COUNCIL MEETING

MONDAY, DECEMBER 10, 2012
7:00 P.M.

FOR THE REGULAR MEETING OF THE REDCLIFF TOWN COUNCIL
MONDAY, DECEMBER 10, 2012 – 7:00 P.M.
REDCLIFF TOWN COUNCIL CHAMBERS

AGENDA ITEM			RECOMMENDATION
1.	**GENERAL**		
	A)	Call to Order	
	B)	Adoption of Agenda *	Adoption
	C)	Accounts Payable *	For Information
	D)	Bank Summary for October 31, 2012 *	For Information
2.	**DELEGATION**		
	A)	D. Prpick, Presentation *	
	B)	K. Donais, Presentation *	
3.	**MINUTES**		
	A)	Council meeting held November 26, 2012 *	For Adoption
	B)	Committee of the Whole meeting held November 26, 2012 *	For Information
	C)	Redcliff Family and Community Support Services Board Special meeting held November 28, 2012 *	For Information
	D)	Redcliff Family and Community Support Services Board Special meeting held December 3, 2012 *	For Information
		i) Family School Liaison Worker Agreement *	Authorize Mayor and Mun. Mgr. to Sign
		ii) FCSS Grant Application Reviews Re: Year-end grant allocation	For Consideration/ Approval
	E)	Redcliff / Cypress Regional Waste Management Authority meeting held, December 6, 2012 *	For Information
4.	**BYLAWS**		
	A)	Bylaw 1727/2012 being the Procedural Bylaw *	2nd & 3rd Reading
	B)	Bylaw 1731/2012 being the Temporary Borrowing Bylaw *	2nd & 3rd Reading
	C)	Bylaw 1732/2012 being the Annual Reserve Allocation Bylaw *	2nd & 3rd Reading

5. STAFF RECOMMENDATION

A)	Write-Off 2011 for Doubtful Receivables *	For Consideration/ Approval
B)	Community Infrastructure Improvement Fund **(**CIFF) Grant Project Endorsements *	For Consideration/ Approval

6. POLICIES

A)	Policy 054, Rates Policy *	For Approval

7. CORRESPONDENCE

A)	Municipal Affairs * Re: Municipal Internship, Regional Collaboration Program	For Information

8. OTHER

A)	Budget 2013 *		Approval in Principle
	i)	Multi Year Capital Infrastructure Plan (MYCIP) *	For Approval
	ii)	Bylaw 1728/2012 being the Garbage and Collection Rates Bylaw *	2nd & 3rd Reading
	iii)	Bylaw 1729/2012 being the Sewer Rates Bylaw *	2nd & 3rd Reading
	iv)	Bylaw 1730/2012 being the Water Rates Bylaw *	2nd & 3rd Reading
B)	Town of Redcliff Transportation Master Plan *		For Information
C)	Redcliff Riverview Golf Course Water Rates		For Discussion
D)	Redcliff Senior Citizens Society Facility Use Agreement *		For Discussion
E)	Eastside Phase 1 Lots Re: extension of 5% discount on lot prices		For Discussion

9. RECESS

10. IN CAMERA

A) Labour

B) Legal

11. ADJOURN

Scheffer Andrew Ltd.
Planners & Engineers

Town of Redcliff

2010 Redcliff Roadway System Master Plan

November 23, 2012
File #: 28364-2.6

EXECUTIVE SUMMARY

The Town of Redcliff retained Scheffer Andrew Ltd (SAL) to undertake the creation of a Roadway System Master Plan. A town-wide transportation study has never been undertaken for the Town of Redcliff. A Roadway System Master Plan is a high-level assessment of short, medium and long term planning frameworks to guide transportation network improvements.

The Roadway System Master Plan consists of:

- Visual condition assessment of the paved roads in the town and recommendations on maintenance,
- Review of safety concerns with the road network,
- Creation and calibration of a four step gravity transportation model (EMME3), and projections of traffic at the 7394 and 10670 population horizons (10 and 20 year time horizons),
- Review of selected intersections capacity using the Syncro 6 model.
- Recommendations for what, when, cost and priorities for improvements that should be made to the road network,
- Evaluation of the current transportation systems ability to accommodate heavy vehicles, public transit, bicycles and pedestrians and the development of integrated strategies for their accommodation and preliminary recommendation on policy future directions.

i. Condition Assessment and Maintenance Recommendations

The total length of the assessed paved roadways was about 52.6 km. The pavement condition of the Town's road network in 2010 was an average Visual Condition Index (VCI) of 8.6, and with an average combined ranking of 10.0. The average VCI values show that the overall condition of Town roads is in the "Good" condition category.

Maintaining the current level of VCI resulted in an annual pavement maintenance cost of $1,924,322 for the 2011 to 2015 time frame and an annual pavement maintenance cost of $833,009 in the 2016 to 2020 time frame.

Allowing the VCI to slip in the 2011 to 2015 time frame to 7.5 resulted annual pavement maintenance cost of $329,373 for the 2011 to 2015 time frame but this increased to an annual pavement maintenance cost of $550,981 in the 2016 to 2020 time frame. It is our opinion that to allow the VCI to slip to 7.5 will result in much higher pavement maintenance costs after 2020 and this option is not recommended.

It is recommended that the Town set a target of maintaining an average VCI of approximately 8.0 because this value allows for a stable average pavement and concrete maintenance cost per year of approximately $750,000 in the 2011 through 2020 time frame.

These costs do not include road geometric improvements, sidewalk improvements, new sidewalks, new paved roads, signage and pavement marking.

The current route signage for truck routes is faded and routes are not clearly marked; standard route signage should be installed.

ii. Current Conditions and Recommendations

Broadway Avenue E from Mitchell Street SE to Saamis Drive SE is the only segment of roadway currently operating at a poor level of service during the PM peak periods. It is not recommended to upgrade this segment of Broadway Avenue E as modeling shows that once 9th Avenue SE is connected to Saamis Drive SE the level of service improves. By the 10670 population horizon this segment will approach current traffic levels and upgrading of the segment to 4 lanes should be considered at that time.

All intersections in the Town of Redcliff currently operate satisfactorily at a Level of Service (LOS) 'C' or better. The intersection of Broadway Avenue E and Mitchell Street E operates at an overall LOS of A however the northbound and southbound left turn movements operate at a LOS 'F' (LOS of F means failure on a scale of A to F where A is the best) during the PM Peak Hour. This situation creates a safety issue with north and south bound left turning vehicles being significantly delayed and taking unnecessary risks. Three solutions to this problem were examined:

- 4-way stop control.
- Traffic signals.
- Roundabout.

A traffic signal warrant shows that traffic signals are warranted at this intersection. It is recommended that this intersection be changed to 4-way stop control as traffic volumes at this intersection are projected to decrease when 9th Avenue SE is connected to Saamis Drive SE. An alternative to traffic signals that should be considered due to its traffic calming and safety benefits is a roundabout. It is recommended that a feasibility study be conducted to provide a preliminary design for signalization and for a roundabout and the estimated costs and benefits be compared.

The intersection of the Transcanada Highway and Broadway Avenue E has an undesirable accident rate. It is recommended that the Town of Redcliff coordinate with Alberta Transportation to revise the signal timing plan.

At 5th Avenue SE and Main Street S it is recommended that the Town of Redcliff conduct intersection traffic counts and have a detailed intersection capacity analysis conducted to determine if the current traffic control is still suitable.

iii. Growth Related Recommendations

The results of the calibration of the Redcliff EMME3 model were well within industry norms. This indicates that the Redcliff EMME3 has been well fit to represent the existing traffic conditions in the Town of Redcliff study area and can be used to predict future traffic.

The only improvement related to growth recommended prior to the 7394 population horizon is the extension of Saamis Drive SE and Mitchell Street SE connected by 9th Avenue SE. The intersection of Saamis Drive SE and 9th Avenue SE should be constructed as a roundabout or with full signalization as left turning traffic from 9th Avenue SE is expected to experience LOS 'E' at the 7394 population horizon and LOS 'F' at the 10670 population horizon.

No additional growth related improvements are recommended prior to the 10670 population horizon.

The tables below layout all of the recommend network upgrades, improvements and studies.

Recommended Road Network Improvements and Upgrades

Road	Recommended Improvements		Suggested Improvements	
	Before 7394	Before 10670	Before 7394	Before 10670
9th Avenue SE to Saamis Drive SE	$2,650,000			
9th Avenue SE between Main Street S and Mitchell Street SE	$2,500,000			
4th Avenue SW and 5th Avenue SW at 4th Street SW				$250,000
Main Street S between Broadway Avenue and 9th Avenue S (two intersections and trees before 7394 population horizon and two after.			$70,000	$70,000
5th Avenue SE between Main Street S and Mitchell Street SE				$3,500,000
South Railway Drive NE at 3rd Avenue NE and 3rd Street NE			$150,000	
Dutton Street NE between Broadway Avenue E and Dacre Street NE			$300,000	
Truck Route Signage	$15,000			
Total	$5,165,000	$0	$520,000	$3,820,000

Recommended Intersection Improvements and Upgrades – Shared Responsibility

Intersection	Recommended Improvements		Other Options
	Before 7394	Before 10670	
Transcanada Highway and Mitchell Street NE Pedestrian Crossing Improvements (AT)	$20,000		
Transcanada Highway and Broadway Avenue E Traffic Signal Timing. (AT)	$10,000		
Transcanada Highway and Broadway Avenue E Pedestrian Crossing Improvements		$20,000	
Total	$30,000	$20,000	

Recommended Intersection Improvements and Upgrades – Town Only

Intersection	Recommended Improvements		Other Options
	Before 7394	Before 10670	
Broadway Avenue W and 8th Street W lighting improvements	$25,000		
Broadway Avenue E and Mitchell Street E 4-way Stop Control	$5,000		
Broadway Avenue E and Mitchell Street E Signalization			$180,000
Broadway Avenue E and Mitchell Street E Roundabout			$250,000
Broadway Avenue E and Saamis Drive SE channelization.	$45,000		
Saamis Drive SE and 9th Avenue SE Signalization	$180,000		
Saamis Drive SE and 9th Avenue SE Roundabout			$120,000
5th Avenue S and Main Street	$5,000		
Total	$260,000		$450,000

Recommended Studies

Studies	Recommended Studies	
	Before 7394	Before 10670
Broadway Avenue E between Transcanada Highway and 20th Street NE Functional Planning Study	$20,000	
Broadway Avenue between 1st Street E and 8th Street W Functional Planning Study		$20,000
Broadway Avenue east if Mitchell Street E and Saamis Drive SE Pedestrian and Bicycle Accommodations Functional Planning Study[1]	$20,000	
Mitchell Street SE between Broadway Avenue E and Redcliff Way SE Functional Planning Study[2]	$20,000	
Mitchell Street SE between Broadway Avenue E and Redcliff Way SE Pedestrian Bicycle Accommodation Functional Planning Study[2]	$30,000	
9th Avenue SE between Main Street S and Mitchell Street SW Functional Planning Study	$20,000	
Main Street between Broadway Avenue and 9th Avenue S Functional Planning Study	$35,000	
5th Avenue SE between Main Street S and Mitchell Street SE		$20,000
South Railway Drive NE Functional Planning Study	$10,000	
Old Transcanada Highway Functional Planning Study	$10,000	
Broadway Avenue E and Mitchell Street E Intersection Signalization and Roundabout Study	$10,000	
5th Avenue S and Main Street S Traffic Study	$5,000	
Total	$130,000	$40,000

Notes:

1. If this study was included as part of the work for re-examining the Eastside ASP and alignment of Saamis Drive SE SAL's opinion of the probable cost for this study would be $10,000. SAL recommends that this study be included as part of the work for re-examining the Eastside ASP and alignment of Saamis Drive SE.
2. If these two studies were combined SAL's opinion of the probable cost for the combined studies would be $40,000. SAL recommends that the two studies be combined.

iv. Non-Motorized Modes of Transportation

It is recommended that bicycle and pedestrian network and improvement plan should be adopted by Council as the long-term strategy to guide decisions related to development of non-motorized modes for the Town.

This report makes recommendations and develops a strategy to achieve the goals laid out in the Municipal Development Plan for the Town of Redcliff, June 2010, in reference to non-motorized modes of travel. Estimated cost of recommended improvements related to non-motorized modes of transportation is $2,799,000. It is important to recognize that priorities and opportunities may change over time so the recommended network should be assumed to be flexible so that the Town can adapt to changes, constraints, and available budget resources.

v. Other Recommendations

It is recommended that a traffic noise policy be established, the outdoor sound level for existing residential adjacent to Transcanada Highway be reviewed and that new residential development should be required to meet a 55 dBA Leq24 measured at an elevation of 1.5 metres and 5 metres from the rear of the residence

The current Town shop is located at the southwest corner of the Town. Relocating the Town Shop close to Broadway Avenue E or into an industrial area north of Transcanada Highway would reduce the impact of heavy Town equipment on the residential street network.

Several concerns were identified with the approved ASP for the Eastside development. New neighbourhoods should be designed to encourage community friendly traffic behaviour where the road design doesn't encourage short-cutting or speeding. The review of the existing Eastside ASP, TIA, and FSR are recommended.

It is recommended that the Town's roadway classification system be changed to include 3 classifications of roads with sub-types by location types of roads:

Arterial	Divided Major Roadway (20th Street NE / Boundary Road – under the jurisdictions of the City of Medicine Hat)	Urban Section	
		Rural Section	
	Undivided Major Roadway (Broadway Avenue E & Saamis Drive SE, 10th Avenue NE and Mitchell Street NE)	Urban Sections	Standard Section
			Downtown Section
			4 through lanes and one two way left turn lane
		Rural Sections	Standard Section
			2 through lanes and one two way left turn lane (interim section)
Collector	Industrial/Commercial Collector Roadway	Urban sections	Standard section with various sidewalk and trail options,
			2 through lanes and one two way left turn lane with various sidewalk and trail options,
			Low impact development section with various sidewalk and trail options,
		Rural sections,	
	Residential Collector Roadway	Urban Sections	Standard section with various sidewalk and trail options,
			Low impact development section with various sidewalk and trail options,
		Rural Sections	Standard Section
			Expanded Ditch Section
Local Road	Local Industrial/Commercial Roadway	Standard Section	
		Low impact development section	
		Rural section	
	Local Residential Roadway	Monolithic sidewalks Section,	
		Separate sidewalks section,	
		Parking on one side section,	
		Low impact development section,	
		Rural section,	
		Rural section with expanded ditches,	
		Downtown section,	
		Public service section,	

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1 Introduction

Scheffer Andrew Ltd. was retained by the Town of Redcliff in 2010 to create a Roadway System Master Plan. Several traffic impact assessments had been undertaken by the Town of Redcliff, however, a Town-wide transportation study has never been undertaken for the Town of Redcliff, and as such no previous study exists.

The Town of Redcliff, is located directly northwest of the City of Medicine Hat along the Transcanada Highway also known as Highway #1 (see Figure 1). From 2001 to 2006, Redcliff experienced a population growth from 4,372 in 2001 to 5,096 in 2006 which is a 16% increase in just 5 years (Source: Statistics Canada).

Due to the nature of the Town's location with respect to Medicine Hat, it is important to effectively plan for anticipated continued growth.

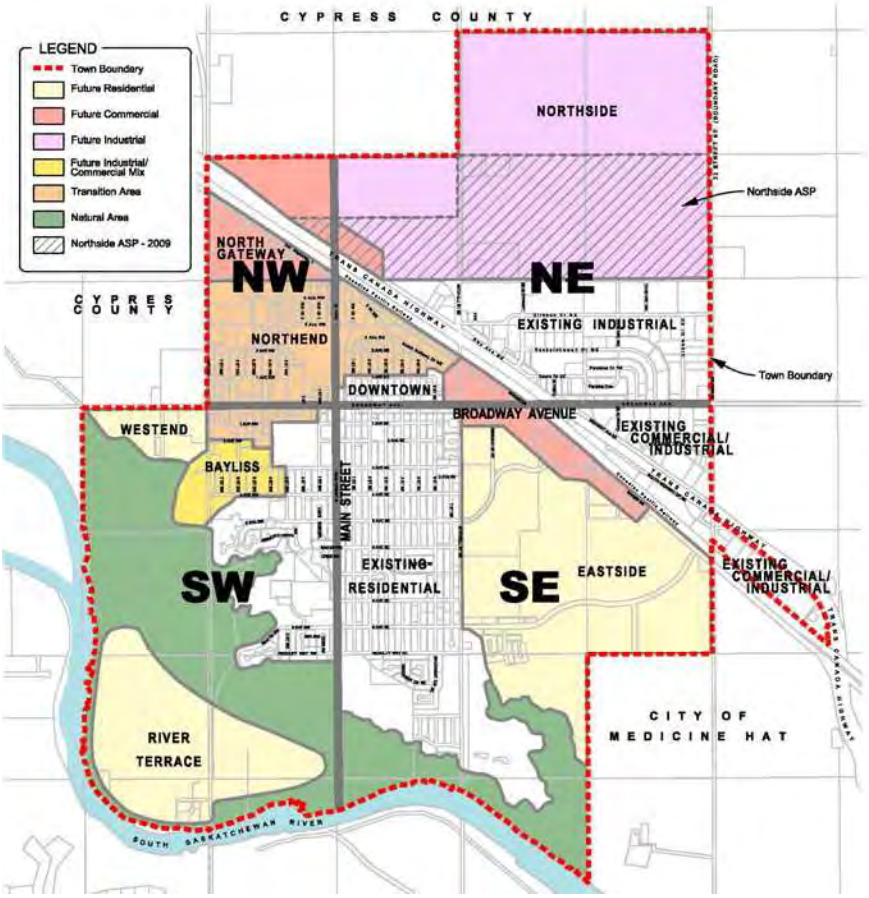
This report provides a review and evaluation of the existing transportation system and determines the overall transportation infrastructure required to meet the demands of the population growth and future physical expansion of the Town.

1.1 Study Area

For the purpose of the Roadway System Master Plan, primary and secondary Study Areas were established and indicated on Figure 1.1. The primary Study Area encompasses:

- Downtown,
- Existing residential,
- Northend,
- Existing industrial
- Existing commercial
- Eastside
- River Terrace
- Westend
- Bayliss
- North Gateway, and
- Northside

within the municipality of the Town of Redcliff. The area includes lands recently annexed by the Town. Within the context of the primary study area, the development of a roadway system plan that reflects current conditions and future trends and will allow the Town to implement



Clip of Figure 1.1 Future Land Use Concept

roadway, transit, bicycle and pedestrian infrastructure improvements in an orderly fashion based on measurable criteria. A secondary study area including all urban reserve lands and future growth areas as identified in the Tri-area Inter-municipal Development Plan was considered to ensure that the longer term and regional transportation needs, opportunities, and initiatives were examined in the development of study recommendations.

1.2 Study Purposes and Objectives

Roadway systems are fundamental to the Town's development as they fill the need for mobility and the movement of goods and services. Roadway systems are major determinants of the form and character of a municipality, and have significant impacts on the development of adjacent land uses and on community growth.

In order to maintain the function and integrity of the roadway system, the 2010 Roadway System Master Plan is intended to provide medium and long term planning frameworks to guide transportation network improvements. There are four main study objectives:

- The identification of a number of locations in the Town that have current transportation issues and locations that may have transportation issues at the 7394 and 10670 population horizons. These locations are to be examined in more detail with high level recommendations made on required improvements.
- The development of transportation infrastructure improvements priorities, estimating projected project costs, and establishing general project schedules and phasing to the design horizon.
- The Evaluation of the current transportation systems ability to accommodate heavy vehicles, public transit, bicycles and pedestrians and the development of integrated strategies for their accommodation and preliminary recommendation on future policy directions.
- A comprehensive review of the impact of future through traffic growth of the TransCanada Highway on the local infrastructure and evaluation of roadway geometric and signalization improvements of the linkages on TransCanada Highway.

1.3 Study Methodology

The following methodology identifies distinct activities required to gather the existing information, project the medium and long term traffic volumes, analyze this data, identify medium and long term requirements, and recommend the best solutions.

1.3.1 Roadway Project Planning / Programming

An inventory of the condition of every Town-owned road was conducted. The inventory included a Visual Condition Index (VCI), and assessment of the condition of curb and gutter, swales, sidewalks, appurtenances, and other features that affect the operation of the roads.

A preliminary list of recommended transportation improvement projects, opinions of probable construction costs, and a preliminary project phasing schedule was developed. Projects were programmed and prioritized into two groups; short term projects (2010-2015), and long range projects (2015-2030).

1.3.2 Travel Demand Model Development

EMME 3 is a computer model used by transportation planners to predict travel patterns based on travel demand and transportation infrastructure. The EMME's travel demand model was built and used to forecast future traffic volumes, identify where and when improvements would be required, and assess the road network alternatives. The following assignments were included in development of the Travel Demand Model.

- Traffic Surveys: Traffic surveys undertaken specifically for this study at the key intersections.
- Land Use Information: The current land use information was obtained from the Town's records, land use bylaw, approved area structure plans, and aerial photographs. The future land use data was estimated based on existing area structure plans and the Town's Municipal Development Plan.
- Base Year Model Calibration: The model was calibrated to reasonably match the existing conditions at key locations. The trip generation rates and attractions in the model were calibrated to match the expected traffic from the respective land uses in each traffic zone.
- Base Year Model Results: The base year scenario provides the current system operation and identifies current capacity.
- Short-term and Long-term Scenarios Testing: The appropriate land use assumptions and network revisions were determined to support the targeted growth scenarios.

1.3.3 Transportation Systems Analysis

Two scenarios (7394 and 10670 population horizons) were developed in the EMME travel demand model and were used to:

- Establish roadway classification based on its functions, design capacity, and traffic demand.
- Analyze the collected data and information to identify where future transportation system improvements are needed and/or required.
- Provide a conceptual road network, and identify associated land requirements and impact on existing land uses.
- Provide a financial plan including project funding estimates.
- Review arterial and connecting street configurations to maximize the 'capacity life' to defer as long as possible the need for widening and new facilities.
- Identify potential need for traffic calming to address residents' concerns regarding speeding and shortcutting on local streets.
- Identify specific access improvements that may be required to accommodate the Eastside Area Structure Plan, Northside Area Structure Plan, and other individual projects.
- Review the intersections on Transcanada Highway at Broadway Avenue and Mitchell Street, including an intersection geometric assessment, traffic control signal capacity analysis, safety assessment, and an assessment of connection linkages.
- Analyze the performance of the transportation network, and assess intersection capacity utilizing the Synchro micro-simulation model. This analysis was limited to the higher traffic corridors within the Town.

1.3.4 Non-motorized Modes of Transportation and Transit

Smart Growth has an aim to building environmentally sustainable communities and encourages the development of a transportation network to give people the option to walk, ride a bike, take transit, or drive. The inventory of pedestrian facilities, sidewalks, bikeways, and transit facilities was reviewed and a plan of proposed expansion was developed which included connections to the current leisure trails, pedestrian and bicycle facilities.

1.3.5 Accident Data Analysis and Safety Improvements

Historical accident data is an important indicator of the safety performance of roadway segments and intersections. However, the randomness and infrequency of accidents affects the precision of comparison with historical accident data. Considering statistical reliability, five-year annual accident data was reviewed. Intersections were ranked using actual accident frequency and accident rate.

Local anecdotal information on intersection safety was reviewed and a comparison to the actual accident rates made. This review while not statistically quantifiable provided additional insight into the perceived safety of intersections as driver behaviour is known to change at unsafe locations which to skew the accident histories.

A road safety audit team consisting of our senior road design and planning professionals reviewed the identified high crash locations, including roadway and intersection geometric design, sight distance, and other traffic safety issues. Traffic safety improvements were identified to address key concerns on specific roadways and at various intersections.

1.3.6 Goods Movement and Traffic Noise Strategies

An overview of the truck routes in and around the Town of Redcliff was conducted. A Strategic Goods Movement Network to facilitate the movement of heavy trucks was identified to maintain a strong economy and ensure a healthy community. Recommendations were made relating to upgrading the pavement structure and cross section of roadways identified as part of the designated truck route system. Noise regulations in other municipalities were reviewed, and thresholds of Noise Level are recommended.

2 Functional Classification

Functional roadway classification is the system that attempts to classify each road according to how it is used, traffic composition, traffic volumes, running speed, accesses, and interconnectivity. This section describes the current functional classification, geometric standards, and a proposed functional classification system for the Town's road network. The functional classification of roadways is a fundamental issue in transportation planning. Given the classification of roads, design criteria are then applied to encourage the intended use of the roads.

A typical functional classification system is made up of expressways, arterial, collector, and local roads, as follows:

- Expressways are intended to carry relative large traffic volumes at high speeds. Due to the high demand and high speeds access to expressways is usually limited to arterial roads and occasionally collector roads.
- Arterial roads are intended to carry relatively large traffic volumes. Due to the high demand usage of these roadway facilities, direct access to arterials is usually restricted to maximize their capacity and operation.
- Collector roads provide the connection between local roads and arterials. There is a balance between land access and traffic movement in this classification.
- The main focus of local roads is access to land and developments. Local roads offer the lowest level of mobility and carry lower traffic volumes at lower speeds.

2.1 Existing Roadway Functional Classification

The Town's current functional classifications are described in the Town's *Design Guideline*, and the characteristics of the Town's road classifications are illustrated in Table 2.1.

Table 2.1: Design Classification Categories – The Town of Redcliff

Categories	Daily Traffic Volume (Vehicles/Day)	Pavement Widths (m)	Right-Of-Way Requirement	Minimum Intersection Spacing
Undivided Major Roadway	10,000 – 30,000	14.8	30.0 m (min)	300 m (min)
Primary Collector Roadway	5,000 – 10,000	7.4 or 10.0	33.0 m (min)	60/120 m (min)
Collector Roadway	1,000 – 5,000	12.0	25.0 m (min)	60 m (min)
Local Residential Roadway	< 1,000	10.5	16.0 m (min)	60 m (min)
Source: Design Guideline Table 7.1, the Town of Redcliff, January 2009.				

The existing roadway classification of the Town of Redcliff does not include an expressway as the only expressway in the Town is Transcanada Highway for which the design criteria and operation are the responsibility of the Alberta Transportation.

The classification of rural residential roadway isn't illustrated in the Design Guideline Table 7.1, but its design cross section is available in the standard detail drawing D-100.

The Town of Redcliff Design Guidelines and standard details provide the necessary details of the design standards for each functional road classification, which include traffic volume, design speeds, right-of-way, cross-section, parking lanes, access management requirements, and other design elements.

Figure 2.1 shows the road network with the current roadway classifications as outlined in the MDP.

2.1.1 Undivided Major Roadway

The term of undivided major roadway used by the Town has the same meaning of major arterial road used by the Transportation Association of Canada. The existing arterial roads in the town are Broadway Avenue, Saamis Drive SE, 8th Street NW and Mitchell Street as indicated in the Town's MDP.

2.1.2 Collector Roadways

Two types of collector roadways are defined in the current road classification categories: collector roadway and primary collector roadway. 9th Avenue SE east of Mitchell Street SE, Main Street south of Broadway Avenue, South Railway Drive NE and Old Transcanada Highway NE are currently classified collector roadways in the Town's MDP.

2.1.2.1 Primary Collector Roadway

The primary collector roadway defined in the Town's Design Guideline is a four lane divided roadway with or without additional parking on both sides.

2.1.2.2 Collector Roadway

The majority of roads in the Town of Redcliff are made up of a grid road network which disperses traffic without concentrating it to particular roads. Grid patterns tend to have a lower percentage of collectors than a contemporary network (including cul-de-sacs). This is the main reason that most collector roadways in the Town currently carry under 2000 vpd.

2.1.3 Local Roadway

The required pavement width of a local residential roadway is 10.5 m. A small proportion of the Town's local roads do not meet the current geometric standards (e.g. top width) but, because of the existing grid road network, local roads in the Town of Redcliff also carry a very low traffic volume; therefore, no widening is necessary for this type of low volume streets.

2.2 Review of Roadway Classifications

As part of the Roadway System Master Plan, the Town's existing roadway classification system was reviewed. The current system while useful was found to be overly general and did not lend itself well to the determination of maintenance requirements or dealing with existing conditions.

2.2.1 City of Medicine Hat Design Classification Categories

While a worthwhile goal is to maintain some consistency with other jurisdictions in the area, other classification systems may not be structured to efficiently describe the roads inside the Town and allow for proper planning of repair and maintenance activities.

A brief review on the roadway classification system of the City of Medicine Hat was undertaken. Table 2.2.1 lists the design-based classification system advocated by the City of Medicine Hat.

Table 2.2.1: Design Classification Categories – The City of Medicine Hat

Categories	Daily Traffic Volume (Vehicles/Day)	Number of Travel Lanes	Right-Of-Way Requirement	Minimum Intersection Spacing
Expressway	>20,000	4 (min)	55.0 m (min)	400 m (min)
Divided Arterial Roadway	10,000 – 30,000	4	47.0 m (min)	400 m (min)
Divided Industrial Arterial Roadway	10,000 – 30,000	4	38.0 m (min)	400 m (min)
Undivided Arterial Roadway	5,000 – 20,000	4	30.0 m (min)	200 m (min)
Major Collector Roadway	1,000 – 12,000	4	24.0 m (min)	100 m (min)
Minor Collector Roadway	1,000 – 8,000	2	21.0 m (min)	60 m (min)
Local Residential Roadway	< 3,000	2	16.0 m (min)	60 m (min)
Industrial/Commercial Collector Roadway	1,000 – 8,000	2	22.0 m (min)	100 m (min)
Local Industrial / Commercial Roadway	1,000 – 5,000	2	20.0 m (min)	60 m (min)
Source: Municipal Servicing Standard, the City of Medicine Hat, April 2002.				

The design classification of the City of Medicine Hat defines four types of roadways based on their functions including expressway, arterial, collector, and local. Based on the impact that larger vehicles have on operational characteristics of a roadway, the design classification also groups the classifications into residential and industrial/commercial roadways.

2.2.2 Recommended Roadway Classification

Roadway classification systems need to:

1. Identify the function of the roadway, typically expressway, arterial, collector and local roads, based on the requirements of free traffic flow and land access. Expressways have high free traffic flow with no land access and few intersections. Arterials give priority to free traffic flow and allow some restricted access. Collectors generally are viewed as having a balance between free traffic flow and land access. Local roads give priority to land access and free traffic flow is not a concern and often is discouraged. The Average Annual Daily Traffic (AADT) is the most important determinant of the functional classification.
2. Identify appropriate spacing of roadways. Arterial roadways in urban environments are typically spaced 1,600 m apart, which allows for reasonable flow of traffic over the overall system, good signalization intersection spacing, and the placement of intervening collector roadways and local roadways to feed the arterials and provide for land access.
3. Identify traffic composition, traffic volumes, turning movements, running speed, on-street parking requirements, design vehicle, and multi-modal needs.
4. Determine how runoff and drainage is handled. This is typically the largest determinant between rural and urban roadways and affects the ROW requirements and whether parking is permitted on the roadway.

As indicated in TAC's Geometric Design Guide for Canadian Roads, a median is typically used on freeway, expressway and arterial roads to control access. Because traffic movement and land access are equal importance for collector roads, little or no access restriction is required for collector roadways. It is also impractical to use a raised-curb median on residential collectors allowing frontage driveways, because the median restricts all left turn movements.

It is important to have a classification defined for all roadways in the Town of Redcliff so the:

- design objectives,
- development requirements,
- road upgrade programs and
- maintenance programs

can be established and applied to encourage the use of the road as intended.

Recognizing that there are different requirements between:

- Arterial, collector and local roadway functions,
- Industrial, commercial and residential roadways,
- Urban and rural roads,

it is recommended that the Town's design classification categories should be expanded to address the differences and to allow detailed criteria to be developed for each category. The recommended roadway classification system is outlined in Table 2.2.2:

Table 2.8.2: Recommended Design Classification Categories – The Town of Redcliff

Function	Categories	Type	Daily Traffic Volume (Vehicles/Day)	Number of Driving Lanes	Right-Of-Way Requirement	Minimum Intersection Spacing	Direct Access Control	Parking Features	Pedestrian Accommodation
	Expressway	Rural	>20,000	4 (min)	55.0 m (min)	400 m (min)	Prohibited	Prohibited	Separate
Arterial	Divided Major Road	Urban	10,000 – 30,000	4	33.0 m (min)	200 m (min)	Restricted[1]	As Required[2]	Separate sidewalk or trail
		Rural			40.0 m (min)			Prohibited	
	Downtown Undivided Commercial Major Road	Urban	5,000 – 20,000	2	30.0 m (min)	100 m (min)	Restricted[3]	Angled	3.0m sidewalk
	Undivided Major Road	Rural	5,000 – 12,000	2	30.0 m (min)	200 m (min)	Restricted[4]	Prohibited	Separate trail
		Urban						As Required	1.8 m separate sidewalk
Collector	Industrial/Commercial Collector Roadway	Urban	1,000 – 12,000	2	27.0 m (min)	120 m (min)	Permitted[5]	Permitted	1.2 m sidewalk
		Rural						Prohibited	
	Residential Collector Roadway	Urban	1,000 – 8,000	2	25.0 m (min)	60 m (min)	Permitted	Permitted	1.5 m sidewalk
		Rural						Prohibited	2.4 m trail
Local	Downtown Commercial Roadway	Urban	1,000 – 8,000	2	20.0 m (min)	100 m (min)	Restricted	Angled or parallel	2.0 m sidewalk
	Public Service Roadway	Urban	1,000 – 8,000	2	20.0 m (min)	100 m (min)	Restricted	Angled or Parallel	1.5 m sidewalk
	Local Industrial / Commercial Roadway	Urban	< 5,000	2	18.0 m (min)	60 m (min)	Permitted	Permitted	1.2 m sidewalk
		Rural			20.0 m (min)			Prohibited	none
	Local Residential Roadway	Urban	< 2,000	2	16.0 m (min)	60 m (min)	Permitted	Permitted	1.2 m sidewalk
		Rural			20.0 m (min)			Prohibited	none

Notes:

1. Access is available to abutting industrial/commercial property and multi-family subject to traffic and design condition. A minimum driveway to intersection spacing of 200 m should be maintained for new construction, and generally restricted to right turns in and out. In the case of large developments with large amounts of traffic an all turns access complete with left turn bays, right turn channelization and potentially signal lights should be reviewed.
2. On street parking should be prohibited in new developments.
3. Access is available to abutting industrial/commercial property and multi-family subject to traffic and design condition. Driveway access to the road is not recommended but can be allowed for specific business uses such as drive through and gas stations but should be limited and restricted if possible.
4. Driveways are permitted on Undivided Major roadways; however, a minimum driveway/intersection spacing of 200 m should be maintained for new construction.
5. Driveways are permitted on Industrial/Commercial Collector roadways; however, a minimum driveway/intersection spacing of 120 m should be maintained for new construction.

In retrofit situations it may not be practical or within budgetary constraints to upgrade a road to meet the Town's standards. Some obvious examples of this are the upgrades required to 9th Avenue SE between Main Street and Mitchell Street to bring it to an Urban Residential Collector standard and River Road to also bring it to an Urban Residential Collector standard. In these cases it is better to carefully weigh the transportation function, access, pedestrian and parking requirements of the roadway and develop a section that suits the specific conditions.

2.2.2.1 Expressway

The only roadway in the Town that meets this classification is the Transcanada Highway which is under the jurisdiction of Alberta Transportation. It is not recommended that the Town adopt any requirements, standards, or guidelines for an Expressway.

2.2.2.2 Divided Major Road

No road in the Town currently meets or requires this category. 20th Street NE is likely to be the first road built to this classification as the City of Medicine Hat has identified this road on the Boundary of the Town and the City as a Divided Industrial Arterial Roadway. 20th Street NE will be built to the City's standards.

It is recommended that the Town develop a standard for a Divided Major Street for the purpose of ensuring that adequate right-of-way is acquired as opportunities arise so that land is available for construction in the future and that access is controlled and does not become a large issue in the future when these roads need to be built. Figure 2.2.3.1 shows which roads are proposed to be ultimately built to this standard. Recommended road cross sections are found in Appendix B for urban and rural sections. It is worthwhile to note that these sections have been designed with a median wide enough for a dual left turn bay. While it may be generations before the Town of Redcliff would require such, the larger median also is more aesthetically pleasing and for the very small increase in the land requirement the potential benefit for the far future is tremendous.

2.2.2.3 Downtown Undivided Commercial Major Road

Three blocks of Broadway Avenue E Between 1st Street E and 4th Street E meet this category. This category allows the Town the flexibility of maintaining the downtown as a separate case from other roads and allows the Town to expand the Downtown section in the future if so desired. It is not recommended that the Town develop or adopt any requirements, standards, or guidelines for a Downtown Undivided Commercial Major Roadway. An example road cross section is found in Appendix B.

2.2.2.4 Undivided Major Road

Most existing arterial roads in the Town fall under this category. The existing arterial roads largely operate satisfactorily under the current conditions and are predicted to operate satisfactorily in the next 20 years therefore this category will likely remain the most common arterial category in the Town. It is not recommended that these roads be upgraded from 2 lane undivided roads to 4 lane undivided roads as experience has shown that, when traffic volumes become large enough to warrant expansion to 4 lanes, often traffic volumes have become large enough for left turns off the road to interfere with the operation of the extra lanes. The cost difference between a 4 lane undivided and a 4 lane divided road is minimal if the right-of-way has been acquired, especially considering the large improvement seen in operation between the two types of roads. Recommended urban and rural road cross sections are found in Appendix B.

A special exception to the building an undivided major road to a 4 lane divided standard is where there is an existing road with numerous existing driveway accesses to the road. Broadway Avenue E between the Transcanada Highway and 20th Street NE / Boundary Road is an example of this situation. It is proposed that this road be upgraded to four through lanes with a two way left turn lane to maintain all turns access to the businesses. Reviewing the traffic volumes projected up to the 10670 population horizon four through lanes in each direction are not necessary, so an interim section with two through lanes and a two way left turn lane was developed. Recommended road cross sections are found in Appendix B.

2.2.2.5 Industrial/Commercial Collector Roadway

Industrial / commercial collector roadways are characterized by the design vehicle (usually a large truck i.e. WB-21) instead of a smaller delivery vehicle (usually a garbage truck i.e. MSUV) for residential roads. Other major differences are:

- the accommodation of pedestrians may or may not be a consideration,
- The day time volume of traffic is likely higher than for residential collectors,
- Special accommodation of left turning vehicles may be required to maintain the roads' level of service.

Recommended road cross sections are found in Appendix B.

2.2.2.6 Residential Collector Roadway

Residential collector roadways are typically characterized by numerous driveways and pedestrian accommodation. Recommended road cross sections are found in Appendix B.

2.2.2.7 Downtown Commercial Roadway

The purpose of this category is to allow the Town flexibility with these local roads for design and operation. While the access and traffic movement of these roads is consistent with a local road, having a separate designation allows the Town to treat them as a higher level of road for operation and maintenance calculations and plans. In addition, it allows the Town to expand the Downtown in the future if so desired. This road category also fits well with much of the current multi-use, walk able community and low impact development concepts. It is not recommended that the Town develop or adopt any requirements, standards, or guidelines for a Downtown Undivided Commercial Roadway. An example road cross section is found in Appendix B.

2.2.2.8 Public Service Roadway

The purpose of this category is to allow the Town flexibility with these local roads for design and operation. While the access and traffic movement of these roads is consistent with a local road having a separate designation allows the Town to treat them as a higher level of road for operation and maintenance calculations and plans. It is not recommended that the Town develop or adopt any requirements, standards, or guidelines for a Public Service Roadway unless the Town would like to increase the road width to accommodate bus parking or increase sidewalk widths. An example road cross section is found in Appendix B.

2.2.2.9 Local Industrial / Commercial Roadway

Local industrial / commercial roadways are characterized by the design vehicle (usually a large truck i.e. WB-20) instead of a smaller delivery vehicle (usually a garbage truck i.e. MSUV) for residential roads. The other major difference is that the accommodation of pedestrians may or may not be a consideration. Recommended road cross sections are found in Appendix B.

2.2.2.10 Local Residential Roadway

Local residential roadways are typically characterized by:

- numerous driveways,
- pedestrian accommodation,
- the desire to minimize vehicle speeds,
- minimize traffic,
- keep out large vehicles, and
- concerns for children on the roadway.

Recommended road cross sections are found in Appendix B.

2.2.3 Recommended Changes to Roadway Classifications

The changes to the roadway classification system necessitate the reclassification of all of the roads in the Town. The recommended classifications are based upon:

- current classification in the MDP,
- location in the road network,
- potential for increases in traffic due to future development,
- current traffic,
- roadway function,
- snow clearing priority, and
- truck route designation.

