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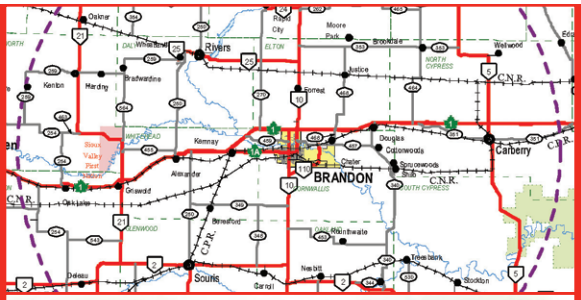

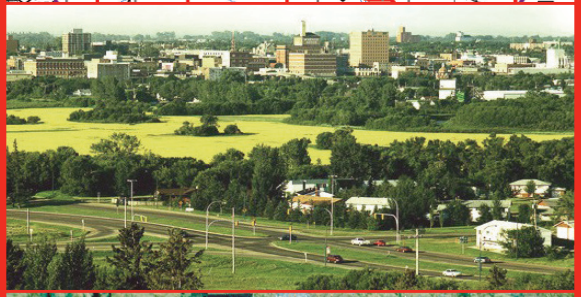

Brandon Area Road Network Development Plan

Prepared for:
Manitoba Infrastructure and Transportation
and The City of Brandon

COMMUNITIES

TRANSPORTATION

BUILDINGS

INFRASTRUCTURE

MMM GROUP

October 2007 | 41396.101

BRANDON AREA ROAD NETWORK DEVELOPMENT PLAN

Prepared For

Manitoba Infrastructure and Transportation
and
The City of Brandon

Submitted By

MMM Group

October 2007

41396.101

STANDARD LIMITATIONS

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EXECUTIVE SUMMARY

Traffic patterns and volumes have been changing throughout the City of Brandon and its surrounding municipalities during the last several years. Continued development and redevelopment within the City of Brandon, including commercial, industrial, institutional and residential, is anticipated to affect traffic patterns and volumes to an even greater extent.

To address these current and anticipated changes, Manitoba Infrastructure and Transportation (MIT) and the City of Brandon (City) commissioned this study to develop a Brandon Area Road Network Development Plan. This Plan establishes a prioritized Infrastructure Investment Plan for the City of Brandon road network and Provincial highways that provide service to and from Brandon within a 60-km surrounding area. Throughout the study process there has been a focus on the interconnectivity, dual funding, and dual responsibility between the Province and the City.

Study Objectives

The objectives of the study include the development of a prioritized Road/Street/Highway Infrastructure Investment Plan for the City of Brandon and its surrounding area. The plan will be used to guide the development and maintenance of a safe, affordable and efficient road network to meet the projected economic development and social needs of the Brandon area over the next 20 years.

The proposed plan will focus on improving public safety, serving the regional economy and social needs while complementing ongoing land development. The plan will recommend solutions with a view to providing an efficient, economical, socially responsible and environmentally sustainable road network in Brandon and its surrounding area. The solutions are to be developed to a conceptual planning level (i.e., single line with associated functional characteristics) with preliminary cost estimates. The plan will recommend strategies that will contribute to sustainable transportation including alternative sources of funding for the recommended solutions.

Methodology

The study focused on six main goals, including:

- Review of current traffic, collisions, roadway conditions, and development patterns.
- A public consultation program that offered residents and stakeholders an opportunity to participate in the study and offer input on transportation-related concerns and mitigation measures.

- Development of a computer-based traffic forecasting model.
- An origin-destination study to identify trip making characteristics.
- Identification of transportation strategies to help guide future transportation decision making, including traffic calming, traffic impact study Policy, alternative funding options, smart growth features, parking standards, road classifications and standards.
- Identification of future transportation infrastructure needs to accommodate forecast year 2026 traffic volumes.

Study Steering Committee

MIT and the City established a Steering Committee to provide guidance and direction to the consultant team based on each of their individual goals. The primary goal of the City of Brandon, with respect to transportation, was to provide a safe, affordable and efficient road network for the users within the City of Brandon. The primary goal of MIT, with respect to transportation, was to provide a safe, affordable and efficient road network for traffic and the transport of goods on the Provincial roadway network within the 60-km study area. Steering Committee members included:

City of Brandon Members	MIT Members
Rod Sage (City Project Director)	Dave Duncan (MIT Project Director)
Ted Snure	Amar Chadha
Steve Hayward	Doug Struthers
Bob McDonald	Brant Magnusson

Environmental Scan

The 2001 Statistics Canada census listed the City of Brandon and surrounding area as having a population of 41,037 people. This marked a 1.1 percent growth in population since the previous 1996 census, a rate that is nearly double that of the Provincial average. Within the entire study area, including the 60-km radius around the city, the 2001 population was 71,885, approximately 57% of which was within the City of Brandon.

Information regarding the transportation mode choice for residents of Brandon to and from places of employment was also reviewed and compared with the Provincial average.

Work-Related Transportation Mode Choice		
Transportation Mode	**Brandon Residents**	**Provincial Average**
Personal Vehicle	78%	72%
Passenger in Personal Vehicle	7%	8%
Public Transportation	3%	9%
Walk / Bicycle / Other	12%	11%

The existing road network for the 60-km study area consists of a mixture of roadway types ranging from local streets to Provincial highways. The primary focus of the study within the City of Brandon was on collector and higher-level roads as these roads carry the bulk of vehicle trips and typically have higher volumes compared to local roads.

The roads around Brandon are comprised of Provincial highways and roads under the jurisdiction of MIT. The primary focus of the study outside the City of Brandon was on provincial trunk highways (PTH) and roads (PR) within a 60-km radius of the City of Brandon that accommodate vehicle trips to and from the city.

A pavement condition assessment was undertaken for roadways within the City of Brandon as well as Provincial highways and roads outside the City of Brandon. Dozens of road segment locations and spot locations were identified as “fair” or worse. Many of these locations were improved in 2006 during pavement work or are planned for improvements in 2007.

A review of design and geometric standards for the City of Brandon found them to be in accordance with the latest revision of the Geometric Design Guide for Canadian Roads by the Transportation Association of Canada (TAC).

The City of Brandon has a designated truck route network, and some of these roads have been further designated for dangerous goods. Changes are recommended to the truck route network and the dangerous goods route based on proposed changes to the major road network.

Parking standards in the City of Brandon are currently controlled by Zoning By-law No. 6642, which identifies minimum parking dimensions as well as the minimum required number of spaces for different land uses, and the Landscape Design Regulations, which sets out specific design standards for landscape screening and internal landscaped islands. The two documents set out a relatively thorough framework for the provision of off-street parking, more so than many jurisdictions

in terms of identifying the number of accessible parking spaces, and setting out landscape design standards. Five modifications to these standards are recommended for consideration.

A review of collision data along Provincial highways for the years 2000 through 2004 was carried out for both the number of reported collisions by road segment and the collision rate. None of the calculated collision rates were sufficiently high enough to warrant further review.

Brandon Transit currently operates 10 transit routes in the City of Brandon that provide access to major destination points in Brandon. Historical transit ridership information was obtained for 1994 through 2006. Annual transit ridership in Brandon has averaged over 750,000 rides per year over the past 13 years. Transit ridership in Brandon tends to peak during the winter months and is lowest during the summer months, typically a reflection of summer vacations and schools being closed.

The Brandon and Area Planning District is a partnership between the City of Brandon, the Rural Municipality of Cornwallis and the Rural Municipality of Elton. The Brandon and Area Planning District Development Plan (By-law #78/01/04), which was revised in 2005, is a long-range plan to guide development in the District. The Plan sets out objectives and policies that direct development locations and standards.

No parking issues were identified during the consultation process with City and MIT personnel. City representatives on the Steering Committee noted early in the process that downtown parking had been examined previously and was not considered a problem.

A high-level overview of safety issues was undertaken within the study area. The identification of critical areas of concern and potential remedial measures was also undertaken. A key element of the overview was a review of intersection collision data where available, and a review of selected highway links within the 60-km study area.

Public Participation

An extensive public consultation program was developed that included:

- A project website (http://www.ndlea.com/brandonroadstudy),
- Two public Open Houses (June 22, 2005 and April 3, 2007),
- Two public Workshops (October 26, 2005 and May 4, 2006),

- A public display (February 3 – 7, 2006 and February 9 – 23, 2006), and
- A formal presentation to City Council (XX, 2007).

In total, more than 700 people visited the project website and over 100 actively participated in the project's open houses and workshops.

Transportation Model

Long-range transportation planning studies such as this typically forecast traffic volumes for a 20-year horizon period using computer-based transportation planning models. For this study a TransCAD model, which was specifically designed for planning, managing, and analyzing the characteristics of transportation systems, was used to develop and analyze the roadway network.

Based on a comparison between existing conditions and forecast Year 2026 conditions, a number of road links were identified as either at or above capacity, particularly in areas expected to accommodate much of the future development. These results suggest that a number of roadway modifications are required in Brandon to accommodate anticipated growth. When these improvements were incorporated, the number of links at or above capacity was dramatically reduced, especially along 1st Street, 18th Street and PTH 1.

Based on TransCAD model results, the environmental scan, and the public consultation program, six general issues and concerns were identified for the transportation network. Strategies to address each specific issue were then developed as the next step in the process leading to recommendations.

Issue Identification and Strategy Development

The following table provides a list of the major issues and concerns that arose during the study and the corresponding strategies that are proposed to be employed to address these issues and concerns in the future.

Issue / Concern	Strategies
1. Alternative Transportation and Environmental Considerations	• Transit development • Adequate multi-use trail system • Ensure sidewalk accessibility
SAFETY	• Minimize traffic related conflicts
2. Route Classification and Goods Movement	• Provide a road system that locates trucks on appropriate routes
3. Access and Traffic Management	• Minimize traffic related conflicts and ensure appropriate access
4. Traffic and Intersection Capacity	• Efficient road network that meets future traffic growth and operation
5. Future Roadway Needs	• Roadway network that meets future traffic and economic needs

Recommendations and Recommended Priorities

Recommended projects were categorized into short-, mid- and long-term planning horizons based on input received through the environmental scan, transportation planning model, public consultation program, and Steering Committee. In addition, some projects were identified as 'beyond horizon year' if they are expected to occur beyond the 20-year study horizon.

Recommended projects identified as 'lower cost' could be undertaken within annual operating budgets or with administrative policy changes. Recommended projects identified as 'Major Capital Upgrades' or 'Major Capital Twinning' would require programming and budgeting in the capital budget process.

Preliminary class D cost estimates (based on 2007 rates and subject to change) were prepared for the recommended road network upgrades based on typical unit costs per metre of roadway, excluding land costs, taxes, utility relocations and engineering. Many of the items recommended, such as changes in classifications and updating of the traffic signal control coordination plans, do

not lend themselves to easily identifiable cost estimates, therefore a yearly allowance was identified.

Prioritized Recommendations – Lower Cost Items					
Recommendation	**Short-Term**	**Mid-Term**	**Long-Term**	**Beyond Horizon Year**	**Prelim. Cost Estimate**
Truck/Dangerous Goods Route Changes	✓	✓	✓	✓	OP/AD[1]
Update Roadway Classifications	✓	✓	✓	✓	OP/AD
Reassessment of Road Jurisdictions	✓			✓	OP/AD
Traffic Calming Guidelines	✓	✓	✓	✓	OP/AD
Traffic Impact Study Policy	✓	✓	✓	✓	OP/AD
Access Management Strategy	✓	✓	✓	✓	OP/AD
Smart Growth Principles	✓	✓	✓	✓	OP/AD
Synchronization of traffic signals	✓				$100,000
Transit signal priority study/implementation	✓				$100,000
Extended hours of operation for Transit	✓				$300,000/yr
Conceptual design of Western By-pass	✓				$200,000
Modifications to Parking Standards	✓				OP/AD
Traffic count monitoring program	✓	✓	✓	✓	$10,000/yr
Intersection reviews and upgrades	✓	✓	✓	✓	As required
Safety review project recommendations	✓	✓	✓	✓	As required

[1] OP/AD indicates a project that can be undertaken within an operational budget or administrative policy change.

Prioritized Recommendations – Major Capital Upgrades				
Recommendation	**Short-Term (to 2012)**	**Mid-Term (to 2019)**	**Long-Term (to 2026)**	**Beyond Horizon Year**
Urban Upgrades				
18th Street (PTH 10): Twin Structures at Assiniboine River (Thompson Bridge)	$17,000,000			
18th Street (PTH 10): CPR Overpass (Daly Overpass)			$20,000,000	
Richmond Avenue: Roundabout at 34th Street	$500,000			
Rural Upgrades				
PTH 1: Phase 1 – Service Roads	$5,000,000	$5,000,000		
PTH 1: Phase 2 – Interchange at 18th Street		$20,000,000	$20,000,000	
PTH 1: Phase 3 – Interchange at 1st Street			$15,000,000	$15,000,000
PTH 1A: CPR Underpass at Kemnay	$2,500,000	$2,500,000		
PTH 10: Forrest By-pass	$5,000,000			
PTH 110: Eastern By-pass Completion	$30,000,000			
Proposed Western By-pass				TBD [1]
Total	**$60,000,000**	**$27,500,000**	**$55,000,000**	**TBD**

[1] TBD: To Be Determined

Note: The above recommendations relate to Provincial roadways that are classed as Core routes, or roadways within the City of Brandon itself.

