balmertown = $3,584,937 to $4,850,209
- Phase 2 – Balmertown to Cochenour = $2,329,277 to $3,151,375
- Phase 3 – Red Lake to Madsen = $499,760 to $676,146
- Phase 4 – Madsen to Starratt-Olsen = $129,335 to $174,983

A detailed copy of the Class "B" cost estimate is enclosed in **Appendix F**.

## *8.2 Projected 5-Year Construction Cost Estimates*

The Class "B" construction cost estimates for each phase have been projected through a 5-year life span. An accumulating percentage of 5 % each year was applied to the construction cost estimate. The 5 % percent figure allows for the increase of construction costs and the general cost of living.

A detailed copy of the projected 5-year construction cost estimates is enclosed in **Appendix G**.

# 9.0 TRAIL IMPLEMENTATION - PHASING

As noted in previous sections, the proposed Active Trail has been broken down into the four following phases:

- Phase 1 – Red Lake to Balmertown (AADT of 3,900 to 4,300)
- Phase 2 – Balmertown to Cochenour (AADT of 1,650)
- Phase 3 – Red Lake to Madsen (AADT of 600)
- Phase 4 – Madsen to Starratt Olsen (AADT of 600)

The phases were initially developed on the basis of serving the greatest population (Average Annual Daily Traffic volumes for 2010 shown above), as confirmed by the Municipality of Red Lake. It is important to note that the phases are not meant to be a priority listing for the construction of the Active Trail.

Further breakdown of the proposed Active Trail phases can be an option for the Municipality based on the amount and availability of future funding.

# 10.0 MITIGATION MEASURES

A *Signed Bike Route with Paved Shoulders* as proposed for the section of the Active Trail from Red Lake through Madsen to Starratt-Olsen, generally falls into the same liability pattern as the roadways and sidewalks, meaning that the Municipality only becomes liable if the route is improperly designed, constructed or maintained.

In the case of the *Shared Use Active Transportation Pathway in Boulevard* as proposed for the section of the Active Trail from Red Lake through Balmertown to Cochenour, even while separated from the highway is still considered a roadway in its own right.

This is important to note because the Active Trail would be covered under many of the same basic immunities as other roads or highways. To ensure that this is the case, the Municipality of Red Lake would have to establish a legal agreement with the Ministry of Transportation for liability, insurance, and maintenance of the Active Trail and adhere to provincial design and construction guidelines.

To protect the Municipality against liability, a number of provisions were made to address safety related issues and concerns. These include but are not limited to the following:

- Route was kept to one side of the highway network to minimize conflicts relating to crossings, side roads and collisions between motor vehicles and the Active Trail users;
- Trail types that were selected that were separated from the highway;
- Pavement markings were utilized to provide separation between Active Trail users and motor vehicles;
- Appropriate warning signage was incorporated;
- Provision were made for lighting in potential high usage areas;
- Maintenance requirements were identified;
- Provincial design guidelines were adhered to;
- Clearing to remove vegetation and improve sightlines was considered;
- Sufficient widths for emergency and maintenance vehicles were considered;
- The Active Trail was kept to the outer edge of the ROW where possible to maintain a sufficient clear zone between it and the highway.

## 11.0 FUNDING AVENUES

To assist in reducing taxpayer costs associated with the development of an Active Trail, outside funding opportunities should be pursued. Recently funding sources made available for active transportation, cycling, pedestrian and trail projects have been increasing in popularity. It is expected that this trend will continue.

The following is list of viable funding avenue:

- Infrastructure Canada – New Building Canada Fund - http://www.infrastructure.gc.ca/plan/nbcp-npcc-eng.html
    - National Infrastructure Component http://www.infrastructure.gc.ca/plan/nic-vin-prog-eng.html
    - Provincial-Territorial Component
        - National and Regional Projects http://www.infrastructure.gc.ca/plan/nrp-pnr-prog-eng.html
        - Small Communities Fund http://www.infrastructure.gc.ca/plan/nrp-pnr-prog-eng.html
- Infrastructure Canada – The Federal Gas Tax Fund
- http://www.infrastructure.gc.ca/plan/gtf-fte-eng.html
- Public Private Partnerships Canada
- http://www.p3canada.ca/
- Federation of Canadian Municipalities – Green Municipal Fund
- http://www.fcm.ca/home/programs/green-municipal-fund.htm
- Ministry of Health and Long-Term Care – Healthy Communities Fund
- http://www.mhp.gov.on.ca/en/healthy-communities/hcf/
- Ontario Trillium Foundation – Capital Grants
- http://www.otf.ca/what-we-fund/investment-streams/capital-grants
- Ministry of Transportation – Ontario Municipal Cycling Infrastructure Fund
- http://www.mto.gov.on.ca/english/safety/ontario-municipal-cycling-infrastructure-program.shtml
- Government of Ontario – Infrastructure Funding for Small Communities
- http://www.ontario.ca/page/infrastructure-funding-small-communities
- Private Sector Groups/Corporate Donations
- Private Citizen Donations

# 12.0 MAINTENANCE

The Active Trail is both an infrastructure and operations plan; therefore, it will require allocated maintenance dollars to ensure its implementation. A maintenance plan should be allowed to grow in an incremental fashion as the length of developed trail increases.

Annual maintenance can include but is not limited to the following:

***On-Road Trail***

- Pavement markings/durables re-application
- Replacement of signage
- Minor asphalt repairs (patching, crack sealing, etc.)
- Sweeping
- Snow removal
- Garbage removal

***Off-Road Trail***

- Drainage and channel maintenance (culvert clean-outs)
- Sweeping
- Removal of debris/trash
- Weed/vegetation management
- Mowing/trimming of grass
- Surface repairs (asphalt, concrete, boardwalk, granular)
- Repair to fixture (benches, signs)

Maintenance costs are estimated in the range of ***$2,500-$5,000 per km*** for signed bike routes with paved shoulders. Off-road shared active transportation paths in boulevards have varying degrees of maintenance costs. Rural areas range from ***$500 - $1000.*** More urbanized areas range from ***$2,500 - $5,000 per km***.

As the Active Trail is developed, the Municipality should review their current annual maintenance budgets to accommodate the maintenance costs of the Active Trail.