Figure 2.2.3 shows the recommended road classification system. Explanations for the classification of each road segment are detailed in Section 6.3, 6.4, 6.5 & 6.6.

2.2.3.1 Ultimate Road Network

Figure 2.2.3.1 shows the recommended road classification system with roads classified as to what we see as an ultimate road network inside the current Town Boundaries and beyond the 10670 population horizon. It is recommended that this figure only be used to provide guidance on right-of-way acquisition and access restrictions. It should not be used to guide current road improvements as current future traffic projections do not warrant the ultimate road network.

2.2.3.2 Potential Long Term Network Improvements

Figure 2.2.3.2 shows the recommended road classification system with roads classified as to what we see as an ultimate road network with a few changes to the road network that are likely to improve traffic movements in the Town in the long term. These changes are only suggested as potential improvements to resolve some public and connectivity concerns. Explanations for potential long term network improvements are detailed in Section 6.3, 6.4, 6.5 & 6.6.

2.2.4 Rules of Cross Section Development

Cross sections were developed following a few basic rules. These rules are as follows:

1. Adequate right of way must be procured for the intended road function; low impact development and rural roads are not to be given a reduced right of way requirement.
2. Low impact development refers to the amount of land covered with pavement not the amount of land required.
3. Where there is no parking lane to push disabled vehicles into a rolled curb is required to make it easier to push disabled vehicles off of the road.
4. Boulevards between sidewalks and curb & gutters must be a minimum of 2.0 metres wide to facilitate plant growth.
5. Minimum sidewalk width is 1.2 metres for separate sidewalk, 1.5 metres for monolithic sidewalk next to a parking lane and 1.8 metres for monolithic sidewalk next to driving lanes. It is suggested that monolithic sidewalks not be used next to driving lanes.
6. Multi use trails are not compatible with R1 and R2 driveways however they can be compatible with major driveways from an apartment building, commercial enterprise or school. An example of where a multi use trail could be desirable in a residential setting is adjacent to a school site with a sidewalk on the other side of the road.
7. Cross sections are only concepts of what is desirable and should be modified to meet specific requirements as necessary especially in retrofit situations.

3 Level of Service

The US Transportation Research Board publishes the Highway Capacity Manual which provides a collection of techniques for estimating the capacity and determining the Level of Service (LOS) for transportation facilities. Intersections and roadways require different techniques to estimate their capacity and determine their level of service which is why intersections and roadways are examined separately.

3.1 Intersection LOS Methodology

The LOS for intersections is based on research conducted that showed how long drivers were prepared to wait at an intersection before being able to proceed through the intersection. The methodology for calculating an intersection LOS is based on the estimated delay per vehicle among all traffic passing through the intersection.

The research found that there were substantial differences in the time that drivers were prepared to wait at an un-signalized intersection and at signalized intersections. The reason for this is at a signalized intersection drivers know that they will get their turn whereas at an un-signalized intersection drivers have to wait for a gap in traffic for their turn. This is especially true of un-signalized intersections that are stop or yield controlled on the minor road.

The level of service criteria for both un-signalized and signalized intersections is documented in the Highway Capacity Manual[1], and is summarized in Table 3.1.

Table 3.1: Intersection Level of Service Criteria

Level of Service (LOS)	Average Delay (Second per Vehicle)	
	Un-signalized Intersection	Signalized Intersection
A	0-10	0-10
B	10-15	10-20
C	15-25	20-35
D	25-35	35-55
E (Capacity)	35-50	55-80
F (Failure)	> 50	> 80
Source: Highway Capacity Manual 2010, Transportation Research Board, Washington, D.C. Dec. 2010.		

The volume-to-capacity (V/C) ratio is another measure of the capacity of intersection operations. The V/C ratio describes the extent to which the traffic volumes can be accommodated by the physical capacity of the road configuration and signal control. V/C ratio values less than 0.90 indicate that generally there is ample capacity and good traffic movement condition. A value between 0.90 and 1.0 suggests unstable operations may occur and volumes are nearing capacity. A calculated value over 1.0 indicates that traffic volumes are theoretically exceeding capacity.

For un-signalized intersections LOS 'A' represents minimal delays for traffic movements on a minor street and LOS 'F' represents an insufficient number of gaps on a major street for minor street motorists to complete their movement without significant delays.

[1] Transportation Research Board, Highway Capacity Manual 2010, Washington D.C., December 2010.

For signalized intersections, the methodology considers the intersection geometry, traffic volumes, posted speed limit, traffic signal phasing/timing plan, and pedestrian volumes. The average delay for each lane, lane group and the overall intersection is then calculated.

3.2 Roadway LOS Methodology

A roadway's LOS is typically governed by the LOS of the intersections along the roadway. In EMME3 every link is given a user defined Volume Delay Function. Volume Delay Functions incorporate the link length, the posted free flow speed, the operating volumes on the link, and the nominal capacity of the link. Using the Volume Delay Function, a link is evaluated for the time it takes vehicles under given traffic conditions to traverse the link. Based on the time it takes for vehicles to travel on the network, EMME3 assigns traffic to the road network which in turn affects the travel time on a given link. EMME3 does not provide LOS, but it provides volume over capacity ratio (v/c) and average vehicle speed. To determine link LOS requires a lot of time including assessing intersection and links together which, for cost reasons, is typically beyond the scope of planning level studies. For planning level studies v/c and average vehicle speed provide a quick and suitable estimate of LOS.

Typically a v/c of more than 0.80 indicates a potential problem with the LOS of a link.

3.3 Traffic Capacity Analysis Assumptions

Table 3.3 presents a list of the arterial and collector analysis assumptions and parameters, based on the Highway Capacity Manual[2] and our previous experiences in similar transportation planning studies.

Table 3.3: Traffic Capacity Analysis Assumptions

Factors	Values	
	Un-signalized Intersection	Signalized Intersection
Peak Hour Factor (PHF)	0.92	0.92
Percentage of Heavy Vehicles	2%	2%
Grade	0%	0%
Lane Width	3.5 m/3.7 m	3.5 m/3.7 m
Ideal Saturation Flow Rate	1800 vph for Through and RT 1700 vph for Left Turn	1800 vph for Through and RT 1700 vph for Left Turn
Cycle Length		150 sec or less
Minimum Green Time		15.0 Sec for Main Street 10.0 Sec for Side Street 8.0 Sec for Left Turn
Amber Time (Intergreen Time)		4.0 Sec for Side Street 3.0 sec for Left Turn
All Red Period (Intergreen Time)		2.0 Sec
Minimum Pedestrian "Walk" Time		7.0 sec
LOS	Maximum of "D"	Maximum of "D"
Reference: Highway Capacity Manual 2010, Transportation Research Board, Washington D.C. 2010		

[2] Transportation Research Board, Highway Capacity Manual 2010, Washington D.C. 2010.

4 Data Collection

Large amounts of traffic data were collected during the course of this study to assess the state of the existing transportation network, traffic operation conditions and to build a transportation demand model.

4.1 Turning Movement Traffic Counts

The turning movements at the existing intersections along Transcanada Highway were obtained from the Alberta Transportation Traffic Count database. Additional traffic count data was available from the Town's records. The location of existing traffic count data and the intersections where SAL conducted traffic counts during the summer of 2010 are show in Figure 4.1. The intersections where SAL preformed traffic counts are:

- Broadway Avenue E & 20 Street NE (West Boundary Road)
- Broadway Avenue E & Saamis Drive SE
- Broadway Avenue E & Mitchell Street E
- Broadway Avenue E & 3 Street E
- Broadway Avenue & Main Street
- Broadway Avenue W & 8 Street W
- Broadway Avenue E & Sissons Drive SE
- South Railway Drive NE & Mitchell Street SE.

To obtain the weekday peak hour traffic volume, two-hour manual traffic counts from 7:00 a.m. to 9:00 a.m. and from 16:00 p.m. to 18:00 p.m. on normal weekdays (Tuesday, Wednesday, or Thursday) were conducted at the key intersections. Generally, the a.m. peak hour occurred from 7:15 to 8:15, and the p.m. peak hour occurred from 4:30 to 5:30. All traffic counts are included in Appendix C. The observed intersection turning movements during the a.m. and p.m. peak hour are illustrated in Figure 4.1a.

4.1.1 Existing Roadway Safety

No detailed accident data of the Town's roadways was available for all areas however sufficient data exists to examine the intersections on the Transcanada Highway. In addition the Town of Redcliff identified concerns with speeding on Main Street south of Broadway Avenue.

The Redcliff RCMP identified safety concerns at the following locations:

- Broadway Avenue E and Mitchell Street E (high traffic volume)
- Broadway Avenue E and Saamis Drive SE (yield sign)
- 5th Avenue SE Intersections with 3rd Street SE and 4th Street SE
- 5th Avenue S and Main Street S (traffic control).

A complete listing of the accident data from 2004 to 2008 at the Transcanada Highway intersections is included in Appendix D. Recognizable accident patterns are described in detail for each intersection in Section 6.7.

5 Travel Demand Forecasting Model

One important component of the Roadway System Master plan is to clearly define the future challenges in the provision of transportation infrastructure and services. A transportation travel demand model was used to forecast future traffic volume, identify when and where improvements would be required, and what the road network alternatives would be.

5.1 EMME3 Model

The Town of Redcliff 2010 EMME3 model was developed from the 2008 Medicine Hat PM Peak Transportation Model. The original Medicine Hat PM Peak Transportation Model was built by Associated Engineering for the City of Medicine Hat in January 2008. It is an EMME2 model using a traditional four step modeling process which includes trip generation, trip distribution, trip assignment and mode split to forecast trip-making by mode and trip purpose in the region's transportation network. It is a "macro" model intended for use in region-wide master planning. The EMME model distributes or allocates appropriate numbers of trips to the road network based on the input of socioeconomic data (population and employment) and network data (road and intersection) by using the matrix calculators and the user's specified balancing procedures or formulas.

EMME3 features network visualization and editing, analysis capabilities, scenario comparison tools, and reporting functions. Model results can be viewed using a number of tables, worksheets, and maps from the EMME database and external data. The model can easily be re-run using the macro "RCrun.mac" that has been developed for this mode. All EMME3 output reports are included in Appendix E.

5.2 Transportation Zones, Nodes, and Links

The EMME model is a zonal-level travel demand forecasting model. Each zone contains detailed population and employment data which are used to determine the amount of travel generated and attracted. The traffic zones are represented in the model by a centroid node which assembles trips onto and off the network.

In the 2008 Medicine Hat PM Peak Transportation Model, Zones 79 and 80 were used to represent the Town of Redcliff. Zone 79 included all residential and industrial land use south of Transcanada Highway, and all land north of Transcanada Highway was assigned to Zone 80.

To explore the Town of Redcliff in more detail, additional zones were created within the Town. The zones were developed to ensure that the land uses within the zone were as homogeneous as possible, and were configured to ensure that zones did not straddle major roadways. Zones 79, 80 were split into 20 zones; 79, 80 and 113 to 130. The EMME 3 Traffic analysis zone Map for the Town of Redcliff is included as Figure 5.2.

Other zones are defined as external zones. The population and employment data of the external zones for the base year of 2009, the mid-term Town of Redcliff horizon population of 7394, and the long-term horizon population of 10670 were obtained from the demographic data in the 2008 Medicine Hat PM Peak Transportation Model (the 2007 horizon, the 75,000 horizon, and the 95,000 horizon respectively). Because a large discrepancy was noted between the traffic counts on Transcanada Highway west of 8th Street NW (Range Road 65) and the results from the 2008 Medicine Hat PM Peak Transportation Model, adjustments were made to the external trip matrix based on the existing 2009 traffic count and historical traffic growth.

The road network of the Town of Redcliff 2010 EMME3 model consists of roadway links and nodes. The model has two types of nodes, regular nodes and centroid nodes. The regular nodes represent intersections

or turn points on the network. Turn penalties were stored for each intersection. A centroid node is the centre of a zone which stores land use data of each zone.

The links connect the nodes and are coded for each direction of the base network. There are two types of roadway links, regular links and centroid connector links. The detailed characteristics of a regular link include its classification, capacity, posted speed, number of lanes, and delays. A user defined Volume Delay Function is a function of the link length, the posted free flow speed, the operating volumes on the link, and the nominal capacity of the link. The model distributes traffic volume into each link using the travel friction factors developed from all input data. Capacity is calculated and stored in the user link data fields.

5.3 Base Year Land Use and Future Land Use for Two Population Horizons

The population of the Town of Redcliff in 2009 is estimated to be 5428 people based on the growth rate of 65.3 people per thousand from 2006 to 2009 in the Lethbridge and Medicine Hat area. This growth rate was taken from the 2008 Medicine Hat PM Peak Transportation Model. The 2008 Medicine Hat PM Peak Transportation Model estimated the total number of employees in the Town of Redcliff in 2009 to be 1,600.

Once the transportation zones were defined the number of people living and working in each zone was estimated. The number of single-family and multi-family dwelling units in each zone for the base year 2009 was determined from the 2009 land use and census statistics. The following factors were used:

- 2.74 people per dwelling unit for single family homes.
- 1.6 people per dwelling unit of low rise apartment.
- 2.4 people per dwelling unit of mobile home park.

The number of employees in each zone was further broken down into categories of commercial, industrial, office, and work at home. The categories used in the Town of Redcliff 2010 EMME3 model are the same as the 2008 Medicine Hat PM Peak Transportation Model in order to maintain consistency and match to ITE trip generation codes.

The 2009 population and employment on a zonal basis are summarized in Table 5.3.

Table 5.3: Population and Employment by Traffic Zone - 2009

Zone	Single family population mo41 popsfu	Multi family population mo42 popmfu	Total population mo43 poptot	Commercial employment mo44 empcom	Industrial employment mo45 empind	Office employment mo47 empoff	Home based employment mo50 emphom	Total employment mo51 emptot
79	1248	152	1400			26	23	49
80			0	160	189	60	0	409
113	438	203	641		30		11	41
114	203	203	406		10	39	7	56
115	130	196	326		33		5	38
116			0				0	0
117			0		35		0	35
118	22		22		11		0	11
119	1482		1482			20	25	45
120	1118		1118				19	19
121	28		28				1	1
122			0	110	338		0	448
123	5		5	30	99		0	129
124			0				0	0
125			0		63		0	63
126			0	10	49		0	59
127			0	150			0	150
128			0		29		0	29
129			0				0	0
130			0		18		0	18
Sum	4674	754	5428	460	904	145	91	1600

The percentage of single family units was assumed to be same as 86% in the 2006 Census Statistics. The study area was estimated to have 1600 jobs in 2009.

5.4 Calibration Process

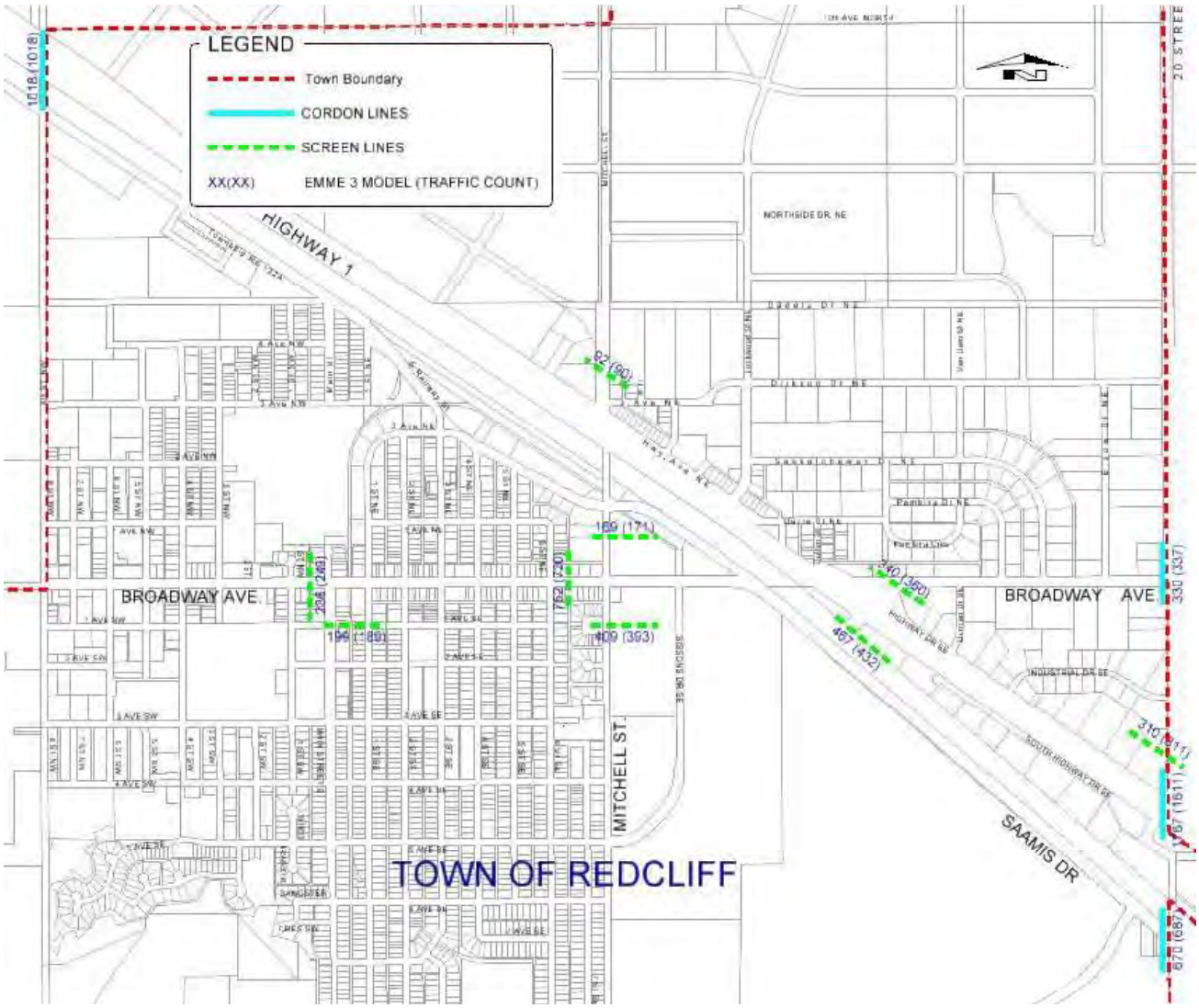
The goal of the calibration process is to have a model assigning traffic to the existing road network which reflects the existing traffic volumes and travel patterns. Specifically the purpose of calibrating a model is to:

- adjust for minor issues in the trip generation,
- adjust un-measureable conditions on the transportation network, and
- adjust for human behaviour and practice.

Calibration is done by comparing the model volumes and the observed existing traffic volumes at "screenlines" through a multi-step process involving checking the trip generation/attraction and trip distribution rates.

A screenline is an imaginary or real boundary that defines a broad corridor through which traffic flows. Traffic counts are conducted at the roads crossing the screen lines. If the total trips estimated by the model are off by more than 10% when compared to the screenline counts, changes to the various elements of the model are made. The overall level of calibration is deemed to be acceptable when the modelled traffic is close to the traffic count volumes.

The cordon lines were first chosen as the screenlines to ensure the inbound and outbound traffic of the study area is reasonably estimated from the model. Nine other screen lines were also chosen to ensure that area-to-area traffic is reasonably estimated from the model. The modeled and counted P.M. traffic volumes at the selected screenline are presented in Table 5.4. The identified screen lines along with outer cordon lines are illustrated in Figure 5.4.



Clip from Figure 5.4 Cordon & Screenlines

Table 5.4: Modeled and Counted Traffic Volumes at Cordonlines and Screenlines

Cordon line Location	P.M. Traffic Volume		Difference (Modeled Base Year -Traffic Counts)/Traffic Counts*100%
	Modeled Base Year	Traffic Counts	
Cordon Lines			
Transcanada Highway west of 8th Street NW (RR 65)	1018	1018	0%
Broadway Avenue E west of 20th Street E	330	337	-2.1%
Transcanada Highway east of 20th Street SE	1767	1611	+9.7%
Saamis Drive SE east of Broadway Avenue E	670	687	-2.5%
Total Cordon Lines	3785	3653	+3.6%

Screen line Location	P.M. Traffic Volume		Difference (Modeled Base Year -Traffic Counts)/Traffic Counts*100%
	Modeled Base Year	Traffic Counts	
Screen Lines North of Transcanada Highway			
Mitchell Street NE north of Transcanada Highway	92	90	+2.2%
Broadway Avenue E northwest of the Transcanada Highway	340	360	-5.6%
20th Street SE north of Transcanada Highway	310	311	-0.3%
Total Screen Lines	**742**	**761**	**-2.5%**
Screen Lines South of Transcanada Highway			
Broadway Avenue E west of Mitchell Street E	752	720	+4.4%
Broadway Avenue W west of Main Street	236	249	-5.2%
Broadway Avenue E south of Transcanada Highway	467	432	+8.1%
Mitchell Street NE north of Broadway Avenue E	169	171	-1.2%
Mitchell Street SE south of Broadway Avenue E	409	393	+4.1%
Main Street south of Broadway Avenue	199	189	-5.3%
Total Screen Lines	**2232**	**2154**	**+3.6%**
Overall Calibration	6759	6568	+2.9%

The overall calibration is within 2.9% of the existing volumes. The area calibrations in the study area are within 2% to 4% of the actual traffic count. The calibration of all screenlines is within a 10% difference between the volumes obtained from the model and the traffic count. EMME3 outputs after calibration are shown in:

- Figure 5.4a - EMME 3 Output – 2010 PM Peak Calibrated Traffic Volume
- Figure 5.4b- EMME 3 Output – 2010 PM Peak Volume Capacity Ratio
- Figure 5.4c - EMME 3 Output – 2010 PM Peak Average Vehicle Speed.

The results of calibration indicate that the Redcliff EMME3 model has been well fit to represent the existing traffic conditions in the Town of Redcliff study area. Future land use projections were then used to forecast future traffic volumes.

5.5 Future Traffic

Two future modeling time frame scenarios were considered as follows:

- 2020 Ten-year Scenario – 7,394 Population: The mid-term traffic impact analysis will provide the potential priority of mitigation measures.
- 2030 Twenty-Year Scenario – 10,670 Population: The long-term development impacts will evaluate the intermediate roadway classification, and the potential intersection configurations and traffic control measures.

These population horizons were selected based on the planning information provided by the Town and available to the consultant team.

Traffic growth within the study area is expected to occur between existing conditions and any given future year due to increased population and employments in the study area and traffic generated from the surrounding region. The future land use growth on a zonal basis corresponds to the 7394 population (10 year) and 10670 population (20 year) horizons.

Traffic growth due to the surrounding regions was also accounted as part of the future modeling. Two types of external zones were included in the model, which are the City of Medicine Hat and the provincial Highways. The City of Medicine Hat is assumed to reach the 75k and 95k population horizon corresponding to the 7394 and 10670 populations in the Town of Redcliff respectively. Traffic growth factors were used to obtain future traffic volumes on Transcanada Highway. A historical five-year growth factor of 0.94% was used to estimate the external trips from Transcanada Highway.

5.5.1 7394 Population Horizon

5.5.1.1 Land Use

As shown in Table 5.5.1, population growth is focused on the east side of the Town with approximately 1,700 new residents at the medium term horizon of 7,394 population. Minor population growth is forecast in Bayliss, River Terrace, and the existing residential area. Employment growth is expected mainly in the Northside Industrial subdivision and minor commercial development is expected in the east side of the Town.

Table 5.5.1: Population and Employment by Traffic Zone – 7394 Population Horizon

Zone	Single family population Mo56 popsfu	Multi family population Mo57 popmfu	Total population Mo58 poptot	Commercial employment Mo59 empcom	Industrial employment Mo60 empind	Office employment Mo62 empoff	Home based employment Mo65 emphom	Total employment Mo66 emptot
79	1248	152	1400			36	23	59
80			0	160	189	60	0	409
113	534	203	737		30		12	42
114	203	203	406		17	49	7	73
115	130	196	326		53		5	58
116	1145	202	1347				22	22
117			0		35		0	35
118	22		22		11		0	11
119	1512		1512			20	25	45
120	1118		1118				19	19
121	127		127				2	2
122			0	110	439		0	549
123	5		5	30	191		0	222
124			0		205		0	205
125			0		63		0	63
126			0	43	49		0	92
127			0	180			0	180
128			0		29		0	29
129			0				0	0
130	336	59	396	40	18		7	65
Sum	6379	1016	7394	563	1330	165	122	2180

Overall, the study area has 7394 people and 2180 jobs at the medium term horizon.

5.5.1.2 Modeled Traffic Volumes

The calibrated transportation demand model was run with the 7394 population and employment figures and, future traffic volumes were derived for the 7394 population horizon. Future traffic conditions at the 7394 population are shown in:

- Figure 5.5.1a - EMME 3 Output – 7394 Population Horizon PM Peak Traffic Volume
- Figure 5.5.1b - EMME 3 Output – 7394 Population Horizon PM Peak Volume Capacity Ratio
- Figure 5.5.1c - EMME 3 Output – 7394 Population Horizon PM Peak Average Vehicle Speed.
- Figure 5.5.1d - 7394 Population Horizon – Intersection Traffic Volume

5.5.2 **10670 Population Horizon**

5.5.2.1 Land Use

Summarized in Table 5.3 below are the population and employment forecasts used for the long term population horizon of 10,670. A significant portion of the population growth is planned in the east side of the Town with approximately 4,855 new residents. Intensification in Bayliss, River Terrace, and the existing residential area is anticipated during the long term horizon. Employment growth in the Town of Redcliff is

planned in the Northside Industrial subdivision mainly adjacent to 20th Street. Minor commercial development is expected in the east side of the Town and along Transcanada Highway.

Table 5.5.2: Population and Employment by Traffic Zone – 10670 Population Horizon

Zone	Single family population Mo71 popsfu	Multi family population Mo72 popmfu	Total population Mo73 poptot	Commercial employment Mo74 empcom	Industrial employment Mo75 empind	Office employment Mo77 empoff	Home based employment Mo80 emphom	Total employment Mo81 emptot
79	1248	152	1400			36	23	59
80			0	160	189	60	0	409
113	716	107	824		30		14	44
114	203	203	406		17	49	7	73
115	130	196	326		53		5	58
116	3092	546	3638	259		60	60	380
117			0		35		0	35
118	22		22		11		0	11
119	1543		1543			20	26	46
120	1118		1118				19	19
121	171		171				3	3
122			0	120	439		0	559
123	5		5	30	191		0	221
124			0		361		0	361
125			0		186		0	186
126			0	114	100		0	215
127			0	180			0	180
128			0		29		0	29
129			0		159		0	159
130	1035	183	1218	40	18	20	20	98
Sum	9283	1387	10670	904	1819	245	177	3145

Overall, the study area has 10,670 people and 3145 jobs at the long term horizon.

5.5.2.2 Modeled Traffic Volumes

The calibrated transportation demand model was run with the 10,670 population and employment figures and, future traffic volumes were derived for the 10,670 population horizons. Future traffic volumes at the 10,670 population are shown in:

- Figure 5.5.2a - EMME 3 Output – 10670 Population Horizon PM Peak Traffic Volume
- Figure 5.5.2b - EMME 3 Output – 10670 Population Horizon PM Peak Volume Capacity Ratio
- Figure 5.5.2c - EMME 3 Output – 10670 Population Horizon PM Peak Average Vehicle Speed.
- Figure 5.5.2d - 10670 Population Horizon – Intersection Traffic Volume

6 Transportation Network Evaluation & Solutions

This section of the report looks at the Transportation Network components and evaluates the capacity of the components and any concerns raised with various components; and proposes solutions to the capacity and safety concerns that were found. This section is not intended to provide a priority of improvements list nor opinions of probable costs. This section is intended to provide a synopsis of the findings for each component and propose and evaluate solutions. Where a component is not noted in this section there were no issues found or raised with the capacity or safety of the component and therefore it is to be assumed that no upgrades for capacity or safety issues are required. Upgrades due to the condition of the roads are dealt with separately in Section 7.

6.1 Current Conditions

An intersection operation analysis was conducted for:

- Un-signalized intersection of the Transcanada Highway and 8th Street NW,
- Three signalized intersections on Transcanada Highway,
- Seven un-signalized intersections along Broadway Avenue, and
- Mitchell Street NE and South Railway Drive NE.

Intersection delays, LOS, and queuing at these intersections during the weekday a.m. and p.m. peak hour were calculated using Synchro Version 6. The LOS analysis indicates that currently most intersections in the Town of Redcliff operate at a LOS 'C' or better which indicates good operating conditions at most of intersections during the morning and afternoon peak hour.

6.2 Future Conditions

An intersection operation analysis was conducted for the same intersections analyzed for current conditions and two additional intersections:

- un-signalized intersection of Saamis Drive SE and 9th Avenue SE, and
- un-signalized intersection of Mitchell Street SE and 9th Avenue SE.

Intersection delays, LOS, and queuing at these intersections were calculated using Synchro Version 6 during the weekday p.m. peak hour only for the following reasons:

- Based on the existing traffic count, the existing traffic volume during the a.m. peak hour in the Town of Redcliff is much lower than the p.m. peak hour.
- Based on the previous operation analysis, the capacity and operational deficiencies during the p.m. peak hour is critical in the Town of Redcliff.
- The traffic model developed for this study was developed from the 2008 Medicine Hat EMME model which only provided the p.m. traffic volume.

The LOS analysis indicates that most intersections in the Town of Redcliff operate at a LOS 'C' or better. This indicates good operating conditions at most intersections in the Town of Redcliff during the afternoon peak hour. Operational conditions of the intersections with lower LOS are discussed as follows:

6.2.1 New Roadways to Facilitate Growth – 7394 Population Horizon

Figure 2.2.3.1 presents the recommended roadway network classifications at the 7394 Population Horizon for the Town of Redcliff.

The Eastside Traffic Impact Assessment (TIA), prepared by Stantec Consulting Ltd. in March, 2006, recommended that 9th Avenue SE should connect Saamis Drive SE and Mitchell Street SE at the time Eastside Phase 11 is constructed.

In reviewing this report SAL recommends the following changes:

1. Eastside Phases 1 to 11 will consist of 768 residential units as illustrated in the Eastside TIA's Traffic Generation Worksheet. For good street connectivity, a second access is typically desirable for subdivisions larger than 100 residential units. Therefore, it is recommended that 9th Avenue SE should connect with Saamis Drive SE and Mitchell Street SE with the 2nd phase or when over 100 residential units are developed. This second connection has two functions as follows:
    - 9th Avenue SE linking Mitchell Street SE to Saamis Drive SE will serve the adjacent development in Town of Redcliff EMME3 Traffic Model Zone 116 (Eastside ASP) as a direct link to the City Medicine Hat. It is estimated that at the 7394 population horizon the Eastside subdivision will have a population of 1347. Commuters from the Eastside of the Town are expected to use 9th Avenue SE and Saamis Drive SE as their major route to and from the City of Medicine Hat.
    - 9th Avenue SE will become an alternative route for the current residents west of Mitchell Street SE. It will relieve pressure on the section of Broadway Avenue E from Mitchell Street E to Saamis Drive SE.
2. The road cross section of 9th Avenue SE put forward in the report calls for a divided major collector road with 2 driving lanes in each direction and parking lanes on each side. We have evaluated the future capacity requirements for 9th Avenue SE and have found that this road section is not appropriate at this location. Some reasons are:
    - Wide roads increase pedestrian crossing distance which then increases the time that pedestrians are in conflict with motor vehicles.
    - Wide roads typically see higher average speeds.
    - Medians cause property access issues especially in residential neighbourhoods with front driveways and garages.
    - Construction of a road wider than will be needed is an unnecessary expense. In the case of 9th Avenue SE, we estimate approximately **one million dollars in savings** to build the remainder of the road to an appropriate section instead of continuing with the current section.

This link was referred to as 9th Avenue SE and modeled as a 2 lane undivided residential collector roadway in this report. A more detailed and thorough examination of the traffic issues with the Eastside Development is found in Appendix F.

If the remaining portion of 9th Avenue SE to be built (approximately 1200 m) is built as currently planned in our opinion the probable cost to build this roadway, excluding the cost of underground utilities, is $3.5 million. However if our recommendations are followed and the road is not overbuilt for projected traffic volumes the probable cost is $2.5 million.

6.2.2 Transportation System Performance – 7394 Population Horizon

Based on the assessment of the traffic conditions at the 7394 population horizon, it was concluded that, with the introduction of a new residential collector roadway (9th Avenue SE), all roadways in the Town of Redcliff will operate at acceptable level of service. Also the congestion at the intersection of Broadway Avenue E and Mitchell Street E will be reduced at the 7394 population horizon.

6.2.3 New Roadways to Facilitate Growth – 10,670 Population Horizon

With continuing development in the Eastside subdivision it is expected that a new roadway link between Mitchell Street SE and Saamis Drive SE will be constructed by the 10670 population horizon. Current planning is this link is expected to be an extension of 5th Avenue SE, however its usefulness as a connector road between Mitchell Street SE and Saamis Drive SE is questionable due to the intersection location on Saamis Drive SE and the tight curves proposed for this road. This link was modeled in EMME3 as a two-lane residential collector roadway without directly connecting between Mitchell Street SE and Saamis Drive SE to reflect the current planning of this road.

6.2.4 Transportation System Performance - 10670 Population Horizon

Based on the assessment of traffic conditions at the 10670 population horizon, it was concluded that, with the introduction of a new residential collector roadway (9th Avenue SE), all roadways in the Town of Redcliff will still operate at acceptable level of service.

Once the intersection of Saamis Drive SE and 9th Avenue SE is signalized, no further intersection improvements are required for 10670 population horizon assuming that the intersection of Broadway Avenue E and Mitchell Street E was signalized or converted to a roundabout prior to the 7394 population horizon.

6.2.5 Ultimate System Build Out

When included in a road or intersection discussion, the intent of this section is to identify long term planning that is beyond the 10,670 population horizon but can be identified now. No modeling was done for this and most of the value of this section is ensuring that roadways have the correct long term classification complete with the reasoning behind the long term classification and land for the road or intersection can be acquired over time as opportunities arise.

6.3 Arterial Roads

As shown in the MDP, Broadway Avenue, Saamis Drive SE, Mitchell Street E between 9th Avenue SE and the Transcanada Highway, and 8th Street NW between Broadway Avenue W and the Transcanada Highway are currently arterial roads. Mitchell Street NE north of the Transcanada Highway, 20th Street NE north of Broadway Avenue E, and 10th Avenue NE will be arterials. This section only includes the road segments that are classified as arterials in the proposed roadway classification system in Section 2.2.3.

The classification of collector roadway was determined more appropriate to Mitchell Street SE between Broadway Avenue E and 9th Avenue SE than the current classification of arterial roadway because:

- Mitchell Street SE ends at Redcliff Way SE due to the natural barrier created by the South Saskatchewan River,
- The current traffic volume of Mitchell Street SE south of Broadway Avenue E is approximately 4200 AADT which is consistent with a collector road.
- The majority of peak hour on Mitchell Street SE are commuter between the Town of Redcliff and the City of Medicine Hat with Mitchell Street SE serving as a primary connector to Broadway Avenue.
- When Mitchell Street SE is connected to Saamis Drive SE by 9th Avenue SE through the Eastside subdivision a large percentage of commuter traffic is expected to utilize 9th Avenue SE instead of Mitchell Street SE to Broadway Avenue.

- Peak hour traffic on Mitchell Street SE is not expected to increase with development of lands east of Mitchell Street SE beyond current levels due to much of the current traffic diverting to 9th Avenue in the future.
- The existing road cross-section of Mitchell Street SE will continue operating at a satisfactory level of service even with the full development of the Eastside subdivision.
- There are multiple accesses to the existing residential development on the west side of Mitchell Street SE which are inconsistent with an Arterial road,
- The function of the road is expected to be more in line with that of a collector road.

10th Avenue NE, Mitchell Street NE north of the Transcanada Highway and 20th Street NE north of the Transcanada Highway should be made arterial roads to maintain satisfactory spacing of an arterial road network and provide the opportunity for future development in the Town of Redcliff.

This section lays out the current operation, AADT, overall road geometry and purpose for roads currently classified or planned as arterial roadways in the Town.

6.3.1 Broadway Avenue E between Transcanada Highway and 20th Street NE

Broadway Avenue east of Transcanada Highway currently serves the developed industrial area north of Transcanada Highway.

6.3.1.1 AADT

The existing traffic volume of Broadway Avenue east of Transcanada Highway is approximately 3600 AADT, while west of 20th Street it is approximately 6000 AADT.

6.3.1.2 Existing Condition

The existing road for this section of Broadway Avenue E has a rural section and varies from 8.9 m to 12.5 m in width. The intersection spacing of Broadway Avenue E east of Transcanada Highway is approximately 200 m, but direct driveways are allowed.

6.3.1.3 Classification

This segment of Broadway Avenue E is currently classified as an arterial road. Based on current traffic volume, traffic composition, running speed and accesses, Broadway Avenue E east of the Transcanada Highway operates as a feeder or collector road. Most land adjacent Broadway Avenue E east of the Transcanada Highway is developed. The need for expansion of this facility is low. Therefore, considering its current function and low need of future potential expansion, Broadway Avenue E east of Transcanada Highway could be classified as a collector road although its location in the transportation network and the fact that traffic is likely to increase substantially in the future when development occurs in the City of Medicine Hat east of 20th Street NE, allows for a classification of arterial roadway.

6.3.1.4 Upgrades

Based on current traffic volumes no upgrades are currently required for this road segment.

6.3.1.5 Ultimate

At some point in the future this link will require upgrading as the development of the Box Springs Business Park in the City of Medicine Hat proceeds since this segment of Broadway Avenue E is a connection to the Transcanada Highway. Due to right of way constraints, and the number of existing accesses, it is impractical that this road be upgraded to a 4 lane divided major street as numerous business accesses would have to be reduced to right-in / right-outs. It is also impractical that this road be upgraded to a 4 lane undivided major street as the numerous existing accesses would result in severely reduced road capacity due to left turning vehicles blocking the left through lane.

As shown in Figure 2.2.3.1 the ultimate configuration of this roadway is recommended to be a 4 lane undivided road with a two way left turn lane. A suggested interim configuration is a 2 lane undivided road with a two way left turn lane and right turn lanes at high volume right turn locations. These options acknowledge the historic access situation and will accommodate increases in traffic without requiring substantial increases of right of way. A 4 lane undivided road section is not recommended as experience has proved that this type of section does not operate successfully with large traffic volumes and numerous access points. It is currently proposed that in the ultimate configuration the intersection of the Transcanada Highway be a changed to an interchange. Property should be reserved on this link to allow for these changes. It is recommended that a Functional Planning Study be carried out for this segment of Broadway Avenue E. Our opinion of the probable cost of such a study is $20,000.

6.3.2 Broadway Avenue E between Transcanada Highway and Saamis Drive SE

Broadway Avenue E between the Transcanada Highway and Saamis Drive SE serves as a connection between the Transcanada Highway, North Industrial area and the remainder of the Town south of the Transcanada Highway.

6.3.2.1 AADT

The existing traffic volume for this section of Broadway Avenue E is approximately 5000 AADT.

6.3.2.2 Existing Condition

The existing road for this section of Broadway Avenue E has a rural section and is 17.4 m in width. This short section of road is characterized by a CPR rail crossing and a tee intersection at the Saamis Drive SE / Broadway Avenue E intersection and has no driveways or other roads accessing it.

6.3.2.3 Classification

Currently this segment is classified as an arterial roadway.

6.3.2.4 Upgrades

No upgrades are proposed at this time for this segment however upgrades are proposed for the intersection of Broadway Avenue E and Saamis Drive SE and long term changes are proposed to Saamis Drive SE which will increase the length of this segment. It is recommended that a functional planning study of this segment of Broadway Avenue E be done in conjunction with a new transportation plan for the Eastside subdivision.

6.3.2.5 Ultimate

At some point in the future this link will require grade separation at the CPR rail crossing. It is currently proposed that in the ultimate configuration the intersection of the Transcanada Highway to be a changed to an interchange. Property should be reserved on this link to allow for these changes.

6.3.3 Broadway Avenue E between Saamis Drive SE and Mitchell Street E

Broadway Avenue E between Saamis Drive SE and Mitchell Street E serves as the primary entrance to the Town of Redcliff from the City of Medicine Hat.

6.3.3.1 AADT

The existing traffic volume for this section of Broadway Avenue E is approximately 11000 AADT.

6.3.3.2 Existing Condition

This section of Broadway Avenue E is characterised by a rural cross section which varies between 14.4 m and 15.9 m wide on the eastern portion to allow for a right turn acceleration lane for westbound traffic and the long radius curve; and an east/west portion with an urban section having a width of 14.4 m. There are no driveways or street accesses on the rural portion however on the urban portion there are several commercial accesses on the north side of the road and a tee intersection with Sissons Drive SE on the south side of the road.