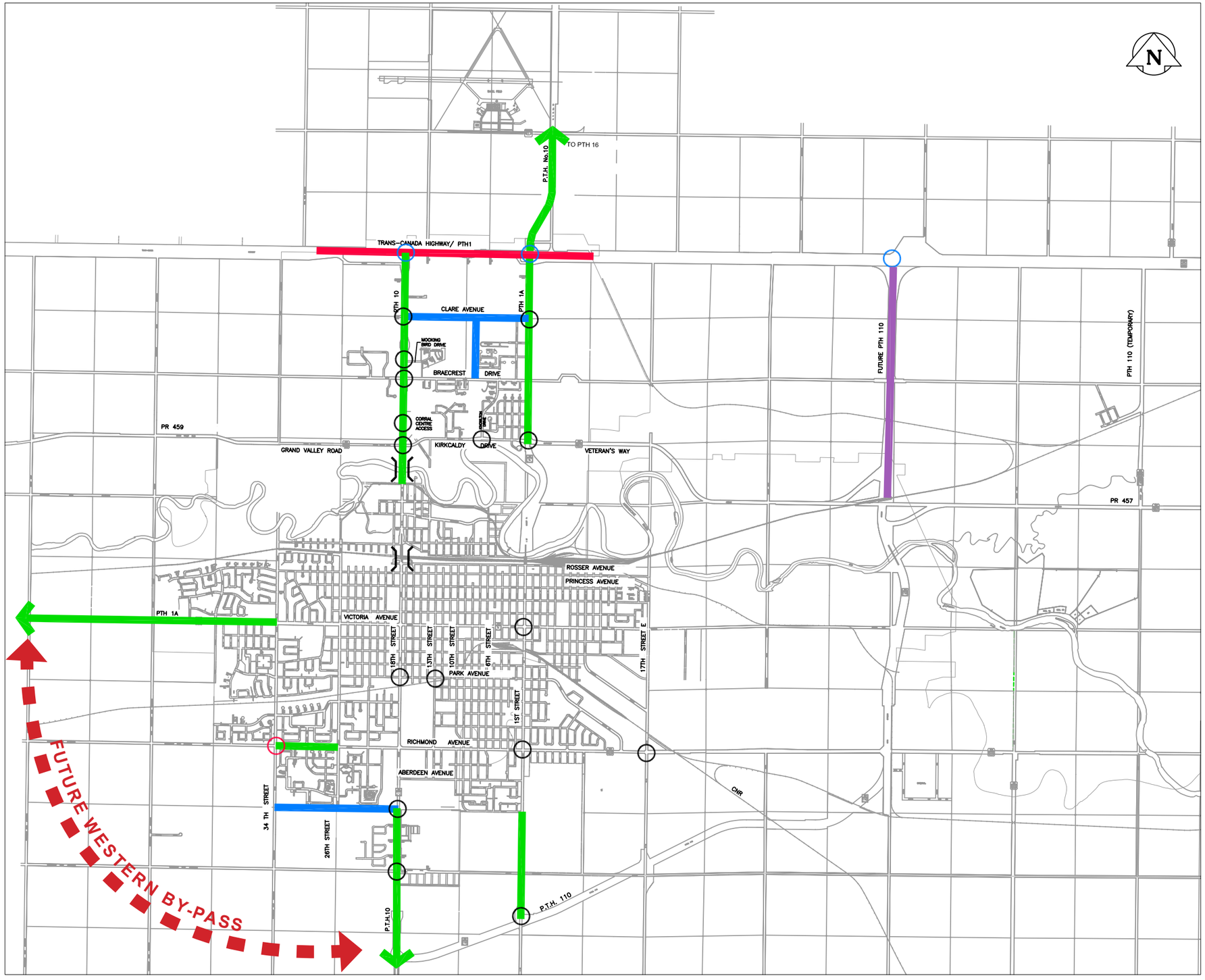
Prioritized Recommendations – Major Capital Twinning (4-lane Divided)				
Recommendation	**Short-Term (to 2012)**	**Mid-Term (to 2019)**	**Long-Term (to 2026)**	**Beyond Horizon Year**
Urban Twinning (4-lane Divided)				
1st Street (PTH 1A): PTH 1 to Braecrest Drive			$5,000,000	
1st Street (PTH 1A): Braecrest Drive to Kirkcaldy Drive		$2,000,000		
1st Street (PTH 1A): Richmond Avenue to PTH 110			$4,000,000	
Victoria Avenue (PTH 1A): 34th Street to 50th Street		$3,000,000		
Victoria Avenue (PTH 1A): 50th Street to Western By-pass				TBD [1]
18th Street (PTH 10): PTH 1 to Braecrest Drive			$5,000,000	
18th Street (PTH 10): Braecrest Drive to Assiniboine River		$2,000,000		
18th Street (PTH 10): Maryland Avenue to Patricia Avenue	$3,000,000			
18th Street (PTH 10): Patricia Avenue to PTH 110			$3,000,000	
Richmond Avenue: 26th Street to 34th Street		$1,000,000		
Rural Twinning (4-lane Divided)				
PTH 10: Brandon to PTH 25	$25,000,000			
PTH 10: PTH 25 to Minnedosa			$40,000,000	
Total	**$28,000,000**	**$48,000,000**	**$57,000,000**	**TBD**

[1] TBD: To Be Determined

Note: The above recommendations relate to Provincial roadways that are classed as Core routes, or roadways within the City of Brandon itself.

Three recommended projects are not categorized above as they are 'development driven' based on future residential development in Brandon, including Clare Avenue (1st Street to 18th Street), Maryland Avenue (26th Street to 34th Street), and Lark Street (Braecrest Drive to Clare Avenue).

Figure ES-1 illustrates the lower and major capital cost recommendations.



LEGEND

IDENTIFIED MAJOR IMPROVEMENT PROJECTS

- ONGOING INTERSECTION REVIEWS
- INTERCHANGE
- ROUNDABOUT
- TWIN BRIDGES
- UPGRADE TO 4 LANE DIVIDED
- UPGRADE TO EXPRESSWAY
- UPGRADE TO CORE ROUTE

DEVELOPMENT DRIVEN PROJECTS

- DEVELOPMENT REVIEW

Manitoba

CITY OF BRANDON MANITOBA

MMM GROUP

Source: City of Brandon

PROJECT TITLE

Brandon Area Road Network Development Plan

FIGURE ES.1: RECOMMENDED UPGRADES

Conclusions

The following conclusions are offered:

1. That as the City addresses future transit service improvements, the measures noted in the Transit Priorities section (7.1.1) are considered.

2. That the smart growth principles noted in the Greenspace and Smart Growth Considerations section (7.1.2) be incorporated when reviewing future development proposals.

3. That the City and MIT undertake the short-term safety initiatives identified in the Safety Improvement Projects section (7.2.1).

4. That the strategies identified in the Traffic Calming Strategy section (7.5.2) be considered when volume and/or speed control measures are deemed necessary.

5. That the City adopt changes to the City's Truck and Dangerous Goods Route Network identified in the Route Classification and Goods Movement section (7.3).

6. That the City adopts the access management guidelines set out in the Access and Traffic Management section (7.4).

7. That modifications noted in the Access Management Strategy for the Brandon Area section (7.4.1) be incorporated into the City's current parking standards.

8. That the policy outlined in the Traffic Impact Study Policy section (7.5.1) and included in Appendix D be adopted by the City and applied to any future development applications.

9. That the City adopts the road classification system, and related design standards, in the Route Classification and Goods Movement section (7.3).

10. That the City and MIT conduct detailed operational reviews at the intersections noted in the Intersections section (7.6.1), selecting two to five intersections per year to examine.

11. That the City and MIT implement road link improvements as noted in the Road Upgrades section (7.6.2).

12. That the alternative funding options discussed in Appendix E be examined in detail by City administration to determine if they are applicable. The funding options focus on incorporating off-site development improvements on a site-by-site basis, transportation assessments, and impact fees.

13. That a traffic count monitoring program be established to monitor operations at key intersections that may need upgrades within the horizon year time frame and review whether adjustments to traffic signal phasing or timing may be required.

14. That traffic control modifications planned by MIT occur within the next two years.

15. That roundabouts continue to be considered at collector – collector intersections if technically feasible as an alternative to traffic signals.

16. That the City ensures the transportation model is updated on a regular basis and maintained for future traffic recommendations.

1.0 INTRODUCTION

1.1 Background

During the past several years, traffic patterns and volumes have been changing throughout the City of Brandon and surrounding municipalities. It is anticipated that traffic patterns will be affected by upcoming and ongoing developments in Brandon, including the proposed development of the former Brandon Mental Health Centre, the industrial sub-division expansion at the Brandon Airport, and several proposed commercial and residential developments between 1st and 18th Streets, south of PTH 1.

Manitoba Infrastructure and Transportation (MIT), in partnership with the City of Brandon (City), commissioned this study to develop a Brandon Area Road Network Development Plan to establish road and street development requirements, focusing on the City of Brandon, as well as Provincial Highways within and around the City that relate to traffic in the City. The goal of the study is to develop a prioritized Infrastructure Investment Plan for the City of Brandon, including roads that provide service to and from Brandon within the 60-km surrounding area shown in Figure 1.1. The plan will be used to guide the development and maintenance of a safe, affordable and efficient road network to meet the projected economic development and social needs of the Brandon area over the next 20 years.

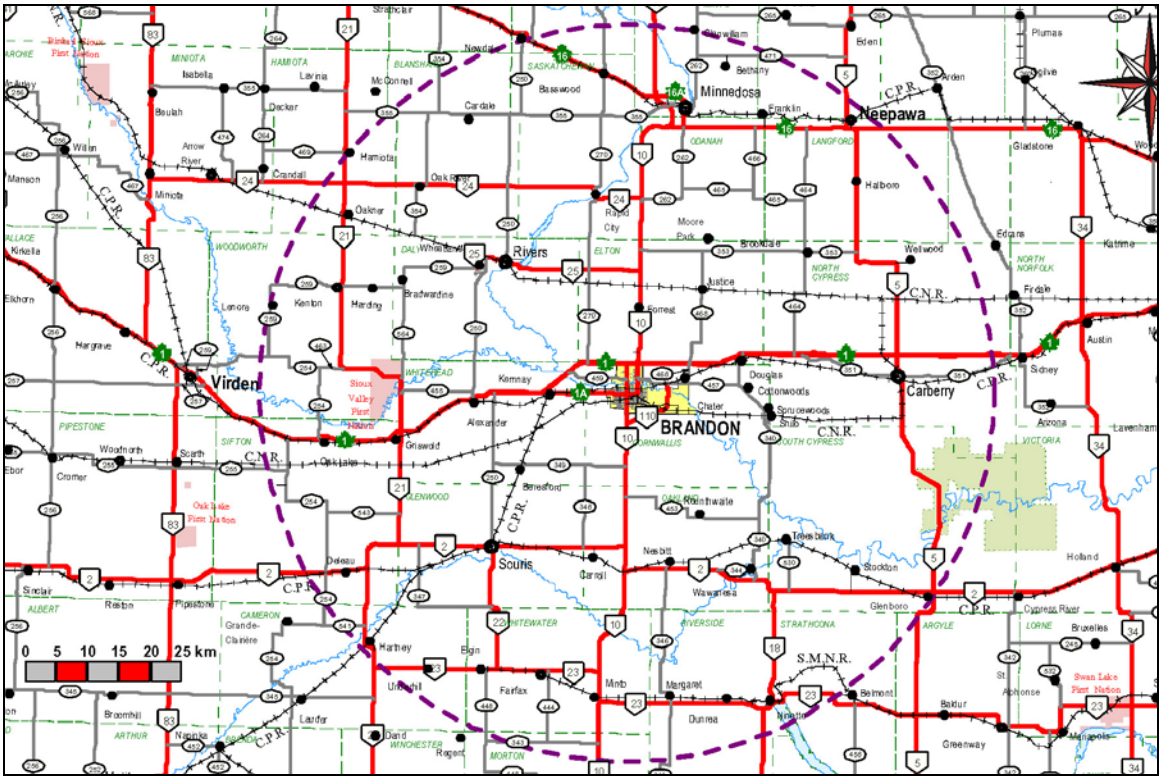


Figure 1.1: Study Area

The objectives of the study include the development of a prioritized Road/Street/ Highway Infrastructure Investment Plan for the City of Brandon and its surrounding area. The plan will be used to guide the development and maintenance of a safe, affordable and efficient road network to meet the projected economic development and social needs of the Brandon area over the next 20 years.

The proposed plan will focus on improving public safety, serving the regional economy and social needs while complementing ongoing land development. The plan will recommend solutions with a view to providing an efficient, economical, socially responsible and environmentally sustainable road network in Brandon and its surrounding area. The solutions are to be developed to a conceptual planning level (i.e., single line with associated functional characteristics) with preliminary cost estimates. The plan will recommend strategies that will contribute to sustainable transportation including alternative sources of funding for the recommended solutions.

The methods that have been used to obtain the study objectives included:

- Reviewing current traffic levels, collision experience, road infrastructure condition, and development patterns.

- Conducting a public consultation program that offered Brandon and area residents an opportunity to participate in the study and offer input to the study team on what are seen as existing transportation-related concerns and what types of mitigation measures should be examined as part of the study.

- Developing a computer-based traffic forecasting model.

- Conducting an origin-destination study to identify trip making characteristics.

- Identifying transportation strategies to help guide future transportation decision making, including measures related to traffic calming, traffic impact study guidelines, alternative funding options, smart growth features, parking standards, road classifications and standards.

- Identifying future transportation infrastructure needs to accommodate forecast year 2026 traffic volumes.

The Infrastructure Investment Plan will focus on improving public safety, serving the regional economy and social needs while complementing ongoing land development. The recommended solutions are intended to provide an efficient, economical, socially responsible and environmentally sustainable road network in Brandon and the surrounding area.

1.2 Study Direction

The City of Brandon has a designated system of public lanes, local, collector and arterial roads under its jurisdiction and control. There are over 320 kilometres of roads within the Brandon city limits, including approximately 67 kilometres of arterials, 55 kilometres of collectors, and 200 kilometres of local streets. The primary goal of the City of Brandon, with respect to transportation, is to provide a safe, affordable and efficient road network for the users within the City of Brandon.

MIT oversees Highways, classified as core, feeder and recreation/tourist routes, throughout the province and within the 60-km study area. This functional classification system is currently under review by the Province in order to develop a strategic highway system that allows for the recommendations of roads, based on consistent and agreed upon criteria that should be the responsibility of the Province, as well as their service levels. Further, there are two classifications of highways in Manitoba with respect to determination of authority and control. The majority of highways in the province are “Declared Highways”, for which the Minister of Infrastructure and Transportation is the traffic authority and MIT is responsible for all costs of construction and maintenance, exclusive of municipal services. “Designated Highways” are generally connecting links between communities, for which the local government is the traffic authority. The Province remains responsible for the costs of construction and maintenance, exclusive of municipal services. The primary goal of MIT, with respect to transportation, is to provide a safe, affordable and efficient road network for traffic and the transport of goods on the Provincial network within the study area.

MIT and the City established a Steering Committee to provide guidance and direction to the consultant team. Steering Committee members included:

- Dave Duncan, MIT (MIT Project Director)
- Rod Sage, City (City Project Director)
- Amar Chadha, MIT

- Ted Snure, City
- Doug Struthers, MIT
- Steve Hayward, City
- Brant Magnusson, MIT
- Bob McDonald, City

The primary consultant team members included:

- Richard Tebinka, MMM Group, Project Manager
- Kerra Mruss, MMM Group
- Veronica Hicks, MMM Group
- Jerry Pilipowicz, MMM Group
- Jesse Crowder, MMM Group
- Dave Krahn, Dillon Consulting Ltd.
- Bill Kavanagh, Dillon Consulting Ltd.

GCS Technology (safety review) and Wordsnorth Communications (origin-destination surveys) provided additional assistance to the consultant team.

2.0 ENVIRONMENTAL SCAN

2.1 Statistics Canada Demographic Data

The 2006 Statistics Canada census listed the City of Brandon and surrounding study area as having a population of 41,511 people. This marked a 4.5 percent growth in population since the previous 2001 census, a rate that is nearly double that of the provincial average.

Information regarding the transportation mode choice for residents of Brandon to and from places of employment was also reviewed and compared with the provincial average. It should be cautioned that the provincial average is heavily influenced by Winnipeg data, which may not be reflective of data collected in the balance of the province, including Brandon. As an example, the provincial average for transit ridership is skewed by the high transit mode split in Winnipeg, which is reflective of a larger city and not comparable to smaller urban centres, many of which have no transit service. The data showed the following:

- Approximately 78 percent of Brandon residents drive to work in a motorized vehicle, compared with a provincial average of 72 percent.
- Over seven percent of Brandon residents are taken to work as passengers in motorized vehicles, compared with a provincial average of eight percent.
- Approximately three percent of Brandon residents use public transportation as their primary mode of transportation to and from work, compared with a provincial average of nine percent.
- Approximately 11 percent of Brandon residents walk or use a bicycle as their primary mode of transportation to and from work, compared with a provincial average of nine percent.
- Approximately one percent uses a motorcycle, taxicab, or another means of travelling to work, compared with a provincial average of one percent.

A graphical summary of mode of trip information for Brandon is included in Figure 2.1. Applicable comparisons of the Statistics Canada 2001 census data and the survey results are discussed in Section 2.10.

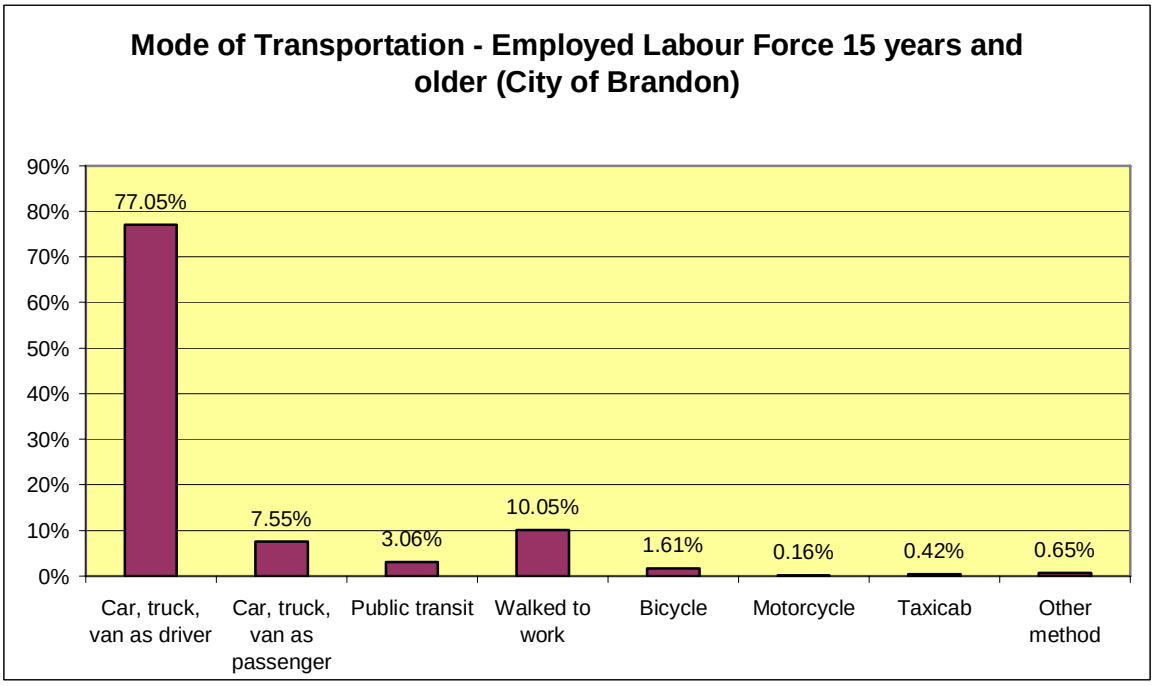


Figure 2.1: Statistics Canada 2001 Mode To Work Information

Statistics Canada demographic data was further reviewed using the PCensus software package for Brandon and a 60 km radius around the City. The 2001 population in the overall study area was 71,885; the City of Brandon comprises 57 percent of the study area population. The study area includes 31,185 dwellings (57 percent within the City).

2.2 Road Network

2.2.1 Existing Roads

The existing road network for the 60-km study area is illustrated in Figure 2.2. The focus of this study is on collector and higher-level roads, which are highlighted.

The streets within the City of Brandon analyzed as part of this study are illustrated in Figure 4.1. Examined roads within the City of Brandon, consisted primarily of collector and higher-level roadways. However, a number of local roads were included as 'connector' links to assist in modelling traffic movements. Roadways classified as collector and higher carry the bulk of vehicle trips and typically have higher volumes compared to local roads.

The roads outside Brandon are comprised of provincial highways, under the jurisdiction of MIT, and municipal roads that are administered by local governments. This study focuses on the major provincial trunk highways within a 60-kilometre radius of the City of Brandon that accommodate vehicle trips to and from the City.

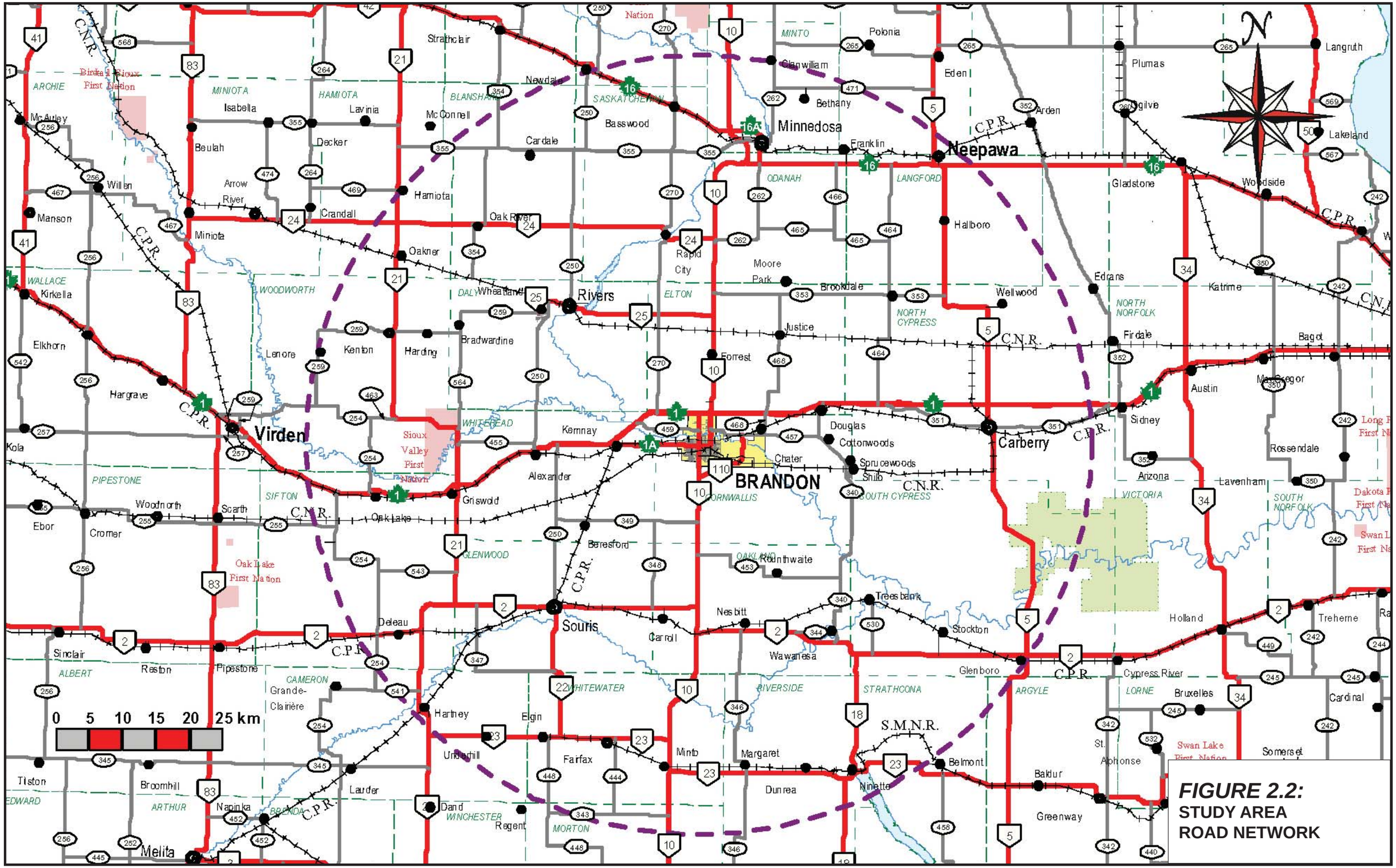


FIGURE 2.2:
STUDY AREA ROAD NETWORK

2.2.2 Road Conditions

The condition of the roadways within and surrounding the City of Brandon have been rated using the Pavement Condition Rating and International Roughness Index methods, respectfully. The condition analyses were carried out in 2005 for the City of Brandon and in 2003 for the roadways under MIT jurisdiction. As such, the ratings are an indication of the pavement condition for the period in time noted and will improve or deteriorate from year to year based on construction works.

2.2.2.1 City of Brandon Roads

Pavement Condition Rating (PCR) is a numerical indicator used across North America to rate the surface condition of pavement. The PCR provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which is also an indication of the structural integrity and surface operational conditions (localized roughness and safety). The PCR provides an objective and rational basis for determining maintenance and repair needs and priorities. Continuous monitoring of the PCR is typically used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs.

The PCR is based on a declining performance scale from 100 to 0, with 100 representing the best possible condition and 0 representing the worst possible condition. The pavement is assigned a condition rating that ranges from “Excellent” to “Failed” based on the PCR value. PCR value ranges and the associated Pavement Condition Ratings are listed below in Table 2.1.

Table 2.1: Pavement Condition Rating Scale

PCR	Pavement Condition Rating
85 to 100	Excellent
70 to 85	Very good
55 to 70	Good
40 to 55	Fair
25 to 40	Poor
10 to 25	Very Poor
0 to 10	Failed

A condition analysis was carried out by the study team for collector and higher-level roads within the City of Brandon in 2005, and was accompanied by video documentation of the roadway conditions as experienced in the rating drive-through. Roadway links that were rated at 50 PCR points or less (fair, poor, very poor or failed) are documented in Table 2.2. A number of the noted road links have been addressed in 2006, with additional upgrade work planned for 2007. Roads in which the PCR rating will have improved due to pavement work in 2006 or 2007 are noted with an asterisk in Table 2.2.

Table 2.2: Critical Roadway Links Identified During Pavement Condition Assessment

Street	Location	PCR
1st Street - Southbound	Victoria Avenue to McTavish Avenue	40 *
18th Street - Southbound	Queens Avenue to Maryland Avenue	45 *
18th Street - Southbound	18th Street Bridge to Rosser Avenue	45 *
18th Street - Northbound	Maryland Avenue to Queens Avenue	45 *
18th Street - Northbound	Victoria Avenue to Louise Avenue	45 *
Elderwood Drive	Queens Avenue to Driftwood Crescent	45 *
26th Street	Durum Drive Northward to 2-Lane/4-Lane Transition	45
1st Street - Southbound	McTavish to Park Avenue	47.5 *
Patricia Avenue	1st Street to 9th Street	47.5 *
1st Street - Southbound	Park Avenue to Richmond Avenue	50 *
1st Street	PTH 110 (East By-pass) to Patricia Avenue	50 *
1st Street - Northbound	Madison Avenue to McTavish Avenue	50 *
18th Street - Southbound	Rosser Avenue to Louise Avenue	50 *
18th Street - Northbound	Louise Avenue to Lorne Avenue	50 *
18th Street - Northbound	Daly Overpass (CPR tracks) to Parker Boulevard	50 *
26th Street	Durum Drive to Ottawa Avenue	50
26th Street - Southbound	Violet Crescent to Ottawa Avenue	50
34th Street	200 m South of Patricia Avenue to Patricia Avenue	50
Victoria Avenue - Eastbound	13th Street to 9th Street	50
Victoria Avenue - Eastbound	Whillier Drive to 26th Street	50

Princess Avenue East	Douglas Street to 13th Street East	50
Rosser Avenue	McDiarmid Drive to 30th Street	50
Richmond Avenue East	Percy Street to 17th Street East	50 *
Park Avenue	10th Street to 13th Street	50
Douglas Street	Rosser Avenue to Victoria Avenue East	50

* - Notes roads that were upgraded in 2006, or are planned to be upgraded in 2007, thereby improving the PCR rating

Critical spot locations, such as intersections and localized pavement failures, were also identified in the condition assessment and are documented in Table 2.3. Locations in which the PCR rating will have improved due to pavement work in 2006 are noted with an asterisk in Table 2.3.