Based on existing conditions, this segment of Broadway Avenue E is the only roadway currently operating at a poor level of service during the p.m. peak periods.

6.3.3.3 Classification

Currently this segment is classified as an arterial roadway.

6.3.3.4 Upgrades

Due to the volume of traffic currently present on this segment of Broadway Avenue E it is expected that enhancements to accommodate existing and future traffic will be required; however when examining the 7394 population horizon, the AADT drops for this segment. It only returns close to the current AADT at the 10670 population horizon. The reason for this behaviour is that at the 7394 population horizon it is assumed that 9th Avenue SE has been extended to Saamis Drive SE and that a substantial portion of the current traffic on this segment has switched to using 9th Avenue SE. Unless structural conditions of the road or realignment of this section are to be undertaken, it is better to extend 9th Avenue SE to Saamis Drive SE than to upgrade this section of Broadway Avenue E.

As this segment is a primary connection to the City of Medicine Hat, the following factors should be considered for upgrading:

- CPR rail line,
- Commercial development planned along Saamis Drive SE,
- Intersection spacing,
- Design speed,
- Road alignment,
- Divided or undivided cross-section.

6.3.3.5 Ultimate

As land is undeveloped for most of this segment of Broadway Avenue E, property should be reserved to allow this link to be upgraded to a Divided Major Road. It is recommended that a functional planning study of this segment of Broadway Avenue E be done in conjunction with a new transportation plan for the Eastside subdivision.

6.3.4 Broadway Avenue E between Mitchell Street E and 4th Street E

Broadway Avenue E between Mitchell Street E and 4th Street E serves both residential and commercial properties on each side of the road.

6.3.4.1 AADT

The existing traffic volume for this section of Broadway Avenue E is approximately 7500 AADT.

6.3.4.2 Existing Condition

This section of Broadway Avenue E has an urban section 17.5 m in width.

Most intersection spacing of Broadway Avenue E west of Mitchell Street E is approximately 100 m which is significantly less than best practices and the current intersection spacing standard of 300 m recommend. However, the majority of roads intersecting and paralleling Broadway Avenue E west of Mitchell Street E in the Town of Redcliff are made up of a grid road network which disperses traffic without concentrating it to particular roads.

6.3.4.3 Classification

Currently this segment is classified as an arterial roadway.

6.3.4.4 Upgrades

Given:

- the already well developed grid roadway network,
- minor traffic growth expectations west of Mitchell Street E,
- few issues with the current roadway patterns and alignments, and
- the limited opportunities for change,

no upgrades are proposed at this time for this segment.

6.3.4.5 Ultimate

Given the location in the road network and the expected future traffic of this segment of Broadway Avenue E, no change in road classification or improvements are proposed.

6.3.5 Broadway Avenue E between 4th Street E and 1st Street E

Broadway Avenue E between 4th Street E and 1st Street E is characterized as a typical Alberta small urban area downtown road section.

6.3.5.1 AADT

The existing traffic volume for this section of Broadway Avenue E is approximately 4500 AADT.

6.3.5.2 Existing Condition

This segment of Broadway Avenue E has commercial development on both sides of the road, angled parking on both sides of the road, intersection spacing of approximately 100m (see commentary on intersection spacing on Broadway Avenue E west of Mitchell Street E in section 6.3.4), and an overall pavement width of 26.1 m. Some improvements to increase pedestrian comfort such as curb extensions have been installed.

6.3.5.3 Classification

Currently this segment is classified as an arterial roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does.

6.3.5.4 Upgrades

No upgrades are proposed at this time for this segment

6.3.5.5 Ultimate

Given the location in the road network and the expected future traffic of this segment of Broadway Avenue E, no change in road classification or improvements are proposed. Future upgrades to aesthetics and pedestrian accommodation for this downtown road are beyond the scope of this report.

6.3.6 Broadway Avenue between 1st Street E and 8th Street W

Broadway Avenue between 1st Street E and 8th Street W serves industrial, horticultural, commercial and residential land uses.

6.3.6.1 AADT

The existing traffic volume for this section of Broadway Avenue is approximately 4500 AADT east of Main Street, 3000 AADT between Main Street and 6th Street W and below 1000 AADT west of 6th Street W.

6.3.6.2 Existing Condition

This section of Broadway Avenue has primarily an urban cross section and an intersection spacing of approximately 100m (see commentary on intersection spacing on Broadway Avenue E west of Mitchell Street E in Section 6.3.4), commercial and residential accesses, and an overall pavement width of 11.7 m.

6.3.6.3 Classification

Currently this segment is classified as an arterial roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does.

6.3.6.4 Upgrades

No upgrades are proposed at this time for this segment. It is recommended that a functional planning study be undertaken for this segment of Broadway Avenue. Our opinion of the probable cost for this study is $20,000.

6.3.6.5 Ultimate

Given the location in the road network and the expected future traffic of this segment of Broadway Avenue, no change in road classification or improvements are proposed.

6.3.7 Saamis Drive SE east of Broadway Avenue E

Saamis Drive SE east of Broadway Avenue E serves as one of two principal connections to the City of Medicine Hat. The other principle connection to the City of Medicine Hat is the Transcanada Highway.

6.3.7.1 AADT

The existing traffic volume for Saamis Drive SE is approximately 7500 AADT.

6.3.7.2 Existing Condition

Saamis Drive SE has a rural cross section and a pavement width of 10.4 m. Currently there is no development, driveways or intersections along this road.

6.3.7.3 Classification

Currently this segment is classified as an arterial roadway.

6.3.7.4 Upgrades

No upgrades are proposed at this time for this segment.

6.3.7.5 Ultimate

As land is undeveloped for most of this segment of Saamis Drive SE property should be reserved to allow this link to be upgraded to a Divided Major Road. It is recommended that a functional planning study of this segment of Broadway Avenue E be done in conjunction with a new transportation plan for the Eastside subdivision.

6.3.8 20th Street NE between Broadway Avenue E and the Transcanada Highway

20th Street NE between Broadway Avenue E and the Transcanada Highway is located along the east boundary of the Town of Redcliff. The road is in the jurisdiction of the City of Medicine Hat.

6.3.8.1 AADT

The existing traffic volume for this segment of 20th Street NE is approximately 3100 AADT.

6.3.8.2 Existing Condition

This section of 20th Street NE has a rural cross section and an intersection spacing of approximately 300 m with industrial driveways located on the west side of the road and accesses to fields and a parking lot on the east side.

6.3.8.3 Classification

Currently this segment is not classified in the MDP although this was likely an over site and it should have been classified as an arterial roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does. The City of Medicine Hat has classified this segment of road as a divided minor arterial in their classification system.

6.3.8.4 Upgrades

No upgrades are required for this segment now or at the 10670 population horizon for growth in the Town of Redcliff.

6.3.8.5 Ultimate

The City of Medicine Hat should be worked with to ensure right of way is preserved for their ultimate plans.

6.3.9 20th Street NE north of Broadway Avenue E

20th Street NE north of Broadway Avenue E is located along the east boundary of the Town of Redcliff. The road is in the jurisdiction of the City of Medicine Hat.

6.3.9.1 AADT

The existing traffic volume for this section of 20th Street NE is less than 1000 AADT.

6.3.9.2 Existing Condition

This section of 20th Street NE has a rural cross section and an intersection spacing in excess of 400 m with industrial driveways located on the west side of the road and accesses to fields and a parking lot on the east side.

6.3.9.3 Classification

Currently this segment is classified in the MDP as a local roadway which is consistent with the existing development in the area. The MDP shows this road to be a future arterial which is consistent with good practice for the spacing of arterial roadways. The City of Medicine Hat has classified this segment of road to be a divided minor arterial in their classification system.

6.3.9.4 Upgrades

No upgrades are required for this segment now or at the 10670 population horizon for growth in the Town of Redcliff. Upgrades for this road segment will be driven by development in Northside and Box Springs Business Park and as such will likely be required beyond the 10670 Population Horizon.

6.3.9.5 Ultimate

The City of Medicine Hat should be worked with to ensure right of way is preserved for their ultimate plans.

6.3.10 Mitchell Street NE between Broadway Avenue E and the Transcanada Highway

Mitchell Street NE between Broadway Avenue E and the Transcanada Highway serves commercial lands on the west side of the road and industrial lands on the east side of the road.

6.3.10.1 AADT

The current traffic volume of Mitchell Street NE between Broadway Avenue E and the Transcanada Highway is approximately 2500 AADT.

6.3.10.2 Existing Condition

A major feature of this segment of Mitchell Street NE is the crossing of the CPR rail line. This segment is currently a two lane road with a rural section and a 12.2 m pavement surface.

6.3.10.3 Classification

Currently this segment is classified as an arterial roadway.

6.3.10.4 Upgrades

No upgrades are proposed at this time for this segment however upgrades are proposed for the intersection of Broadway Avenue E and Mitchell Street E which will have an impact on this road segment.

6.3.10.5 Ultimate

North of South Railway Drive NE, Mitchell Street NE is proposed to be upgraded to a Divided Major Road. Property should be acquired and retained for this purpose.

6.3.11 **Mitchell Street NE north of the Transcanada Highway**

Mitchell Street NE north of the Transcanada Highway serves industrial lands both sides of the road.

6.3.11.1 AADT

The current traffic volume of Mitchell Street NE north of the Transcanada Highway is less than 1000 AADT.

6.3.11.2 Existing Condition

This segment is currently a two lane road with a rural section with 7.0 m pavement surface.

6.3.11.3 Classification

Currently this segment is classified as an arterial roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does.

6.3.11.4 Upgrades

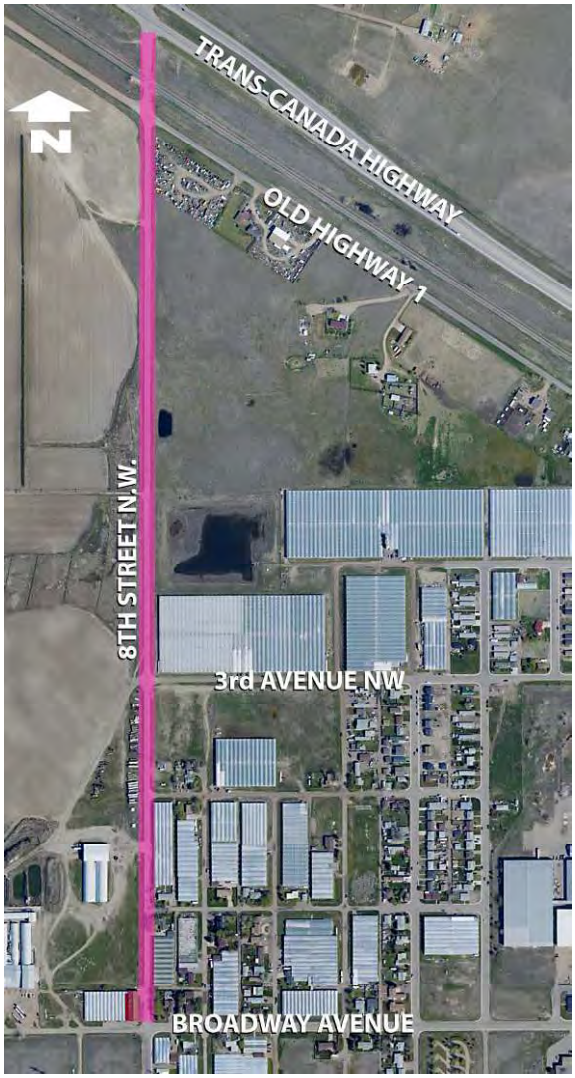
No upgrades are proposed at this time for this segment. Road upgrades for this segment will be driven by development in the Northside subdivision.

6.3.11.5 Ultimate

This segment of Mitchell Street NE is proposed to be upgraded to a Divided Major Road. Property should be acquired and retained for this purpose.

6.3.12 8th Street NW

8th Street NW currently serves residential and horticultural areas with its primary function being connection of the west end of Broadway Avenue W with the Transcanada Highway.



6.3.12.1 AADT

The current traffic volume of 8th Street NW is less than 1000 AADT.

6.3.12.2 Existing Condition

8th Street NW is currently a two lane rural road with an 8.4 m pavement surface.

6.3.12.3 Classification

Currently this segment is classified as an arterial roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does.

6.3.12.4 Upgrades

No upgrades are proposed at this time for this segment.

6.3.12.5 Ultimate

This segment of 8th Street NW is proposed to be upgraded to a Divided Major Road. Property should be acquired and retained for this purpose.

6.4 Collector Roads

As shown in the MDP, Main Street S between Broadway Avenue and 9th Avenue S, South Railway Drive NE and Old Transcanada Highway are collector roads. All other roads are designated as local roads, future collector roads, future arterial roads, or arterial roads.

It is proposed that the following roads be made collector roads, Mitchell Street SE between Broadway Avenue E and 9th Avenue SE, 9th Avenue SW east of Main Street S and 9th Avenue SE as constructed west of Mitchell Street SE.

9th Avenue SE between Main Street S and Mitchell Street SE should also be upgraded to collector road status in preparation for 9th Avenue SE connecting to Saamis Drive SE; however this upgrading will not be needed until 9th Avenue SE is connected to Saamis Drive SE so the upgrading can wait for several years.

Mitchell Street SE between 9th Avenue SE and Redcliff Way SE, and Redcliff Way SE between 6th Street SE and Mitchell Street SE, should be upgraded to collector roadways as they service the Redcliff Golf Course. The traffic generated by this facility typically warrants a collector road connection to the road network.

Redcliff Way SE between Main Street S and 6th Street SE currently functions as a collector road due to the pavement width of 9th Avenue SE. This road could be upgraded to a collector in recognition of its current function.

4th Street SW between Broadway Avenue W and 4th Avenue SW currently services a horticultural area and is maintained in winter at the same level as a collector road. Because of the road's location in the road network and the large public service site east of the road breaking up the grid pattern, it is suggested that this road be upgraded to an industrial/commercial collector.

6.4.1 9th Avenue SE between Main Street S and Mitchell Street SE

This segment of 9th Avenue SE is currently classified as a local residential road. Current planning is to upgrade this road to a collector classification due to its location in the road network as the primary east/west corridor on the south side of Town connecting 9th Avenue SW to Mitchell Street SE and eventually to Saamis Drive SE.

6.4.1.1 AADT

This section of 9th Avenue SE is proposed to be upgraded to a collector roadway however currently there are no measurements of the traffic on this road. It is likely less than 1000 AADT.

6.4.1.2 Existing Condition

This section of 9th Avenue SE varies in width from 7.3 m to 8.0 m.

6.4.1.3 Upgrades

Currently there is no need to upgrade this segment of road. This segment of road should be upgraded to a collector roadway standard prior to 9th Avenue SE connecting to Saamis Drive SE which will direct a large volume of traffic to this road. The upgrade should examine parking requirements, road structure, as well as attempt to minimize access to the road. Signage along the road should be changed when the road is upgraded to reflect the higher classification, the road should be widened, and sidewalks constructed on each side. The length of 9th Avenue SE to be upgraded is approximately 800 m.

In our opinion, the probable cost to upgrade 9th Avenue SE from the current local roadway standard to a collector roadway standard is $2.5 million.

6.4.2 Mitchell Street SE between Broadway Avenue E and Redcliff Way SE

Mitchell Street SE currently serves residential areas plus the Redcliff Golf Course located at its south end and the RCMP station located on the east side of the road approximately at 4th Avenue SE. In the past Mitchell Street SE also served a brick plant located on the east side of the road between 6th Avenue SE and 8th Avenue SE, however this plant has been permanently closed for many years.

6.4.2.1 AADT

The current traffic volume of Mitchell Street SE south of Broadway Avenue E is approximately 4200 AADT.

6.4.2.2 Existing Condition

Mitchell Street SE is currently a two lane road with curb and gutter on both sides but no sidewalks. The pavement surface varies between 9.3 m and 11.2 m.

6.4.2.3 Classification

Currently this segment is classified as an arterial roadway however due to the location it is proposed to change the classification to a collector roadway. Because this road also functions as a truck route it is recommended that this road be classified as an industrial/commercial collector.

6.4.2.4 Upgrades

No upgrades are proposed at this time for this segment. It is recommended that a functional planning study be undertaken for this segment of Broadway Avenue E. Our opinion of the probable cost for this study is $20,000.

6.4.3 9th Avenue SE east of Mitchell Street SE

9th Avenue SE east of Mitchell Street SE was planned as a primary collector roadway in the 2001 approved Eastside Area Structure Plan.

6.4.3.1 AADT

This section of 9th Avenue SE is a new road currently serving only a new development, as such there is no measurement of the traffic on this road, though it is likely less than 1000 AADT.

6.4.3.2 Existing Condition

The total pavement width of the current constructed section is 23.5 m, which includes one 2.5 m parking lane and two driving lanes in each direction and a 3.5 m median. Two types of median, raised median and flush median, were used in this section. The length of flush median is 288 m, which is 78% of the total length. Therefore, the section will function as a five-lane TWLTL design, not a true four-lane divided design.

6.4.3.3 Classification

Currently this segment is classified as a Primary Residential Collector roadway and it is proposed to change the classification to a residential collector roadway.

6.4.3.4 Safety

Past researches indicated that the five-lane TWLTL design is most appropriate for suburban highways with commercial development, high left-turn volumes, and/or high rates of rear-end and angle accidents associated with left-turn manoeuvres. Traffic volumes at the full build out stage are projected to be less than 6,000 AADT in the existing section. The current section of 9th Avenue SE is substantially overbuilt for projected traffic volumes.

9th Avenue SE east of Mitchell Street SE should be reclassified as a residential collector roadway; while detailed cross section, design elements, and interconnectivity should be addressed in a revised Eastside ASP.

6.4.3.5 Upgrades

No upgrades are proposed at this time for this road segment however it is likely that traffic calming measures will be required in the future when 9th Avenue SE is connected to Saamis Drive SE. Without knowing what traffic calming measures will be selected we recommend that $150,000 be budgeted for installation of traffic calming measures.

6.4.4 Main Street S between Broadway Avenue and 9th Avenue S

Main Street south of Broadway Avenue serves residential and public service areas including the Town shop, library, swimming pool and arena.

6.4.4.1 AADT

The existing traffic volume for Main Street S between Broadway Avenue and 3rd Avenue S is approximately 2000 AADT and south of 3rd Avenue S is less than 1000 AADT.

6.4.4.2 Existing Condition

Main Street S south of Broadway Avenue to 9th Avenue S is currently a two lane collector with parking on each side and a pavement width of:

- 11.7 m from Broadway Avenue to 7th Avenue S,
- 9.5 m from 7th Avenue S to 8th Avenue S,
- 10.0 m from 8th Avenue S to 9th Avenue S,

6.4.4.3 Classification

Currently this segment is classified as a collector roadway.

6.4.4.4 Safety

The Town has noted that vehicle speeds are a safety concern for this road. The segment of road between Broadway Avenue and 3rd Avenue is narrower than the Town's standard for a collector roadway, however along this segment of road:

- The road serves properties that have onsite parking and the on street parking is rarely used;
- public facilities along the road have setbacks far greater than would be seen on a typical residential road;
- driveways are much less frequent than would be seen on a residential road.

These factors create a situation where drivers feel that the road should be driven at a higher speed than allowed. This higher speed is likely being carried forward to the road south of 3rd Street.

The segment of road between 7th Avenue S and 9th Avenue S narrows to typical local residential road widths and does not follow the alignment of the road north of 7th Avenue with some very short transition sections. This could create some future operational and safety issues if traffic on the road increases.

6.4.4.5 Upgrades

No upgrades are proposed at this time for this segment however traffic calming measures could be employed such as:

- Curb extensions at the intersections of 1st Avenue S, 2nd Avenue S, 3rd Avenue S, 5th Avenue S and 9th Avenue S. Our opinion of probable costs is $30,000 per intersection.
- Planting trees adjacent to the roadway to reduce the feeling of openness. Our opinion of probable costs is $40,000 for the whole length of road.
- Removing the unused parking lanes and reducing the roadway pavement width. Our opinion of probable costs is $1.0 million for the whole length of road. This option should be considered in conjunction with a major road rebuild.

Installation of speed tables and speed bumps on Main Street S are not recommended as Main Street S is designated a collector road. Speed tables and speed bumps are not compatible with the allowable operating speed of the road and the installation of such will push traffic to parallel roads in the grid system which will increase traffic problems on the local roadways.

Rumble strips are compatible with the allowable speeds on Main Street however they substantially reduce driver comfort, bring new maintenance issues, and can be rendered ineffective due to winter weather conditions.

We recommend that a functional plan of the road be created. Our opinion of probable cost to perform a functional plan for this road is $35,000. Upgrading intersections with curb extensions and planting trees in the boulevards could be done as a multi year project.

6.4.5 **South Railway Drive NE**

South Railway Drive NE serves industrial lands on the north side and light industrial, commercial and residential lands to the south.

6.4.5.1 AADT

The existing traffic volume for this segment of South Railway Drive NE is approximately 1500 AADT.

6.4.5.2 Existing Condition

South Railway Drive NE is currently a 2 lane rural road with a pavement width that varies between 7.1 m and 9.3 m.

6.4.5.3 Classification

Currently this segment is classified as a collector roadway.

6.4.5.4 Upgrades

No upgrades are proposed at this time for this segment. The traffic volumes on this road do not warrant classification as a collector roadway however its location in the overall traffic system does. It is suggestion that a functional planning study be undertaken for this segment of South Railway Drive NE. Our opinion of the probable cost for this study is $10,000.

6.4.6 Old Transcanada Highway

Old Transcanada Highway serves primarily as a connector between 3rd Street NE and the Transcanada Highway and provides access for a few light industrial and residential sites.

6.4.6.1 AADT

The existing traffic volume for this segment of Old Transcanada Highway is less than 1000 AADT.

6.4.6.2 Existing Condition

Old Transcanada Highway is currently a 2 lane rural road with a pavement width of 8.2 m. Township Road 132A is a 2 lane rural road with a pavement width of 8.2 m.

6.4.6.3 Classification

Currently this segment is classified as a collector roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does.

6.4.6.4 Upgrades

While the road's pavement width is significantly below the standard it is not necessary to upgrade this road because of the low traffic volume. No upgrades are proposed at this time for this segment. It is suggestion that a functional planning study be undertaken for this segment of Old Transcanada Highway. Our opinion of the probable cost for this study is $10,000.

6.4.7 River Road SW and 9th Avenue SW west of Main Street S

This road is the only vehicle access to the river valley from the Town. Currently there are a few residences and a Town park in the river valley.

6.4.7.1 AADT

The existing traffic volume for this segment of road is less than 1000 AADT.

6.4.7.2 Existing Condition

River Road SW and 9th Avenue SW is currently a 2 lane urban road with a pavement width of 10.6 m until the intersection with Redcliff Way SW. Beyond this intersection River Road SW is a 2 lane rural road.

6.4.7.3 Classification

Currently this segment is classified as a local residential roadway. It is proposed that the classification of this road be changed to a residential collector roadway.

6.4.7.4 Safety

This road is the only access to a Town Park and a few homes by the river. However as development proceeds in the river valley, the lack of a secondary access becomes a large concern since a traffic accident or road closure could prevent emergency responders from accessing the river valley and could back up traffic.

The National Fire Protection Association has a published standard "NFPA 1141 Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas (2012)" which provides guidelines for minimum access for emergency vehicles. Table 5.1.4.1(a) in NFPA 1141 provides the following guidance:

Table 5.1.4.1(a) from NFPA 1141

Number of Households	Number of Access Routes
0-100	1
101-600	2
>600	3

NRPA 1141 guidelines provide the following guidance on emergency access routes:

- Multiple means of access shall be located as remotely from each other as practical,
- To be constructed of a hard all weather surface,
- Maximum grade of 10%,
- Minimum width 5.0m for one way traffic, can be reduced if only vehicle use is emergency access.
- Minimum width for two way traffic is 7.4m.

Our experience has been that most fire departments are accepting of a 3.0m wide paved surface with 1.5m wide flat surface on each side and with curve widening to deal with vehicle of tracking for narrow curves. However the emergency access to the river bottom is an excessively long and should likely be built to at least the minimum width.

It is recommended that development in the river valley be restricted to fewer than 100 households unless a secondary access is built. The secondary access could be an emergency only access built in accordance with the NRPA 1141 guidelines.

6.4.7.5 Upgrades

No upgrades are proposed at this time for this segment.

6.4.7.6 Ultimate

If future planning allows for more than 100 households in the river valley being serviced only by River Road SW then a second emergency access will have to be constructed. If more than 300 households are approved in the river valley then the second access should be a public road and not an emergency access.

6.4.8 8th Street SW between Broadway Avenue W and 3rd Avenue SW

8th Street SW between Broadway Avenue W and 3rd Avenue SW currently serves horticultural areas and a few residences.

6.4.8.1 AADT

The current traffic volume of 8th Street SW is less than 1000 AADT.

6.4.8.2 Existing Condition

8th Street SW between Broadway Avenue W and 1st Avenue SW is paved with a parking lane, sidewalk curb and gutter on the east side and a rural section with a gravel shoulder on the west side. 8th Street SW between 1st Avenue SW and 3rd Avenue SW is a 2 lane gravel road with a rural section

6.4.8.3 Classification

Currently this segment is classified as a collector roadway. The traffic volumes on this road do not warrant this classification however its location in the overall traffic system does.

6.4.8.4 Upgrades

No upgrades are proposed at this time for this segment.

6.4.9 4th Street SW between Broadway Avenue W and 4th Avenue SW

4th Street SW between Broadway Avenue W and 4th Avenue SW currently services a horticultural area and is maintained in winter at the same level as a collector road.

6.4.9.1 AADT

There is no measurement of the traffic on this road section although it is likely less than 1000 AADT.

6.4.9.2 Existing Condition

4th Street SW is currently a two lane road with a rural section and pavement surface that varies between 6.6 m and 7.4 m in width.

6.4.9.3 Classification

Currently this segment is classified as a local residential roadway however because of the road's location in the road network and the large public service site east of the road breaking up the grid pattern, it is suggested that this road be upgraded to an industrial/commercial collector roadway.

6.4.9.4 Upgrades

No upgrades are proposed at this time for this segment.

6.4.10 Northside Drive NW – Future Collector Road

Northside Drive NW is the future collector road which will service the future industrial development intended in the NW part of the Town. This road will be built as the Northlands industrial development progresses.

6.4.10.1 AADT

There is no data for the future traffic volume of Northside Drive NW.

6.4.10.2 Existing Condition

This roadway currently does not exist.

6.4.10.3 Classification

This roadway segment is classified as an industrial/commercial collector.

6.4.10.4 Upgrades

No upgrades are proposed at this time for this segment.

6.4.11 Link between Transcanada Highway and Northside Drive NW

The link between Transcanada Highway and Northside Drive NW is a future collector road to connect the future industrial development intended in the NW part of the Town to the Transcanada Highway and the rest of the Town. This road will be built as the Northlands industrial development progresses.

6.4.11.1 AADT

There is no data for the future traffic volume of Northside Drive NW.

6.4.11.2 Existing Condition

This roadway currently does not exist.

6.4.11.3 Classification

This roadway segment is classified as an industrial/commercial collector.

6.4.11.4 Upgrades

No upgrades are proposed at this time for this segment.

6.5 Potential Network Improvements

Potential network improvements are defined as possible improvements that have been identified but are not required by the road network yet may improve overall function of the road network. See Figure 2.2.3.2.

6.5.1 4th Street SW between 4th Avenue SW and 5th Avenue SW

Adding a link between 4th Avenue SW and 5th Avenue SW at 4th Street SW is desirable to further develop the grid system in the Town. This link would improve traffic flow servicing the horticultural area and the large public service site adjacent to 4th Street SW. This link becomes even more important if 5th Avenue SW is reclassified as a collector road as it would be a connecting link in the collector road system.

6.5.1.1 AADT

There is no data for the future traffic volume on this section of 4th Street SW. 4th Street SW between Broadway Avenue W and 4th Avenue SW is less than 1000 AADT.

6.5.1.2 Existing Condition

This roadway currently does not exist.

6.5.1.3 Classification

This roadway segment is classified as a residential roadway, however if built, it is recommended to classify this roadway segment as a collector road.

6.5.1.4 Upgrades

No upgrades are proposed at this time for this segment. Our opinion of probable costs to build this segment of new road is $250,000 excluding utilities and any land acquisition costs.

6.5.2 5th Avenue SW between Main Street S and 4th Street SW

Based on a roadway spacing requirement 5th Avenue SW may function as a residential collector roadway though it is classified as a local residential road. 5th Avenue SW has a couple of horticultural uses (greenhouses) on the north side with residential properties on the south side.

6.5.2.1 AADT

The existing traffic volume for this section of 5th Avenue SW is less than 1000 AADT.

6.5.2.2 Existing Condition

5th Avenue SW is a 2 lane roadway with a 10.8 m pavement width.

6.5.2.3 Classification

Currently this segment is classified as a local residential roadway.

6.5.2.4 Upgrades

No upgrades are proposed at this time for this segment. It is suggested that this road be reclassified as a residential collector.

6.5.3 5th Avenue SE between Main Street S and Mitchell Street SE

Based on a roadway spacing requirement 5th Avenue SE may function as a residential collector roadway although it is classified as a local residential road. 5th Avenue SE services residential properties.

6.5.3.1 AADT

The existing traffic volume for this section of 5th Avenue SE is less than 1000 AADT.

6.5.3.2 Existing Condition

5th Avenue SE is a 2 lane roadway with a 7.4 m pavement width.

6.5.3.3 Classification

Currently this segment is classified as a local residential roadway.

6.5.3.4 Safety

The Redcliff RCMP have a concern with the intersections at 3rd Street SE and 4th Street SE and recommends changing the yield and stop control from east/west to north/south.

No intersection traffic counts exist for these intersections so it is impossible to determine which direction currently has the primary traffic movements.

The Town does not wish to change the direction of the yield and stop signs because 5th Avenue SE is not constructed as a collector road and is fairly narrow. In addition, there are several at grade drainage crossings (swales) which cross 5th Avenue SE and can only be negotiated safely at relatively low speeds. The Town feels that the current configuration of the yield and stop signs helps to keep traffic speeds on 5th Avenue SE low and improves the safety of the road.

Changing the stop and yield signs as per the Redcliff RCMP's suggestion should only be undertaken if 5th Avenue SE is re-designated a collector road and is upgraded to a collector standard between Main Street S and Mitchell Street SE. As part of the upgrading the vertical alignment of this section of 5th Avenue will have to be changed as the current vertical alignment gives priority to the roads crossing this section of 5th Avenue SE and with the change in classification 5th Avenue SE should be given priority over the crossing roads. This would also require the removal of the at grade drainage crossings which will likely require major upgrades to the storm drainage system.

6.5.3.5 Upgrades

No upgrades are proposed at this time for this segment. In the future if 5th Avenue SE connects to Saamis Drive SE this road may need to be upgraded to a collector roadway.

Upgrades to this segment of road should be assessed with any changes to the Eastside ASP. The assessment should include:

- parking requirements,
- road structure,
- access
- changes to the vertical alignment.

It is suggested that this road be reclassified as a residential collector in the future and that the benefits and costs to upgrade the road be more thoroughly examined in conjunction with the Eastside side development. Our estimate to improve this road to a collector standard is $3.5 million dollars including installation of a storm sewer system to handle changes in the drainage network. It is suggestion that a functional planning study be undertaken for this segment of 5th Avenue SE. Our opinion of the probable cost for this study is $20,000.

6.5.4 Main Street S between 9th Avenue S and Redcliff Way S

This segment of Main Street S currently functions as a collector road. It may be prudent to classify this road segment as a collector in recognition of its current function.

6.5.4.1 AADT

The existing traffic volume for this segment of Main Street S is less than 1000 AADT.

6.5.4.2 Existing Condition

Main Street S is a 2 lane roadway with a 10.5 m pavement width.

6.5.4.3 Classification

Currently this segment is classified as a local residential roadway.

6.5.4.4 Upgrades

No upgrades are proposed at this time for this segment. It is suggested that this road be reclassified as a residential collector.

6.5.5 Redcliff Way SE between Main Street S and 6th Street SE

This segment of Redcliff Way SE currently functions as a collector road. It may be prudent to classify this road segment as a collector in recognition of its current function.

6.5.5.1 AADT

The existing traffic volume for this segment of Redcliff Way SE is less than 1000 AADT.

6.5.5.2 Existing Condition

Redcliff Way SE is a 2 lane roadway with a 10.6 m pavement width.

6.5.5.3 Classification

Currently this segment is classified as a local residential roadway.

6.5.5.4 Upgrades

No upgrades are proposed at this time for this segment. It is suggested that this road be reclassified as a residential collector.

6.5.6 South Railway Drive NE at 3rd Avenue NE and 3rd Street NE

South Railway Drive NE at 3rd Avenue NE and 3rd Street NE is currently configured as a through road with 3rd Avenue NE.

6.5.6.1 AADT

The existing traffic volume for this segment of South Railway Drive NE is less than 1000 AADT.

6.5.6.2 Existing Condition

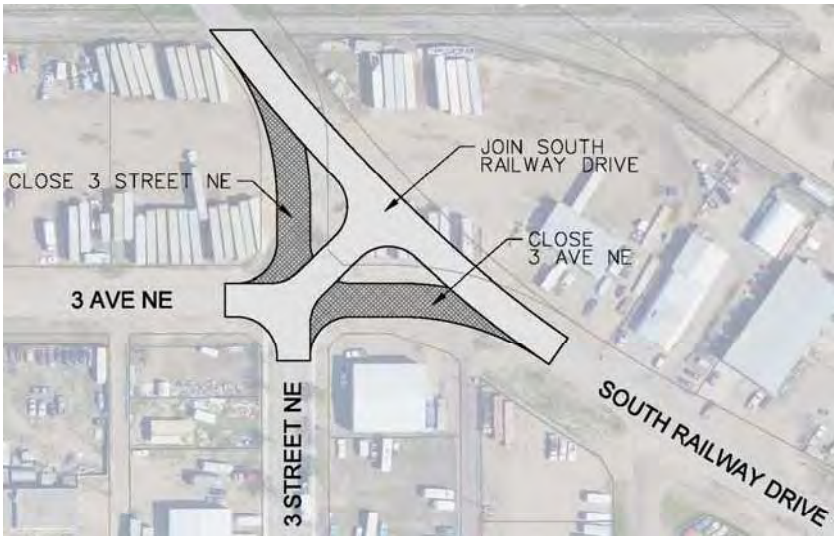
South Railway Drive NE is a 2 lane roadway with a 9.3 m pavement width.

6.5.6.3 Classification

Currently this segment is classified as a local residential roadway.

6.5.6.4 Upgrades

No upgrades are proposed at this time for this segment.



It is suggested that this intersection be reconfigured so that 3rd Avenue NE and 3rd Street NE form a Y intersection and that a tee intersection between the linked 3rd Avenue NE and 3rd Street NE be made with the realigned South Railway Drive NE. This change would create a continuous road link from 8th Street NW to Mitchell Street NE and would be improving the functionality of this road and reducing the flow of industrial traffic into the downtown core of the Town. Our opinion of the probable costs for this improvement is $150,000.

6.5.7 Dutton Street NE between Broadway Avenue E and Dacre Street NE

Currently the access to Dacre Street NE from Broadway Avenue E is through Dutton Street NE which is a local residential road. Linking Dacre Street NE and Broadway Avenue E at Pembina Crescent NE would improve the connectivity of the road network in this area; allow Dutton Street NE to be changed to a dead ended street on the south end eliminating industrial traffic using the street; and pull the intersection of Broadway Avenue E and Dutton Street NE further away from the intersection of the Transcanada Highway and Broadway Avenue E. Some property acquisition would be required to establish this link though it appears that the acquisition could be done without affecting any existing buildings. Additionally access to at least one land parcel would have to be resolved as an existing segment of Dutton Street NE would be closed. Our opinion of probable costs to build this road is $300,000 excluding land and utilities.

6.5.7.1 Classification

Currently this segment would be classified as a local industrial roadway however it is suggested that it would likely function as a collector road and should be classified as such.

6.6 Local Roads

The proposed changes to local roads are to split the classification into four categories to highlight the four unique traits that these roads have. These classifications are:

- Downtown Commercial Roadway,
- Public Service Roadway,
- Local Industrial/Commercial Roadway,
- Local Residential Roadway.

See figure 2.2.3 for locations and classifications.

6.6.1.1 Upgrades

No capacity, alignment, or classification changes other than those previously listed are proposed at this time.

6.7 Intersections of Interest

Intersections of interest are intersections where one or more of the following conditions were met:

- A traffic count was conducted;
- A safety issue was identified;
- An intersection where current or future traffic volumes may require additional lanes, traffic control, etc. to maintain an acceptable LOS;
- An intersection which is already signalized.

Most intersections of interest were modeled using Synchro Version 6. Intersection traffic volumes modeled are found in:

- Figure 4.1.a – Intersection Traffic Volumes from Intersection Traffic Counts
- Figure 5.5.1d - 7394 Population Horizon – Intersection Traffic Volume
- Figure 5.5.2d - 10670 Population Horizon – Intersection Traffic Volume

It is noteworthy that for the current conditions actual traffic count data was used, while for the future horizons EMME3 outputs were used.

6.7.1 Intersection Transcanada Highway and 8th Street NW (Range Road 65)

The intersection of Transcanada Highway and 8th Street NW is an un-signalized intersection on a four-lane divided highway, with stop control on 8th Street NW, constructed at approximately a 60° angle. Right-turn decelerate and accelerate tapers exist on Transcanada Highway. Left turn lanes and decelerate taper exist on eastbound and westbound Transcanada Highway. As Transcanada Highway and 8th Street NW are generally straight and flat in this section, the intersection sight distances are adequate for all types of vehicles.

6.7.1.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.1. Detailed Synchro reports are attached in Appendix G.

Table 6.7.1 Intersection LOS - Intersection Transcanada Highway and 8th Street NW (Range Road 65)

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	B	B	B
Overall	**10670 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	B	C	B

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.1.2 Safety

The intersection of Transcanada Highway and 8th Street NW (Range Road 65) experienced 5 collisions from 2004 to 2008. There were two accidents caused by driver fatigue. Two accidents were caused by failure to yield right of way which the intersection skew angle may have been a contributing factor.

The intersection has lighting on the eastbound right turn deceleration lane and the eastbound right turn acceleration lane. As traffic increases at this intersection the lighting at this intersection should be reviewed.

6.7.1.3 Improvements

Overall, the intersection's safety performance is acceptable. No geometric improvement for the intersection is required at this time to improve safety or increase intersection capacity.

6.7.1.4 Ultimate

As traffic increases due to development along 8th Street NW and when 10th Avenue NE is extended to the Transcanada Highway, this intersection should be realigned to meet the intersection angles between 75° and 105° as recommended by the TAC Manual. In the far future it is assumed that this intersection will be converted to an interchange.

6.7.2 Intersection Transcanada Highway and Mitchell Street NE

The intersection of Transcanada Highway and Mitchell Street NE is a signalized intersection on a four-lane highway, constructed at approximately 60° angle. Exclusive left turn and right turn lanes exist on both directions of Transcanada Highway. Right turn channelization exist for northbound and westbound traffic. No exclusive left turn lanes exist on Mitchell Street NE.

6.7.2.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.2. Detailed Synchro reports are attached in Appendix G.

Table 6.7.2 Intersection LOS - Transcanada Highway and Mitchell Street NE

Overall	**2010 AM Peak Hour**									
	A									
Approach	eastbound			westbound			northbound		southbound	
	A			A			A		A	
Movement	left	through	right	left	through	right	left/through	right	left/through	right
	A	B	A	A	B	A	A	A	A	A
Overall	**2010 PM Peak Hour**									
	A									
Approach	eastbound			westbound			northbound		southbound	
	A			A			A		A	
Movement	left	through	right	left	through	right	left/through	right	left/through	right
	A	B	A	A	A	A	B	A	B	A
Overall	**7394 Population Horizon PM Peak Hour**									
	B									
Approach	eastbound			westbound			northbound		southbound	
	A			A			A		B	
Movement	left	through	right	left	through	right	left/through	right	left/through	right
	A	A	A	B	A	A	B	A	B	A
Overall	**10670 Population Horizon PM Peak Hour**									
	A									
Approach	eastbound			westbound			northbound		southbound	
	A			A			A		C	
Movement	left	through	right	left	through	right	left/through	right	left/through	right
	A	A	A	B	A	A	B	A	C	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.2.2 Safety

The intersection of Transcanada Highway and Mitchell Street NE experienced 13 collisions from 2004 to 2008. Three accidents were Failure to Yield and Rear End collision types. Approximately 50% of all accidents happened during the year 2004. This intersection was signalized in 2007.