Table 2.3: Critical Spot Locations Identified During Pavement Condition Assessment

Street	Location	PCR
Richmond Avenue	Pavement Failure at Mailboxes South of Wankling Drive	35
1st Street / McTavish Avenue Intersection		40 *
Richmond Avenue / Park Avenue South East Intersection		40 *
50th Street (Murray Street) (gravel)	200 m south to 200 m north of Patricia Avenue	40
50th Street (Murray Street) (gravel)	200 m south to 200 m north of Richmond Avenue	40
18th Street Bridge – Daly Overpass		45 *
1st Street / Kirkcaldy Drive Intersection		45
1st Street / Princess Avenue Intersection		45 *
1st Street / Queens Avenue Intersection		45 *
10th Street / Queens Avenue Intersection		45
13th Street / Park Avenue Intersection		45 *
18th Street / Richmond Avenue Intersection	Northbound and southbound lanes	45 *
18th Street / Aberdeen Avenue Intersection		45 *
26th Street / Park Avenue Intersection		45 *
1st Street / Richmond Avenue Intersection		50 *
1st Street / Rosser Avenue Intersection		50 *

13th Street / Victoria Avenue Intersection		50
18th Street / Richmond Avenue Intersection	Eastbound lanes	50 *
18th Street / Hilton – Parker Intersection		50 *
21st Street / Victoria Avenue Intersection		50
26th Street / Pacific Avenue Intersection		50
34th Street / Victoria Avenue Intersection		50
34th Street / Park Avenue Intersection		50

* - Notes locations that were upgraded in 2006, or are planned to be in 2007, thereby improving the PCR rating.

A full table of the observed pavement condition ratings, including ratings higher than 50 PCR points, is included in Appendix A. The Brandon roads pavement condition is graphically illustrated on Figure 2.3. Roadway links that were upgraded to 'adequate' in 2006, or are planned for 2007, are noted in the figure.

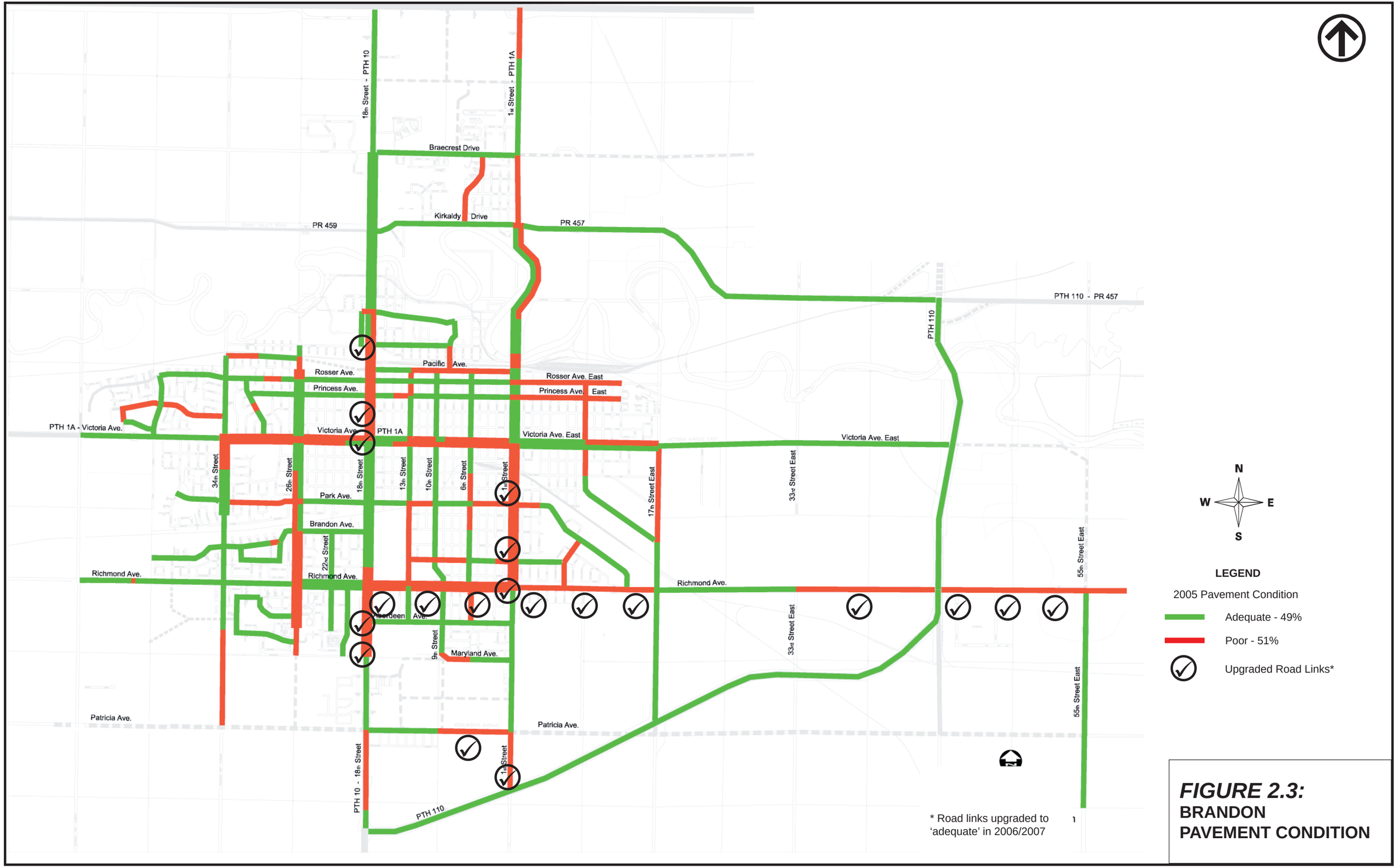


FIGURE 2.3:
BRANDON
PAVEMENT CONDITION

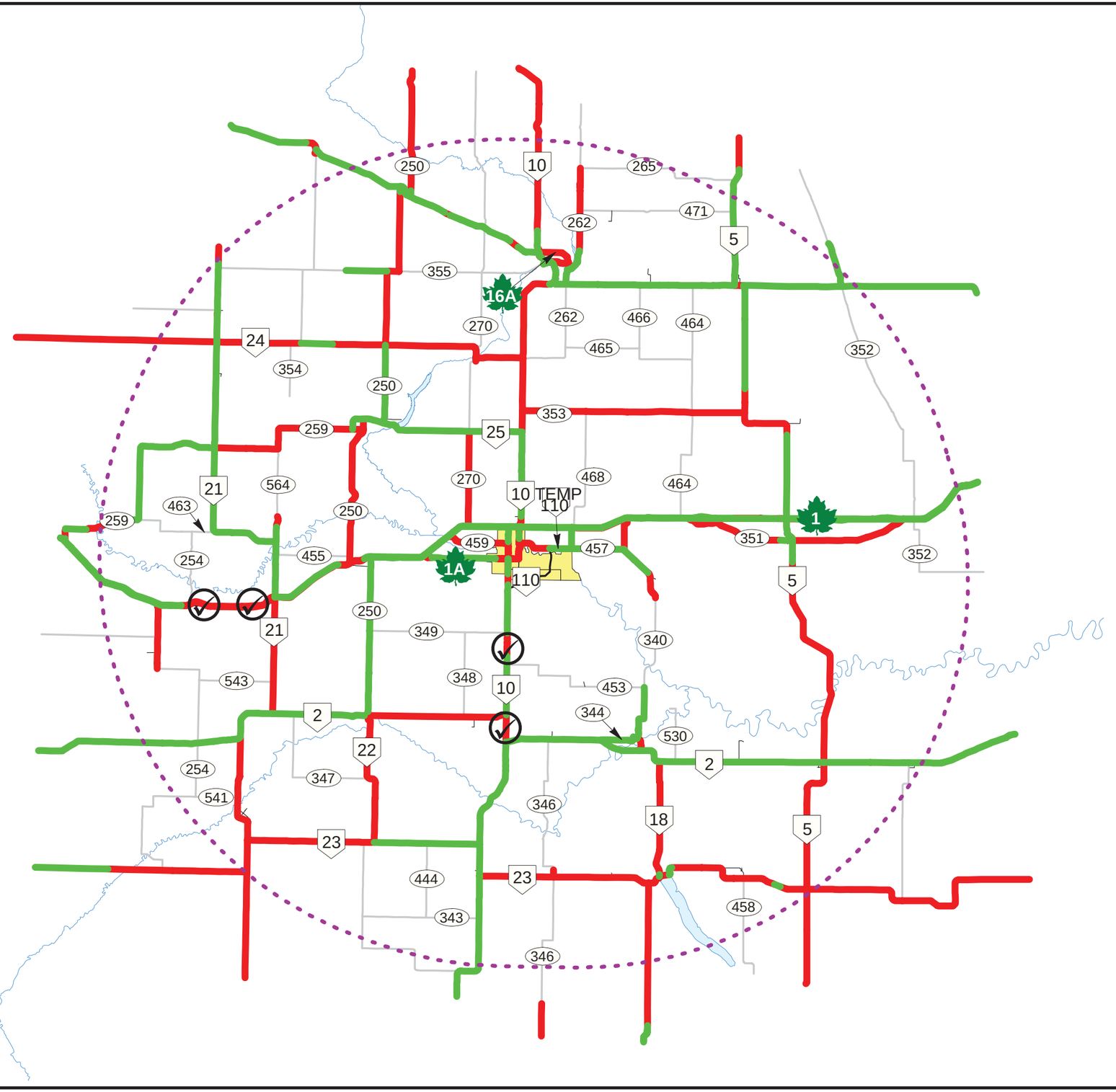
2.2.2.2 Provincial Roads

For roads outside the City of Brandon, MIT measures pavement quality in terms of the smoothness of the pavement surface. The International Roughness Index (IRI) is used to measure pavement roughness on a scale of 0.0 to 5.0. IRI ratings were converted into three broad categories of pavement conditions in the Prairie Provinces Transportation System Study1, and these same classifications are used in this study and are as follows:

- **Good:** Roadway links with IRI values less than 2.5 (IRI < 2.5) are considered to be in good condition.
- **Moderate:** Roadway links with IRI values between 2.5 and 3.5 (2.5 < IRI < 3.5) are considered to be in moderate condition.
- **Poor:** Roadway links with IRI values greater than or equal to 3.5 (IRI > 3.5) are considered to be in poor condition.

Surface condition information for provincial highways and roads around Brandon was obtained from MIT for 2003 and is illustrated in Figure 2.4. Roadway links that were upgraded to 'adequate' in 2006, or are planned for 2007, are noted in the figure.

[1] DS-Lea Consultants and the Battelle-UMTIG Prairie Region Freight Studies Alliance, *Prairie Provinces Transportation System Study*. Transport Canada, December 1998.



LEGEND

2003 Pavement Condition

- Study Area
- Adequate - 49%
- Poor - 51%

Upgraded Road Links*

* Road links upgraded to 'adequate' in 2006/2007

FIGURE 2.4:
PROVINCIAL PAVEMENT CONDITION (2003)

2.3 Functional Classification System

2.3.1 Road Classification Systems

Road classification systems are intended to allow a road network to perform efficiently and safely from both traffic operations and road safety perspectives. This objective is achieved by the designation and operation of roadways to their intended purposes. Classification systems group roads according to the type of service each group is intended to provide and are a fundamental tool for asset management. Typically, urban and rural roadways are grouped into four major hierarchical categories: local streets, collector streets, arterial streets and expressways. Local street traffic is collected by collector roadways, which provide access to arterials, which may then connect to expressways. Grouping roads with similar functions can improve transportation planning, geometric design, maintenance and operations. As well, a road classification system can also aid in managing urban development and access control.

The Transportation Association of Canada specifies various characteristics associated with the classification of a roadway. These characteristics include service function, land service, traffic volume, flow characteristics, design and average running speed, vehicle type and normal connections. Speed limits, traffic volumes and flow characteristics tend to be higher on higher level roadways such as expressways. Conversely, access to abutting property, parking, and pedestrian and cyclist activity is generally limited on higher levels roads. Arterial roadways typically provide relatively high traffic service levels with some property access.

Road classification assists with the establishment of right-of-way widths, cross-sections, pavement structures, drainage systems, and sidewalks. The co-ordination of traffic control guidelines, pavement markings and speed limits is also aided by road classification.

With respect to road classification, the City of Brandon and MIT have differing mandates. The City of Brandon has a transportation focus of providing freight movements as well as local and commuter traffic with a safe, affordable and efficient road network within the City. Concurrently, MIT has a transportation focus towards accommodating the movement of freight into, around and through the City, and study area, in a safe, efficient and affordable manner. The result of these differing perspectives is alternate definitions of functional classification, truck routes and dangerous goods routes for each jurisdiction.

2.3.2 City of Brandon Road Classification

The City has a designated system of collector and arterial roads, as identified on maps found in the City's Traffic By-Law No. 5463/16/87 and on the City's website. The classification of existing roads, including MIT facilities, is shown in Figure 2.5. There are over 320 kilometres of roads within the Brandon city limits, including approximately 67 kilometres of arterials, 55 kilometres of collectors, and 200 kilometres of local streets.

The Brandon and Area Planning District Development Plan By-law No. 78/01/04 (April 2006) classifies roads into the following categories:

a) **Expressways** intended to handle high speed traffic around the City for the efficient movement of people and goods;

b) **Arterial stree**ts intended to accommodate large volumes of traffic with a high level of safety and efficiency;

c) **Collector streets** intended to accommodate moderate volumes of traffic raveling at moderate speeds;

d) **Local streets** intended to provide for vehicular access to individual building lots and which accommodate low volumes of traffic traveling at low speeds; and

e) **Public lanes** intended to provide for vehicular access to individual properties at locations where it is inappropriate to provide access from a street.