6.7.2.3 Pedestrian Crossing of the Transcanada Highway

The pedestrian crossing distance of the Transcanada Highway at this location is 26m. At an average walking speed of 1.2m/s crossing time is 21.6 seconds. Currently the signal lights timing provides for 22 seconds of green time for the through movement across the Transcanada Highway. The current signal timing provides adequate average walking time. A pedestrian refuge (such as a channelization island or sidewalk) located on the north side of the Transcanada Highway would improve pedestrian perception that this is a safe place to cross the Transcanada Highway. It is recommended that the intersections of Transcanada Highway with Mitchell Street NE be refitted with a pedestrian crossing of Transcanada Highway on the west side of the intersections in addition to the existing pedestrian crossing on the east side of the intersections. The probable cost to refit this intersection is $20,000.

6.7.2.4 Improvements

Considering the last three years of accident data only one rear-end accident occurred after the intersection was signalized, therefore the installation of a traffic control signal has significantly improved the intersection safety performance. The current intersection's safety performance with traffic control signal is acceptable. No improvement is recommended at this time for the intersection to improve safety or increase intersection capacity.

6.7.2.5 Ultimate

No improvements are envisioned to be required at the design horizons considered in this report. In the far future it is assumed that this intersection will be closed when an interchange is built at the intersection of the Transcanada Highway and Broadway Avenue E. This intersection is a possible location for an interchange if interchange spacing is an issue with the Broadway Avenue E location.

6.7.3 Intersection Transcanada Highway and Broadway Avenue E

The intersection of Transcanada Highway and Broadway Avenue E is a signalized intersection on four-lane highway, constructed at approximately 82° angle. Exclusive left turn and right turn lanes exist on both directions of Transcanada Highway. Exclusive left turn lanes and shared through right lanes with large turning radii exist on Broadway Avenue E.

6.7.3.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.3. Detailed Synchro reports are attached in Appendix G.

Table 6.7.3 Intersection LOS - Transcanada Highway and Broadway Avenue E

Overall	**2010 AM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	B			B			A			B		
Movement	left	through/right		left	through	right	left	through	right	left	through	right
	A	B		A	B	A	B	B	A	B	B	A
Overall	**2010 PM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	B			B			A			B		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	B	A	A	B	A	B	B	A	B	B	A
Overall	**7394 Population Horizon PM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	B			B			A			B		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	B	A	A	B	A	B	B	A	C	C	A
Overall	**10670 Population Horizon PM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	B			B			A			C		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	C	A	A	B	B	A	C	A	C	C	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.3.2 Safety

The intersection of Transcanada Highway and Broadway Avenue E accounted for the highest number of collisions in the Town of Redcliff and it is the busiest intersection in the Town. The intersection experienced 32 accidents from 2004 to 2008. The accident rate for this intersection is 1.1 accidents per million vehicles entering the intersection which is considered a little high. Because approximately 68% of these were a Rear End and Failure to Yield Collision accident types, the signal timing of the intersection should be reviewed in detail. All turning movements operate at LOS 'B' or better during the a.m. and p.m. peak hour, therefore, the current intersection geometric design provides sufficient capacity at this intersection.

6.7.3.3 Pedestrian Crossing of the Transcanada Highway

The pedestrian crossing distance of the Transcanada Highway at this location is 25m. At an average walking speed of 1.2m/s crossing time is 20.8 seconds. Currently the signal lights timing provides for 26 seconds of green time for the through movement across the Transcanada Highway. The current signal timing provides adequate average walking time. It is recommended that the intersections of Transcanada Highway with Broadway Avenue E be refitted with a pedestrian crossing of Transcanada Highway on the west side of the intersections in addition to the existing pedestrian crossing on the east side of the intersections. The probable cost to refit this intersection is $20,000.

6.7.3.4 Improvements

Considering the undesirable accident rate but good levels of service up to the 10,670 population horizon, it recommended that the Town of Redcliff coordinate with Alberta Transportation to revise the signal timing with a goal of improving safety. Items that should be examined are:

- Actual speeds on the road vs. the signed speed,
- If the yellow lengths on the Transcanada Highway are sufficient given typical speeds on the Transcanada Highway.
- Is the visibility of the signals adequate given the typical running speeds on the Transcanada Highway?
- Examine the length of all red time to reduce potential for conflicts from vehicles running yellow lights.
- Examine the cycle length and actuation of the signals to reduce side street wait times but allow signals on the Transcanada Highway to be green when there is no traffic on the side streets.
- Examine if there are any speed reduction measures that could be introduced.

The probable costs to revise the signal timing plan are less than $10,000.

6.7.3.5 Ultimate

No improvements are envisioned to be required at the design horizons considered in this report. In the far future it is assumed that this intersection will be converted to an interchange. However if an interchange is constructed at the Transcanada Highway 20th Street NE intersection the distance between the two interchanges is likely insufficient to allow proper weaving traffic. If this is the case then a potential location for an interchange is the intersection of the Transcanada Highway with Mitchell Street NE with this intersection being closed.

6.7.4 Intersection Transcanada Highway and 20th Street NE

The intersection of Transcanada Highway and 20th Street NE is within the City of Medicine Hat limits. This intersection is currently signalized and exclusive left turn lanes exist at all legs.

6.7.4.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.4. Detailed Synchro reports are attached in Appendix G...

Table 6.7.4 Intersection LOS - Transcanada Highway and 20th Street NE

Overall	**2010 AM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	B			B			B			B		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	B	C	A	A	B	A	B	B	B	B	B	A
Overall	**2010 PM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	C			B			B			C		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	B	C	A	B	B	A	C	C	A	C	C	B
Overall	**7394 Population Horizon PM Peak Hour**											
	B											
Approach	eastbound			westbound			northbound			southbound		
	C			B			C			C		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	C	A	B	B	A	C	D	B	C	C	A
Overall	**10670 Population Horizon PM Peak Hour**											
	F											
Approach	eastbound			westbound			northbound			southbound		
	D			B			C			F		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	D	A	B	B	A	C	D	B	F	C	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration today. In the future this intersection will have an unsatisfactory level of service for southbound traffic in its current configuration at the modeled population horizons.

6.7.4.2 Safety

This intersection experienced 26 collisions from 2004 to 2008. Approximately 38% of these were Rear End and Failure to Yield Collision types. A significant number of the collisions were turning related type accidents. The geometrics of the intersection should be checked in detail. While the southbound left turn movement from 20th Street to Transcanada Highway currently has a satisfactory level of service during the pm peak it is below local drivers expectations (A or B) and this may be a contributing factor to the safety of this intersection.

6.7.4.3 Improvements

At the 10670 population horizon the modeling shows a large increase in traffic making the southbound left turn which will operate at a LOS 'F' and pushes the overall intersection to a LOS 'F'. The increase in traffic is mostly due to the traffic being generated by the Box Springs Business Park in Medicine Hat. Two improvements were examined for this intersection, converting the through lane to a combined through left turn lane and creating an excusive dual left turn lane.

Table 6.7.4a Intersection LOS Improvements - Transcanada Highway and 20th Street NE

Overall	**10670 Population Horizon PM Peak Hour – Southbound Left Turn Lane with a Combined Southbound and Through Left Lane**											
	D											
Approach	eastbound			westbound			northbound			southbound		
	D			B			C			D		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	D	A	C	B	A	C	D	B	E	D	A
Overall	**10670 Population Horizon PM Peak Hour – Southbound Left Turn with Dual Left Lanes**											
	D											
Approach	eastbound			westbound			northbound			southbound		
	D			B			C			D		
Movement	left	through	right	left	through	right	left	through	right	left	through	right
	A	D	A	B	B	A	C	D	B	D	C	A

It is recommended that sometime between the 7394 and the 10670 population horizon that this intersection should be upgraded to dual left turn lanes southbound. It is not recommended to convert two exclusive dual left turns immediately as the intersection will operate effectively in the nearer term with a shared left and through lane and an exclusive left turn lane without geometric improvements required by an exclusive dual left turn lane. In our opinion the probable cost to modify the lane assignment will be less than $15,000 and upgrading to a dual left turn lane $150,000. It is noted that this intersection is not in control of the Town and Town generated traffic will not likely be what causes improvements to be required at this intersection. For these reasons this intersections improvements have be left of the list of recommended projects.

6.7.4.4 Ultimate

This intersection is on the boundary of the City of Medicine Hat and the Town of Redcliff but is under the jurisdiction of Alberta Transportation. It is likely that the City of Medicine Hat will be looking to have this intersection converted into an interchange in the future.

6.7.5 Intersection Broadway Avenue W and 8th Street W

The intersection of Broadway Avenue W and 8th Street W is a four-way stop controlled intersection located on the boundary of the Town and Cypress County. 8th Street NW is the western most access to the Transcanada Highway however, due to the road network within the Town; this access to the Transcanada Highway is lightly used. The western leg of this intersection is known as TWP Road 132A in Cypress County.

6.7.5.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.5. Detailed Synchro reports are attached in Appendix G.

Table 6.7.5 Intersection LOS - Broadway Avenue W and 8th Street W

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	Westbound	northbound	southbound
	A	A	A	A
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	Westbound	northbound	southbound
	A	A	A	A
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	Westbound	northbound	southbound
	A	A	A	A
Overall	**10670 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	Westbound	northbound	southbound
	A	A	A	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.5.2 Safety

The only safety concern identified with this intersection is that it has poor lighting at night.

6.7.5.3 Improvements

It is recommended that lighting at this intersection be improved. The probable cost to install street lighting at this intersection is $25,000.

6.7.5.4 Ultimate

Ultimately this intersection will be a major intersection in the Town of Redcliff however estimating sizing and requirements are beyond the scope of this report as the timing is beyond the 10670 population horizon.

6.7.6 Intersection Broadway Avenue and Main Street

The intersection of Broadway Avenue and Main Street is two-way stop controlled with the stop control on Main Street.

6.7.6.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.6. Detailed Synchro reports are attached in Appendix G.

Table 6.7.6 Intersection LOS - Broadway Avenue and Main Street

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	B
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	A
Overall	**10670 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.6.2 Safety

No safety issues have been noted with this intersection.

6.7.6.3 Improvements

No improvements are required for this intersection.

6.7.6.4 Ultimate

No substantial improvements of this intersection are envisioned for the foreseeable future.

6.7.7 Intersection Broadway Avenue W and 3rd Street E

The intersection of Broadway Avenue E and 3rd Street E is four-way stop controlled intersection located in the downtown area of the Town.

6.7.7.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.7. Detailed Synchro reports are attached in Appendix G.

Table 6.7.7 Intersection LOS - Broadway Avenue W and 3rd Street E

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	A
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	B	A	A
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	A
Overall	**10670 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.7.2 Safety

No safety issues have been noted with this intersection.

6.7.7.3 Improvements

No improvements are required for this intersection.

6.7.7.4 Ultimate

No substantial improvements of this intersection are envisioned for the foreseeable future.

6.7.8 Intersection Broadway Avenue E and Mitchell Street E

The intersection of Broadway Avenue E and Mitchell Street E is the major intersection within the Town of Redcliff and functions as a major route for traffic both entering and exiting the Town of Redcliff. As a result, traffic volumes at this intersection are very high. This intersection is an un-signalized intersection with two-way stop control on the northbound and southbound legs. Exclusive left turn lanes exist at all legs.

6.7.8.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.8. Detailed Synchro reports are attached in Appendix G.

Table 6.7.8 Intersection LOS Current Configuration - Broadway Avenue E and Mitchell Street E

Overall	**2010 AM Peak Hour**					
	A					
Approach	eastbound	westbound	northbound		southbound	
	A	A	B		C	
Movement			left	through/right	left	through/right
			C	B	D	B
Overall	**2010 PM Peak Hour**					
	A					
Approach	eastbound	westbound	northbound		southbound	
	A	A	C		E	
Movement			left	through/right	left	through/right
			F	B	F	D
Overall	**7394 Population Horizon PM Peak Hour**					
	A					
Approach	eastbound	westbound	northbound		southbound	
	A	A	B		D	
Movement			left	through/right	left	through/right
			D	B	E	D
Overall	**10670 Population Horizon PM Peak Hour**					
	A					
Approach	eastbound	westbound	northbound		southbound	
	A	A	D		F	
Movement			left	through/right	left	through/right
			F	D	F	F

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration today for the A.M. peak hour however is currently failing during the P.M. peak hour. The slight improvement to the intersection performance shown for the 7394 population horizon is due to the 9th Avenue SE connection between Saamis Drive SE and Mitchell Street having been added to the road network. By the 10670 population horizon north and southbound traffic are experiencing greater delays than currently being experienced.

6.7.8.2 Safety

Major delays and the difficulty of finding results in safety concerns at this intersection. A traffic control signal is now warranted at this location. The Town has also voiced concerns about the lack of pedestrian crosswalks at the intersection. The northeast corner of the intersection also requires a wheelchair ramp.

6.7.8.3 Improvements

This intersection should have crosswalks installed across all four legs of the intersection. A wheelchair ramp should be installed on the northeast corner of the intersection.

Three mitigation options to address the delay issues at the intersection were reviewed:

- all-way stop control installation,
- traffic signal installation, and
- a roundabout.

a. All-way stop control

A summary of the Synchro intersection capacity analysis for the intersection with 4-way stop control is presented in Table 6.7.8a. Detailed Synchro reports are attached in Appendix G.

Table 6.7.8a Intersection LOS 4-Way Stop Control - Broadway Avenue E and Mitchell Street E

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	A
Overall	**2010 PM Peak Hour**			
	C			
Approach	eastbound	westbound	eastbound	westbound
	A	C	A	A
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	eastbound	westbound
	A	A	A	A
Overall	**10670 Population Horizon PM Peak Hour**			
	B			
Approach	eastbound	westbound	northbound	southbound
	B	B	A	B

The Synchro report indicates that changing the intersection to 4-way stop control will:

- increase the AM Peak Hour delay from 5.5 to 8.5 seconds,
- significantly increase the PM Peak Hour delay from 6.9 seconds to 16.0seconds.

All-way stop control could result in a complicated environment for drivers. Moreover, the traffic volume on Broadway Avenue E is over four times the traffic volume on Mitchell Street E, which may make all-way stop control not a desirable option at this intersection.

In our opinion, the probable cost for installation of 4 way stop control at this intersection would be less than $5,000.

b. Signalization

A summary of the Synchro intersection capacity analysis for the intersection with signalization is presented in Table 6.7.8a. Detailed Synchro reports are attached in Appendix G.

With a traffic signal installation, the overall intersection delay will:

- Increase during the AM Peak Hour from 5.5 to 5.9 seconds,
- Decrease during the PM Peak Hour from 6.9 seconds to 6.8 seconds.

Table 6.7.8b Intersection LOS Signalization - Broadway Avenue E and Mitchell Street E

Overall	**2010 AM Peak Hour**							
	A							
Approach	eastbound		westbound		northbound		southbound	
	A		A		A		A	
Movement	left	through/right	left	through/right	left	through/right	left	through/right
	A	A	A	A	A	A	A	A
Overall	**2010 PM Peak Hour**							
	A							
Approach	eastbound		westbound		northbound		southbound	
	A		A		A		A	
Movement	left	through/right	left	through/right	left	through/right	left	through/right
	A	A	A	A	B	A	B	A
Overall	**7394 Population Horizon PM Peak Hour**							
	A							
Approach	eastbound		westbound		northbound		southbound	
	B		A		A		B	
Movement	left	through/right	left	through/right	left	through/right	left	through/right
	B	B	A	A	B	A	B	B
Overall	**10670 Population Horizon PM Peak Hour**							
	B							
Approach	eastbound		westbound		northbound		southbound	
	B		B		B		B	
Movement	left	through/right	left	through/right	left	through/right	left	through/right
	A	B	A	B	B	B	B	B

The traffic signal installation warrant studies were performed by using the *Canadian Matrix Traffic Signal Warrant Analysis Excel Sheet*. Based on the 2010 traffic counts, a new traffic control signal is warranted at the intersection of Broadway Avenue E and Mitchell Street E. The detailed signal warrant calculation is included in Appendix G.

In our opinion, the probable cost for traffic signal installation at this intersection would be $180,000.

c. Roundabout

This intersection could be a good candidate for a roundabout to improve its overall safety and operation. Synchro does not effectively model roundabouts however when the SimTraffic module is run a single lane roundabout operates effectively at the current AM and PM peak hours and at the 7394 and 10670

population horizons PM peak hours. If the Town wishes to explore this option further a roundabout feasibility study should be conducted to provide a preliminary design, identify ROW requirements and an estimated construction cost for comparison to signalization. A roundabout at this location would also provide a gateway feature for the Town and act as a traffic calming measure to reduce vehicular speeds.

4-way stop control will provide an acceptable level of service now and in the future. While upgrading the intersection with a traffic control signal or proper roundabout design may improve the overall safety and operation of the intersection either of these improvements are not required to meet the current intersection capacity requirements.

At the 7394 Population Horizon the modeling shows that there will be an improvement in the LOS due to a reduction in traffic at this intersection if 9th Avenue SE has been constructed between Mitchell Street SE and Saamis Drive SE.

Considering that the current congestion at this intersection is only a short-term problem, a traffic control signal may not be the best option to improve the overall safety and operation of the intersection. 4-way stop control would free up the funds that would be spent on signalization for other more critical projects.

AT 10670 Population Horizon the congestion at the intersection of Broadway Avenue E and Mitchell Street E will increase to above current levels because of additional development in the east and north areas of the Town. If the intersection has not been signalized and two-way stop control on the northbound and southbound legs is left in place, the left turn movements southbound will operate at an unacceptable LOS 'F' during the afternoon peak. Signalization will be warranted at this horizon to improve the LOS. As noted previously, a roundabout at this location should be investigated further as an alternative to signalization. The capacity analysis of single lane roundabout was conducted and the result indicates that a single lane roundabout will have ample capacity to accommodate the traffic volume of this intersection at the 10670 population horizon.

A roundabout should be investigated further as an alternative to a traffic control signal to improve the overall safety and operation of the intersection. It is recommended roundabout feasibility study be conducted to provide a preliminary design, estimated cost, and comparison with signal option. In our opinion the cost for such a study will be less than $10,000.

With the limited information available, the probable cost for roundabout installation would be approximately $250,000.

6.7.8.4 Ultimate

Ultimately this intersection will be either signalized or be converted to a roundabout.

6.7.9 Intersection Broadway Avenue E and Sissons Drive SE

The intersection of Broadway Avenue E and Sissons Drive SE is a tee intersection with stop control on Sissons Drive SE. A driveway to an industrial site creates a fourth leg.

6.7.9.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.9. Detailed Synchro reports are attached in Appendix G.

Table 6.7.9 Intersection LOS - Broadway Avenue E and Sissons Drive SE

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	A	C
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	C	A
Overall	**10670 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.9.2 Safety

No safety issues have been noted with this intersection.

6.7.9.3 Improvements

No improvements are required for this intersection. Long term planning is for Sissons Drive SE to be closed.

6.7.9.4 Ultimate

It is possible in the future that this intersection is converted to a commercial driveway entrance.

6.7.10 Intersection Broadway Avenue E and Saamis Drive SE

The intersection of Broadway Avenue E and Saamis Drive SE is the first intersection east of Town of Redcliff. Both Transcanada Highway and Saamis Drive SE function as major routes from and to the City of Medicine Hat and as a result traffic volumes at this intersection are very high.

A Canadian Pacific Railway main line runs through the Town of Redcliff. The railway line runs on a straight line parallel to the alignment of Transcanada Highway through the Town. As the rail line is the main line across the County there is significant rail traffic. Realignment of Saamis Drive SE to provide additional separation between Saamis Drive SE and CPR rail tracks is currently proposed in the Eastside ASP and is included in current Town planning. A much more extensive discussion of the need and options for this realignment are in Appendix F.

As Saamis Drive SE is generally straight and flat in this section, sight distances are adequate for all types of vehicles at this intersection.

6.7.10.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.10. Detailed Synchro reports are attached in Appendix G.

Table 6.7.10 Intersection LOS - Broadway Avenue E and Saamis Drive SE

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	southbound	
			B	
Movement	A	A	left	right
			D	A
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	westbound	southbound	
			C	
Movement	A	A	left	right
			D	B
Overall	**7394 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	southbound	
			B	
Movement	A	A	left	right
			C	B
Overall	**10670 Population Horizon PM Peak Hour**			
	A			
Approach	eastbound	westbound	southbound	
			C	
Movement	A	A	left	right
			D	B

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.10.2 Safety

The Redcliff RCMP has a concern regarding the yield sign for southbound traffic on Broadway Avenue E and feels it should be changed to a stop sign. In reviewing the intersection it was noted that there is a wide radius corner and an 87.5m long acceleration lane (consistent with a 60 km design speed) with a taper for southbound right turning vehicles so a stop sign is not warranted. In addition, due to the short stacking distance to the CPR rail line, reducing the free flow of southbound traffic may contribute to additional vehicles being trapped on the rail line. A field inspection of the intersection noted that the acceleration lane is not readily visible to drivers and that, with the normal vehicle speeds east of the intersection (not posted speeds) on Saamis Drive SE, the acceleration lane is not long enough to allow a southbound right turning vehicle to merge into westbound traffic.

6.7.10.3 Improvements

It is recommended that a channelization island be added to the north quadrant of the intersection of Broadway Avenue E and Saamis Drive SE and that the length of the acceleration lane be increased to allow acceleration and merging at typical vehicle speeds. In addition, it is recommended that a stop sign replace the yield sign for southbound left turn traffic from Broadway Avenue E to eastbound Saamis Drive SE. These improvements should serve the following functions:

- Provide stop control for southbound left turning traffic,
- Provide protection of the acceleration lane,
- Improve comfort of southbound right turning drivers to use the acceleration lane,
- Restrict the physical roadway width for westbound traffic on Saamis Drive SE,
- Provide better visibility of the acceleration lane for southbound right turning drivers,
- Reduce driver confusion on how the intersection is to operate,
- Improve the free flow for southbound right turning drivers.

This intersection would also operate successfully as a roundabout however with the changes proposed in the future the expense of a roundabout at this location is not justifiable. When the intersection is realigned in the future a roundabout could be examined for this intersection.

Intersection In our opinion, the probable cost of these improvements will be $45,000.

6.7.10.4 Ultimate

The ultimate configuration of this intersection is currently outlined in the Eastside FSR. The intent is to move the intersection to create space for a larger vehicle queue between the intersection and the CP Rail line to improve safety. Also the ultimate configuration of this intersection will be impacted if the intersection of the Transcanada Highway and Broadway Avenue E is upgraded to an interchange.

6.7.11 Intersection Broadway Avenue E and 20th Street NE

The intersection of Broadway Avenue E and 20th Street NE is a two-way stop controlled intersection with the stop control on 20th Street NE. This intersection is on the boundary between the City of Medicine Hat and the Town of Redcliff and is inside the jurisdiction of the City.

6.7.11.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.11. Detailed Synchro reports are attached in Appendix G.

Table 6.7.11 Intersection LOS - Broadway Avenue E and 20th Street NE

Overall	**2010 AM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B
Overall	**2010 PM Peak Hour**			
	A			
Approach	eastbound	westbound	northbound	southbound
	A	A	B	B
Overall	**7394 Population Horizon PM Peak Hour**			
	B			
Approach	eastbound	westbound	northbound	southbound
	A	A	C	C
Overall	**10670 Population Horizon PM Peak Hour**			
	B			
Approach	eastbound	westbound	northbound	southbound
	A	A	F	F

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the 7394 population horizon. The failure of the intersection at the 10670 population horizon is due to the north and south legs of the intersection being stopped controlled. It is noteworthy that at the 7394 population horizon that there is minimal traffic from the east leg of the intersection. At the 10670 population horizon there is substantial traffic from the east leg of the intersection with a very heavy left turn movement.

6.7.11.2 Safety

No safety issues have been noted with this intersection.

6.7.11.3 Improvements

No improvements are required for this intersection in the near future. When traffic starts being generated from the Box Springs Business Park in the City of Medicine Hat substantial upgrades to the intersection will be required. A summary of the Synchro intersection capacity analysis for the intersection with 4-way stop control and signalization is presented in Table 6.7.11a. Detailed Synchro reports are attached in Appendix G.

Table 6.7.11a Intersection LOS - Broadway Avenue E and 20th Street NE

Overall	**10670 Population Horizon PM Peak Hour 4-Way Stop Control**							
	C							
Approach	eastbound		westbound		northbound		southbound	
	B		D		B		B	
Overall	**10670 Population Horizon PM Peak Hour Signalization**							
	B							
Approach	eastbound		westbound		northbound		southbound	
	B		A		B		B	
Movement	left	through/right	left	through/right	left	through/right	left	through/right
	B	B	A	A	B	B	B	B

For the signalization to achieve this level of service an exclusive dual left turn lanes are required on the westbound approach to accommodate the traffic volume. An examination of the SimTraffic model shows that a single lane roundabout would also work at this intersection however more advanced modeling would be required to confirm this.

6.7.11.4 Ultimate

The ultimate configuration of this intersection will likely be dictated by the City of Medicine Hat.

6.7.12 Intersection Mitchell Street NE and South Railway Drive NE

The intersection of Mitchell Street NE and South Railway Drive NE is a tee intersection with the stop control on South Railway Drive NE. A driveway to an industrial site creates a fourth leg to the intersection.

6.7.12.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.12. Detailed Synchro reports are attached in Appendix G.

Table 6.7.12 Intersection LOS - Mitchell Street NE and South Railway Drive NE

Overall	**2010 AM Peak Hour**		
	A		
Approach	eastbound	westbound	northbound
	A	A	A
Overall	**2010 PM Peak Hour**		
	A		
Approach	eastbound	westbound	northbound
	B	A	A
Overall	**7394 Population Horizon PM Peak Hour**		
	A		
Approach	eastbound	westbound	northbound
	A	A	A
Overall	**10670 Population Horizon PM Peak Hour**		
	A		
Approach	eastbound	westbound	northbound
	B	A	A

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration both today and at the modeled population horizons.

6.7.12.2 Safety

No safety issues have been noted with this intersection.

6.7.12.3 Improvements

No improvements are required for this intersection.

6.7.12.4 Ultimate

No substantial improvements of this intersection are envisioned for the foreseeable future.

6.7.13 Intersection Mitchell Street SE and 9th Avenue SE

The intersection of Mitchell Street SE and 9th Avenue SE has stop control on 9th Avenue SE. Currently there is minimal traffic at this intersection however, as the Eastside subdivision develops, 9th Avenue SE will be connected to Saamis Drive SE and a substantial increase in traffic is predicted. For the current traffic there is no need to model this intersection.

6.7.13.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.13. Detailed Synchro reports are attached in Appendix G.

Table 6.7.13 Intersection LOS

Overall	**7394 Population Horizon PM Peak Hour**				
	A				
Approach	eastbound	westbound		northbound	southbound
		B			
Movement	B	left	through/right	A	A
		B	B		
Overall	**10670 Population Horizon PM Peak Hour**				
	A				
Approach	eastbound	westbound		northbound	southbound
		B			
Movement	B	left	through/right	A	A
		B	B		

The Synchro intersection capacity analysis shows that this intersection operates satisfactorily with the current configuration at the modeled population horizons.

6.7.13.2 Safety

No safety issues have been noted with this intersection.

6.7.13.3 Improvements

No improvements are required for this intersection.

6.7.13.4 Ultimate

No substantial improvements of this intersection are envisioned for the foreseeable future.

6.7.14 Intersection Saamis Drive SE and 9th Avenue SE

This intersection does not currently exist. As discussed in Section 6.2.1, the internal road connections for the Eastside subdivision will be revisited with the Eastside ASP. Without a final roadway plan of the Eastside subdivision only cursory analysis was conducted for the intersection of Saamis Drive SE and 9th Avenue SE in this study.

6.7.14.1 Synchro Intersection Capacity Analysis

A summary of the Synchro intersection capacity analysis for the existing intersection configurations is presented in Table 6.7.14. Detailed Synchro reports are attached in Appendix G.

Table 6.7.14 Intersection LOS

Overall	**7394 Population Horizon PM Peak Hour**				
	A				
Approach	eastbound	westbound		northbound	
	A	A		A	
Movement	A	left	through	left	right
		A	A	E	B
Overall	**10670 Population Horizon PM Peak Hour**				
	B				
Approach	eastbound	westbound		northbound	
	A	A		C	
Movement	A	left	through	left	right
		B	A	F	B

The new intersection of Saamis Drive SE and 9th Avenue SE will note operate satisfactorily as an un-signalized intersection with a stop control on 9th Avenue SE at the 7394 and 10670 population horizons. The left turn movement from the minor road (9th Avenue SE) will operate at a LOS "E" at the 7394 population horizon and at a LOS `F` at the 10670 population horizon.

A summary of the Synchro intersection capacity analysis for the 3-way stop control intersection and signalization is presented in Table 6.7.14a. Detailed Synchro reports are attached in Appendix G.

Table 6.7.14 Intersection LOS

Overall	**7394 Population Horizon PM Peak Hour 3-Way Stop Control**					
	A					
Approach	eastbound		westbound		northbound	
	A		C		A	
Overall	**7394 Population Horizon PM Peak Hour Signalization**					
	B					
Approach	eastbound		westbound		northbound	
	B		A		A	
Movement	right	through	left	through	left	right
	B	A	B	A	B	A
Overall	**10670 Population Horizon PM Peak Hour 3-Way Stop Control**					
	E					
Approach	eastbound		westbound		northbound	
	B		F		B	
Overall	**10670 Population Horizon PM Peak Hour Signalization**					
	A					
Approach	eastbound		westbound		northbound	
	B		A		A	
Movement	right	through	left	through	left	right
	A	B	A	A	A	A

For the signalization to achieve this level of service an exclusive dual left turn lanes are required on the westbound approach to accommodate the traffic volume. An examination of the SimTraffic model shows that a single lane roundabout would also work at this intersection however more advanced modeling would be required to confirm this.

The probable cost to signalize this intersection is $180,000. The probable cost to build the intersection initially as a roundabout $120,000 above the cost of a standard intersection.

6.7.14.2 Ultimate

A more detailed analysis of the future requirements of this intersection should be undertaken before it is built to allow any changes to planning and layout of the Eastside development to be included.

6.7.15 Intersection 5th Avenue S and Main Street S

The intersection of 5th Avenue S and Main Street S is an un-signalized intersection with stop control on 5th Avenue S since Main Street S is classified as a collector roadway and 5th Avenue S is classified as a local roadway. No intersection traffic counts were done at this intersection and no data to perform a level of service calculation is available. Given the location of the intersection and the traffic data available, it is likely that this intersection performs at a LOS 'A' due to the very light traffic conditions.

6.7.15.1 Safety

The Redcliff RCMP has a concern on the traffic control of this intersection as they feel that 5th Avenue S should be a collector road.

6.7.15.2 Improvements

It is recommended that the Town of Redcliff conduct intersection traffic counts and have a detailed intersection capacity analysis done to determine if the current traffic control is still suitable for the existing intersection of 5th Avenue S and Main Street. In our opinion, the probable cost of this analysis is $5,000.

6.8 Other Potential Improvements

6.8.1 Relocate the Town Shop

The current Town shop is located at the southwest corner of the Town in a residential area. Relocating the Town Shop close to Broadway Avenue or into an industrial area north of Transcanada Highway would reduce the impact and frequency of heavy Town equipment on the residential street network and should be considered. It should be noted that an environmental investigation and assessment will be needed to reclaim the land where the Town shop is currently located before re-sale or re-purposing the land. An environmental clean-up may be required due to the presence hydrocarbons or other contaminates though the scope and probable cost of any clean up, if required, cannot be determined at this time.

An approximate cost to relocate the Town shop to an industrial area would be $800,000 not including land costs, though a more detailed assessment should be completed.

It should be noted that an environmental investigation and assessment will be needed to reclaim the land where the Town shop is currently located before re-sale or re-purposing the land. An environmental clean-up may be required due to the presence hydrocarbons or other contaminates; though the scope and probable cost of any clean up, if required, cannot be determined at this time. The cost to complete an environmental assessment will likely be less than $15,000.

6.9 Summary of Transportation Network Improvement and Upgrade Costs

The following tables summarize the opinion of probable costs of Network Improvements and Upgrades and studies. Upgrades beyond the 10670 population horizon are not included.

Table 6.9 Road Network Improvements and Upgrades

Road	Recommended Improvements		Suggested Improvements	
	Before 7394	Before 10670	Before 7394	Before 10670
9th Avenue SE to Saamis Drive SE	$2,650,000			
9th Avenue SE between Main Street S and Mitchell Street SE	$2,500,000			
4th Avenue SW and 5th Avenue SW at 4th Street SW				$250,000
Main Street S between Broadway Avenue and 9th Avenue S (two intersections and trees before 7394 population horizon and two after.			$70,000	$70,000
5th Avenue SE between Main Street S and Mitchell Street SE				$3,500,000
South Railway Drive NE at 3rd Avenue NE and 3rd Street NE			$150,000	
Dutton Street NHE between Broadway Avenue E and Dacre Street NE			$300,000	
Total	$5,150,000	$0	$520,000	$3,820,000

Table 6.9a Intersection Improvements and Upgrades

Intersection	Recommended Improvements		Other Options
	Before 7394	Before 10670	
Transcanada Highway and Mitchell Street NE Pedestrian Crossing Improvements (AT)	$20,000		
Transcanada Highway and Broadway Avenue E Traffic Signal Timing. (AT)	$10,000		
Transcanada Highway and Broadway Avenue E Pedestrian Crossing Improvements		$20,000	
Broadway Avenue W and 8th Street W lighting improvements	$25,000		
Broadway Avenue E and Mitchell Street E 4-way Stop Control	$5,000		
Broadway Avenue E and Mitchell Street E Signalization			$180,000
Broadway Avenue E and Mitchell Street E Roundabout			$250,000
Broadway Avenue E and Saamis Drive SE channelization.	$45,000		
Saamis Drive SE and 9th Avenue SE Signalization	$180,000		
Saamis Drive SE and 9th Avenue SE Roundabout			$120,000
5th Avenue S and Main Street	$5,000		
Total	$290,000	$20,000	

Table 6.9b Recommended Studies

Studies	Recommended Studies	
	Before 7394	Before 10670
Broadway Avenue E between Transcanada Highway and 20th Street NE Functional Planning Study	$20,000	
Broadway Avenue between 1st Street E and 8th Street W Functional Planning Study		$20,000
Mitchell Street SE between Broadway Avenue E and Redcliff Way SE Functional Planning Study	$20,000	
9th Avenue SE between Main Street S and Mitchell Street SW Functional Planning Study	$20,000	
Main Street between Broadway Avenue and 9th Avenue S Functional Planning Study	$35,000	
5th Avenue SE between Main Street S and Mitchell Street SE		$20,000
South Railway Drive NE Functional Planning Study	$10,000	
Old Transcanada Highway Functional Planning Study	$10,000	
Broadway Avenue E and Mitchell Street E Intersection Signalization and Roundabout Study	$10,000	
5th Avenue S and Main Street S Traffic Study	$5,000	
Total	$130,000	$40,000

7 Roadway Physical Condition Evaluation and Management

This section deals with roadway maintenance planning in the Town of Redcliff. First, it outlines the methods of roadway pavement evaluation and second, it presents the manner in which these evaluations are used to create a maintenance plan.

7.1 Roadway Evaluation Methodology

Roadway pavement evaluation refers to the procedure of going to the field and measuring and/or observing the current state of various pavement characteristics. The roadway conditions assessment in this study used the method outlined in the City of Edmonton's Conditions Survey Manual[3], which is derived from the American Public Works Association (APWA) Paver – Pavement Condition Index Field Manual for asphalt pavements.

7.1.1 Visual Condition Index (VCI)

The Visual Condition Index (VCI) is a statistical measure of all factors of road surface deterioration: alligator cracking, block (mapping) cracking, edge cracking, longitudinal and transverse cracking, distortion, rutting, and ravelling (weathering) deformation. The VCI cannot determine subsurface conditions. It is only a measure of the surface conditions and will only register subsurface conditions that have projected through the pavement to the surface.

A visual inspection of the roadway was conducted manually and all visible pavement distress recorded. The pavement rating system defined in the City of Edmonton's Conditions Survey Manual was used as part of this pavement condition assessment. In the calculation of VCI the collected distress values were entered into the equations defined in the Alberta Municipal Pavement Management System's (MPMS) engineering documentation. Table 7.1.1 summarizes the rating system for pavements, sidewalks, and curb and gutters.

Table 7.1.1: Pavement Rating System

Condition	Pavement VCI	Curb and Gutter Rating	Sidewalk Rating
Very Good	8.1 - 10.0	4.1 - 5.0	4.5 - 5.0
Good	6.1 - 8.0	3.6 - 4.0	3.9 - 4.4
Fair	4.1 - 6.0	3.0 - 3.5	3.2 - 3.8
Poor	2.1 - 4.0	2.0 - 2.9	2.1 - 3.1
Very Poor	0.0 - 2.0	1.0 - 1.9	1.0 - 2.0

6. Source: The City of Edmonton Conditions Survey Manual, May 2007. Attached as Appendix H.

The pavement index ranges from 1 to 10, where 1 represents a very poor pavement condition and 10 represents a brand new road. A VCI over 6.0 indicates roads in "Good" condition. A VCI below 4.0 indicates roads in "Poor" condition. For Curb and Gutter, and Sidewalk, the rating index ranges from 1 to 5, where 1 represents a very poor condition, and 5 a very good or new condition.

Overall condition was determined by combining the ratings of the roadway, curb and gutter, and sidewalk. The combined rating was calculated using a modified methodology from the City of Edmonton which is illustrated in Table 7.1.1a The methodology places increased weighting on the roadway and sidewalk rating as compared to the curb & gutter rating to develop a combined rating. The lower the combined rating the

[3] City of Edmonton Transportation Streets Engineering Branch, Conditions Survey Manual, May 2007.

better condition of the roadway, curb & gutter and sidewalk. The factors on the roadway with only a curb & gutter and the roadway without curb & gutter or sidewalk make the combined ranking for these roadway configurations have the same weighting in the system as a roadway with curb & gutter and sidewalk.

Table 7.1.1a: Overall Conditions – Combined Ranking Calculation Methodology

Condition	Roadway with Curb & Gutter and Sidewalk	Roadway Only with Curb & Gutter	Roadway without Curb & Gutter and Sidewalk
Roadway (VCIr)	4.0 * (10.0 – VCI)	4.0 * (10.0 – VCI)	4.0 * (10.0 – VCI)
Curb and Gutter (VCIcg)	4.0* (5.0 – VCI)	4.0* (5.0 – VCI)	
Sidewalk (VCIs)	8.0* (5.0 – VCI)		
Combined Ranking	VCIr+VCIcg+VCIs	(VCIr+VCIcg)*1.67	VCIr*2.2

The City of Edmonton's criteria to warrant reconstruction of the entire roadway is a combined rating of 44 or greater.

7.1.2 VCI Decision Matrix

The VCI can help identify trigger points for preventive maintenance to stop a road from deteriorating to the point that it needs expensive rehabilitation; and it can also assist with planning and prioritizing pavement rehabilitation. The criteria governing the decision to perform maintenance or rehabilitation differs among municipalities. The City of Edmonton suggests that a roadway with a VCI of 5.0 or less warrants a replacement/repair of pavement; and for a VCI of 3.0 or less, repair of curb and gutter and sidewalk is warranted. The Ministry of Transportation Ontario considers additional factors in the rehabilitation decision such as funds, traffic volume, road classification, and planning periods. To ensure that road maintenance budgets are spent wisely road functional classification and planning periods are considered in this study. The three categories of road functional classifications considered in this VCI decision matrix were major roads, collector roads, and local roads. The detailed classifications of residential, commercial, and industrial roadways were not used as a factor in this study. The recommended VCI decision matrix is outlined in Table 7.1.2.

Table 7.1.2: VCI Decision Matrix

Time of Improvement	Major/Arterial Road		Collector Road		Local Road	
	Roadway VCI	Combined Ranking	Roadway VCI	Combined Ranking	Roadway VCI	Combined Ranking
Adequate	> 8.5	< 13.2	> 8.0	< 17.6	> 8.0	< 17.6
Long Term (6 to 10 years)	7.6 – 8.5	13.3 – 22.0	6.6 – 8.0	17.7 – 30.8	6.1 – 8.0	17.7 - 35.2
Short Term (1 to 5 years)	5.6 – 7.5	22.1 - 39.6	5.1 – 6.5	30.9 – 44.0	4.6 – 6.0	35.3 – 48.4
Now Rehabilitate	5.0 – 5.5	39.7 - 44.0	4.5 – 5.0	44.1 - 48.4	4.0 – 4.5	48.5 – 52.8
Now Reconstruct	<5.0	>44.0	<4.5	>48.4	<4.0	>52.8

Table 7.1.2 illustrates the range of rating values that trigger different maintenance treatment for paved roads. The above table is a general guideline for decision makers to maintain roadways at an acceptable level of service to the public. A field investigation and detailed maintenance assessment should always take precedence over these general guidelines.

7.1.3 VCI Limitations

The Visual Condition Index is a useful planning tool for comprehensive review of the entire road network. It can help categorize maintenance and rehabilitation requirements for budgeting and planning but it has its limitations, specifically, that maintenance and rehabilitation actions shouldn't always be based solely on the actual distress of the pavement itself. Other factors such as drainage issues, utility replacement, sub-base conditions and traffic loads should also be considered in the pavement analysis.

7.2 Current Road System Physical Conditions

The first step in a pavement condition assessment is the division of the pavement network into manageable sections. The Municipal Infrastructure Management System lists the existing roads network within the Town's jurisdiction as 56.76 km of paved roads and 7.72 km of unpaved roads.

The existing roads network within the Town's jurisdiction was divided into 389 sections. The total length of the assessed paved roads is 52.6 km with an additional 5.9 km of unpaved roads. The reason for the discrepancies between Municipal Infrastructure Management System and the assessed length is that River Road was only assessed 100 m east of Redcliff Way as beyond this point the road has a rural section and the Vossler subdivision was not assessed.

Copies of the visual condition survey are found in Appendix I. Unpaved roads are not included in the calculations for VCI. In addition, all 1.45 km of 20th Street west/ West Boundary Road was removed from the VCI calculations as this road is under the jurisdiction of the City of Medicine Hat and its maintenance and improvements will be driven by the City.

Based on the conditions observed in 2010, the pavement condition of the Town's road network had an average VCI of 8.6 and an average combined ranking of 9.7. The average VCI value shows that the overall condition of Town's roads is in the "Very Good" condition category. Table 7.2 summarizes the condition of the road network in the Town of Redcliff. A more detailed break down of the assessed sections is included in Appendix J.

Table 7.2: 2010 Town of Redcliff Road Condition Summary

Condition Category	VCI Range (VCI)	Total Length (km)	Percent of the Network (%)
Very Good	8.1 - 10.0	37.7	71.6%
Good	6.1 - 8.0	11.5	21.9%
Fair	4.1 - 6.0	1.6	3.1%
Poor	2.1 - 4.0	1.5	2.9%
Very Poor	0.0 - 2.0	0.3	0.5%

7.2.1 2011 and 2012 Road Repairs and Improvements

During the 2011 and 2012 construction season the Town conducted repairs and improvements to several road sections. These improvements were classified by the Town as follows:

- Deep repairs,
- Rehabilitation,
- Overlay,
- Isolated deep repairs,
- Isolated deep repairs and some overlay.

Location of the repairs and improvements is shown on Figure 7.2.1. No condition assessment was made on these repairs and improvements however for the purposes of future projections we have assumed the following:

- Deep repairs will restore the VCI to a near new condition, Pavement VCI = 9.5;
- Rehabilitation will restore will restore the VCI to a good condition, Pavement VCI = 8.8
- Overlay will restore the VCI to a good condition, Pavement VCI = 9.2;
- Isolated deep repairs will restore the VCI to a good condition, Pavement VCI = 9.2;
- Isolated deep repairs and some overlay will restore the VCI to a good condition, Pavement VCI = 8.5.

Based on the information provided by the Town and the above assumptions the average VCI of the paved road network was estimated to be:

- In 2011 including 2011 improvements
  - VCI 8.51
  - Combined ranking 10.35.
- In 2012 including 2012 improvements
  - VCI 8.25
  - Combined ranking 11.69.

Table 7.2.1 and Table 7.2.2 summarize the estimated condition of the road network in the Town of Redcliff after the 2011 and 2012 road work respectively. The condition of all roads was reduced by an amount equal to only normal maintenance being preformed. A more detailed break down of the assessed sections is included in Appendix J.

Table 7.2.1: Town of Redcliff Road Condition Summary after 2011 Repairs

Condition Category	VCI Range (VCI)	Total Length (km)	Percent of the Network (%)
Very Good	8.1 - 10.0	39.4	74.9%
Good	6.1 - 8.0	9.5	18.0%
Fair	4.1 - 6.0	2.7	5.1%
Poor	2.1 - 4.0	0.8	1.4%
Very Poor	0.0 - 2.0	0.3	0.6%

Table 7.2.2: Town of Redcliff Road Condition Summary after 2012 Repairs

Condition Category	VCI Range (VCI)	Total Length (km)	Percent of the Network (%)
Very Good	8.1 - 10.0	38.3	72.7%
Good	6.1 - 8.0	10.1	19.2%
Fair	4.1 - 6.0	3.0	5.7%
Poor	2.1 - 4.0	0.9	1.7%
Very Poor	0.0 - 2.0	0.3	0.6%

7.3 Road Pavement Improvement Strategies

A network level road improvement plan is the component of a pavement management program which involves making decisions about planning and programming for the overall network. Each score range of VCI is assumed to warrant a specific type of treatment. Treatments can be grouped into five general categories:

1. Routine maintenance typically includes crack sealing, pothole repair, spray patching, shallow patching, spall repairs, partial slab repairs, drainage improvement, etc…
2. Preventive maintenance refers to localized treatment works in discontinuous sections, such as slurry sealing, micro-surfacing, chip sealing, full depth patching, or thin overlay (40 mm or less in thickness). Overlay thicknesses to be selected based on the detailed assessment of the roadway condition.
3. Rehabilitation treatment refers to improvements or treatment works which extend over the entire length of the section, for example moderate to progressively thicker overlay or mill & inlay treatments applied to increase structural capacity and restore serviceability and ride. These treatments could be applied to mid-life and late life pavement. The required thickness should be based on the 10 year and 20 year structural capacity assessment.
4. Resurfacing is considered to be a more expensive rehabilitation work, when significant surface pavement distresses and cracking need to be removed and/or repaired with a full width and uniform depth milling process.
5. Reconstruction involves either reconstruction of a portion or of the total base and pavement structure where the existing pavement has completely failed.

Table 7.3 gives the pavement maintenance actions recommended and approximate costs for each of the five VCI ranges.

Table 7.3: Pavement Maintenance Actions for the five VCI ranges

Actions Required	Cost of Treatment Per km						
	Arterial	Residential Collector	Residential Local	Other Collector	Other Local	Curb & Gutter	Sidewalk
Routine maintenances such as crack sealing and fog seals	$8,000	$7,000	$6,000	$8,000	$7,000		
Preventive maintenances include localized repairs, seals, and thin overlay	$141,000	$122,000	$97,000	$122,000	$97,000		
Rehabilitation treatments like localized repairs followed by a moderate to progressively thicker overlays or Resurfacing	$397, 000	$317,000	$244,000	$344,000	$269,000		
Reconstruction of portion or of the pavement structure	$721,000	$577,000	$440,000	$625,000	$484,000		
Full reconstruction including base layers	$1,263,000	$1,010,000	$740,000	$1,094,000	$815,000	$150,000	$175,000

When roadways are in the “very good” category, only small routine maintenance treatments such as crack seals are required to extend the life of the pavement. Approximately 72.7% of Redcliff’s paved roads at the end of 2012 would benefit from these relatively inexpensive, life-extending treatments.

Approximately 19.2% of Redcliff’s paved roads at the end of 2012 fall into the “good” condition category. Roadways in this category would benefit from minor rehabilitation such as seals with full depth patching and overlays to extend the life of the pavement by preventing speedy deterioration. The timing of effective maintenance and rehabilitation treatments is critical. Deferring the action by even one year may excessively

increase the level of deterioration and thereby require increasingly extensive and costly corrective maintenance.

Approximately 5.7% of Redcliff's paved roads at the end of 2012 fall into the "fair" condition category. Pavements in this range show frequent moderate distress or wear that requires more than a life-extending treatment. By this point the road has served at least 75% of its life, and the quality of the pavement has dropped by about 40%. The road surface may require a thick overlay or resurface.

The remaining 2.3% of the paved roads at the end of 2012 fall into the "poor" and "very poor" condition categories. These pavements are near the end of their service life and typically require either reconstruction of a portion of the pavement structure or reconstruction of the total base and pavement structure.

7.4 Network Level Road Improvement Plan

The goal of a pavement maintenance plan is to continuously maintain the Town's transportation infrastructure system in a safe, comfortable and fiscally responsible manner. It is recommended that a minimum target value for the Town's road network be an average VCI of 7.5.

Roads deteriorate with age and traffic. Pavement tends to deteriorate slowly during the first few years after construction and then very rapidly once it is aged. Aged pavement with a condition of less than 6.0 on the VCI scale of 10.0 would be considered for much more expensive rehabilitation or reconstruction. With the proper maintenance plan a higher road surface rating can be maintained and the overall capital expenditures over the life cycle of pavements may be reduced.

Three network level road improvement plans were developed by examining different targets and applying a modification factor to the decision matrix (Table 7.1.2) until the desired target achieved: The modification factor was only applied to the pavement portion of the decision matrix and no attempt was made to modify the decision matrix to give different classifications of roads a different priority.

- Balancing yearly maintenance costs, (2015 VCI = 8.0 and 2020 VCI=8.1)
- Maintaining current VCI, (2015 and 2020 VCI=8.6)
- Achieving minimum target VCI (2015 and 2020 VCI=7.5)

Figures 7.4 and 7.4a present the roadway maintenance plans 2013 – 2015 and 2016 – 2020 time frames respectively. Tables 7.4 and 7.4a present the estimated total and yearly average roadway maintenance costs by category for 2013 – 2015 and 2016 – 2020 time frames respectively for each plan.

Table 7.4: Roadway Improvement Plan – 2013-2015

Treatment Category	Estimated Costs								
	2015 VCI = 8.0			2015 = 8.6			2015 VCI = 7.5		
	Arterial	Collector	Local	Arterial	Collector	Local	Arterial	Collector	Local
Routine Pavement Maintenance	$57,232	$20,895	$218,634	$21,520	$12,327	$143,262	$61,952	$31,010	$236,088
Preventive Maintenance	$16,215	$159,820	$208,647	$359,550	$107,848	$1,218,514	$0	$0	$48,985
Rehabilitation Treatment	$188,575	$42,795	$189,927	$805,513	$523,050	$572,019	$0	$0	$62,708
Resurface	$0	$0	$0	$342,475	$77,895	$46,948	$0	$0	$66,000
Reconstruction	$0	$0	$800,680	$0	$0	$1,186,470	$0	$0	$125,800
Three Year Total	$262,022	$223,510	$1,417,888	$1,529,058	$721,120	$3,167,213	$61,952	$31,010	$539,581
Sidewalk, Curb & Gutter Replacement	$355,575			$355,575			$355,575		
Three Year Total	$2,258,995			$5,772,966			$988,118		
Average Year Cost	$752,998			$1,924,322			$329,373		

Table 7.4a: Roadway Improvement Plan – 2016-2020

Treatment Category	Estimated Costs								
	2020 VCI = 8.1			2020 VCI = 8.5			2020 VCI = 7.5		
	Arterial	Collector	Local	Arterial	Collector	Local	Arterial	Collector	Local
Routine Pavement Maintenance	$5,896	$26,110	$179,586	$3,800	$18,683	$133,182	$43,640	$18,515	$213,942
Preventive Maintenance	$567,807	$43,920	$1,008,703	$666,366	$214,842	$1,768,601	$30,174	$80,520	$344,350
Rehabilitation Treatment	$1,183,060	$107,780	$26,900	$1,009,571	$0	$0	$762,240	$356,625	$180,053
Resurface	$0	$0	$0	$0	$0	$0	$111,755	$0	$179,960
Reconstruction	$0	$0	$0	$0	$0	$0	$0	$0	$83,130
Five Year Total	$1,756,763	$177,810	$1,215,189	$1,679,737	$233,525	$1,901,783	$947,809	$455,660	$1,001,435
Sidewalk, Curb & Gutter Replacement	$350,000			$350,000			$350,000		
Five Year Total	$3,499,762			$4,165,045			$2,754,904		
Average Year Cost	$699,952			$833,009			$550,981		

When the Town does not have the necessary funds the prioritization of projects should be based on good engineering judgement, detailed road maintenance assessments, subsurface utility improvements, and net positive impact on the community and drivers. A detailed cost per linkage sheet proposed plan is included in Appendix J

8 Non-Motorized Modes of Transportation

Interests in bicycle and pedestrian planning have grown significantly in the last two decades. One of the best reasons to promote bicycling and walking is that it improves public health through increased physical activity. Recent research has reported that lifestyle choices are heavily influenced by transportation and urban development patterns, and that physical activity for non-exercise purposes has been removed from many North Americans' lives.

Part of the public facilities component of the Redcliff Roadway System Master Plan is to encourage bicycling and walking as part of a healthy lifestyle. The goals for pedestrian and bicycle planning are to:

- Increase the number of bicycling and walking trips as alternative modes for short trips.
- Improve the bicycle and walking network to promote physical activity for the Town's residents.

8.1 Policy Context

The Municipal Development Plan for the Town of Redcliff, June 2010, outlines several objectives, which relate to or directly refer to non-motorized modes of travel.

MDP Section	Objective
Recreation Development 11.3.4.	To maximize the use of open space, a pedestrian trail system between the various existing open spaces should be expanded.
Recreation Development 11.3.5.	A regional trail connection to the City of Medicine Hat should be explored to provide a pedestrian/bicycle connection between the communities.
Transportation System 12.4.6.	The Town shall consider improvements to the pedestrian environment within Redcliff, including the addition of crosswalks and expansion of the pedestrian trail system.
From Municipal Development Plan for the Town of Redcliff4, June 2010	

Section 11.3.4 Recreation Development, provides direction to expand the current pedestrian trail system between the various existing open spaces throughout the Town, and Section 11.3.5 Recreation Development includes the objective to explore a regional multi-use trail connection to the City of Medicine Hat.

In the Transportation System section the objectives for the future transportation extension include greater emphasis on the improvements to the pedestrian environment within Redcliff. Section 12.4.6 Transportation System provides guidance to develop additional sidewalks, crosswalks and expand the pedestrian trail system.

8.2 Existing Pedestrian Facilities

Sidewalks are generally located in the existing commercial and residential areas of the town; there are virtually no sidewalks in existing industrial areas. In old residential subdivisions, separated sidewalks are provided on both sides of most north-south Streets and provided along one side of east-west avenues. New residential subdivisions incorporate sidewalks on both sides of roads and provide good accesses to the Red Brick trail and River Valley Trail. Painted Street crossings and signage exist at some significant pedestrian

[4] Municipal Development Plan for the Town of Redcliff , Town of Redcliff, June 2010.

activity centers. Figure 8.2 provides a mapped inventory of the existing sidewalks, existing trails and significant activity centers.

The existing sidewalk system works but is missing some segments. Gaps in the sidewalk network exist between some significant activity centers especially for east-west movements. These gaps remain as obstacles to acceptable connectivity, accessibility, sense of safety, and the quality of the pedestrian environment.

8.3 On-Road Bicycling Facilities

At present, there are no officially designated bike routes or striped lanes for bicycles in the Town of Redcliff. Currently, cyclists share all the roadways with automobiles and/or pedestrians in the Town. Most roads in the Town of Redcliff have lower traffic volumes so bicyclists are able to avoid major roadways and travel on lower volume Streets. However, the lack of bicycle lanes, wide outside lanes, wide adequate shoulders, and other infrastructure for bicycles sets an unsafe and uncomfortable environment for cyclists.

A major barrier for commuter bicyclists is the Transcanada Highway. Pedestrian crossings of Transcanada Highway are only provided on the east sides of the intersections of Transcanada Highway with Mitchell Street NE and with Broadway Avenue E. The northbound right turn movement and southbound left turn movement are much heavier than the northbound left turn and southbound right turn movements, therefore the location of the pedestrian crossings expose pedestrians and bicyclists to much more traffic conflicts than if the pedestrian crossing of Transcanada Highway was located on the west side of the intersection. A discussion of crossing distances and times is found in Sections 6.7.2 & 6.7.3. It is recommended that these intersections be refitted with a pedestrian crossing of Transcanada Highway on the west side of the intersections. In addition, high traffic volumes and travel speed on Mitchell Street NE and Broadway Avenue E discourage people from commuting between the south residential area and the north industrial area.

8.4 Existing Off-Road Multi-Use Trail System

Only limited special facilities for bicycles and pedestrian exist in the town of Redcliff. Red Brick Trail and River Valley Trail serve as recreational multi-use trails for pedestrians, bicyclists, parents with children in strollers, and so on. The trails are currently developed with an approximately 2.4 m - 3.0 m wide asphalt or shale surface.

8.5 Existing Public Transportation

Redcliff does not have a public transit service. While expansion of the City of Medicine Hat's transit service into Redcliff is one option to provide transit service to the Town, transit rider surveys should be undertaken to determine when a basic regular bus service is warranted in the Town of Redcliff, which is beyond the scope of this project.

8.6 Bicycle and Pedestrian Planning and Design Consideration

This section discusses the various types of bicycle and pedestrian facilities, the typical design considerations for each mode, and locality specific needs for each mode.

8.6.1 Pedestrian Facilities

Both the potential users of sidewalks and the type of Streets influence the design and the appropriate width of sidewalks. Sidewalk widths should vary according to the number of pedestrians anticipated to use the sidewalks. Naturally, a sidewalk along a residential Street will be narrower than a sidewalk in the central business districts (CBDs). The general sidewalk standards from the existing Town's standard road cross-sections allow for various road classifications and are described as follows:

- Minimum 1.1 m wide monolithic sidewalk for residential areas.
- Minimum 1.5 m wide monolithic sidewalk or minimum 1.7 m wide meandering separate sidewalk for collector roads.
- Minimum 1.4 m wide separate sidewalk for primary collectors and undivided major Streets.

A number of guidelines for pedestrian facility design were reviewed. ITE's Transportation Planning Handbook[5] states that the Americans with Disabilities Act (ADA) must be followed for new or reconstructed pedestrian facilities. ITE's Transportation Planning Handbook goes on to state that in the ADA:

- A minimum sidewalk width of 1.2 m is required. Where sidewalks are adjacent to the traveled way or there is higher pedestrian traffic wider sidewalks are desirable.
- Accommodations for persons with disabilities (i.e. curb ramps) are required.
- A buffer space between the sidewalk and the traveled way (driving lane) is recommended. The minimum buffer space on local and collector streets is 0.6 m (1.2 metres is preferable). Higher speed roads should have a larger buffer.
- Off road paths (trails) intended for multiple users (i.e. pedestrians and cyclists) should have a minimum path width of 3.0 metres.
- Off road paths have a recommended maximum slope of 5%.
- Curb radii should adequately accommodate the design vehicle but not be too large to encourage high vehicle speeds and longer crossing distances for pedestrians.
- Median islands should be considered when crossing distances which exceed 18.3 m at signalized intersections, but they can also be used at intersections with shorter crossing distances.
- Consideration should be made for providing median or other crossing islands on two-way Streets with high traffic volumes, speeds, or pedestrian volumes.
- Providing median or other crossing islands at complex intersections should be considered.
- Newly-constructed median crossing islands should be 1.8 m wide or more.
- The intersection skew angle should be minimized.
- Marked crosswalks should be at least 1.8 m wide. (TAC recommends a minimum of 2.4 m wide)
- Stop lines, when used, should be set back at least 1.2 m from the pedestrian crosswalk. At marked crosswalks in uncontrolled locations on multi-lane highways, desirable yield line setbacks are 6 m to 15 m from the marked crosswalk to provide adequate sight distance from the motor vehicles to pedestrians.
- Newly constructed curb ramps should be minimum of 1.2 m wide, not including the flared sides.

It is noted that, while the ADA is a United States federal act, it does provide a minimum recognized standard.

We note that the City of Medicine Hat changed their sidewalk width requirement from 1.1 m to 1.2 m with the introduction of the City's Municipal Servicing Standard Manual in 2006. 1.1 m was found by the City as to be too narrow for two people to comfortably walk side by side.

[5] Institute of Transportation Engineers, Transportation Engineering Handbook, 6th Edition, Washington D.C. 2009.

Because the higher traffic volumes and higher motor vehicle speeds on collector and arterial roads create uncomfortable and potentially dangerous conditions for pedestrians, physical separation of the sidewalk from the road should be considered to provide protection from traffic.

Meandering sidewalk is desirable in a park or along a waterway or other natural feature. It is considered inappropriate for sidewalks along a Street, because it unnecessarily creates a longer walking distance and requires a substantial increase in right of way requirements.

Curb ramps provide access between the Street and the sidewalk for individuals using walkers, wheelchairs, shopping carts, or baby carriages. People with visual impairments rely upon the curb to identify the transition between sidewalk and Street. The existing design standard of curb ramps takes into account both types of users and should be used at all intersections and mid-block crossings.

Curb extensions currently exist at a few crosswalks in the Central Business District in conjunction with angled parking adjacent to the curb. Curb extensions improve pedestrian crossing safety by shortening the crossing distance and giving pedestrians a better chance to see traffic and be seen before committing to crossing the road. Consideration should be given to additional curb extensions in the Town wherever long crossing distances and high pedestrian traffic volumes exist to improve pedestrian safety.

Reduced curb return radii can be an effective means of increasing pedestrian comfort and safety at road crossings. Large corner radii increase the speed at which vehicles are able to navigate a corner and increase the ease of navigation of large vehicles around corners. Large corner radii have very negative effects on pedestrians by increasing the pedestrian crossing distance, increasing vehicle speeds around the corners, reducing the visibility of the pedestrian to traffic by pushing the pedestrian back from the corner, and reducing the pedestrian's ability to see traffic. We recommend that in residential neighbourhoods the corner radii be selected as the minimum radius required allowing the design vehicle to navigate the corner. We recommend the design vehicle be selected based on what vehicle will frequently be required to negotiate the corner (typically a municipal garbage truck). Larger vehicles than the design vehicle can still be accommodated by the larger vehicle utilizing the oncoming traffic lanes to negotiate the corner. This typically causes few if any problems on low volume residential roadways where large vehicles and high speeds are not desirable.

Pedestrian Street crossings are defined as any location where the pedestrian leaves the sidewalk and enters the roadway. Crosswalk markings are used to define the preferred pedestrian path and alert drivers to the crosswalk's location at some high volume pedestrian crossing locations in the Town. All marked crosswalks and signage should be designed in conformance with the Manual of Uniform Traffic Control Devices for Canada.

8.6.2 Bicycle Facilities

There are two main categories of bicycle facilities: on-road bicycle facilities and off road multi-use trails. Designated bike lanes or wide outside lanes for bicycles are not included in any of the current road classifications or standard roadway cross-sections. With the current standards a motorist will usually have to cross into the adjacent travel lane to pass a bicycle on Street. Several treatments can enhance shared roadways for cyclists – bike routes, wide outside lanes, bike lanes, paved shoulders and bike boulevards. [6]

Bike routes are shared roadways that assist bicyclist with way-finding. Pavement markings or bicycle route signs provide directional information and, if appropriate, the distance to the destination. The proposed bike

[6] Institute of Transportation Engineers, Transportation Planning Handbook, 3rd Edition, Washington D.C. 2009.

route is a part of an interconnected system of bicycle facilities which generally provides a reasonably good LOS to bicyclists and meets a set of minimum design and operational criteria for bicycle compatibility.

Wide outside lanes which are 4.3 m wide allow an average size vehicle to more safely pass a bicyclist without crossing into the adjacent lane. This is generally considered an appropriate facility only for advanced bicyclists.

Bike lanes are a portion of the roadway designated for the exclusive or preferential use of bicyclists through signage, striping and other pavement markings. The typical width of a bike lane is from 1.2 m to 1.5 m. Many communities have begun installing bike lanes not only for the additional operating space for bicyclists, but also as a method to encourage more bicycle travel. When the traffic volume of a collector Street is greater than 3,000 vehicles per day and observed speeds are greater than 50 km/h, bike lanes increase the comfort of the bicyclist and motorists and increase drivers' awareness of bicycles while driving.

Paved shoulders adjacent to the travel lanes can improve conditions for bicyclists along rural roadways with no curb and gutter. Paved shoulders from 1.2 m to 1.8 m wide on both sides of the roadway are preferred. In addition to the benefits to bicyclists, paved shoulders can also extend pavement life and provide a breakdown area for motorists.

Off-road multi-use sidewalks are physically separated from motor vehicle traffic by an open space or barrier. They can accommodate a variety of users for both recreation and transportation purposes including pedestrians, bicyclists, people in wheelchairs, and so on. The minimum width for two-directional trails is 3.0 m, as recommended by ITE's Transportation Planning Handbook. Previous research by Thom R., Clayton A., and Omar H., "Winnipeg's Bicycle Accident Experience: Facts and Opportunities for Improvement" indicates that sidewalk riding may result in at least twice as many car/bicycle collisions than riding on the road since the number of possible conflicting roadway crossings at any intersection is increased significantly for bicycles and motor vehicles. Therefore, intersection crossings must be designed carefully to minimize the relative risks of collisions between bicyclists and vehicles.

Recreational multi-use trails function as a recreational amenity that serves a wide range of users – pedestrians, bicyclists, walkers, joggers, children in strollers, and so on. It is noted that the potential for greater utilization of the trail system can be increased by creating trail connections between activity park destinations; neighbourhood trail systems, and other activity areas. There are many design factors to take into account, such as trail classification, safety, environmental, structural, etc. The Town's existing trail standard is a 2.4 m wide surface. The TAC manual recommends that multi-use trails designed to accommodate bicycle traffic and pedestrians should have a minimum width of 3.0 m. It is recommended that the Town modify its standard to require a 3.0 m wide trail where it is anticipated the trail will be used for commuter bicycle trips as well as recreational purposes.

8.7 Recommendations

8.7.1 Non-motorized Modes Strategies

The following discussions and recommendations present integrated strategies to accommodate and encourage the use of non-motorized modes in the Town of Redcliff for both transportation and recreation purposes:

- Development of multi-purpose pedestrian and bicycle facilities, where appropriate, to accommodate recreational walking and cycling and also to provide a choice of alternative modes instead of short auto trips.

- Improvement of accessibility for pedestrians by providing connection between significant pedestrian activity centers.
- Consideration of bicycle and pedestrian facilities as normal and expected aspects of a roadway.
- The Town should work with other entities to improve the safety, aesthetics, and convenience of pedestrian and bicycle networks.
- Physical facilities are only part of the bicycle and pedestrian planning process. It is equally important to implement safety, education, and encouragement programs to increase walking and bicycle activities.

8.7.2 Pedestrian Facilities

It is recommended that the following guidelines be adopted by the Town for new and reconstruction projects:

- 3.0 m wide multi-use trails,
- Minimum 1.2 m wide sidewalks,
- Minimum buffer of 0.6 m from the traveled way (driving lane) to any sidewalk or 0.6 m of extra sidewalk width.
- 1.2 m wide separate sidewalk with a minimum 2.0 m boulevard for collector roads.
- Desirable 1.5 m wide separate sidewalk with a minimum 2.0 m boulevard for arterial roads.

8.7.3 Pedestrian/Bicycle Network Improvement Plan

Specific recommendations with respect to expansion of the pedestrian and bicycle network include:

- Consideration of physical separation to provide protection for pedestrians from traffic on collector roads. Collector roads typically serve higher-volume and higher speed traffic which creates dangerous and uncomfortable conditions for pedestrians using monolithic sidewalk. Meandering sidewalks should be avoided along a Street because it creates a longer walking distance. The recommended cross section for collector roads with separate sidewalks is included in Appendix B, Recommend Roadway Standard.
- The current sidewalk standard for primary collectors and undivided major Streets is a minimum 1.4 m wide separate sidewalk, which is narrower than for the collector roads. For consistency, a minimum 1.5 m wide sidewalk with a minimum setback of 2 m on arterial and primary collector Streets is recommended for the Town's roadway standard.
- Provision of sidewalks on both sides of all roadways in residential areas as shown on the existing standard cross-sections for urban roadways.
- Implementation of a plan to connect existing gaps in the pedestrian network through the creation of a prioritized list for new sidewalk construction. Figure 8.7.3 illustrates future multi-use trail improvements. Figure 8.7.3a shows the recommended sidewalk improvement plan. The location and estimated cost are shown in Table 8.7.3.3.
- Development of a comprehensive network of facilities for bicycles which will enhance the active transportation modes within the Town of Redcliff. Figure 8.7.3 illustrates the recommended bicycle network plan, including planned on-Street bike routes, bike lanes, recreational multi-use trails, future neighbourhood trails and future regional trail connections. The purpose of the recommended bicycle network plan is to provide the Town with a "starting point" for the development of bicycling facilities in the road allowances which will allow cycling in the Town of Redcliff to be more convenient, comfortable and safe. It is a system which links the pedestrian and bicycle networks,

incorporates trail-based recreational activities, and also encourages cycling as an alternative mode of transportation.

- Creation of a bicycle-friendly roadway system by incorporating bicycle transportation needs into the roadway design standard to facilitate future implementation. The recommended cross section for collector roads with bike lanes is included in Appendix B, Recommended Roadway Standard. The collector road has 3.5 m wide travel lanes with 1.2 m bicycle lanes on both sides and a 2.2 m allowance for parking lanes on both sides if required.
- Creation of trail / bicycle map kiosks at strategic locations to provide directions for trail users.
- Expansion of the trail and bicycle route signage; including bicycle route signs with directional information and the distance to the destination, and trail signs with trail name and distance at trail heads.
- Recognition that bicycle/pedestrian systems are built out over many years so it is recommended that dedicated funding be established for both installation and maintenance of the network. Improvements to sidewalks and the designation of bicycle lanes should be included in every routine Street maintenance project.

8.7.3.1 Mitchell Street Pedestrian and Bicycle Accommodation

Initially consideration was given to constructing sidewalks on both sides of Mitchell Street from 9th Avenue SE to the Transcanada Highway and upgrading the road to accommodate bicycle lanes (Option 1). SAL completed an opinion of probable cost excluding land acquisition and utility relocations of Option 1. Due to the high cost of Option 1, SAL completed an opinion of probable cost on a second Option of constructing a multi-use trail on one side of the road (Option2). A summary of the comparison is presented in Table 8.7.3.1.

Table 8.7.3.1 Opinion of Probable Costs for Pedestrian and Bicycle Accommodation on Mitchell Street

Categories/Items	Opinion of Probable Costs
Option 1	
Develop sidewalk on both sides of Mitchell Street from 9th Avenue SE to Transcanada Highway (1850 m) - $220/lm – 1.2 m Mono Sidewalk	$814,000
Widen Mitchell Street to the standard collector road with bike lane from 9th Avenue SE to Transcanada Highway (1850 m) -$250/lm per side	$925,000
Total	$1,739,000
Option 2	
Develop multiuse Trail on one side of Mitchell Street from 9th Avenue SE to Transcanada Highway (1850 m) - $200/lm - 3.0 m Asphalt Trail	$370,000

Without examining the feasibility, safety aspects, etc of either option SAL recommends that on cost alone that Option 2 be further investigated.

SAL recommends that a functional planning study be conducted for the Mitchell Street Pedestrian and Bicycle Accommodation to identify all of the probable costs and constraints. Our opinion of the probable cost for this study is $30,000.

It is noted that a functional planning study for Mitchell Street E is recommended. If the road functional plan and the pedestrian and bicycle accommodation functional plan were combined SAL's opinion of the probable cost for the combined studies would be $40,000. SAL recommends that the two studies be combined.

8.7.3.2 Broadway Avenue E and Saamis Drive SE Pedestrian and Bicycle Accommodation

SAL devised three options for providing Pedestrian and Bicycle Accommodation on Broadway Avenue E east of Mitchell Street E and along Saamis Drive SE. A summary of the three options with opinions of probable cost is presented in Table 8.7.3.2.

Table 8.7.3.2 Opinion of Probable Costs for Pedestrian and Bicycle Accommodation on Broadway Avenue E and Saamis Drive SE

Categories/Items	Opinion of Probable Costs
Option 1	
Develop sidewalk on one side of Broadway Avenue E between Mitchell Street E and Saamis Drive SE (400 m) - $220/lm – 1.2 m Mono Sidewalk	$88,000
Widen Broadway Avenue E between Mitchell Street E and Saamis Drive SE and Saamis Drive SE between Broadway Avenue E and the east Town boundary to include bike lanes. (2000 m)	$1,000,000
Develop gravel trail parallel to Saamis Drive SE between Broadway Avenue E and the east Town boundary. (1600 m)	$160,000
Total	1,248,000
Option 2	
Develop sidewalk on one side of Broadway Avenue E between Mitchell Street E and Saamis Drive SE (400 m) - $220/lm – 1.2 m Mono Sidewalk	$88,000
Widen Broadway Avenue E between Mitchell Street E and Saamis Drive SE and Saamis Drive SE between Broadway Avenue E and the east Town boundary to include bike lanes. (400 m)	$200,000
Multiuse trail parallel to Broadway Avenue E between Mitchell Street E and Saamis Drive SE and Saamis Drive SE between Broadway Avenue E and the east Town boundary. (1600 m)	$320,000
Total	$608,000
Option 3	
Develop multiuse Trail on one side of Broadway Avenue E from Mitchell Street E to the east Town Boundary (2000 m) - $200/lm - 3.0 m Asphalt Trail	$400,000

SAL recommends that a functional planning study be conducted for the Broadway Avenue E and Saamis Drive SE Pedestrian and Bicycle Accommodation to identify all of the probable costs and constraints. Our opinion of the probable cost for this study is $20,000.

If this study was included as part of the work for re-examining the Eastside ASP and alignment of Saamis Drive SE that are recommended elsewhere in this report SAL's opinion of the probable cost for this study would be $10,000. SAL recommends that this study be included as part of the work for re-examining the Eastside ASP and alignment of Saamis Drive SE.

8.7.3.3 Pedestrian/Bicycle Network Improvement Plan List and Opinion of Probable Costs

Table 8.7.3.3 contains a non prioritized list of bicycle and pedestrian accommodation improvements along with planning level opinions of probable costs. As pedestrian and bicycle network improvements tend to be driven by political expediency and funding availability no effort has been made to prioritize them. It is recommended that pedestrian and bicycle network improvements be made when repairs or upgrading of a road is done.

The recommended bicycle/pedestrian network and improvement plan should be adopted by Council as the long-term strategy to guide decisions related to development of non-motorized modes for the Town. It is important to recognize that priorities and opportunities may change over time therefore the recommended network should be assumed to be flexible so that the Town can adapt to changes, constraints, and available budget resources.

Table 8.7.3.3: Bicycle and Pedestrian Improvements

Categories/Items	Opinion of Probable Costs
Sidewalk Improvements ($220/lm – 1.2 m Mono Sidewalk)	
Connect on one side of 9th Avenue SE between Main Street S and Mitchell Street SE (790 m)	$194,000
Connect on one side of 5th Avenue SE between 1st Street SE and Mitchell Street SE (690 m)	$170,000
Complete sidewalk on both sides of 3rd Avenue S between 1st Street SW and 6th Street SE (750 m)	$206,000
Complete sidewalk on both sides of 1st Street S from 1st Avenue SE to 3rd Avenue SW (300 m)	$110,000
Extend sidewalk from 3rd Street SE to the sport ground of Margaret Wooding Elementary School (80 m)	$22,000
Multi-use Trail Improvements* ($200/lm - 3.0 m Asphalt Trail)	
Develop a Multi-use Trail parallel to Mitchell Street from Redcliff Way SE to Transcanada Highway (1850 m)	$370,000
Connect Red Brick Trail and River Valley Trail (240 m)	$48,000
Trail from River Valley Park north to River Valley Park Trail Parallel to River Road(800 m)	$160,000
Trail parallel to Broadway Avenue E between Mitchell Street E and Saamis Drive SE and Saamis Drive SE between Broadway Avenue E and the east Town boundary (2000m).	$400,000
Trail parallel to South Railway Drive NE and Old Transcanada Highway, Mitchell Street NE and 8th Street NW (2000m).	$450,000
Future Trail to the City of Medicine Hat (3,300m)	$660,000
Street Crossing Improvements	
Painted Street Crossing at the intersection of 1st Street SW and 3rd Avenue SW	$500
Painted Street Crossing at the intersection of Main Street S and 3rd Avenue SE	$500
Painted Street Crossing at the intersection of 1st Street SE and 3rd Avenue SE	$500
Painted Street Crossing at the intersection of 5th Street SE and 3rd Avenue SE	$500
Painted Street Crossing at the intersection of 6th Street SE and 3rd Avenue SE	$500
Painted Street Crossings (4) at the intersection of Broadway Avenue E and Mitchell Street E	$3,000
Curb Ramp Improvements	
South Redcliff Way SE at the intersection of Main Street S and Redcliff Way S	$1,500
NE corner of the intersection of Broadway Avenue E and Mitchell Street E	$2,000
Total	$2,799,000

7. Notes: 1. The construction cost of a multi-use trail is based on the 2010 unit cost for a 2.4 m asphalt trail in the *Medicine Hat Leisure Trails Future Development Plan April 2010*.

9 Goods Movement and Traffic Noise Strategies

This section addresses the issue of goods movement and traffic noise in the Town of Redcliff. Traffic noise is a type of pollution produced by the movements of people and freight which can negatively affect public health and a community's quality of life. In order to support liveable and healthy communities, the management of ongoing exposure to traffic-related noise is important. To establish a traffic noise policy is the first step to ensure a uniform approach to identifying the necessity for an assessment and the needs of noise mitigation. Common elements recommended to be included in the Traffic Noise Policy are:

- To provide acceptable noise level thresholds for existing residential land uses and new residential areas.
- To develop a noise assessment guideline.
- Implementation strategies for traffic noise mitigation.

Major industrial development and residential land uses in the Town of Redcliff are separated by the Transcanada Highway. This separation provides the benefit of maintaining acceptable noise levels. Alberta Transportation adopts a noise level of 65 dBA Leq24 measured 1.2 m above ground level and 2 m inside the property line. This permissible sound level criteria is also used for existing residential development in other jurisdictions such as Edmonton and Strathcona County. Based on this threshold, it is recommended that the outdoor sound level for existing residential properties adjacent to Transcanada Highway be reviewed.

For new residential development, developers in other jurisdictions are required to provide a design which meets a 55 dBA Leq24 maximum noise level. As identified in Section 3, future growth will be focused on the east side of the Town. Residential development near Saamis Drive SE should be carefully planned and a noise impact assessment should be required if any residential development is proposed along Saamis Drive SE. The assessment must address background noise levels, the impact of current traffic levels, and the impact of traffic at the projected road design capacity.

Improving existing and planned truck route networks will decrease the requirements for stronger pavement structures. The current Town shop is located at the southwest corner of the Town. Relocating the Town Shop close to Broadway Avenue or into an industrial area north of Transcanada Highway would reduce the impact of heavy Town equipment on the residential Street network.

The current route signage for truck routes is faded therefore new standard route signage should be installed on south entrances of the Town.

9.1.1 Truck Routes

Review of the current Transportation Bylaw (1681 / 2011) of the Town of Redcliff shows the Town has identified Heavy Truck Routes and Restricted Heavy Truck Routes. The difference between Heavy Truck Routes and Restricted Heavy Truck Routes is the hours of operation which is specified in the Sign Bylaw.

Currently most of the Truck Route signage is missing and what is installed is faded. Figure 9.1.1 shows the minimum signage to provide truck route directions. If the Town wishes to sign Restricted Truck Routes additional signage will be required in addition to signage designating the hours in which the Restricted Truck Route is in effect.

Two issues were identified in the review of truck routes:

The map attached as Schedule B in the bylaw is of low quality, hard to read and is unclear in a couple of places. This map should be updated.

The truck routes shown on Schedule B in the bylaw do not make a lot of sense as several routes dead end with no logical reason for termination. Some unrestricted routes terminate to a restricted route with no opportunity for a truck to turn around therefore a truck traveling outside of the restricted truck route hours may find themselves in a situation where they are now on a prohibited road with no opportunity to turn around. The truck route system should be reviewed and changes made to provide a logical, workable unrestricted truck route network which then can be augmented by restricted heavy truck routes.

Our opinion of the probable cost to install the signage should be less than $15,000.

9.1.2 Traffic Noise Policy

It is recommended that a traffic noise policy be established, the outdoor sound level for existing residential adjacent to Transcanada Highway be reviewed, and that new residential developments should be required to meet a 55 dBA Leq24 measured at an elevation of 1.5 m and 5 m from the rear of the residence. In our opinion, the probable cost to establish a traffic noise policy will be less than $10,000.

10 Conclusions and Recommendations

The intent of this section is to highlight the findings and recommendations of this study.