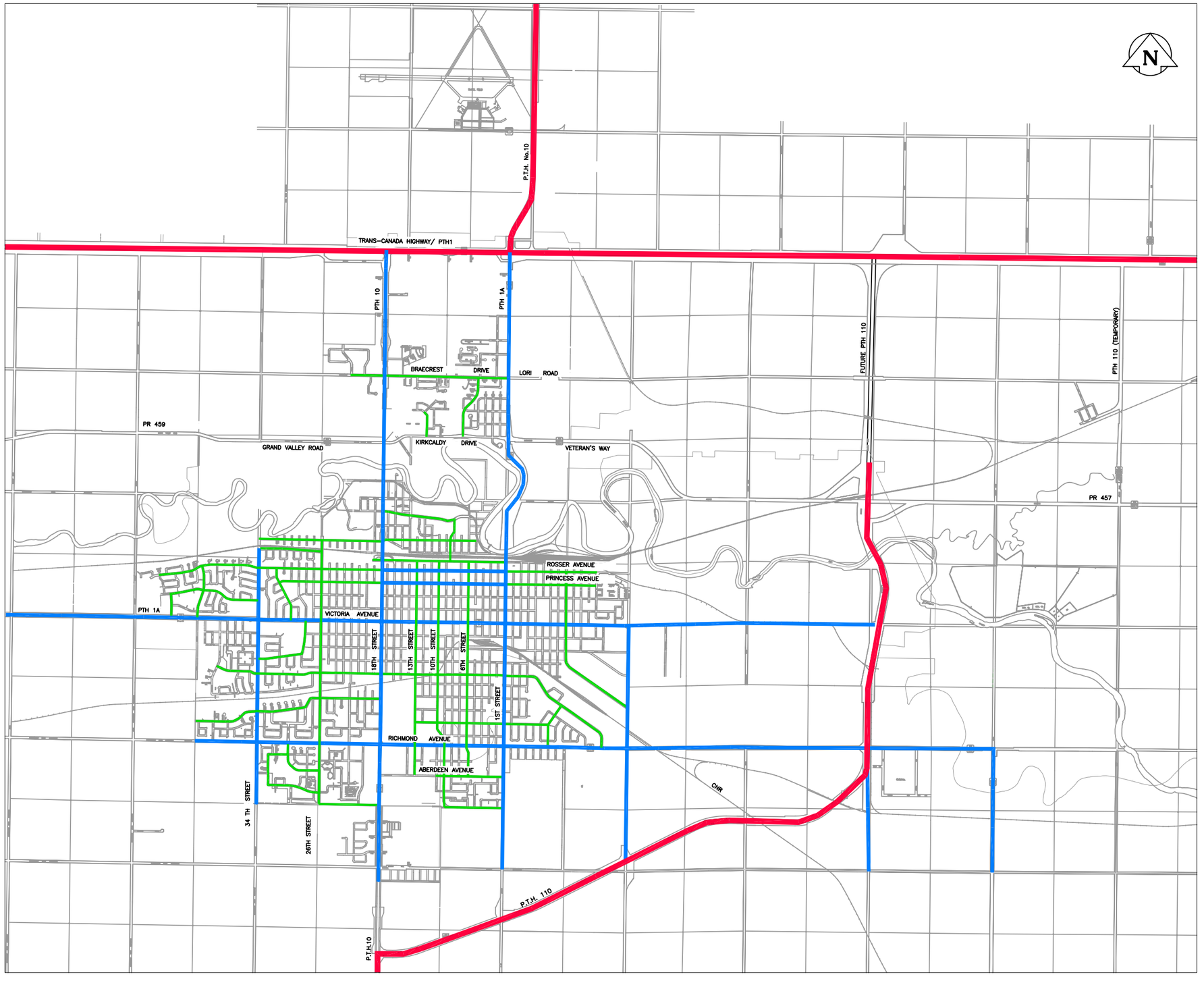
Brandon has a number of key routes classified as arterial within city limits. Examples of these routes are 1st Street, 18th Street, PTH 1A, PTH 110, Victoria Avenue and Richmond Avenue. These routes have been treated as major thoroughfares for commuter, local and truck traffic within the city. Arterials intersect with other arterials and collectors, and collectors intersect with local streets and lanes. Recommended solutions for the various functional classifications should be reflective of the volume and type of traffic using the route.

Preferably, the traffic flow on arterials is typically uninterrupted except at intersections and crosswalks. Direct access should not be permitted on these facilities, except on minor arterials or by site-specific study and design for major developments (e.g., shopping centres).

Road classification dictates design standards for areas such as alternative transportation, sidewalks, parking and right-of-way requirements.

Transit routes are concentrated on the arterial-collector system. Scheduled bus routes avoid local streets. Special design (e.g., lane widening) or separate facilities are required to accommodate bicycle paths on arterials, but bicycles can operate unrestricted on collectors and local streets.

The selection of right-of-way widths must be done with careful consideration of the required lane assignments and clearances for the various municipal utilities. Deviation from the standards will occasionally be required to accommodate major utility corridors, future traffic demands, bicycle paths, etc.



LEGEND

- Expressway / Core Route
- Arterial / Feeder Route
- Collector

Source: City of Brandon

PROJECT TITLE

Brandon Area Road Network Development Plan

FIGURE 2.5:
CITY OF BRANDON ROAD CLASSIFICATION SYSTEM

2.3.3 Provincial Roadways

2.3.3.1 Provincial Classification System

The MIT publication entitled the Transportation Planning Manual from February 1998 includes a highways functional classification policy as well as a design and cross-section standards policy. The Provincial classification includes expressways, primary and secondary arterials and three types of collectors. Factors in differentiating between the roadway classes includes their function servicing through traffic, extent the highway provides access to adjacent lands, the population of areas to be connected, as well as the extent of recreational traffic. This classification system was in use up until 2006.

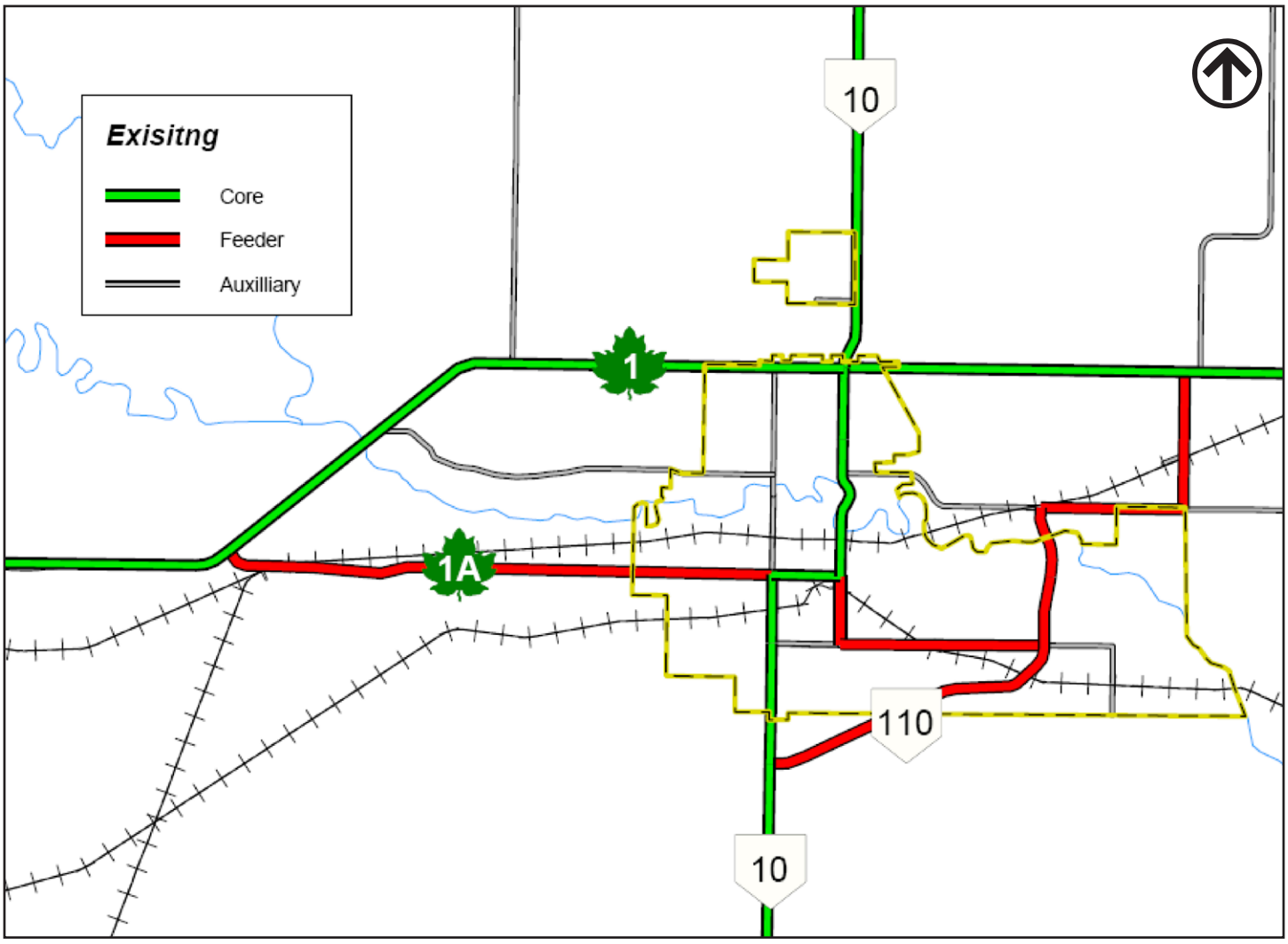
The Province is currently conducting a review of the Provincial highway network that will result in a new classification system. The new Strategic Highway System will comprise the key economic highways throughout the Province and will be identified as Core, Feeder, and Recreation/Tourist Routes). In addition, all other Provincial routes will be include in a secondary system that will be referred to as the Auxiliary Highway System.

Further, there are two classifications of highways in Manitoba with respect to determination of authority and control. The majority of highways in the province are “Declared Highways”, for which the Minister of Infrastructure and Transportation is the traffic authority and MIT is responsible for all costs of construction and maintenance, exclusive of municipal services. “Designated Highways” are generally connecting links between communities, for which the local government is the traffic authority. The Province remains responsible for the costs of construction and maintenance, exclusive of municipal services.

Figure 2.6 shows the existing Provincial Highway Classification System for the Brandon area as it is currently being presented in preliminary discussions (note that this is a proposal and is potentially subject to change). It is included to illustrate the nature of the classification system that is being examined.

Major MIT routes within the study area include PTH 1, PTH 10, PTH 110 (Brandon Eastern Access) and Richmond Avenue. Under the new Strategic Highway System PTH 1 and PTH 1A/PTH 10 are classified as core routes for primary access into and through the City. PTH 1A (to Kemnay), PTH 110 (Brandon Eastern Access) and Richmond Avenue are classified as feeder routes for truck traffic and commuter access to the industrial area in southeast Brandon. These routes have been treated as major thoroughfares for truck traffic through and around the city. As such, the recommended solutions for these roadways reflect the

priorities of the MIT network with respect to functional classification, truck routes and dangerous goods transportation.



Source: Manitoba Infrastructure and Transportation (October 2007)

FIGURE 2.6:
Provincial Highway Classification System

2.3.3.2 Strategic Routes

Criteria for Strategic Core Routes (approximately 4,740 km of highway) includes routes that connect to:

- All National Highway System (NHS) routes,
- Urban centres with a population greater than 10,000,
- Other major population areas with an urban core of at least 5,000 and a minimum catchments area population of 30,000, or
- International border crossings with $250M in trade annually (four crossings qualify, including the PTH 10 Boissevain crossing).

Criteria for Strategic Feeder Routes (approximately 1,440 km of highway) includes routes connecting to a Core Route, and:

- Providing connections to populations greater than 1,000, and either having at least 100 trucks per day, or supporting $150M per year in regional economic development or five percent of Manitoba's GDP;
- Providing connections to major industrial parks and intermodal facilities, and having at least 100 trucks per day; and
- Cross-border spacing between 50 and 80 km, and connects to existing NHS routes in the USA or trade routes with $5M per year, or connects to Class 1 and 2 highways in Saskatchewan that form part of trade routes.

The Eastern Access is currently considered a Feeder Route, however, given that it is expected to play a more important role when the final leg of the Access is completed (the permanent connection to PTH 1) and it carries more of the truck traffic between PTH 1 and routes to the north, and PTH 10 south of Brandon, it should be considered for upgrade to Core Route status.

Criteria for Strategic Routes identified as Recreation and Tourist routes (approximately 410 km of highway) includes:

- Rural routes connecting Primary or Feeder Routes to major recreation routes that have an average route summer daily volume of 1,000 vehicles per day and a seasonal peak increase in traffic of at least 20 percent.

Proposed operating characteristics for the Strategic Highway System are summarized in Table 2.4. In addition to characteristics noted in the table, criteria for Level of Maintenance, Reliability, and Surface Condition/Ride-ability/Rutting are to be determined.

The total proposed routes identified, as part of the Strategic Highway System, is 6,590 km, of which 6,180 km is to meet the RTAC load standard.

Table 2.4: Operating Characteristics

Operating Characteristics	Core Routes	Feeder Routes	Recreation & Tourist Routes
Proposed Legal Classification	PTH	PTH	PTH
Traffic Flow	Uninterrupted	Interrupted	Interrupted
Running Speed	90 – 110 km/hr	70 – 100 km/hr	70 – 90 km/hr
Level of Service	B	B	C (SADT[1])
Land Service	Full/Limited Access Highway	Limited Access Highway	Limited Access Highway
Loading	RTAC Non-Restricted	RTAC Non-Restricted	Non-RTAC
Bridge Loading	> HSS 25 Design Truck / HS 30 Lane Loading / LRFD HL – 93 Loadings		
Surface Type	Paved	Paved	Paved (Traffic Volume Based)
Vertical Clearance	Subject to Applicable Engineering Standards		

[1]SADT – Summer Average Daily Traffic

2.3.3.3 Auxiliary Highways

The balance of the Provincial highway system (11,580 km) is considered under the Auxiliary Highway guidelines. The Auxiliary system includes High Volume (an AADT of at least 2,000 vpd, 390 km of highway qualify), Medium Volume (an AADT of 400 – 2,000 vpd, 3,350 km of highway qualify), and Low Volume (less than 400 vpd, 7,560 km qualify) routes. The High and Medium Volume routes would generally be paved, with Low Volume routes having a gravel surface).

2.3.4 Comparison of Road Classification Standards

A survey of current road standards by classification for other medium sized cities, as well as Winnipeg, was completed. The focus was on arterials, collectors, locals and laneways. The comparison can be found in Appendix F.

2.3.5 Existing Brandon Classification System

Compared to the other jurisdictions examined, Brandon has fewer standards related to roadway classification, although many of the other communities examined were larger in size. Where comparisons are possible, Brandon's standards fall within the range of the other cities examined. General standards from the Transportation Association of Canada (TAC) and the Institute of Transportation Engineers (ITE) are also included in the comparison, as well as from the Smart Code Manual (although these are based on different method of classifying roadways and therefore are not directly comparable).

Table 2.5 summarizes the desirable attributes of the various roads classifications. Road classes are generally distinguished by the combination of attributes, with no rigid distinction between the different classes. Information for expressways is not included, as Brandon does not utilize this classification for City roadways.