10.1 Functional Roadway Classification System

It is recommended that the functional roadway classification system be changed to more accurately reflect the current and future functions of the road network to allow for different road cross sections and requirements for special purpose roads and to simplify future road maintenance and operations. The recommended road classification system includes the following classifications:

- Arterial Roads
  - Divided Major Street,
  - Downtown Undivided Major Roadway,
  - Undivided Major Road,
- Collector Roads
  - Industrial/Commercial Collector Roadway,
  - Residential Collector Roadway
- Local Roads,
  - Downtown Commercial Roadway,
  - Public Service Roadway,
  - Local Industrial / Commercial Roadway,
  - Local Residential Roadway.

All but the Downtown and Public Service classifications are further subdivided into Urban and Rural cross sections. Figure 2.2.3.1 presents the future roadway classification of the Town of Redcliff.

10.2 Network Upgrades

Network upgrades are those upgrades required to accommodate current and future traffic and safety improvements. They are split between two categories, roadways and intersections. These categories are further defined as currently required and future upgrades. Upgrades to the road network not included in this section are:

- Upgrades required by change in classification to achieve a desired performance function,
- Pedestrian and bicycle improvements,
- Suggested network improvements,
- Non traffic related improvements such as signage.

10.2.1 Recommended Roadway Upgrades

Currently all roads in the Town with the exception of the segment of Broadway Avenue E from Mitchell Street E to Saamis Drive SE operate during the AM and PM peaks at acceptable levels of service. The segment of Broadway Avenue E only operates at a poor level of service during the PM. peak period. It is not recommended that this segment be upgraded at this time because:

- Poor level of service is for a very short time period,

- Few access and driveways on this segment create a situation where the actual level of service appears to be better than what is reflected by traffic volume numbers.
- When 9th Avenue SE is connected to Saamis Drive SE the traffic on this segment of road drops dramatically,
- that upgrades to this road need to be coordinated with the Eastside Development Concepts.

10.2.2 New Roads

9th Avenue SE needs to be connected to Saamis Drive SE prior to the 7394 population horizon to reduce PM peak hour traffic on Broadway Avenue E between Mitchell Street E and the Transcanada Highway.

When 9th Avenue SE is connected to Saamis Drive SE the following road upgrades will be required:

- 9th Avenue SE between Main Street S and Mitchell Street SE, widened and vertical alignment fixes to accommodate increased traffic.
- 9th Avenue SE east of Mitchell Street SE, safety improvements to deal with the over wide road.

10.2.3 Intersection Improvement Recommendations

Most intersections in the Town of Redcliff operate or will still operate at a good LOS in the future except the following two intersections.

10.2.3.1 Broadway Avenue and Mitchell Street

Broadway Avenue E and Mitchell Street E currently operates unsatisfactorily. When 9th Avenue SE is extended to Saamis Drive SE, the intersection will operate with an acceptable level of service in its current configuration for a couple of years. Upgrades to the intersection considered were:

- Four way stop which operates acceptably at the current and future traffic volumes,
- A roundabout which operates acceptably at the current and future traffic volumes,
- Signalization which operates acceptably at the current and future traffic volumes. A signalization warrant shows that signal lights are currently warranted.

We note that a roundabout configuration is a better option than signalization to improve the overall safety and operation of this intersection. A roundabout feasibility study should be conducted today to provide a preliminary design, estimated cost, and comparison made with the signal option. Major improvements to this intersection could be deferred by building 9th Avenue SE to connect with Saamis Drive SE.

10.2.3.2 Saamis Drive SE and 9th Avenue SE

The new Tee intersection of Saamis Drive SE and 9th Avenue SE will operate marginally as an un-signalized intersection with stop control on 9th Avenue SE at the 7394 population horizon but operate unsatisfactorily at the 10670 population horizon with stop control on 9th Avenue. Upgrades to the intersection considered were:

- Three way stop will operate acceptably at the 7394 population horizon but unacceptably at the 10670 population horizon,
- A roundabout which operates acceptably at future traffic volumes,
- Signalization which operates acceptably at future traffic volumes.

We note that a roundabout configuration is a better option than signalization to improve the overall safety and operation of this intersection. A roundabout feasibility study should be conducted prior to any further subdivision, road development, or changes to area structure plans in the area of this intersection, to provide

a preliminary design, estimated cost, and comparison made with the signal option. If the signalization option is selected the operation of the Saamis Drive SE and 9th Avenue SE intersection should be monitored and a traffic signal should be installed at this intersection when it is warranted.

10.2.4 Safety Improvement Recommendation

Both historical accident data and safety concerns raised by Town Staff and the Redcliff RCMP were reviewed and the following improvements are recommended.

10.2.4.1 Accident data Review

Historical accident data along Transcanada Highway and potential locations of concern were reviewed. The recommendations are described below:

- Transcanada Highway and Broadway Avenue E. Considering the undesirable accident rate, it recommended that the Town of Redcliff coordinate with Alberta Transportation to revise the signal timing plan to provide drivers with ample decision time.
- The intersection of 5th Avenue S and Main Street S is an un-signalized intersection with stop sign control on 5th Avenue S. The Redcliff RCMP has a concern with the traffic control of this intersection. It is recommended that the Town of Redcliff conduct intersection traffic counts and have a detailed intersection capacity analysis performed to determine if the current traffic control is still suitable for the existing intersection.

10.2.4.2 Broadway Avenue E and Saamis Drive SE

The Redcliff RCMP has a safety concern regarding the yield sign for southbound traffic on Broadway Avenue. It is recommended that a channelization island be added to the north quadrant of the intersection of Broadway Avenue E and Saamis Drive SE and that the length of the acceleration lane be increased to allow acceleration and merging at typical vehicle speeds.

10.3 Suggested Improvements

The improvements listed here are physical upgrades to the road network that will provide benefits to the overall network but are not required to make the network function or improve safety (see figure 2.2.3.2). Our opinion of probable costs for suggested improvements is $3,370,000.

10.3.1.1 4th Street SW between 4th Avenue SW and 5th Avenue SW

Adding a link between 4th Avenue SW and 5th Avenue SW at 4th Street SW is desirable to further develop the grid system in the Town.

10.3.1.2 South Railway Drive NE at 3rd Avenue NE and 3rd Street NE

South Railway Drive NE at 3rd Avenue NE and 3rd Street NE is currently configured as a through road with 3rd Avenue NE. It is suggested that this intersection be reconfigured so that 3rd Avenue NE and 3rd Street NE form a Y intersection and that a tee intersection between the linked 3rd Avenue NE and 3rd Street NE be made with the realigned South Railway Drive NE.

10.3.1.3 Dutton Street NE between Broadway Avenue E and Dacre Street NE

Currently the access to Dacre Street NE from Broadway Avenue E is through Dutton Street NE which is a local residential road. Linking Dacre Street NE and Broadway Avenue E at Pembina Crescent NE would improve the connectivity of the road network in this area; allow Dutton Street to be changed to a dead ended street on the south end eliminating industrial traffic using the Street; and pull the intersection of

Broadway Avenue E and Dutton Street NE further away from the intersection of the Transcanada Highway and Broadway Avenue E.

10.4 Existing Road Condition Survey

The existing road network within the Town's jurisdiction was divided into 389 segments based on logical segment boundaries. The total length of the assessed paved roadways is about 52.6 km. The paved road network in 2010 had an estimated average VCI of 8.6 and after 2011 maintenance work the estimated average VCI was 8.5 and after 2012 maintenance work the estimated average VCI was 8.3. The average combined ranking of the road network in 2010 was 9.7 and after 2011 maintenance work the average combined ranking worsened to 10.4 and after 2012 maintenance work the average combined ranking worsened to 11.7. The average VCI values show that the overall condition of Town Streets is in the "Good" condition category.

While the overall conditions of the road network is good, several roads are in extremely poor condition as well a small percentage of some road segments may be in very bad condition with the rest of the road in a good condition which results in a fair or good VCI classification however public perception will likely be that the whole of the road segment is in a very poor condition. Target road repairs to fix known issues may provide a higher public opinion of the overall road conditions than general major rehabilitation of complete road segments.

The goal of a pavement maintenance plan is to continuously maintain the Town's transportation infrastructure system in a safe, comfortable and fiscally responsible manner. The recommended minimum target for the average VCI of the Town's road network is 7.5. However, analysis of maintaining the road network at the minimum average target VCI showed a disturbing trend in that, while costs for maintaining the road network for the first five years are very low, the costs for the next five years increase dramatically. This trend indicates that when allowing the average VCI to fall to the minimum target VCI the long term costs of maintenance will be far greater. Maintaining the current average VCI of the network was examined and it proved cost prohibitive however it indicated a declining road maintenance cost trend. A balanced (maintenance costs remain static over time) plan was examined. Opinions of probable costs for each plan are presented in Table 10.4.

Table 10.4 Summary of Maintenance Cost Options

Target VCI	Opinion of Probable Costs			
	2013 to 2015		2016 to 2020	
	Three Year Total	Average Cost per Year	Five Year Total	Average Cost per Year
Target VCI = 7.5	$988,118	$329,373	$2,754,904	$550,981
Target VCI = 8.0 (2015) and 8.1 (2020)	$2,258,995	$752,998	$3,499,762	$699,952
Target VCI = 8.6	$5,772,966	$1,924,322	$4,165,045	$833,009

These costs do not include road upgrades (i.e. gravel road converted to paved road, signalization of intersections, etc.), geometric improvements (removal of overland drainage crossings, revised curb returns, etc) new roads, new sidewalks, new curb & gutters, 20th Street NE (under the jurisdiction of the City of Medicine Hat) and signage or pavement markings.

It is recommended that a balanced maintenance program be followed (approximately $1,000,000 per year) as delivering the best long term costs and satisfactory overall road network conditions. Figures 7.4 and 7.4a show the road maintenance plan for the present to 2015 time frame and the 2016 to 2020 time frame.

10.5 Non-motorized Modes Strategies

The following discussions and recommendations present an integrated strategy to accommodate and encourage the use of non-motorized modes in the Town of Redcliff for both transportation and recreation purposes. The following strategies should be implemented:

- Development of multi-purpose pedestrian and bicycle facilities, where appropriate, to accommodate recreational walking and cycling and also to provide a choice of alternative modes instead of short auto trips.
- Improvement of accessibility for pedestrians by providing connection between significant pedestrian activity centers.
- Consideration of bicycle and pedestrian facilities as normal and expected aspects of a roadway.
- The Town should work with other entities to improve the safety, aesthetics, and convenience of pedestrian and bicycle networks.
- Physical facilities are only part of the bicycle and pedestrian planning process. It is equally important to implement safety, education, and encouragement programs to increase walking and bicycle activities.

The recommendations for non-motorized modes include:

- That dedicated funding is established for both installation and maintenance of the network. Improvements to sidewalks and the designation of bicycle lanes should be considered for every routine Street maintenance project.
- That the following guidelines be adopted by the Town for new and reconstruction projects:
  - 3.0 m wide multi-use trails,
  - Minimum 1.2 m wide sidewalks,
  - Minimum buffer of 0.6 m from the traveled way (driving lane) to any sidewalk or 0.6 m of extra sidewalk width.
  - 1.2 m wide separate sidewalk with a minimum 2.0 m boulevard for collector roads.
  - Desirable 1.5 m wide separate sidewalk with a minimum 2.0 m boulevard for arterial roads.
- That a bicycle and pedestrian network and improvement plan be adopted by Council as the long-term strategy to guide decisions related to development of non-motorized modes for the Town. The probable costs of recommended improvements related to non-motorized modes of transportation is $2,294,000.

10.6 Goods Movement and Traffic Noise Strategies

The recommendations for goods movement and traffic noise in the Town of Redcliff include:

- To establish a traffic noise policy as the first step to ensure a uniform approach for assessment and the need of noise mitigation. In our opinion, the probable cost to establish a traffic noise policy will be less than $10,000.
- Review the outdoor sound level for existing residential adjacent to Transcanada Highway. The probable cost to review the outdoor sound level should be less than $5,000.
- Relocate the current Town shop close to Broadway Avenue or into an industrial area north of Transcanada Highway to reduce the impact of heavy Town equipment on the residential Street network. Opinion of probable costs $800,000 not including land.
- Install new standard route signage for truck routes on south entrances to the Town since the current route signage is faded. The probable cost to install the signage should be less than $5,000.

10.7 Eastside Neighbourhood

Several concerns were identified with the approved ASP for the Eastside development. New neighbourhoods should be designed to encourage community friendly traffic behaviour where the road design doesn't encourage short-cutting or speeding. It is estimated that there is $1.0 million in savings by changing the classification and cross section of remaining portion of 9th Avenue SE to be built to an appropriate road for the traffic expected. Review of the existing Eastside ASP, TIA, and FSR are recommended.

Corporate Authorization

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Permit to Practice P1054

Appendix A
Figures

FIGURE 1

LOCATION PLAN

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE: NTS
October 2012

Scheffer Andrew Ltd.
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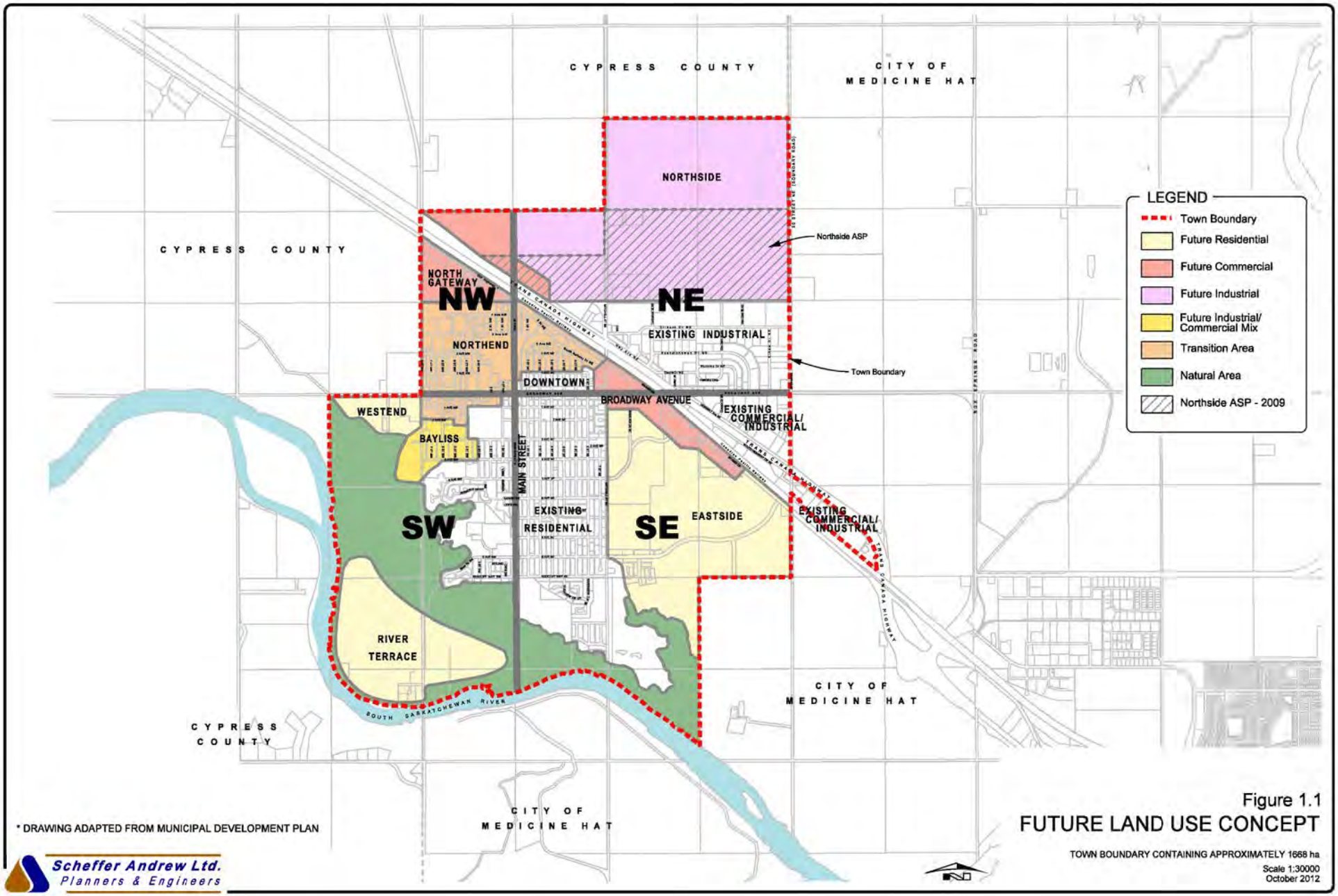
CYPRESS COUNTY
CITY OF MEDICINE HAT
NORTHSIDE
Northside ASP
Town Boundary
NORTH GATEWAY
NW
NE
NORTHEND
EXISTING INDUSTRIAL
DOWNTOWN
BROADWAY AVENUE
EXISTING COMMERCIAL/ INDUSTRIAL
WESTEND
BAYLISS
MAIN STREET
SW
EXISTING RESIDENTIAL
SE
EASTSIDE
RIVER TERRACE
SOUTH SASKATCHEWAN RIVER
LEGEND
Town Boundary
Future Residential
Future Commercial
Future Industrial
Future Industrial/ Commercial Mix
Transition Area
Natural Area
Northside ASP - 2009
* DRAWING ADAPTED FROM MUNICIPAL DEVELOPMENT PLAN
Scheffer Andrew Ltd.
Planners & Engineers
Figure 1.1
FUTURE LAND USE CONCEPT
TOWN BOUNDARY CONTAINING APPROXIMATELY 1668 ha
Scale 1:30000
October 2012

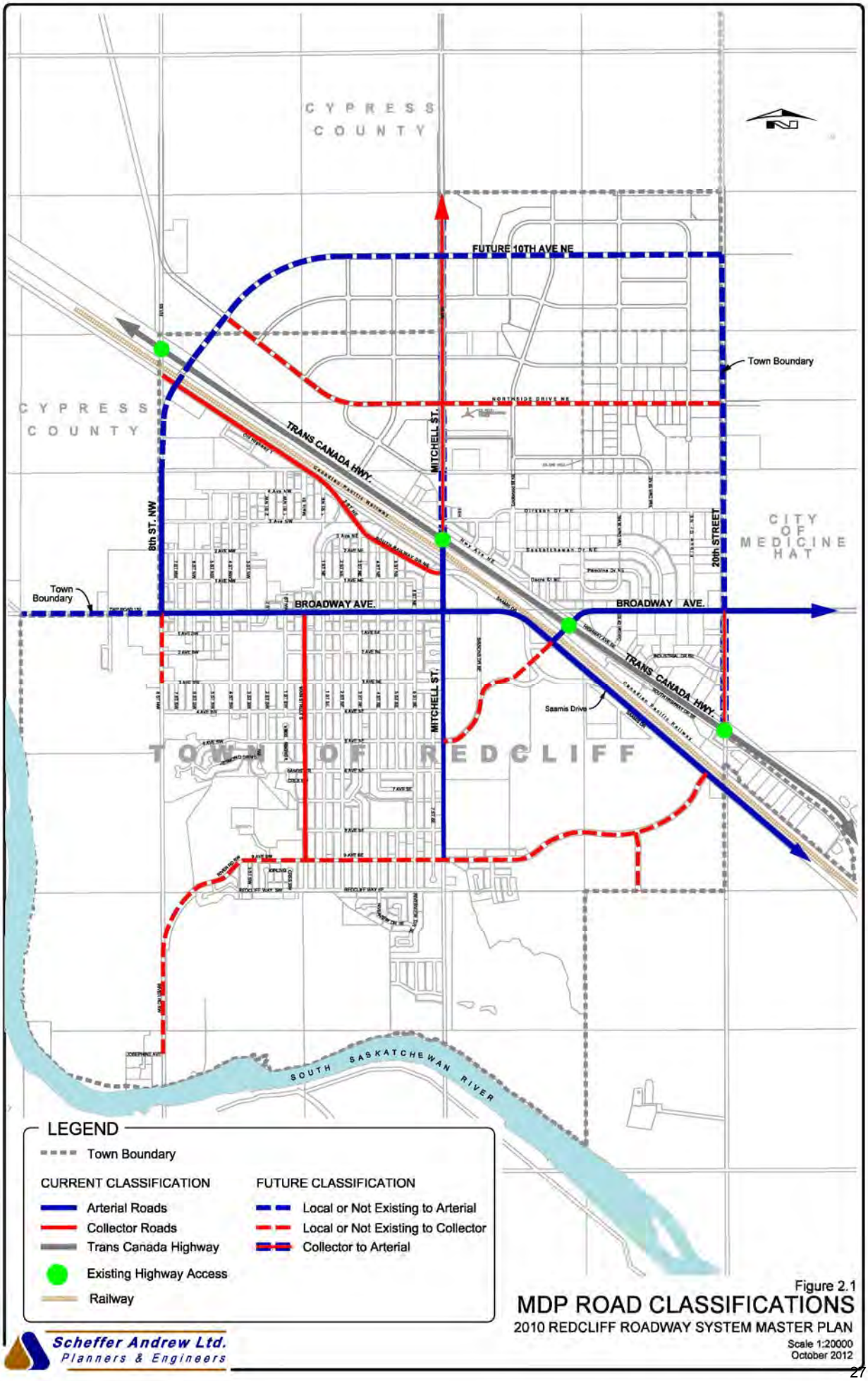

Figure 2.1
MDP ROAD CLASSIFICATIONS
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
Scale 1:20000
October 2012

Scheffer Andrew Ltd.
Planners & Engineers

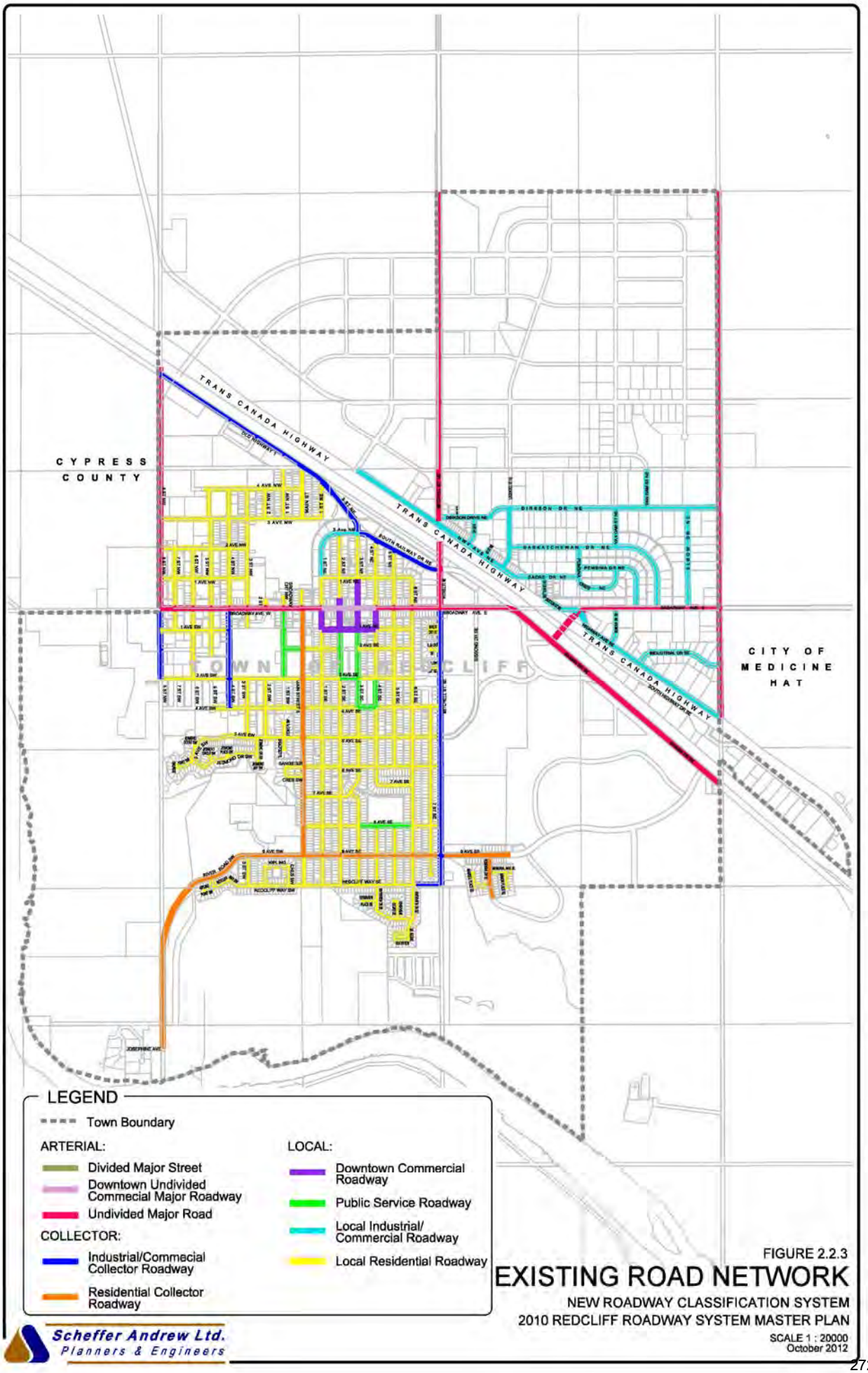

FIGURE 2.2.3

EXISTING ROAD NETWORK

NEW ROADWAY CLASSIFICATION SYSTEM
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 20000
October 2012

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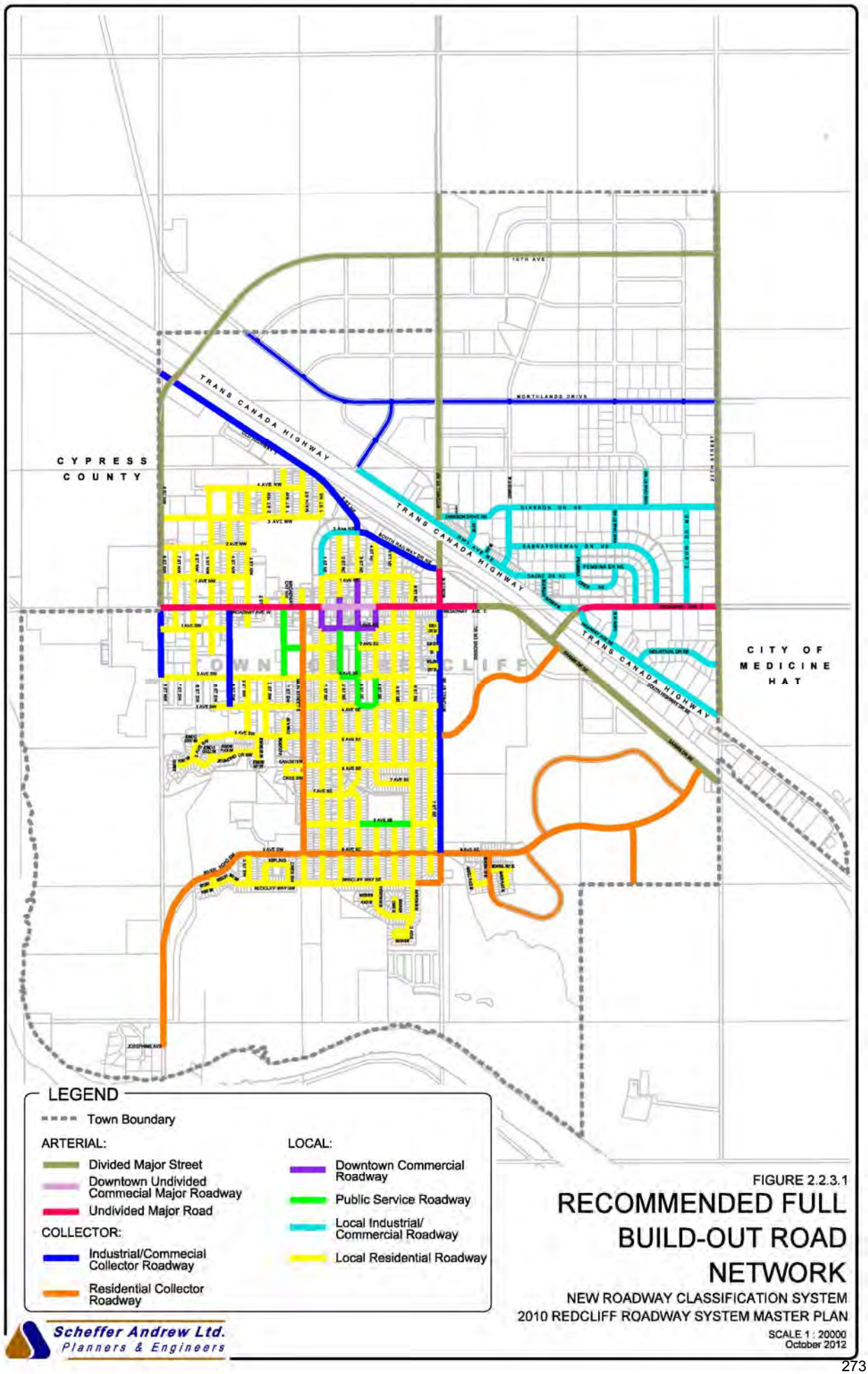

FIGURE 2.2.3.1

RECOMMENDED FULL BUILD-OUT ROAD NETWORK

NEW ROADWAY CLASSIFICATION SYSTEM
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 20000
October 2012

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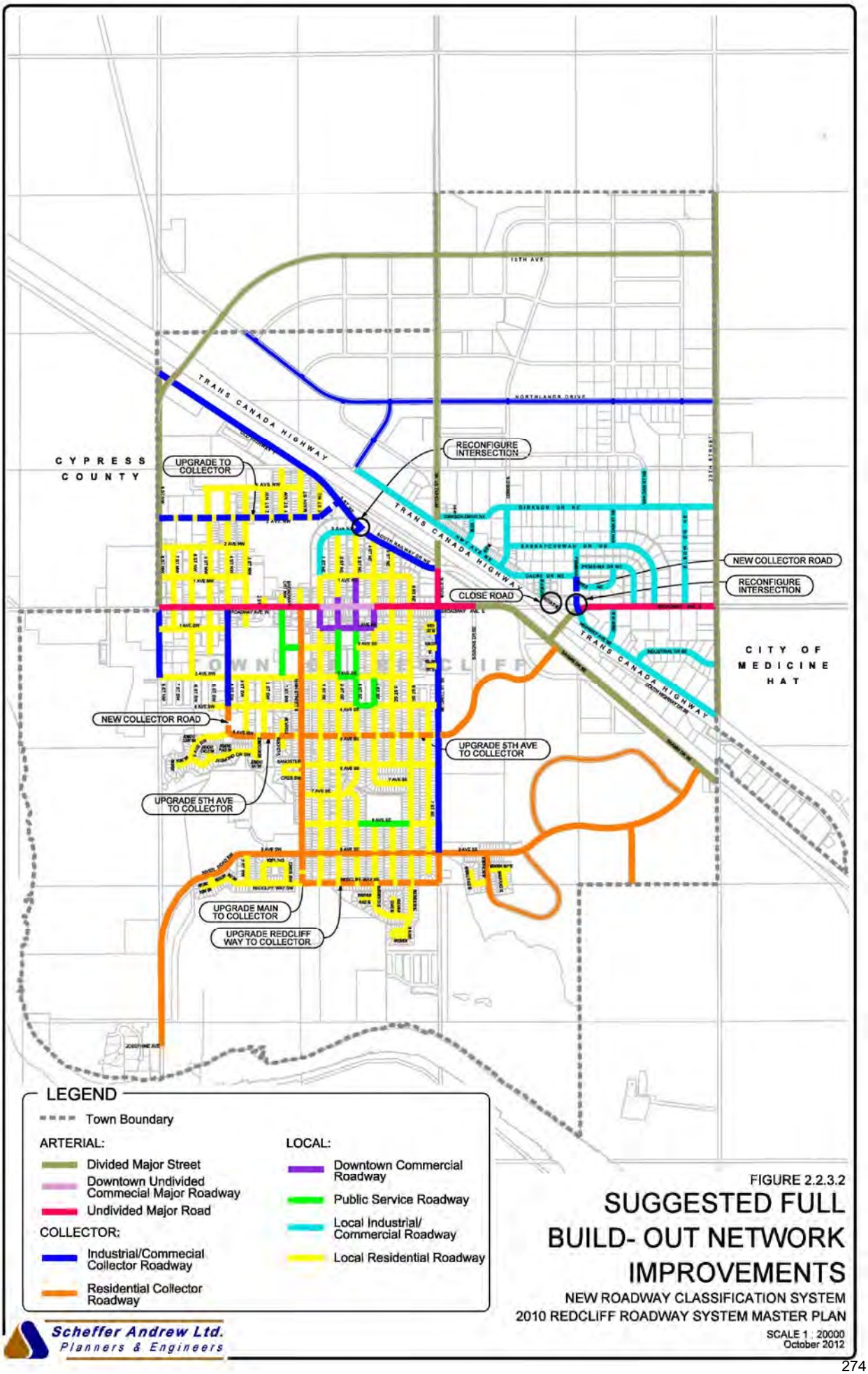

FIGURE 2.2.3.2

SUGGESTED FULL BUILD- OUT NETWORK IMPROVEMENTS

NEW ROADWAY CLASSIFICATION SYSTEM
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 20000
October 2012

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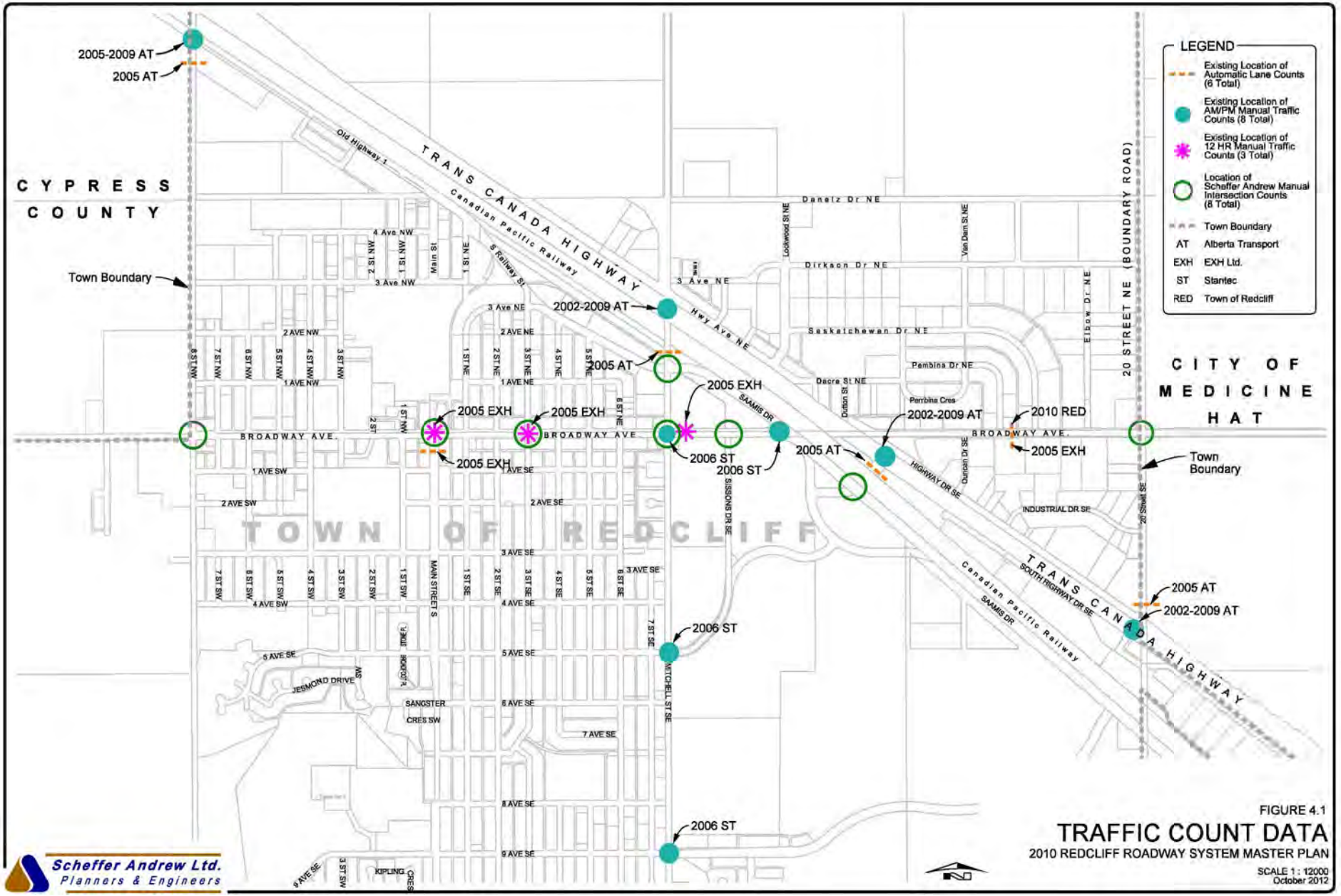

FIGURE 4.1

TRAFFIC COUNT DATA

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 12000
October 2012

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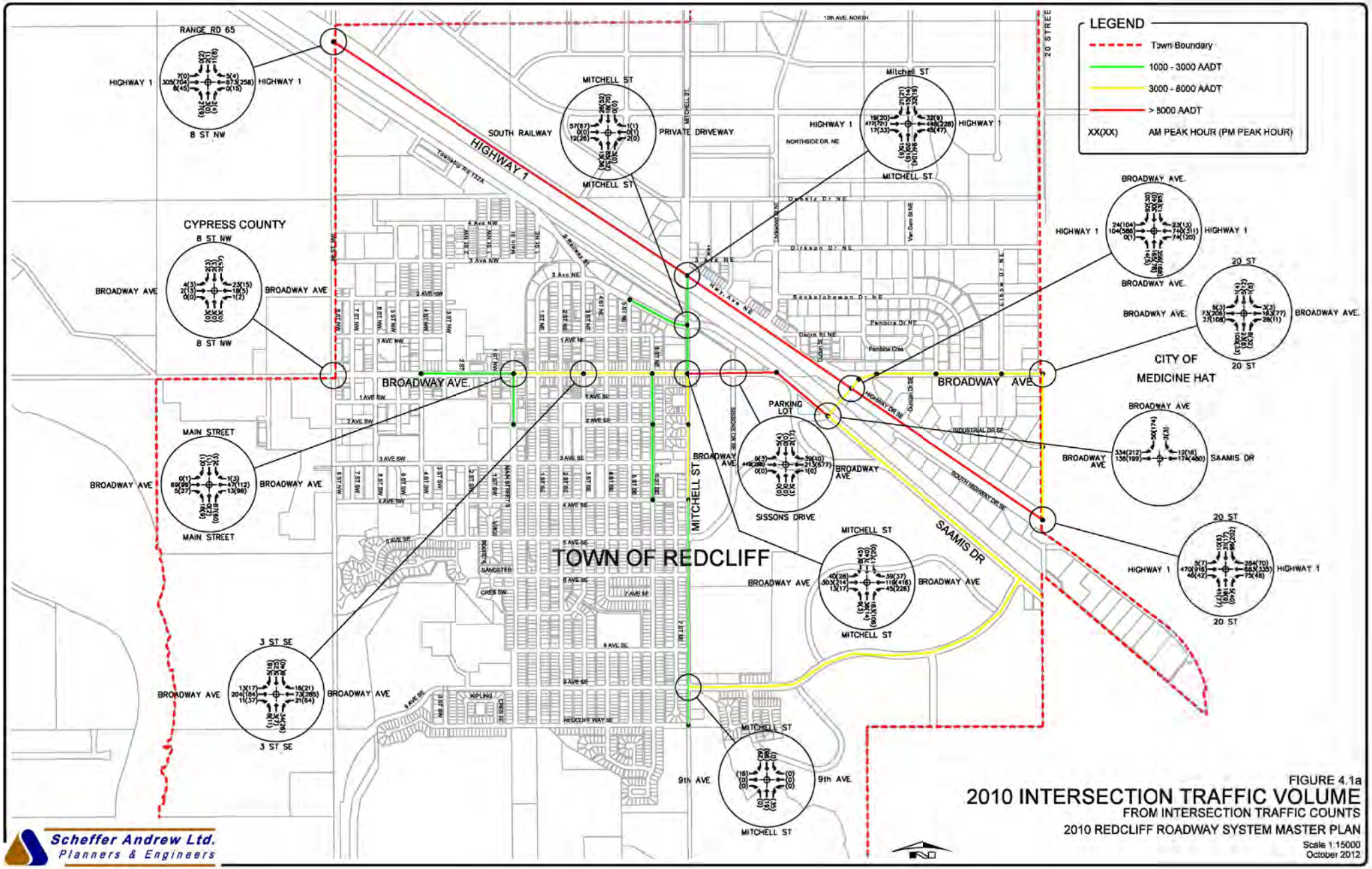