Table 2.5: Road Classification System

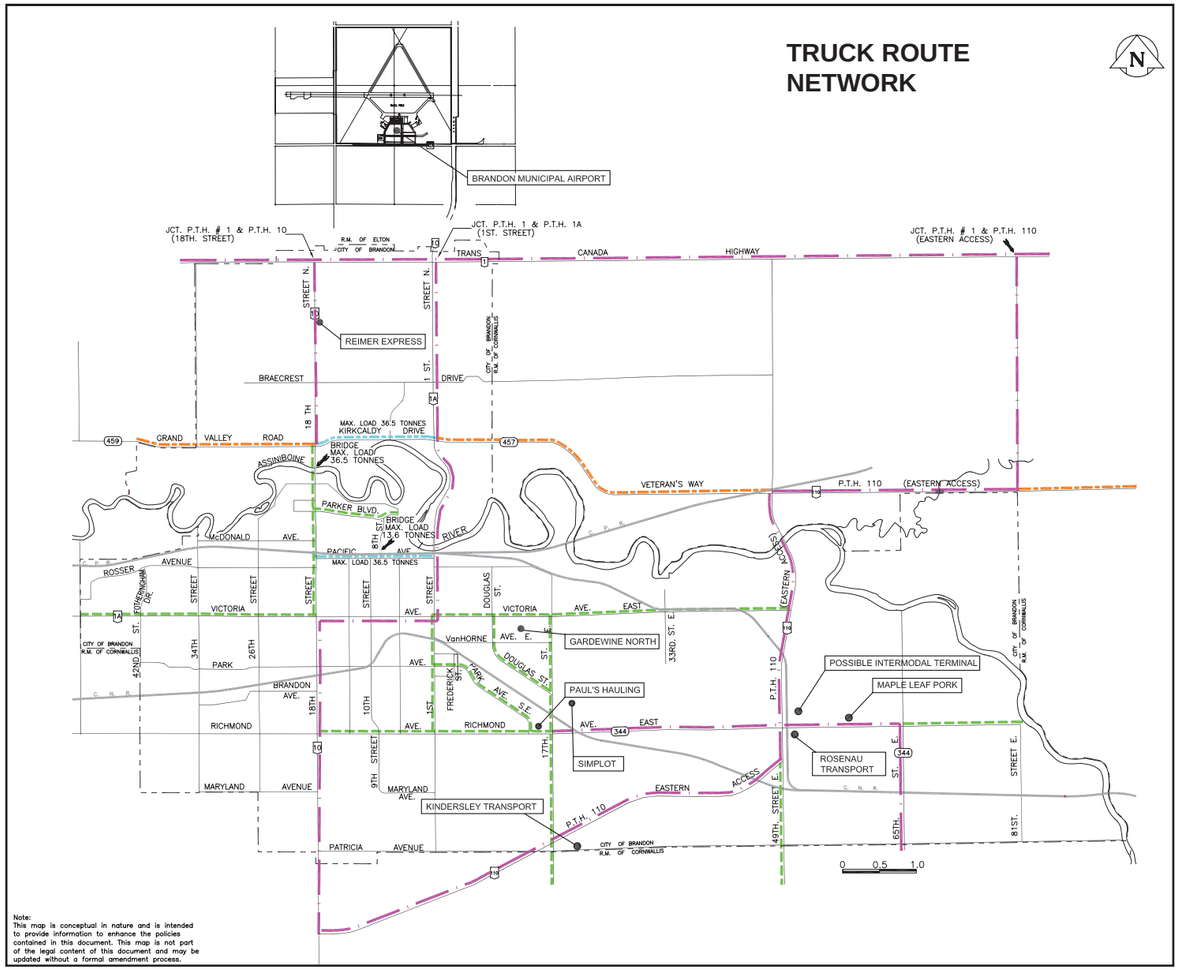
Road Classification	Traffic Function	Traffic Volumes (vpd)	Design Speed (km/h)	Basic No. of Lanes	Access Control	Intersection Spacing	Right-of-Way
Arterial	Through traffic, restricted land access	5,000 – 30,000	60 - 100	2 or 4	Restricted access	400 m	20 - 40 m
Collector	Through traffic & land access	< 10,000	50 - 70	2 or 4	Access with some restrictions	60 m	20 - 32 m
Local	Land access	< 1500	50 - 60	2	Access with few restrictions	60 m	16 - 20 m

2.4 Design and Geometric Standards

Design and geometric standards for the City of Brandon are in accordance with the latest revision of the Geometric Design Guide for Canadian Roads by the Transportation Association of Canada. Proposed design standards used in the design of Brandon streets are listed in Table G.1 in Appendix G.

2.5 Existing Truck and Dangerous Goods Route System

The City of Brandon has a designated truck route network, and some of these roads have been further designated for dangerous goods. The purpose of the truck route network is to minimize widespread deterioration of the local road system as a result of heavy truck traffic and to minimize traffic hazards and nuisance factors of noise and dust in residential areas. The dangerous goods routes concentrate this traffic to areas less vulnerable to exposure to dangerous goods. The current truck and dangerous goods route network is illustrated in Figure 2.7.



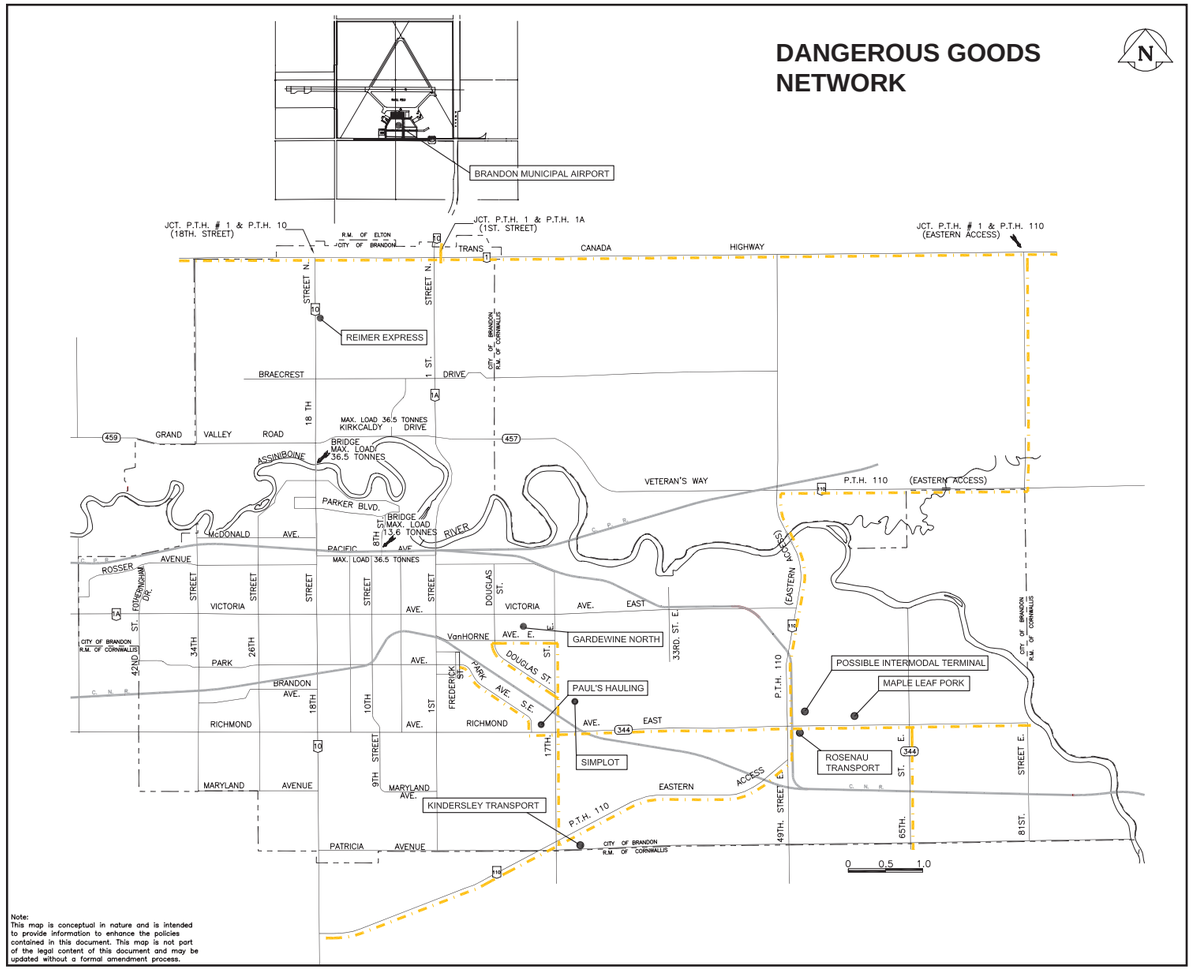
Source: City of Brandon

LEGEND

- CITY AND HIGHWAY TRUCK ROUTES – CLASS A1 — GVW 56,500kg
- HIGHWAY TRUCK ROUTES – CLASS B1 — GVW 47,630kg
- CITY RESTRICTED TRUCK ROUTES – CLASS A — GVW 36,500kg
- RTAC PROVINCIAL TRUCK ROUTES — GVW 62,500kg
- RAILWAYS
- PROV. TRUNK HIGHWAY
- PROV. ROAD
- CITY OF BRANDON LIMITS

EFFECTIVE: JAN./ 76
REVISED: 1979, 1989, 1993, 1997.

- TRUCKING CENTRE



Source: City of Brandon

LEGEND

- DANGEROUS GOODS ROUTES
- RAILWAYS
- PROV. TRUNK HIGHWAY
- PROV. ROAD
- CITY OF BRANDON LIMITS

EFFECTIVE: JAN./ 76
REVISED: 1979, 1989, 1993, 1997.

- TRUCKING CENTRE

FIGURE 2.7:
CITY OF BRANDON TRUCK AND DANGEROUS GOODS ROUTE NETWORK

2.5.1 Truck Operator Telephone Survey

A survey of truck operators in the Brandon area was undertaken as part of this study. Companies contacted included Paul's Hauling, Maple Leaf Pork, Koch Nitrogen (formerly Simplot Chemicals), Gardewine North, Kindersley Transport, Reimer Express, and Rosenau Transport. Information obtained through the telephone survey includes:

- Paul's Hauling: Estimate of 50 trips in / 50 trips out per day via Eastern Access. Trucks use the Eastern Access due to company policy.
- Maple Leaf Pork: Estimate of 50 trips in / 50 trips out per day live hog trucks, plus 40 reefer (refrigerated) trucks in / 40 trucks out via Eastern Access.
- Koch Nitrogen (formerly Simplot Chemicals): Estimate of 70 trips in / 70 trips out per day via Eastern Access, although trips vary seasonally with a maximum of 200 in/200 out per day. Annually, there are approximately 24,000 trucks in 340 days of operation.
- Gardewine North: Estimate of 15 trips in / 15 trips out per day to/from Winnipeg via Victoria Avenue to the Eastern Access, plus 60 delivery trips per day within Brandon itself via the arterial road system.
- Kindersley Transport: Estimate of three trips in / three trips out via 17th Street/Victoria (PTH 1A); trucks do not use the Eastern Access.
- Reimer Express: Estimate of 12 trips in / 12 trips out via 18th Street (PTH 10).
- Rosenau Transport: Estimate of 10 trips in / 10 trips out via the Eastern Access, with a range of three to 15 depending on the time of year. Rosenau would like to see the construction of a western access.

The majority of the truck traffic seems to be using the Eastern Access, based on the responses. One company stated that more traffic uses 1st Street and 18th Street to access the Trans-Canada Highway than the companies may admit to.

2.5.2 Origin Destination Patterns for Trucks

Information was also requested on general origin-destination patterns to/from Brandon. The summary is graphically illustrated in Figure 2.8. The major origin-destination is to/from the east (44 percent), with approximately the same demand to/from the west and south (25 and 24 percent respectively), the remaining seven percent to/from north of Brandon.

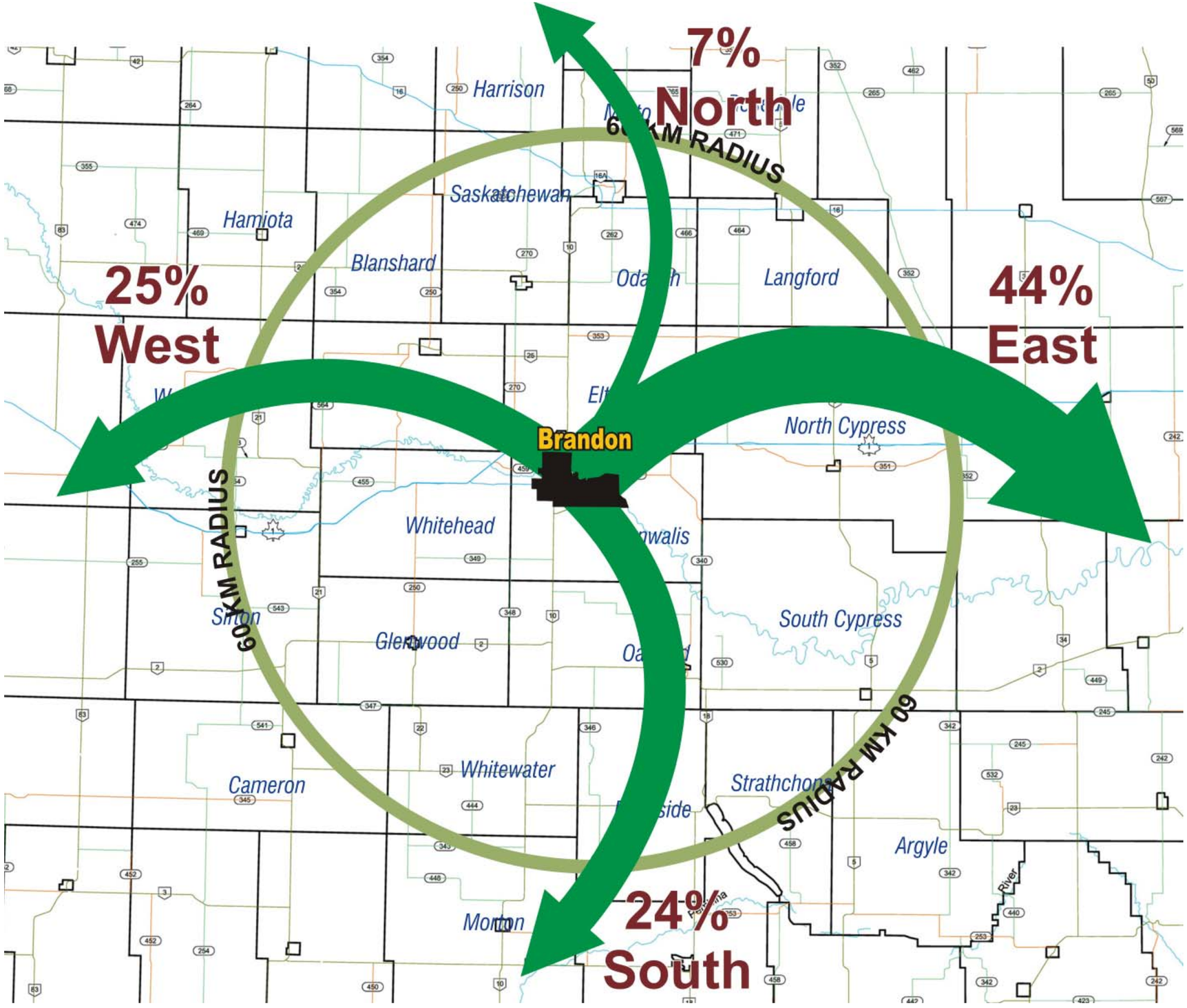


FIGURE 2.8:
TRUCK SURVEY ORIGIN-DESTINATION DATA

2.6 Parking Standards

2.6.1 Parking Issues

Parking issues were not identified during the consultation process with City and MIT personnel. City representatives on the Steering Committee noted early in the process that downtown parking had been examined previously and was not considered a problem.