FIGURE 4.1a

2010 INTERSECTION TRAFFIC VOLUME

FROM INTERSECTION TRAFFIC COUNTS

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

Scale 1:15000

October 2012

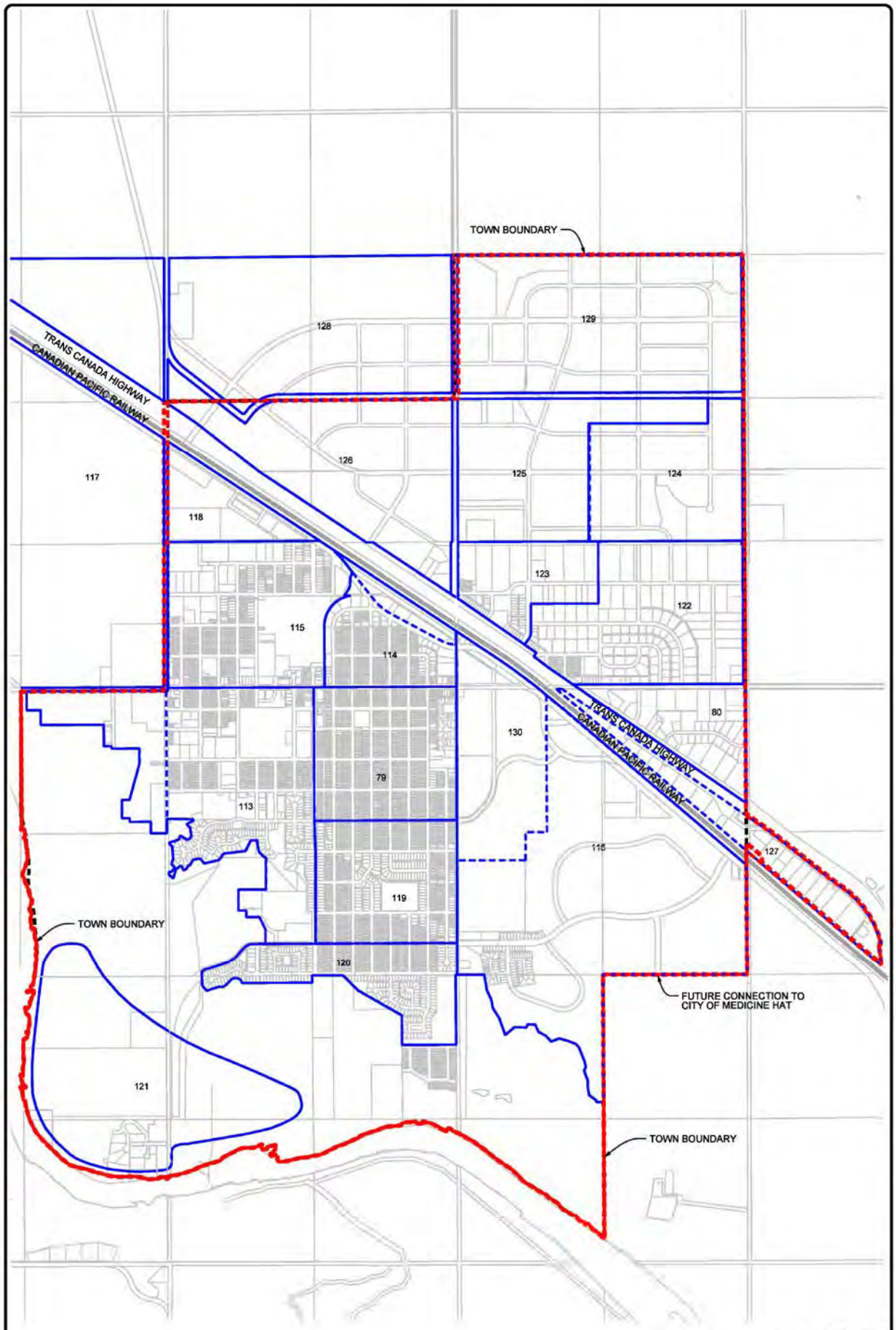

FIGURE 5.2

TRAFFIC ZONE MAP

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

Scale 1:20000
October 2012

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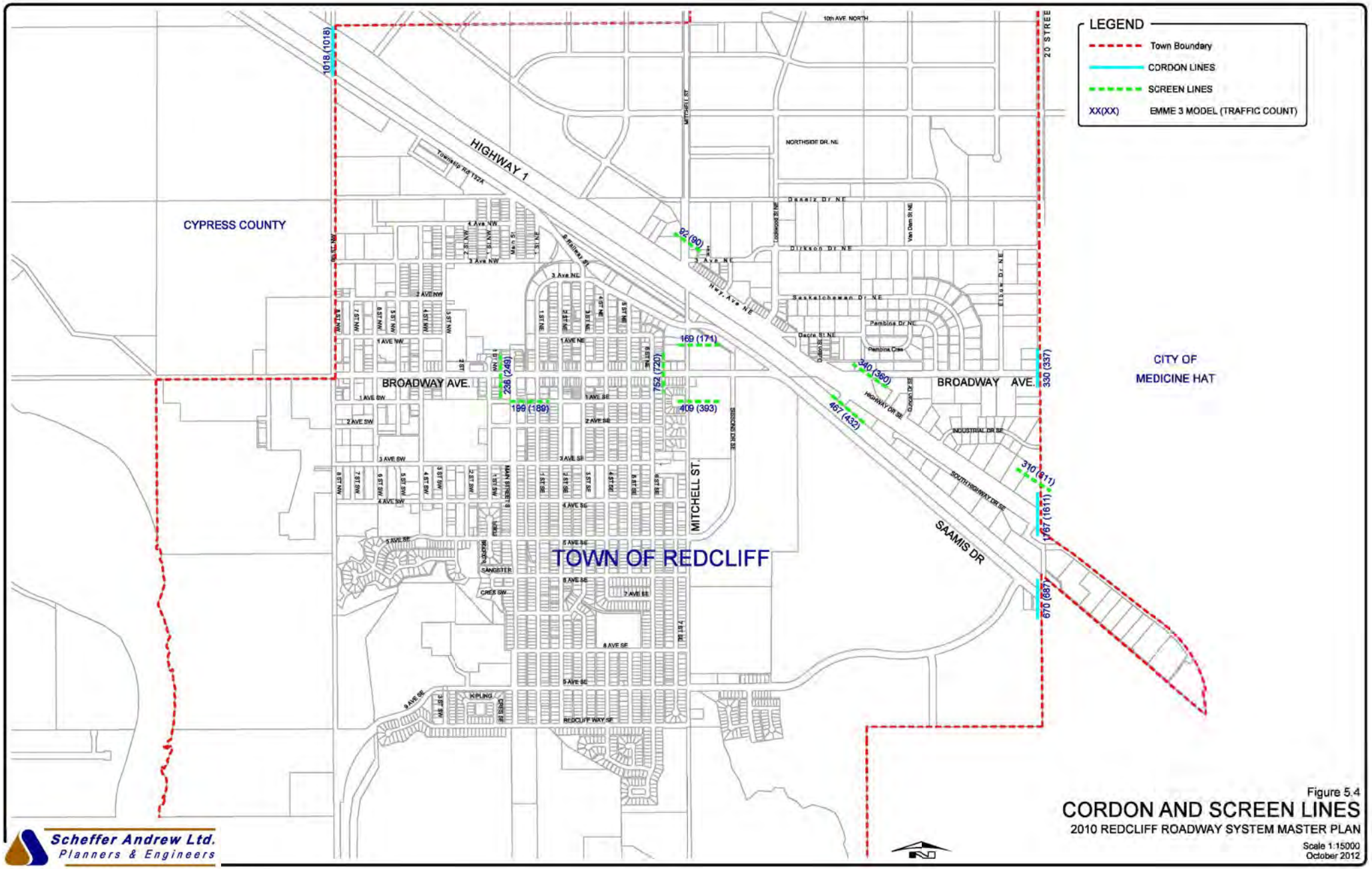
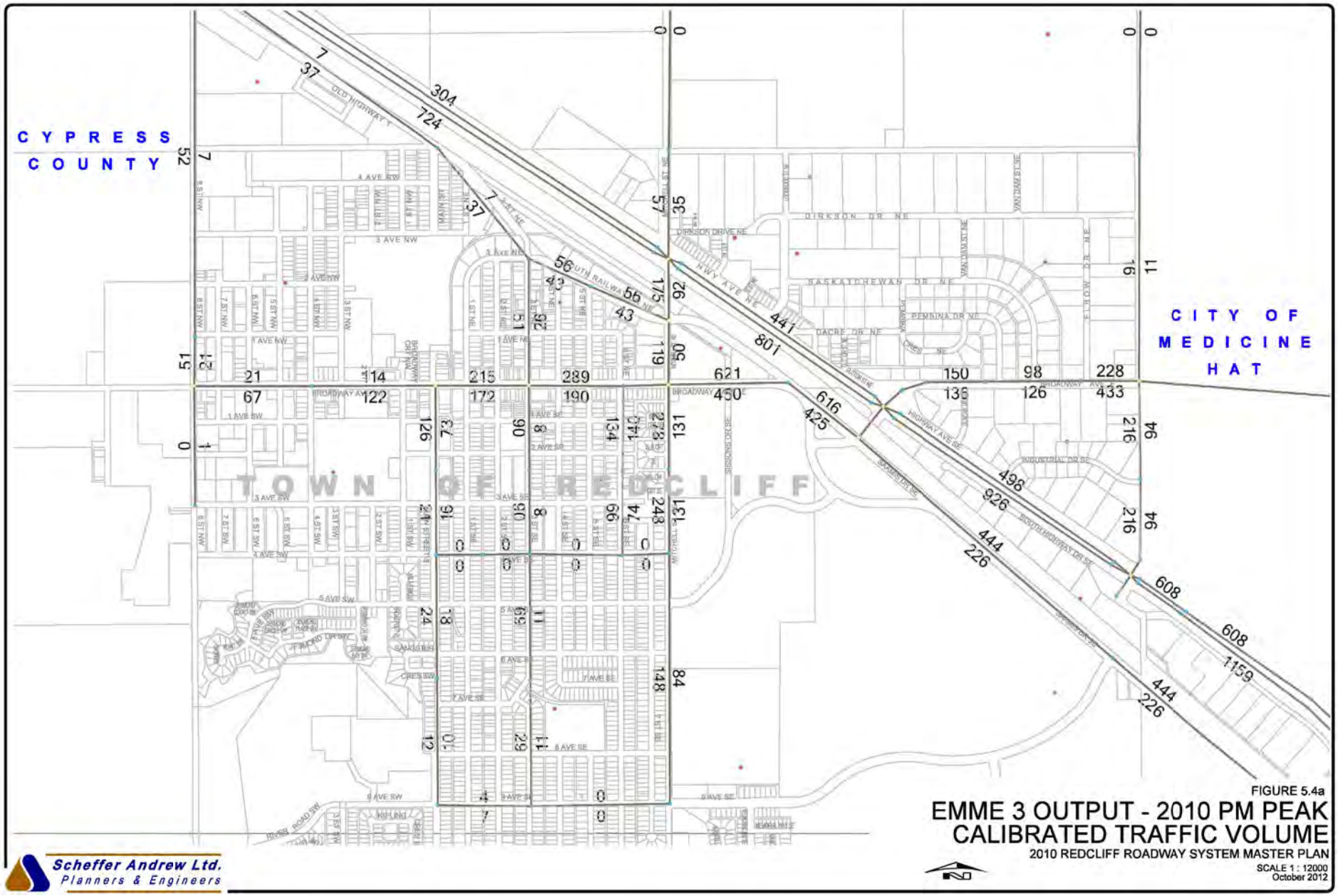
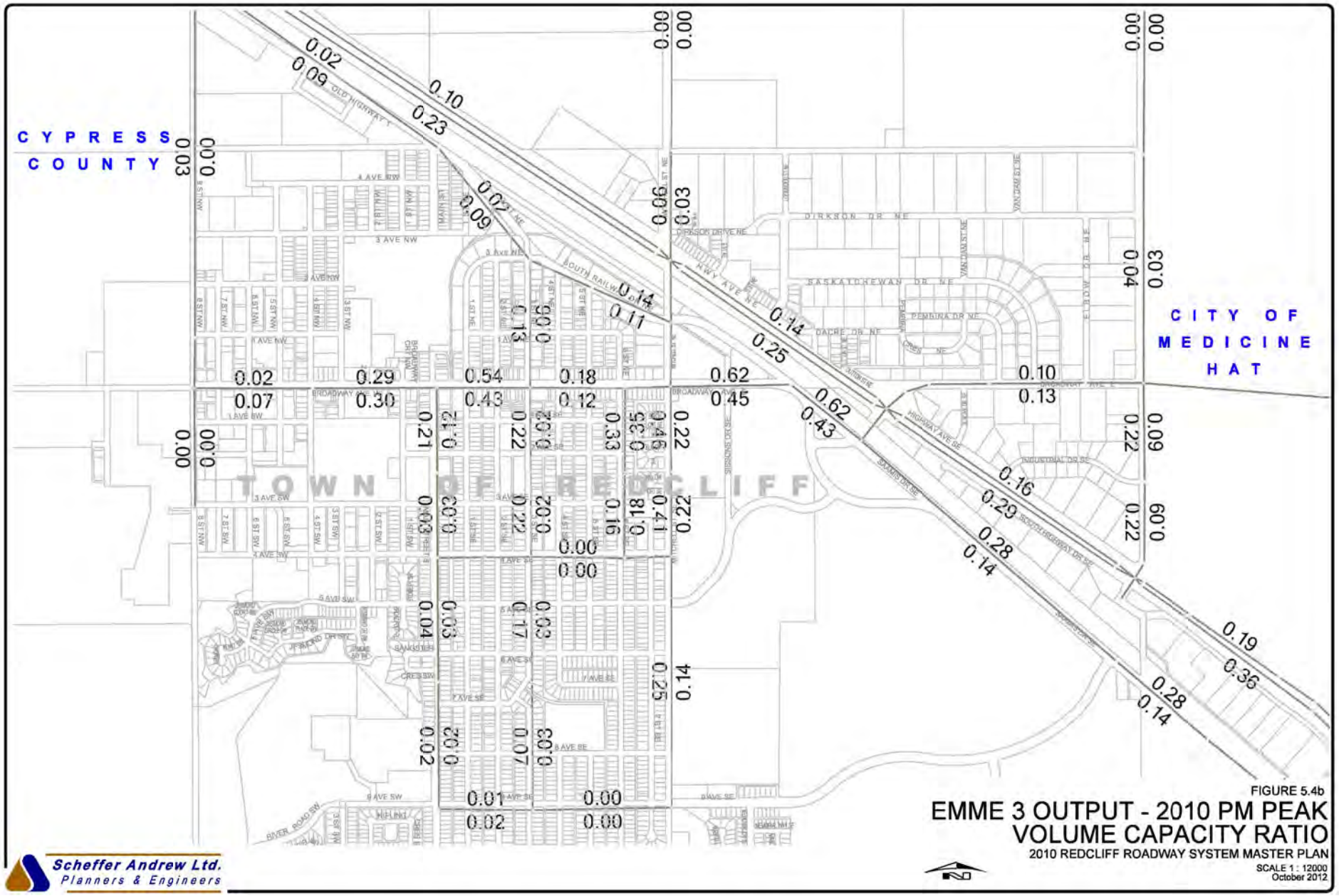
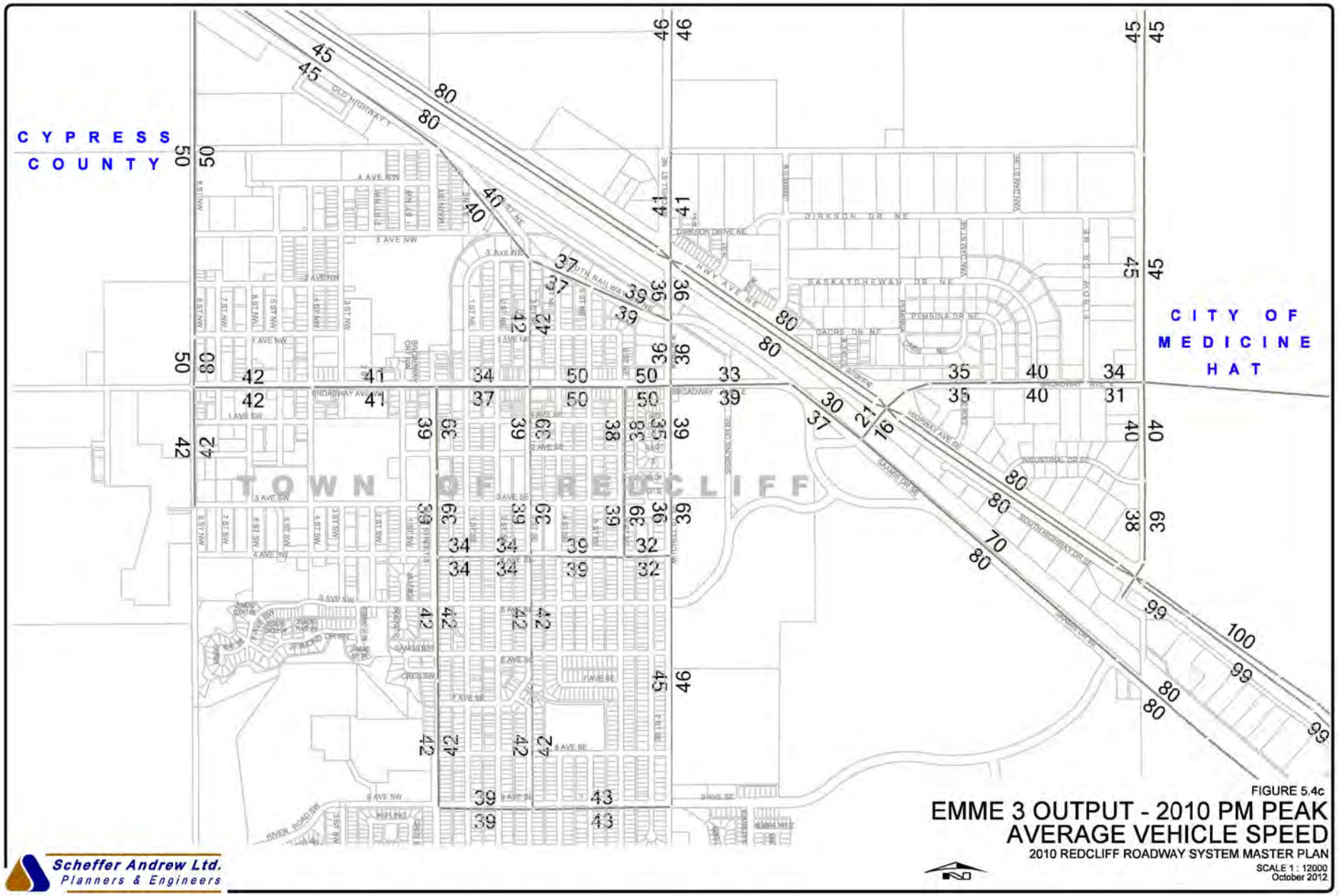


Figure 5.4
CORDON AND SCREEN LINES
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
Scale 1:15000
October 2012

Scheffer Andrew Ltd.
Planners & Engineers


CYPRESS COUNTY
CITY OF MEDICINE HAT
TOWN OF REDCLIFF
BROADWAY AVE
HIGHWAY AVE SE
SOUTH HIGHWAY DR SE
INDUSTRIAL DR SE
DIRKSON DR NE
SASKATCHEWAN DR NE
PEMBINA DR NE
DACRE DR NE
OLD HIGHWAY 1
SOUTH RAILWAY ST NE
HWY AVE NE
304
724
441
801
616
425
496
926
444
226
608
1159
FIGURE 5.4a
EMME 3 OUTPUT - 2010 PM PEAK
CALIBRATED TRAFFIC VOLUME
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
SCALE 1 : 12000
October 2012
Scheffer Andrew Ltd.
Planners & Engineers


CYPRESS COUNTY
CITY OF MEDICINE HAT
TOWN OF REDCLIFF
FIGURE 5.4b
EMME 3 OUTPUT - 2010 PM PEAK
VOLUME CAPACITY RATIO
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
SCALE 1 : 12000
October 2012
Scheffer Andrew Ltd.
Planners & Engineers


CYPRESS COUNTY
CITY OF MEDICINE HAT
TOWN OF REDCLIFF
BROADWAY AVE NW
BROADWAY AVE SE
HWY AVE NE
HIGHWAY AVE SE
SOUTH RAILWAY AVE SE
OLD HIGHWAY 1
DIRKSON DR NE
SASKATCHEWAN DR NE
PEMBINA DR NE
DACHE DR NE
INDUSTRIAL DR SE
SAMMIS DR SE
SOUTH HIGHWAY DR SE
RIVER ROAD SW
HILLING
FIGURE 5.4c
EMME 3 OUTPUT - 2010 PM PEAK
AVERAGE VEHICLE SPEED
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
SCALE 1 : 12000
October 2012
Scheffer Andrew Ltd.
Planners & Engineers

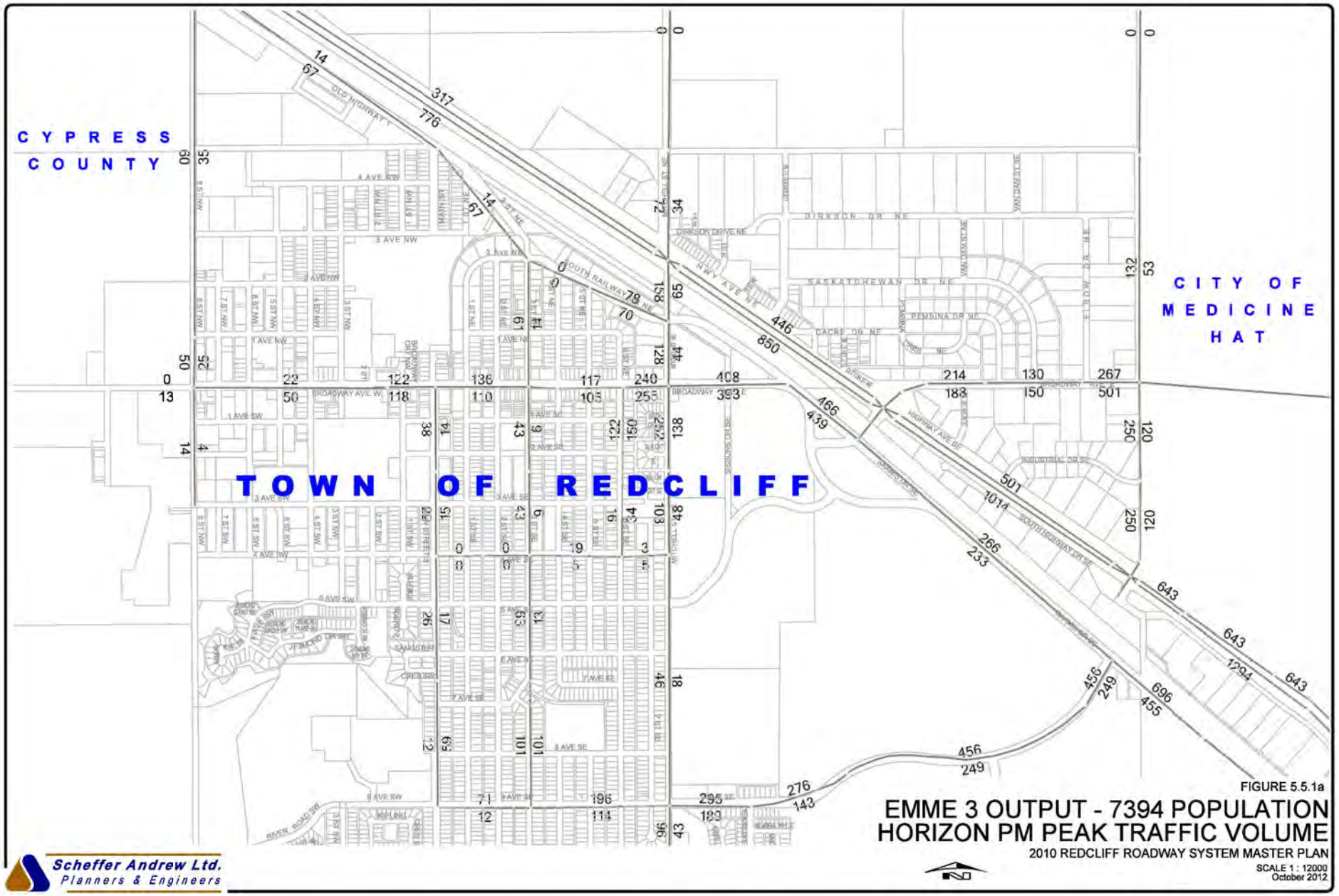


FIGURE 5.5.1a

EMME 3 OUTPUT - 7394 POPULATION HORIZON PM PEAK TRAFFIC VOLUME

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 12000
October 2012

Scheffer Andrew Ltd.
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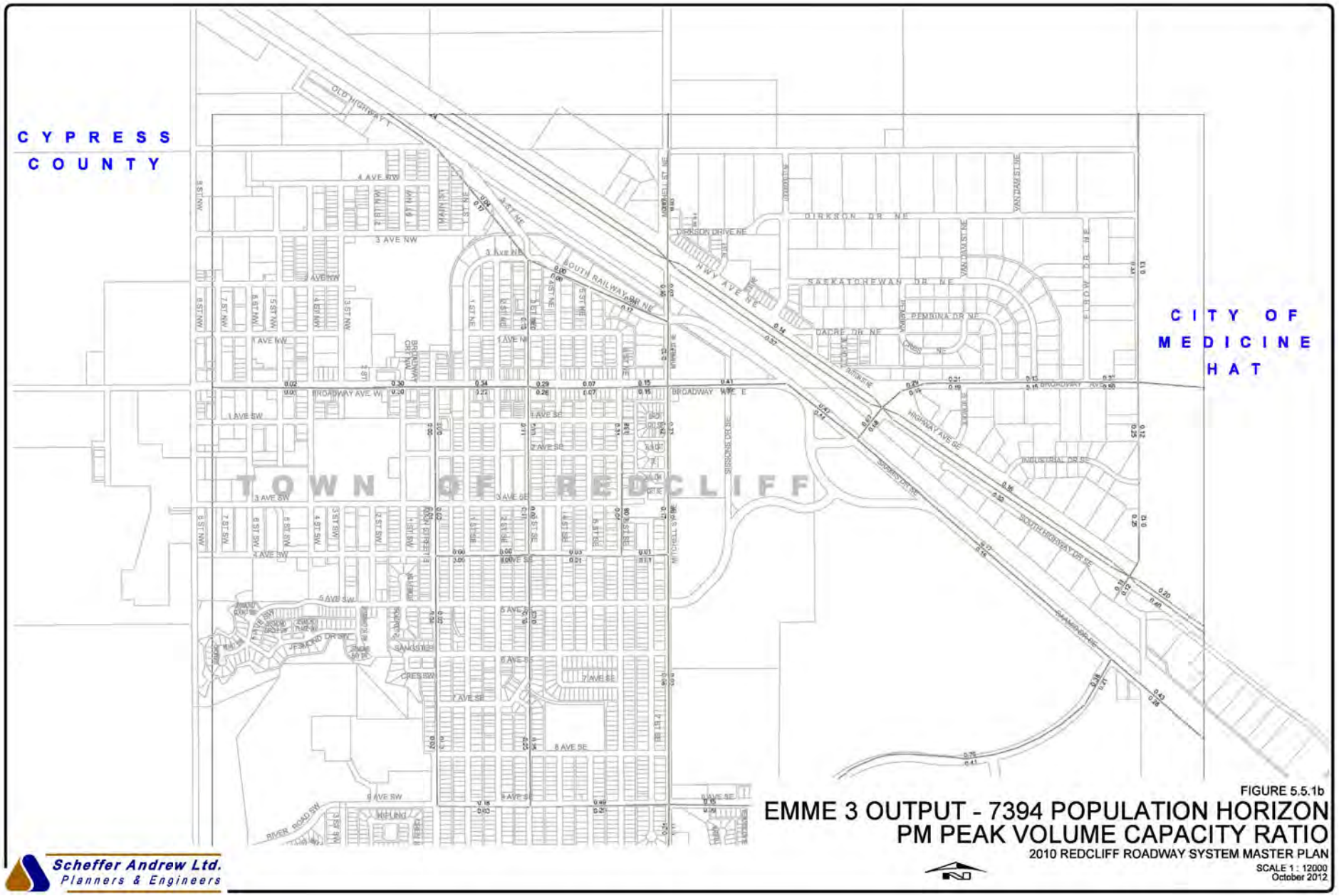

FIGURE 5.5.1b

EMME 3 OUTPUT - 7394 POPULATION HORIZON PM PEAK VOLUME CAPACITY RATIO

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 12000

October 2012

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Planners & Engineers

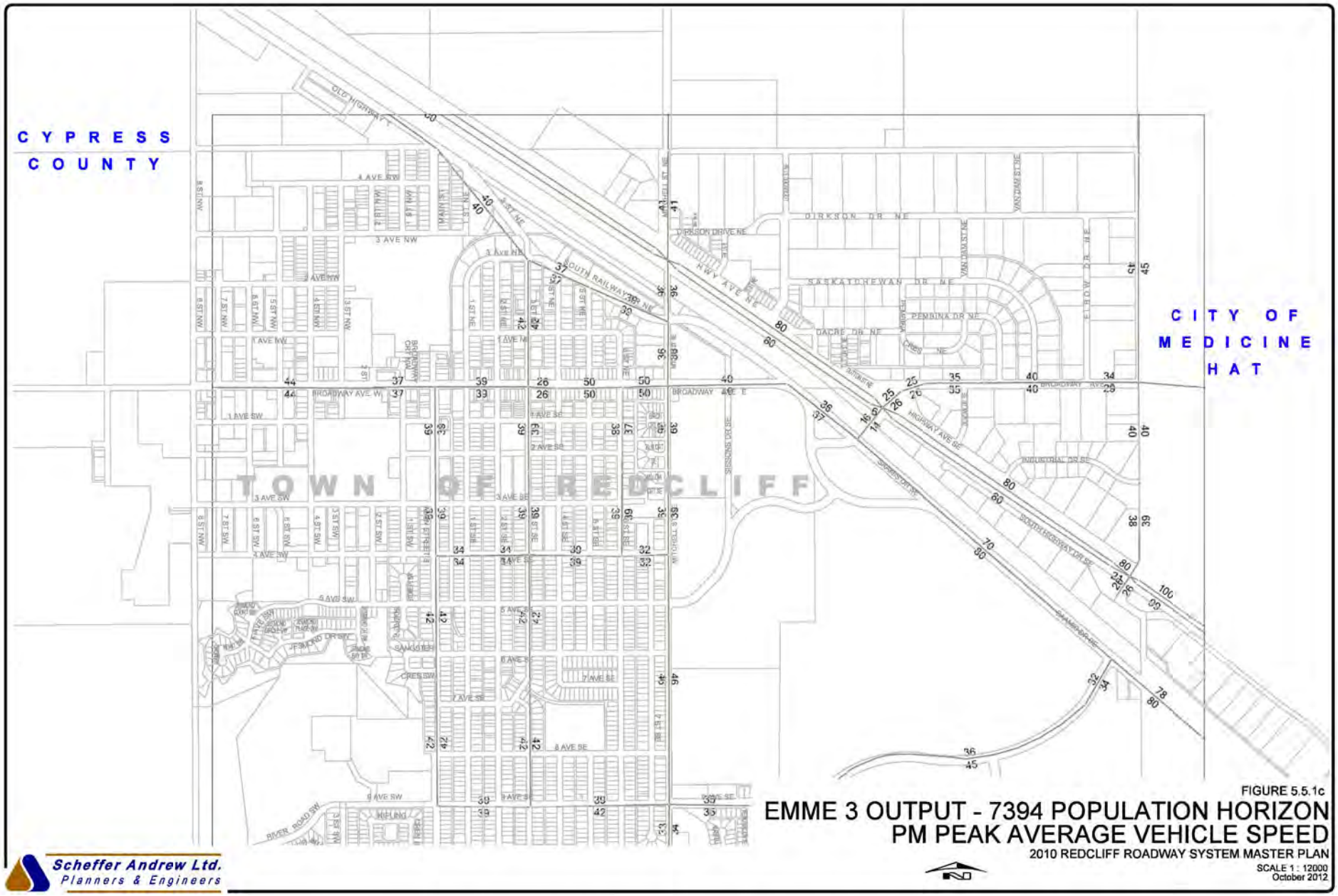


FIGURE 5.5.1c

EMME 3 OUTPUT - 7394 POPULATION HORIZON PM PEAK AVERAGE VEHICLE SPEED

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 12000
October 2012

Scheffer Andrew Ltd.
Planners & Engineers

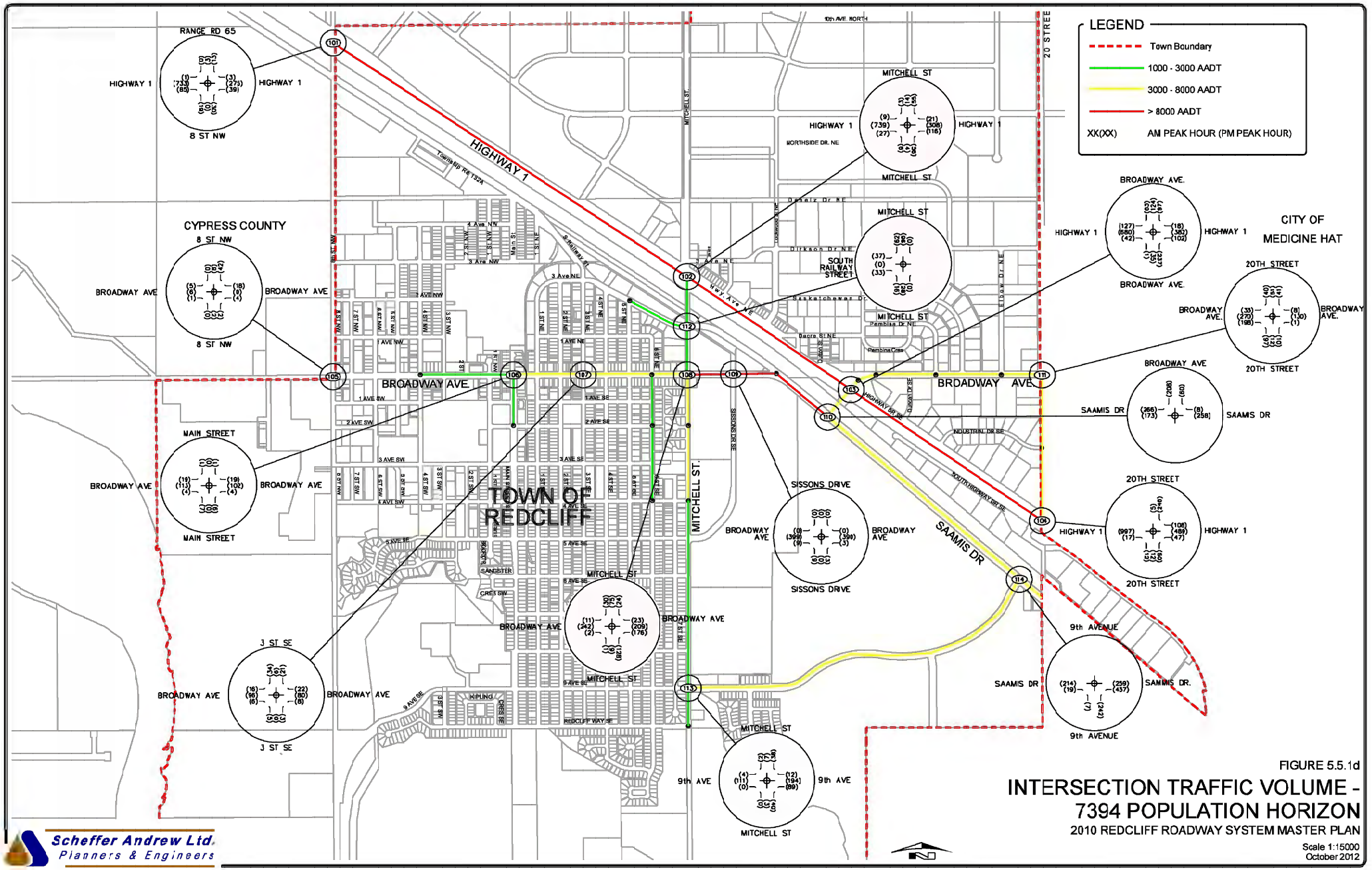


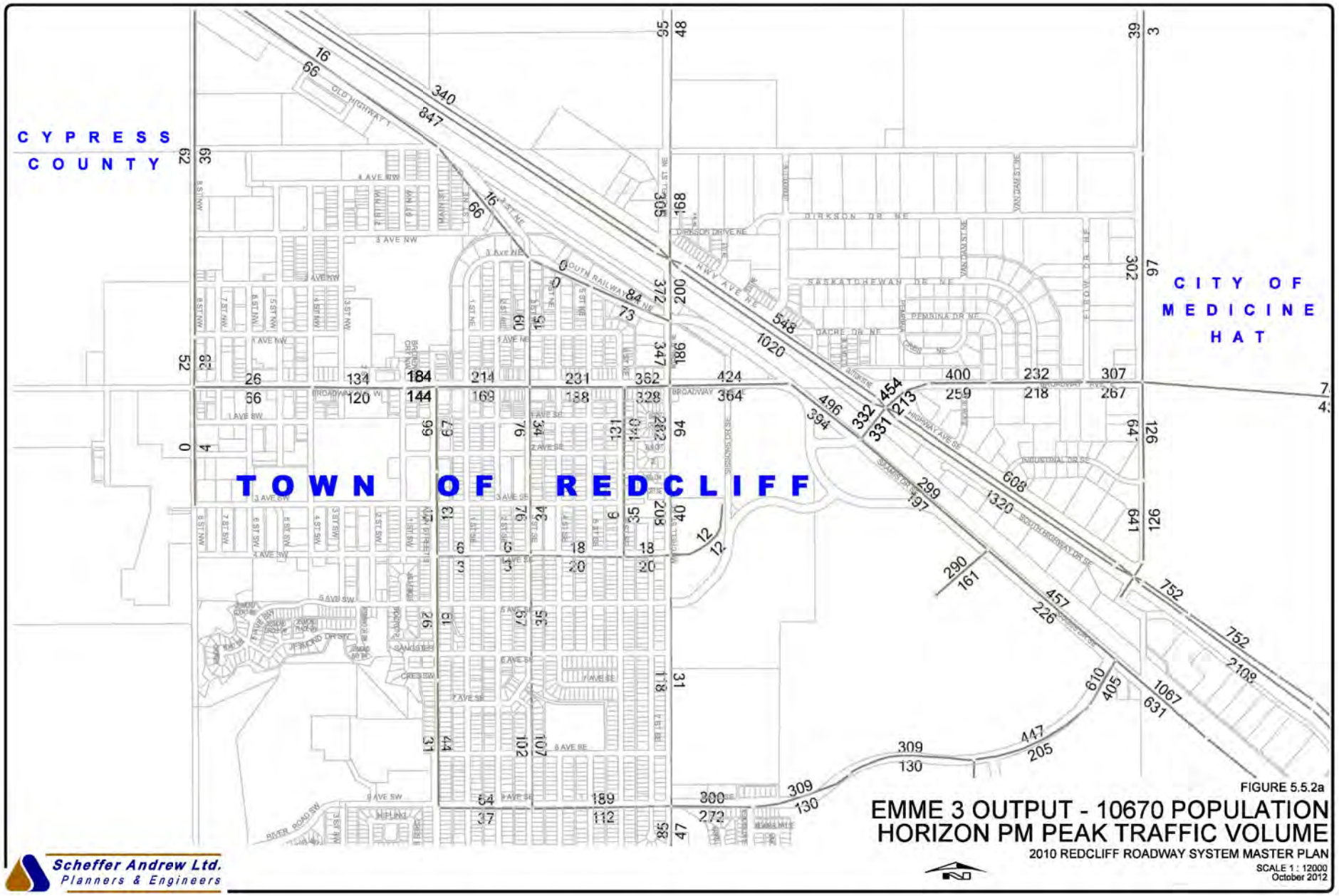
FIGURE 5.5.1d

INTERSECTION TRAFFIC VOLUME - 7394 POPULATION HORIZON

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

Scale 1:15000
October 2012

Scheffer Andrew Ltd.
Planners & Engineers


CYPRESS COUNTY
CITY OF MEDICINE HAT
TOWN OF REDCLIFF
SOUTH RAILWAY ST NE
HWY 1 AVE NE
BROADWAY
HIGHWAY AVE SE
SOUTH HIGHWAY DR SE
INDUSTRIAL DR SE
DIRKSON DR NE
SASKATCHEWAN DR NE
PENINSULA DR NE
DACHE DR NE
OLD HIGHWAY 1
RIVER ROAD SW
JEFFERSON DR SW
MAIN ST
1 AVE NW
3 AVE NW
1 AVE NE
3 AVE NE
1 AVE SW
3 AVE SW
5 AVE SW
1 AVE SE
3 AVE SE
5 AVE SE
7 AVE SE
8 AVE SE
9 AVE SE
1 ST SW
3 ST SW
5 ST SW
1 ST NE
3 ST NE
5 ST NE
1 ST SE
3 ST SE
5 ST SE
7 ST SE
16 ST NE
16
66
340
847
548
1020
454
496
394
332
331
213
400
259
232
218
307
267
424
364
362
328
347
372
305
299
197
608
1320
752
2109
457
226
290
161
610
405
1067
631
447
205
309
130
300
272
189
112
64
37
FIGURE 5.5.2a
EMME 3 OUTPUT - 10670 POPULATION
HORIZON PM PEAK TRAFFIC VOLUME
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
SCALE 1 : 12000
October 2012
Scheffer Andrew Ltd.
Planners & Engineers

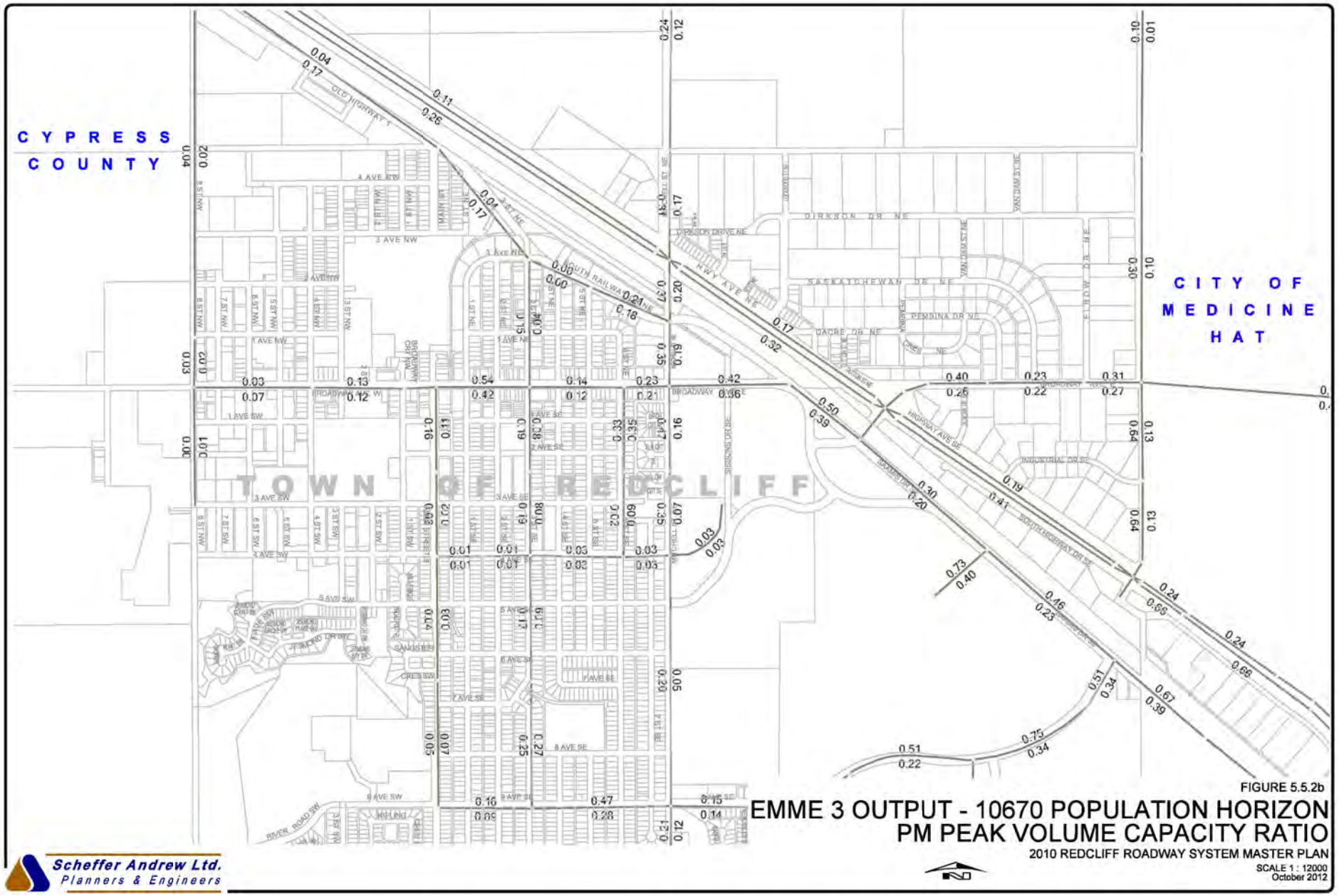


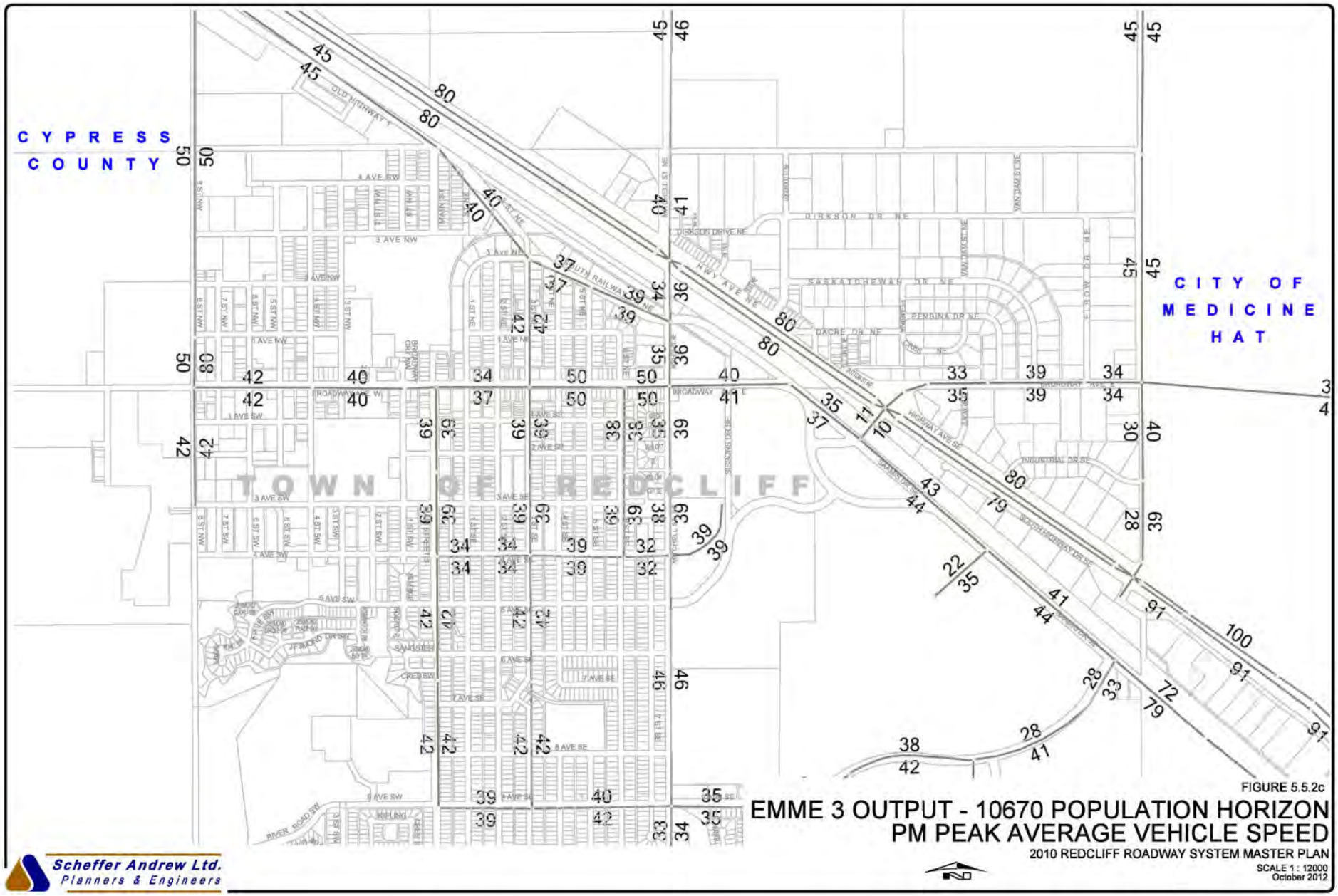
FIGURE 5.5.2b

EMME 3 OUTPUT - 10670 POPULATION HORIZON PM PEAK VOLUME CAPACITY RATIO

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 12000
October 2012

Scheffer Andrew Ltd.
Planners & Engineers


CYPRESS COUNTY
CITY OF MEDICINE HAT
TOWN OF REDCLIFF
FIGURE 5.5.2c
EMME 3 OUTPUT - 10670 POPULATION HORIZON
PM PEAK AVERAGE VEHICLE SPEED
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
SCALE 1 : 12000
October 2012
Scheffer Andrew Ltd.
Planners & Engineers

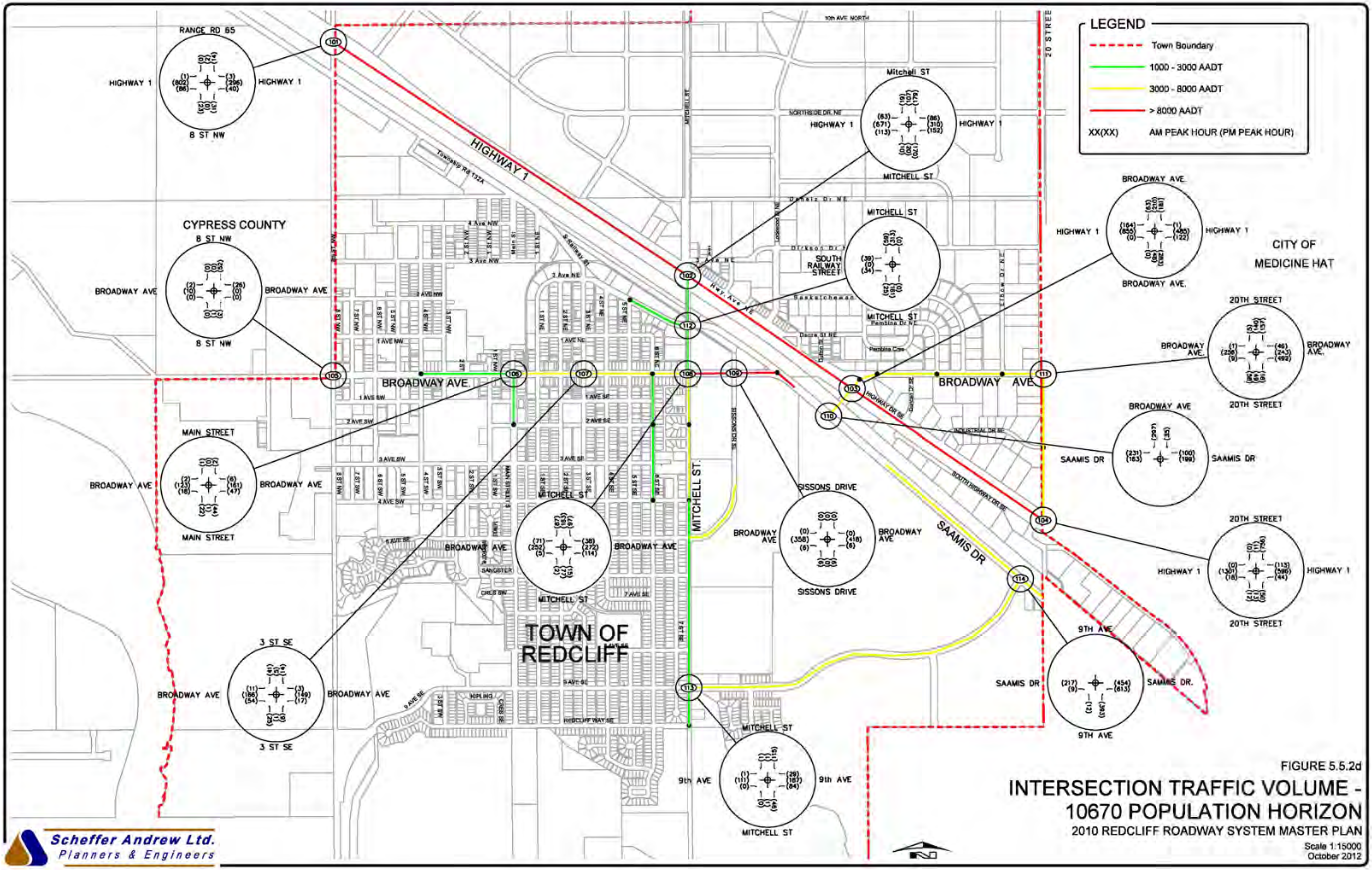


FIGURE 5.5.2d

INTERSECTION TRAFFIC VOLUME - 10670 POPULATION HORIZON

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

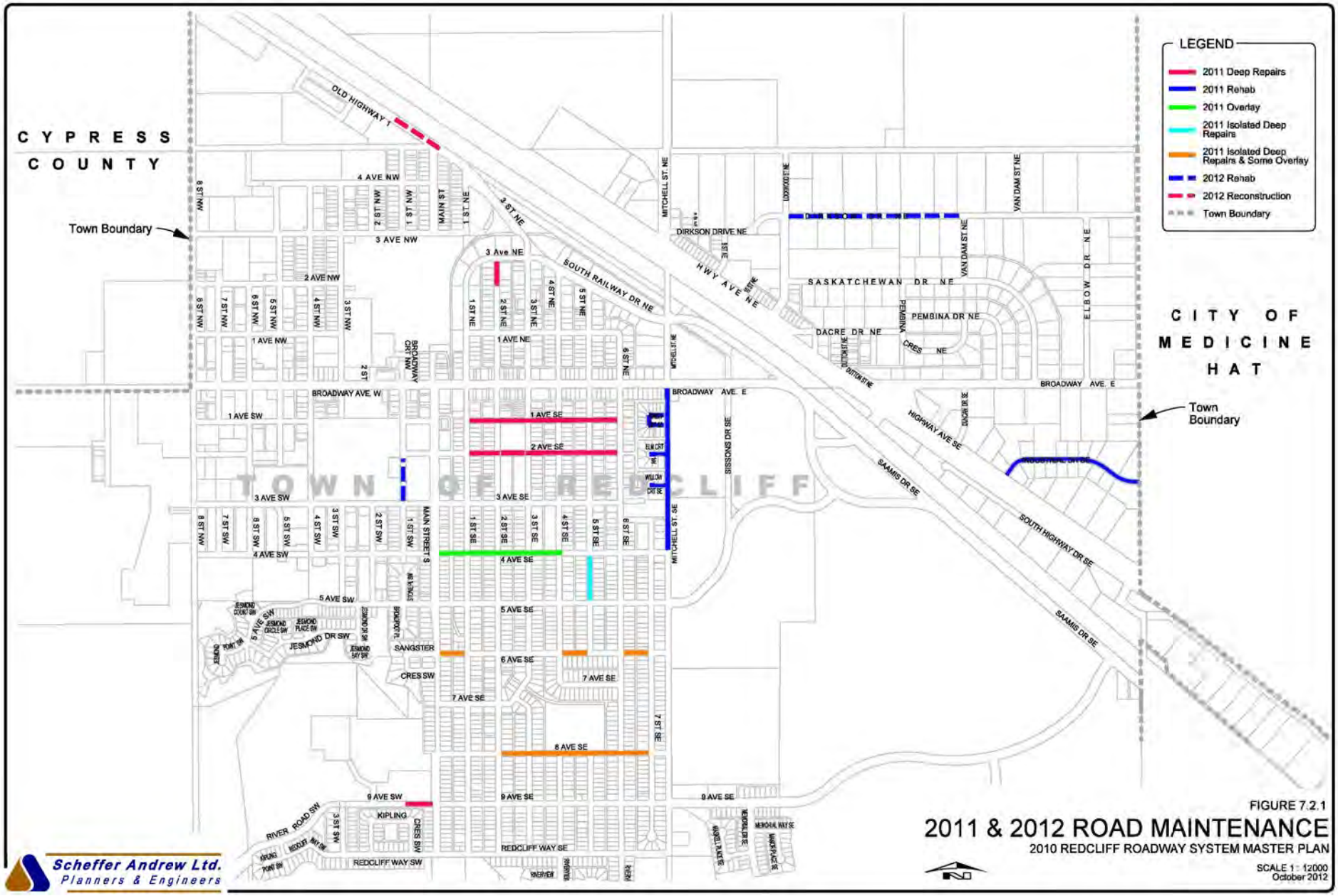


FIGURE 7.2.1

2011 & 2012 ROAD MAINTENANCE

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 12000
October 2012

Scheffer Andrew Ltd.
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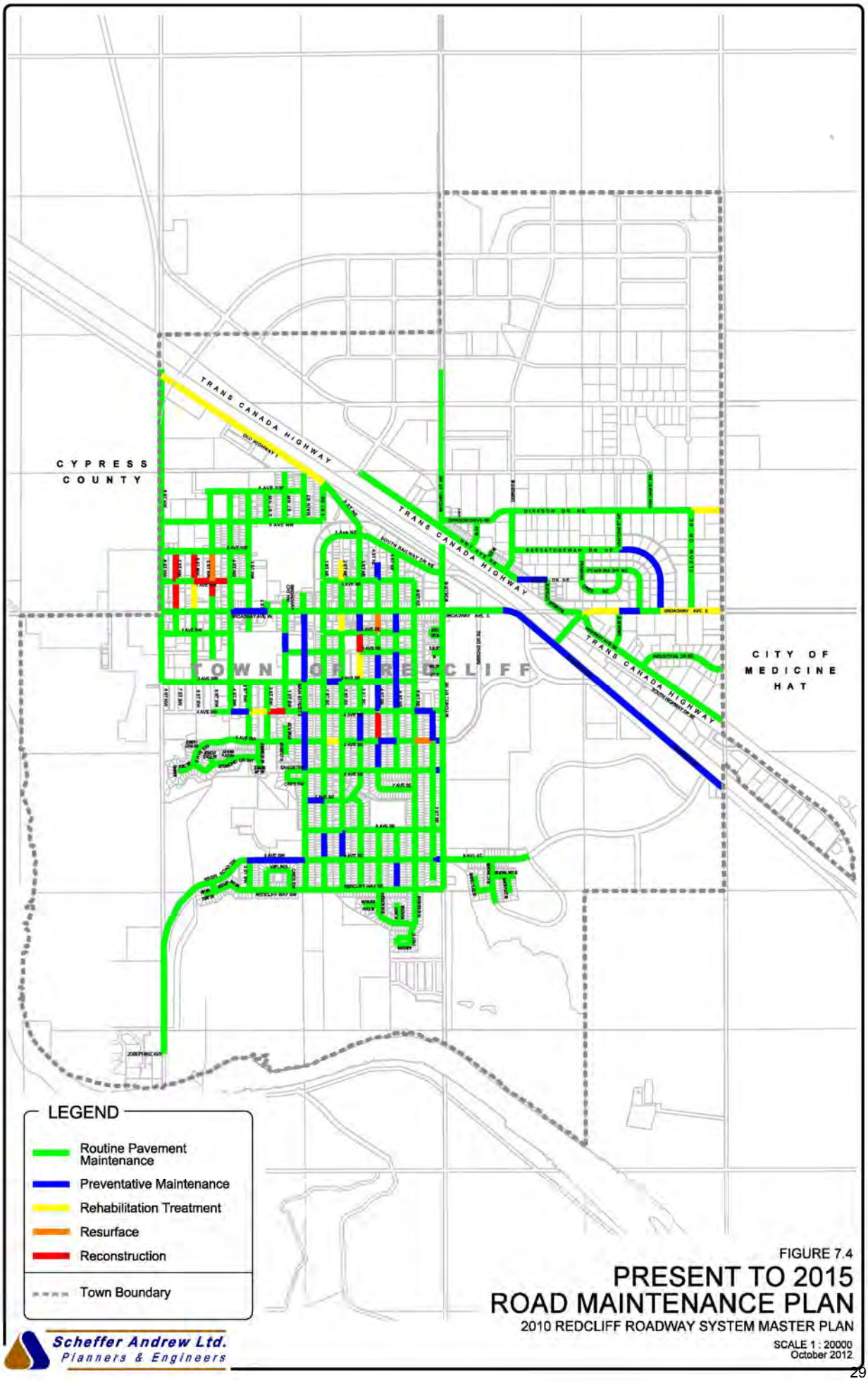

FIGURE 7.4

PRESENT TO 2015 ROAD MAINTENANCE PLAN

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 20000
October 2012

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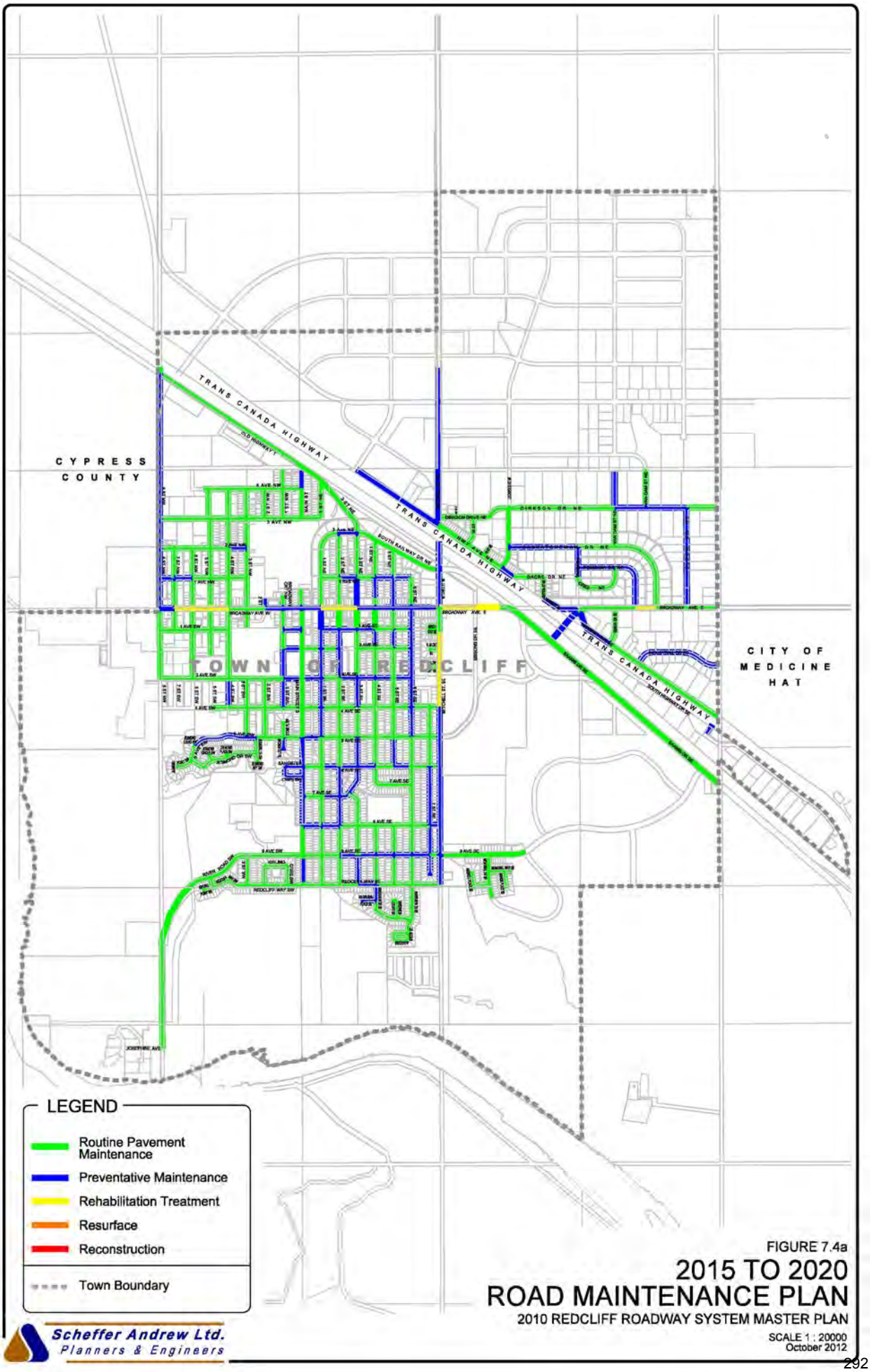

FIGURE 7.4a

2015 TO 2020 ROAD MAINTENANCE PLAN

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

SCALE 1 : 20000
October 2012

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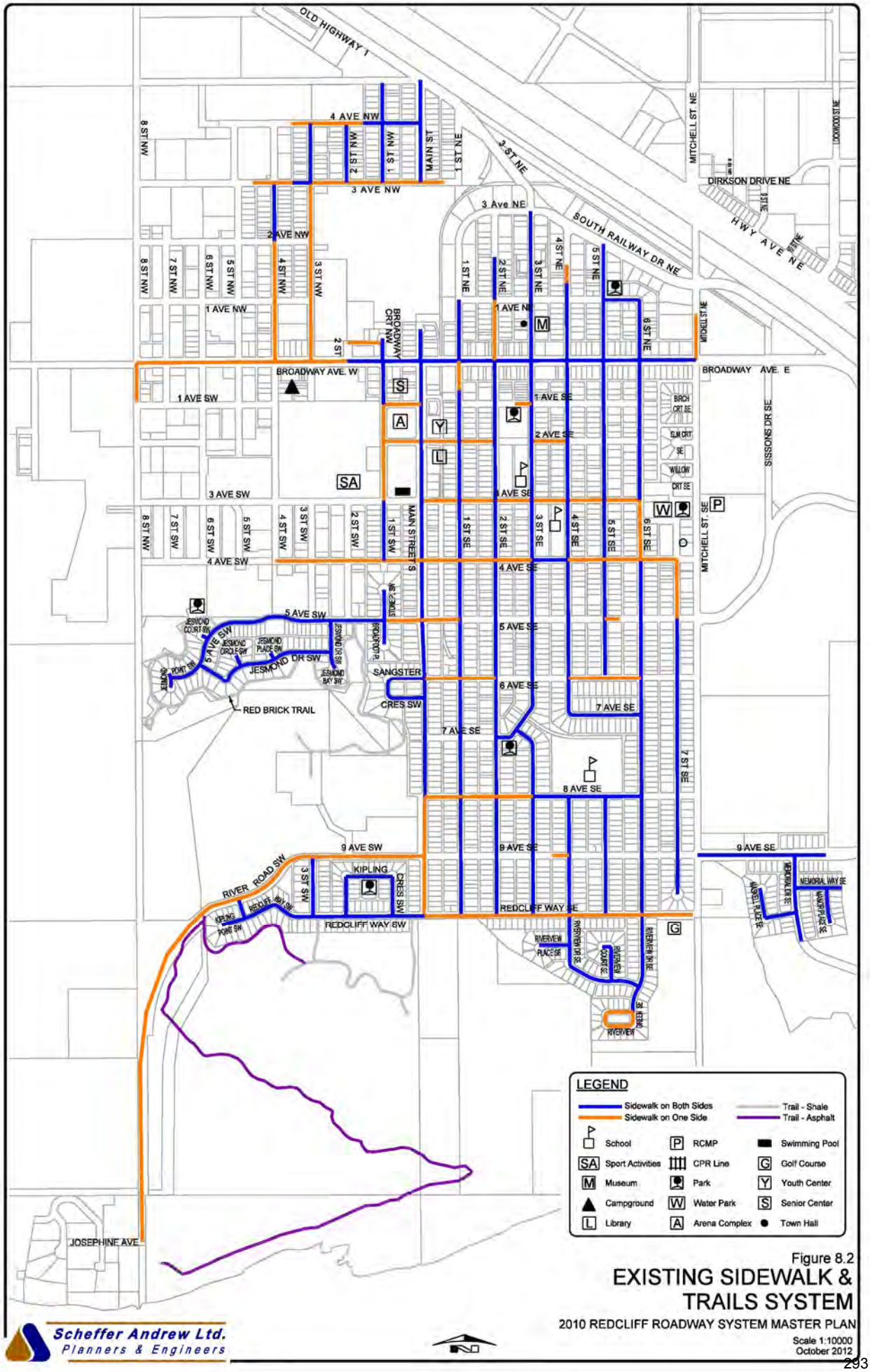

Figure 8.2

EXISTING SIDEWALK & TRAILS SYSTEM

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

Scale 1:10000
October 2012

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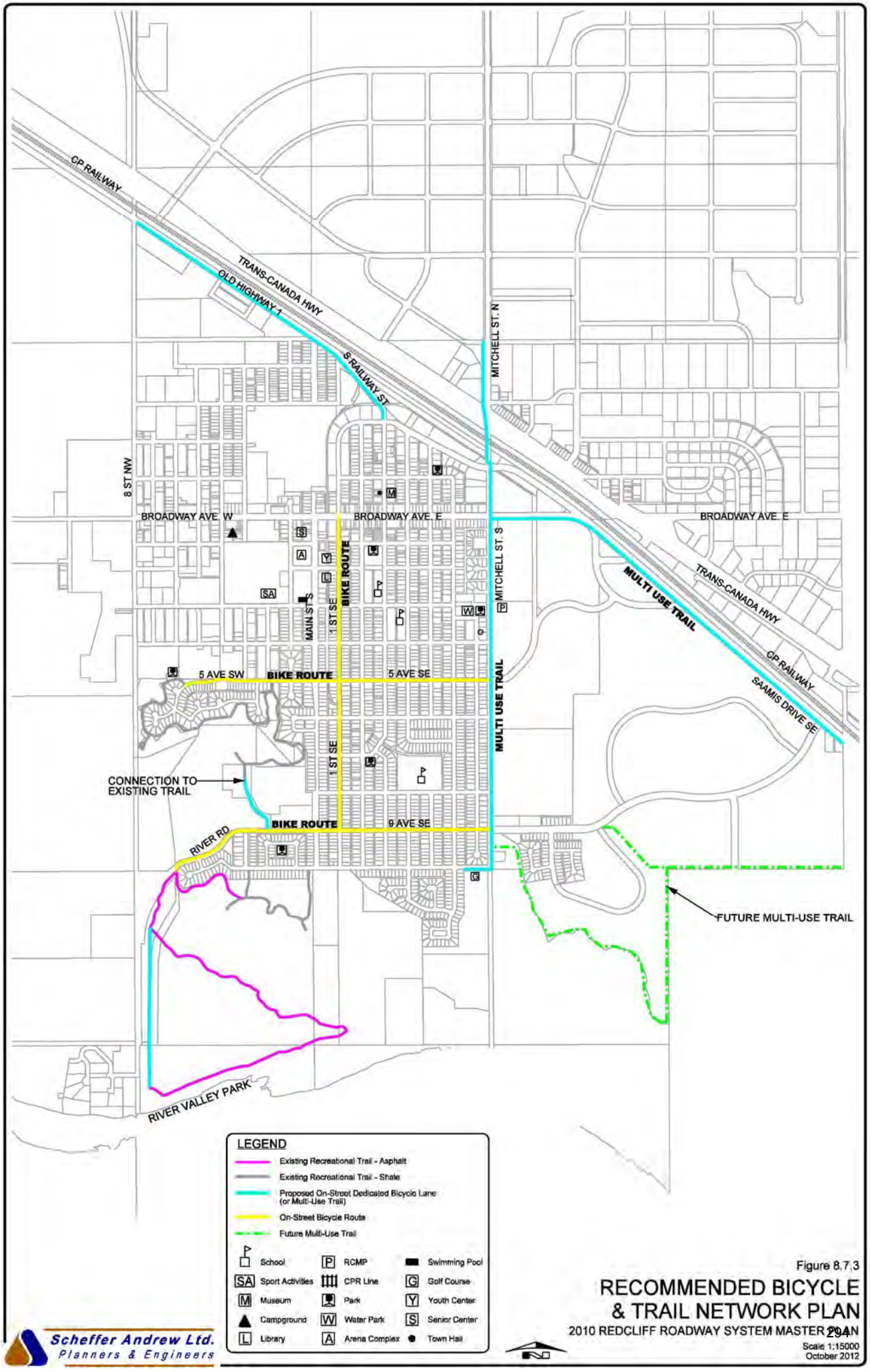

Figure 8.7.3

RECOMMENDED BICYCLE & TRAIL NETWORK PLAN

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

Scale 1:15000
October 2012

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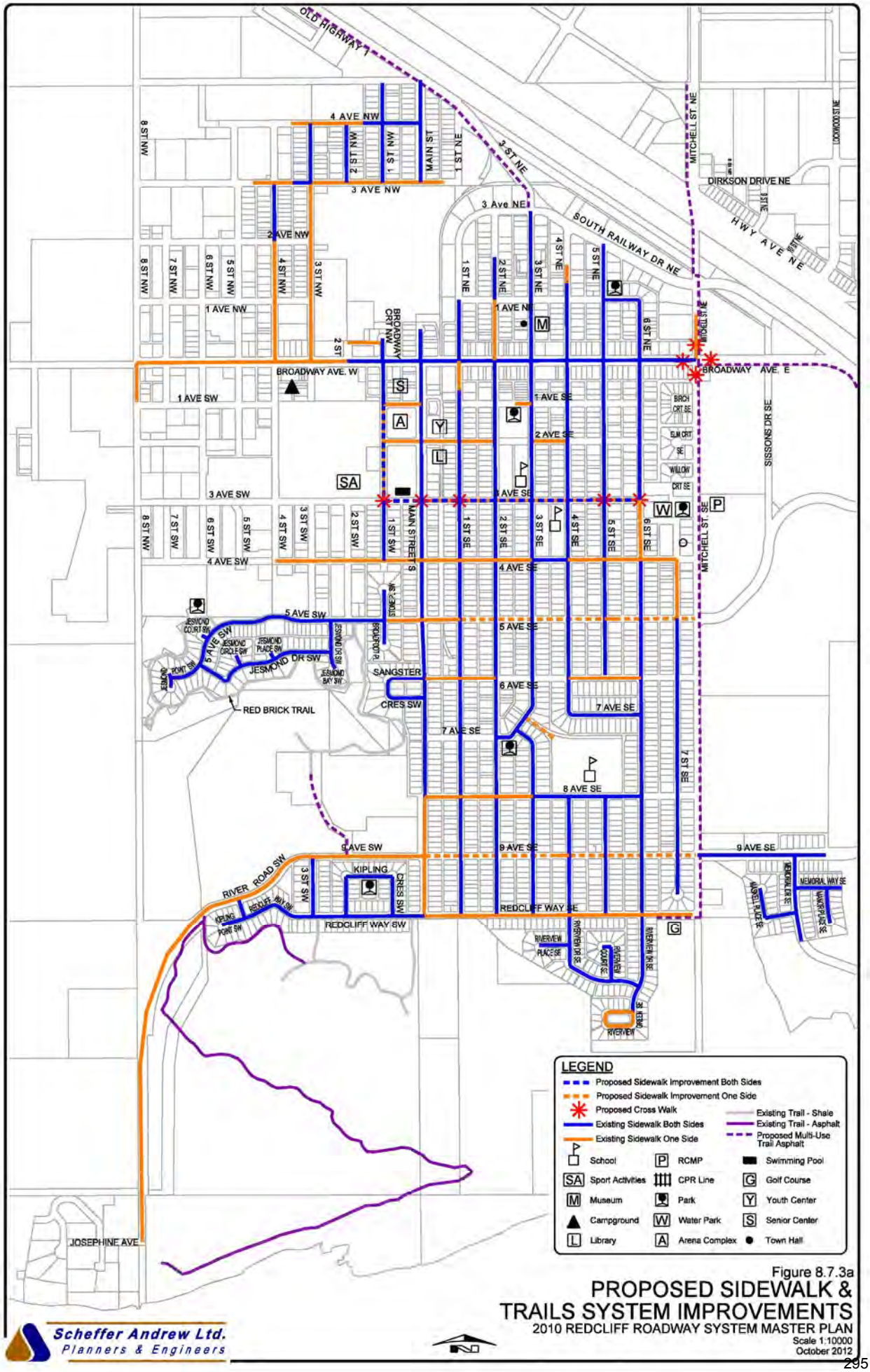

Figure 8.7.3a

PROPOSED SIDEWALK & TRAILS SYSTEM IMPROVEMENTS

2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN

Scale 1:10000

October 2012

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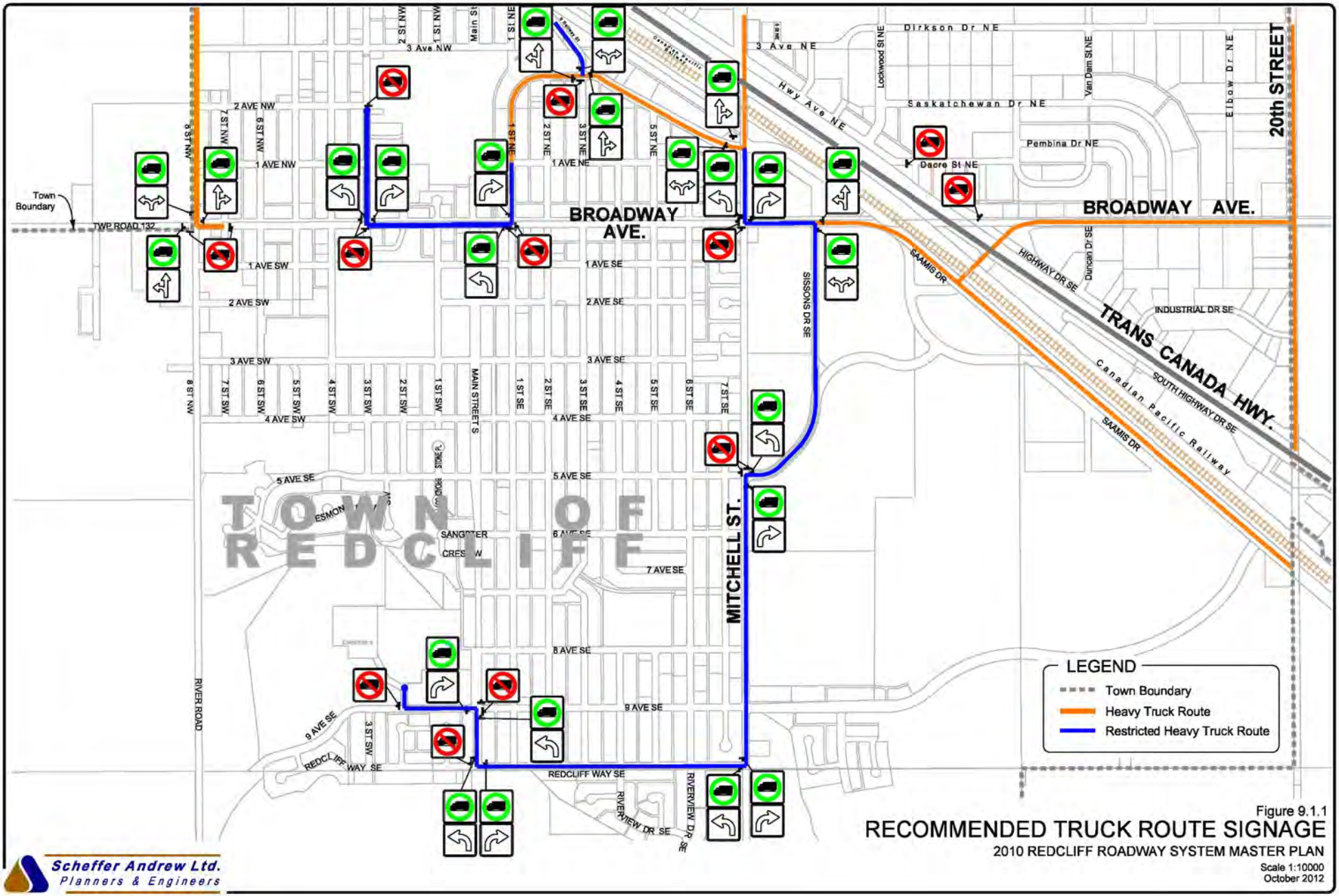

Figure 9.1.1
RECOMMENDED TRUCK ROUTE SIGNAGE
2010 REDCLIFF ROADWAY SYSTEM MASTER PLAN
Scale 1:10000
October 2012

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