2.6.2 Existing On-site Parking Standards

Parking standards in the City of Brandon are currently controlled by Zoning By-law No. 6642, which identifies minimum parking dimensions for various angles of parking for both regular and accessible parking. It also sets out the minimum required number of spaces for different land uses, including the minimum number of accessible spaces that must be provided.

The City of Brandon Landscape Design Regulations sets out specific design standards to provide for landscape screening as well as internal landscaped islands.

The two documents sets out a relatively thorough framework for the provision of off-street parking, more so than many jurisdictions in terms of identifying the number of accessible parking spaces, and setting out landscape design standards.

The intent of this study was to review the current City standards and identify possible modifications for consideration by the City, especially for non-residential uses. As noted above, the City of Brandon's standards extend beyond what many urban jurisdictions identify.

2.7 Collision Data and Safety Review

Collision data was provided by MIT for Provincial highways within the study area. However, similar collision data was not available for City of Brandon streets and as such, only collision data for PTH routes outside of Brandon was reviewed. On major routes within the City, a safety review was undertaken in order to supplement and compensate for the limited availability of collision data.

2.7.1 Review of Collision Data on Provincial Highways

MIT has provided historical collision data for the following highways that provide access to the City of Brandon: PTH 1, PTH 2, PTH 5, PTH 10, PTH 16, PTH 25, PR 340, PR 457, PR 468 and PR 610 (Richmond Avenue).

Sectional Collision Rates

Table 2.6 shows the yearly collision distribution of reported collisions by road segment for the years of 2001 through 2004. The table also shows the collision rate for individual highway links. Collision rate is calculated by dividing the total number of collisions by the total vehicle ilometers of travel on a specific section of highway over a specific period of time and is expressed in collisions per million vehicle ilometers.

MIT considers a collision rate for rural highways that exceeds 1.5 incidents per MVK (million vehicle ilometers) on a highway segment as warranting further review. Two sections of rural highway, both on PR 457, demonstrate a collision rate of higher than 1.5 collisions per million vehicles ilometers and thus, these sections warrant further review. Collision data provided does not indicate specific details of collisions along the road sections and thus further detailed review is warranted.

In addition, MIT monitors rural highway sections with collision rates between 1.0 and 1.5 collisions per MVK on an ongoing basis. Rural highway sections that had a collision rate in the 1.0 to 1.5 range included PTH 1 (1st St. to PR 340), PTH 10 (PTH 2 to PTH 110), PTH 10 (PTH 25 to PTH 24), PTH 16 (PTH 10 to PTH 16A), PTH 110/PR 457 (PTH 110 to PR 468).

Collision rates on urban sections within the City of Brandon can often be considerably higher than those on rural routes. This can be due to local issues that must be reviewed on a site specific basis. As a result, a safety review of the urban sections of these routes has been undertaken and has been appended to this report.

Table 2.6: Yearly Collision Distribution (2001-2004)

Road Link	Segment Length	2001	2002	2003	2004	Total	AADT (2006)	Collision Rate1
PTH 1 (PTH 1A to 18th St.)	14.6	1	1	0	1	3	4950	0.03
PTH 1 (18th St. to 1st St.)	1.6	0	6	8	4	18	10160	0.76
PTH 1 (1st St. to PR 340)	17.1	63	55	54	50	222	6700	1.33
PTH 1A (PTH 1W to 34th St.)	11.3	19	9	19	12	59	2620	1.36
PTH 1A (34th St. to 18th St.)	1.9	47	45	49	43	184	14250	4.65
PTH 1A (18th St. to PR 457)	4.5	62	64	94	127	347	14600	3.62
PTH 1A (PR 457 to PTH 1E)	2.2	3	7	13	7	30	9350	1.00
PTH 10 (PTH 2 to PTH 110)	19.8	46	42	28	23	139	3800	1.27
PTH 10 (PTH 110 to N of Maryland Ave.)	1.9	89	21	35	35	180	6200	10.47
PTH 10 (N of Maryland Ave. to Victoria Ave.)	2.5	12	64	70	73	219	17200	3.49
PTH 10 (Victoria Ave. to Assiniboine River)	1.9	38	49	55	70	212	20750	3.68
PTH 10 (Assiniboine River to PTH 1)	3.0	19	23	19	36	97	14100	1.57
PTH 10 (PTH 1 to PTH 25)	14.8	19	23	15	17	74	4300	0.80
PTH 10 (PTH 25 to PTH 24)	11.5	15	9	22	20	66	3900	1.01
PTH 10 (PTH 24 to PTH 16)	15.3	20	21	24	15	80	3600	0.99
PTH 16 (PTH 10 to PTH 16A)	2.0	3	3	3	2	11	2700	1.40
PTH 16 (PTH 16A to PTH 5)	26.1	23	26	33	18	100	3200	0.82
PTH 110 (PTH 10 to PR 457)	10.8	4	5	4	5	18	1780	0.64
PTH 110/PR 457 (PTH 110 to PR 468)	3.2	6	6	2	8	22	3560	1.32
PTH 110/PR 468 (PR 457 to PTH 1)	3.2	0	2	0	1	3	1070	0.60
PR 457 (PTH 1A to PTH 110W)	5.1	6	8	13	8	35	1510	3.11
PR 457 (PTH 110E to PR 340)	8.3	10	13	12	9	44	2230	1.63
1st St. (Richmond Ave. to Victoria Ave.)	1.6	17	24	41	26	108	13000	3.56
Richmond Ave. (18th St. to 1st St.)	1.6	17	27	29	36	109	12000	3.89
Richmond Ave. (1st St. to PTH 110)	4.8	20	12	15	6	53	6000	1.26

[1] Collision rate presented as collisions per million vehicles entering the intersection

Intersection Collision Rates

Table 2.7 shows the number of reported collisions within the study area during the years of 2001 through 2004 at each major intersection on the Provincial highway network. The collision rates for intersections are expressed as collisions per million vehicles entering the intersection. Intersections with a total of less than five collisions (higher than one collision per year) over the four-year data period are not included.

MIT considers an intersection with a collision rate of greater than 1.5 collisions per MVE to be in need of further review. None of the intersections had a collision rate exceeding 1.50 incidents per MVE and, thus, none of these intersections warrant further review. It should

be noted that a Safety Review of urban intersections was undertaken under separate cover and is appended to this document.

Table 2.7: Collision Statistics by Intersection (2001-2004)

Intersection	Collisions	Million Vehicles Entering Per Year (Average)	Collision Rate1
PTH 1 / PTH 10 (18th Street)	15	7,654,050	0.49
PTH 1 / PTH 1A (1st Street) / PTH 10	14	8,537,350	0.41
Victoria Ave. (PTH 1A) / 1st Street	40	11,301,130	0.88
1st St. (PTH 1A) / Princess Avenue	12	12,501,250	0.24
1st St. (PTH 1A) / Rosser Avenue	11	13,096,200	0.21
1st St. (PTH 1A) / Kirkaldy Drive (PR 457)	12	11,537,650	0.26
18th St. (PTH 10) / Aberdeen Avenue	16	9,303,850	0.43
18th St. (PTH 10) / Richmond Ave. (PR 610)	74	13,843,355	1.34
18th St. (PTH 10) / Queens Avenue	31	8,245,350	0.94
18th St. (PTH 10) / Brandon Avenue	23	14,742,350	0.39
18th St. (PTH 10) / PTH 1A (Victoria Ave.)	91	15,432,200	1.47
18th St. (PTH 10) / Kirkaldy Drive (PR 459)	22	13,096,200	0.42
PTH 10 / PTH 16	5	3,569,700	0.35
PTH 110 / PR 457W	7	1,737,035	1.01
Richmond Ave. (PR 610) / 13th Street	7	15,910,350	0.11
Richmond Ave. (PR 610) / 9th Street	23	12,501,250	0.46
Richmond Ave. (PR 610) / 1st St.	18	6,373,630	0.71

[1] Collision rate presented as collisions per million vehicles entering the intersection

Table 2.8 shows the number of reported collisions at intersections on the Provincial highway network where there was incomplete traffic data to determine a collision rate for the intersection. These collision statistics are provided for information purposes. Again, it is noted that a Safety Review of urban intersections was undertaken under separate cover. A number of the intersections in table 2.8 are addressed in the Safety Review document.

Table 2.8: Collision Statistics by Intersection (2001-2004)

Intersection	Collisions	Million Vehicles Entering Per Year	Collision Rate
Victoria Ave. (PTH 1A) / 6th Street	21	---[1]	---[2]
Victoria Ave. (PTH 1A) / 8th Street	12	---	---
Victoria Ave. (PTH 1A) / 9th Street	10	---	---
Victoria Ave. (PTH 1A) / 13th Street	17	---	---
Victoria Ave. (PTH 1A) / 26th Street	32	---	---
18th Street (PTH 10) / Parker Boulevard	9	---	---
1st Street (PR 610) / McTavish Avenue	20	---	---

[1, 2] Collision rate could not be calculated due to lack of traffic volume data

2.7.2 Safety Review

A high-level overview of safety issues was also undertaken within the study area as part of the inputs for the ongoing road monitoring program by the City of Brandon. The identification of critical areas of concern and potential remedial measures was also undertaken. A key element of the overview was a review of intersection collision data where available, and a review of selected highway links within the 60-kilometre radius of the study.

Discussions were held with several stakeholders in the Brandon area to get their views and comments on potential safety issues on the road system, including:

- City of Brandon Engineering Staff;
- City of Brandon Transit Staff;
- City of Brandon Police Department;
- Manitoba Infrastructure and Transportation Staff;
- Royal Canadian Mounted Police (RCMP);
- Paul's Hauling; and
- Gardewine North.

The road safety audit involved an assessment of multiple transportation facilities, or roadways, to determine the potential for the geometry and operational features of each

facility to contribute to collisions. The audit was an independent and formal process carried out by road safety engineers who provided opinions, based on experience and expertise, on the safety issues from the perspective of the road user.

The analysis of collision data involved a review of the collision history of multiple facilities to establish collision rates on each facility and to identify possible relationships between those collisions and geometric features or operational conditions of the facility.

The road safety audit was conducted in accordance with traditional safety audit procedures carried out internationally as well as the Transportation Association of Canada's (TAC) "Guide to In-Service Road Safety Reviews". The safety audit focused on the identification of existing and potential road safety concerns on various roads and highways, at major intersections, and at major railroad crossings within the study area.

The audit was field based with day and night time audits conducted during the period May 30 to June 1, 2005. In total, 14 road/highway stretches were included in the road safety audit.

The road safety audit identified a number of geometric and operational safety issues on several roads and highways that have the potential to contribute to collisions. These issues should be addressed through the road improvement / upgrade program to reduce the potential for collisions. Items identified included:

- Short weaving sections;
- Lack of left and right-turn lanes;
- Additional signage and lighting requirements;
- Barrier locations; and
- Sidewalk location/availability.

A collision analysis was carried out at various intersections on the existing road system within the City of Brandon based on collision data provided by MIT. This data included a summary of the number, type, and related statistics of reported collisions. The collision data was examined to determine the frequency, severity and collision rates at 17 intersections from 1996 to 2002. Findings included:

- Frequency refers to the number of collisions per year. Only one of the intersections studied had a collision rate above the MIT threshold of 1.5 collisions per million

vehicles entering (MVE) the intersection (the rate at which an intersection would warrant further examination). The top five locations examined were:

- 18th Street at Victoria Avenue (1.67 collisions per MVE);
- 18th Street at Richmond Avenue (1.35 collisions per MVE);
- 34th Street at Victoria Avenue (1.17 collisions per MVE);
- 18th Street at Park Avenue (1.13 collisions per MVE); and
- 1st Street at Victoria Avenue (1.09 collisions per MVE).

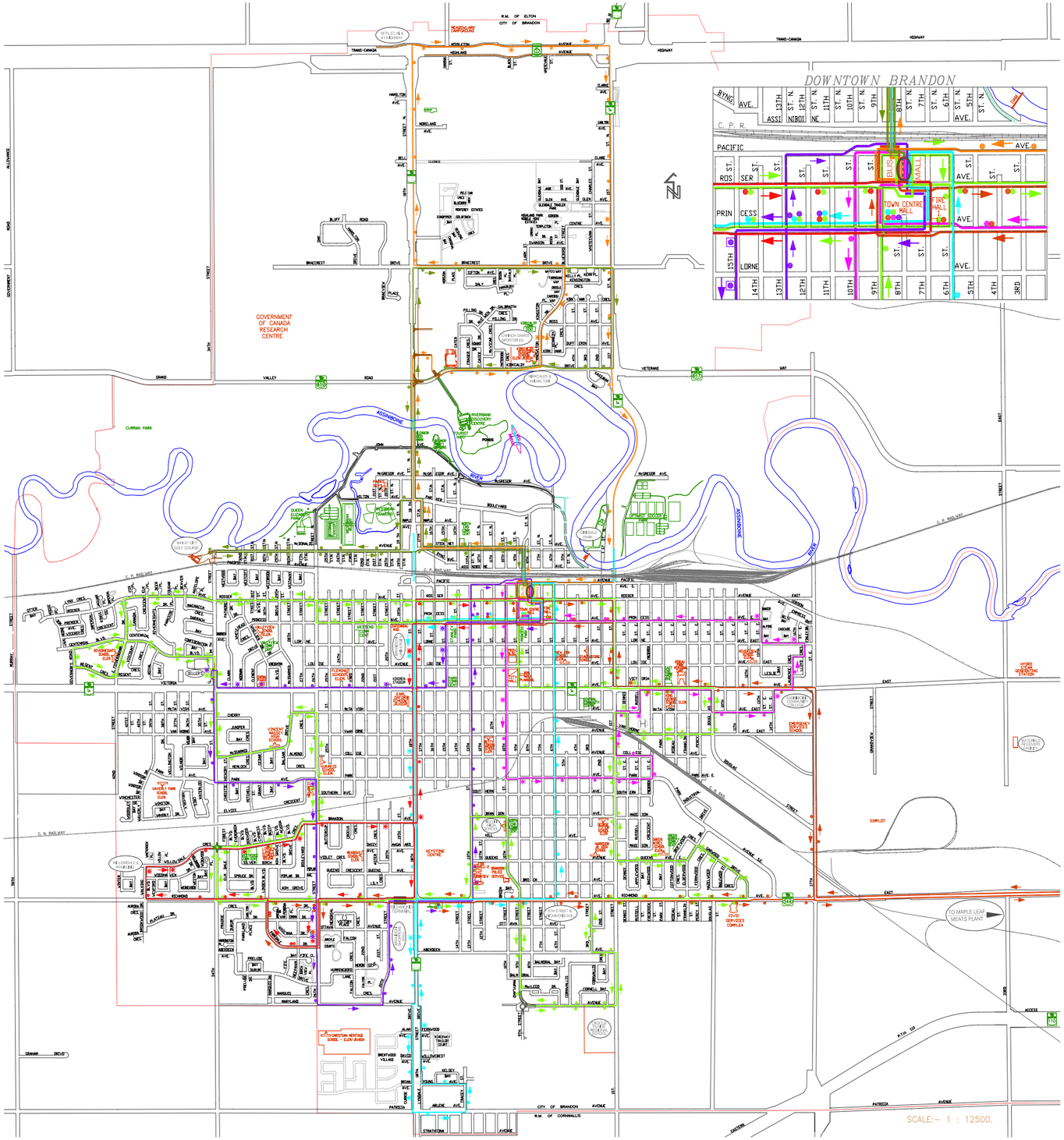
- Severity identifies the type of outcome, such as a fatality, personal injury, or property damage. Comments include:
  - There were no fatalities recorded in the last seven years of data at the intersections examined;
  - 27 percent of collisions involved a personal injury; and
  - 73 percent of collisions involved property damage.
- Time and type of collisions was examined. Comments included:
  - Most collisions occurred on a weekday during the day; and
  - Rear end collisions were the most common (40 percent), followed by left turn with through traffic (20 percent), right angle collisions (20 percent), other (15 percent), side swipes (four percent) and pedestrians (less than two percent).
- Driver error was the primary cause of collisions, with items such as:
  - Driver inattention or distraction;
  - Disobeying traffic control devices;
  - Failing to yield right of way;
  - Following too close; and
  - Driving too fast for travel conditions.

2.8 Brandon Transit

Brandon Transit currently operates 10 transit routes in the City of Brandon, which are illustrated in Figure 2.9. Brandon Transit provides access to major destination points in Brandon, including downtown Brandon, the Keystone Centre, Brandon Shoppers Mall, Brandon Regional Health Centre, Brandon University, Assiniboine Community College, Wheat City Golf Course, Canada Games Sportsplex, Optimist Soccer Park, the Corral Centre and the Maple Leaf Plant.

Historical transit ridership information was obtained from Brandon Transit. Annual ridership for 1994 through 2006 is illustrated in Figure 2.10. Annual transit ridership in Brandon has averaged approximately 780,000 rides per year over the past 13 years. Ridership decreased by almost 12 percent between 2001 and 2003 but increased by an average of over 10 percent between 2004 and 2006.

Monthly ridership for 2003 to 2006 is illustrated in Figure 2.11. Transit ridership in Brandon tends to peak during the winter months due to the weather and community levels of activity, and is lowest during the summer months, typically a reflection of summer vacations and schools being closed.



LEGEND

- Ⓗ - BDN. REGINAL HEALTH CENTRE
- RICHMOND WEST NO. 1:
- KIRKCALDY NO. 3:
- VICTORIA EAST NO. 6:
- REC. CENTRE NO.7:
- 18TH. SOUTH NO. 9:
- CENTRAL BELT NO.10:
- INDUSTRIAL NO. 11-12:
- CITY CIRCULAR: ROUTE 20 & 21-

Manitoba

CITY OF BRANDON MANITOBA

MMM GROUP

Source: City of Brandon

PROJECT TITLE

Brandon Area Road Network Development Plan

FIGURE 2.9:
BRANDON TRANSIT ROUTES

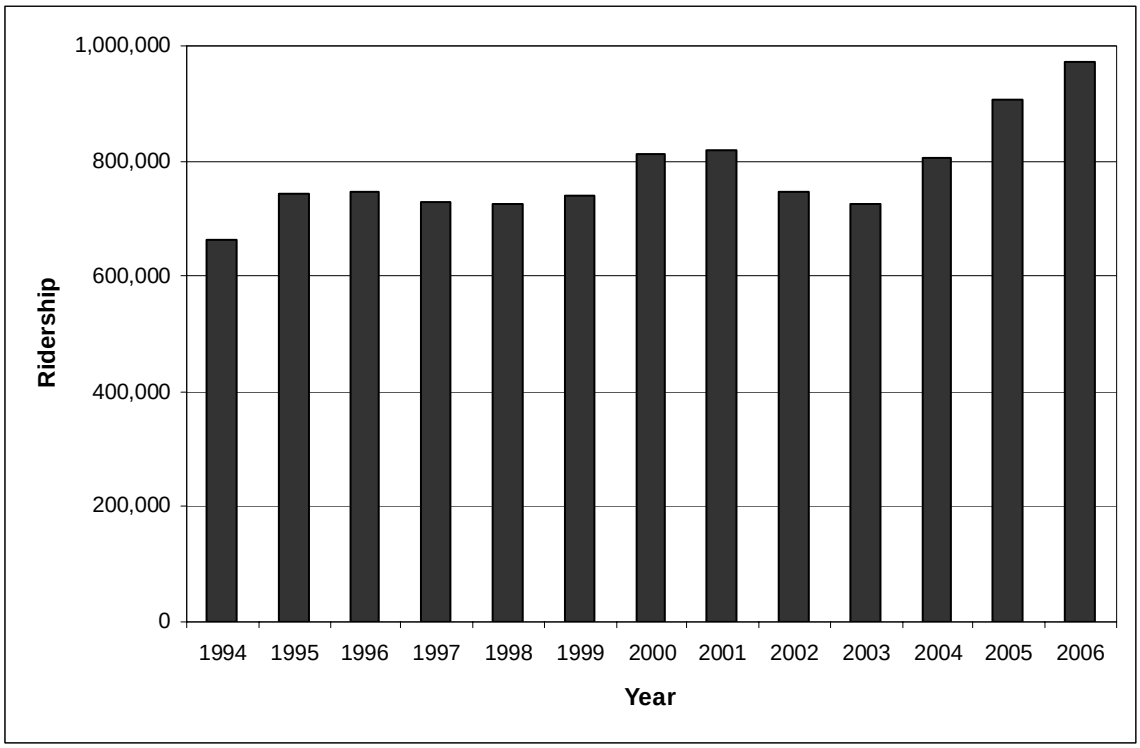


Figure 2.10: Annual Brandon Transit Ridership

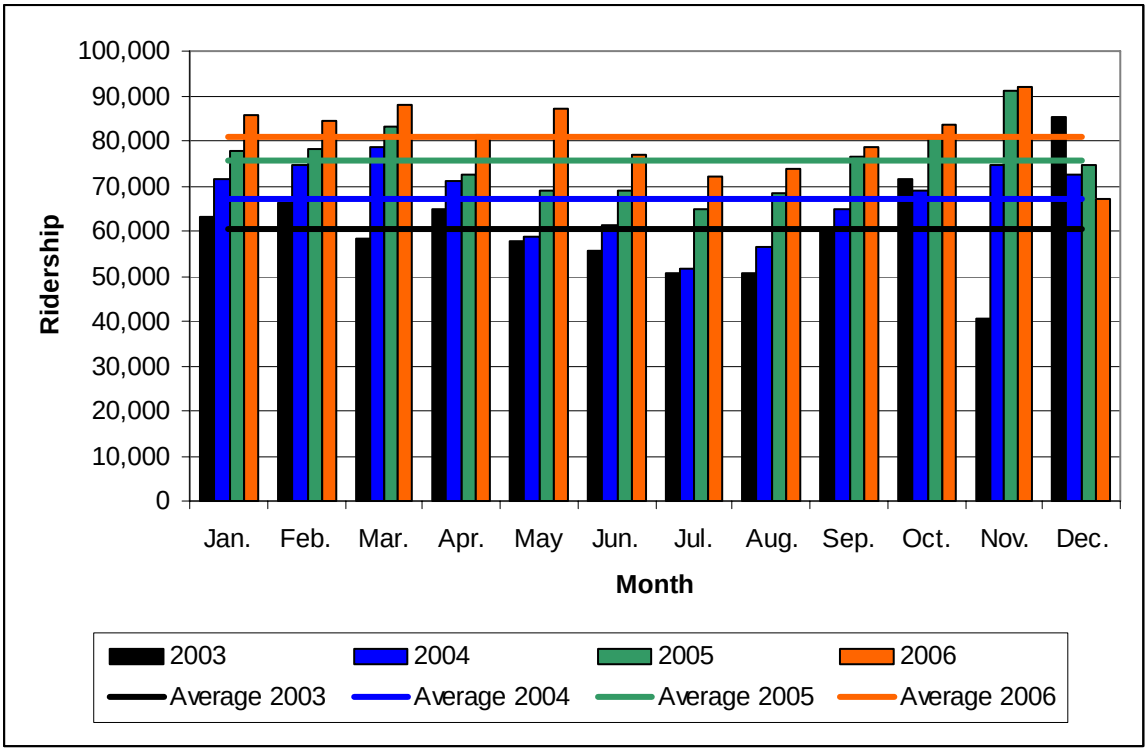


Figure 2.11: Monthly Brandon Transit Ridership

2.9 Brandon and Area Planning District Development Plan

The Brandon and Area Planning District Development Plan (By-law #78/01/04) was revised in 2005. The Brandon and Area Planning District is a partnership between the City of Brandon, the Rural Municipality of Cornwallis and the Rural Municipality of Elton. The Development Plan is a long-range plan to guide development in the District. The Plan sets out objectives and policies that direct development locations and standards.

Section 13.0 of the Plan is focused on Transportation System Policies and includes policies for pedestrian and bicycle systems, public transit, urban roadways, development of roadways, setback requirements, access limitations, parking, loading and services areas, highway protection, designated truck routes, setback from railways, and airport protection in the City of Brandon and the Rural Municipalities of Cornwallis and Elton. Specific objectives of Section 13.0 are [2]:

a) To encourage and promote energy efficiency in all modes of transportation, and to encourage the use of public transit, pedestrian and bicycle systems;

b) To ensure the efficient and logical hierarchy of streets throughout the District, which appropriately serves the adjacent land, uses;

c) To ensure that developments adjacent to provincial highways and urban arterial streets do not adversely affect the safe and efficient movement of traffic; and

d) To provide for a system of truck routes and dangerous goods routes at appropriate locations within the Planning District.

The plan recommends an urban transportation system for the District, including future proposed arterials and collectors, and identifies existing and future paths and trails (as recommended in the Greenspace Master Plan completed in 2002). A copy of the recommended enhancements can be found in Appendix H.

Anticipated development for Brandon during the study horizon is based upon a study of the Brandon and Area Planning District Development Plan as well as discussions with Economic Development Brandon, Provincial and City staff.

Residential development is anticipated to occur in four major areas within the City of Brandon for the 20-year study horizon. These areas located in the north, south, southwest

2 Brandon and Area Planning District Development Plan By-law #78/01/04, August 2005.

and western sections of the City. The northern residential development, as known as the North Hill/Black Property Site, is located in north central Brandon between 1st Street and 18th Street, north of Braecrest Drive and south of the TransCanada Highway. The site is approximately 400 acres in size with about 250 acres designated for residential development. A significant portion of the residential development is anticipated to occur over the next 20 years and is assumed to include 1,200 residential dwelling units. The North Hill/Black Property constitutes the largest single area of residential development since the remaining residential sites within the City are assumed to include approximately 800 dwelling units combined. Therefore, a total of approximately 2,000 residential dwelling units, of varying types, are assumed to come online during the study horizon.

Commercial and industrial growth is anticipated to occur primarily in the northern and southeast sections of Brandon. Commercial development in the order of approximately 150 acres is expected in the North Hill/Black Property development. Commercial development of the North Hill/Black Property is assumed to be a variety of commercial and retail generating approximately 22,300 total daily vehicle trips to and from the site. As well, the former Brandon Mental Health Centre Site is anticipated to be the relocation of the Assiniboine Community College. This relocation, occurring over the next 20 years, was assumed to increase trips to the College by 20 percent to reflect growth of the institution. The forecast transportation planning model also included additional industrial development in southeast Brandon. Two parcels were identified, with total development area of 690 acres.

Brandon officials also anticipate that the inner city area will experience an increase in households, with higher densities occurring. This has also been assumed in the modelling process.

2.10 Origin-Destination Surveys

Origin-destination surveys were conducted to create an origin-destination matrix that can be used in the development of a transportation model. Both a telephone survey and a vehicle intercept survey were conducted as part of the study.

Throughout the telephone and traffic intercept survey, the term “trip” was used to signify a portion of an overall journey that the person may have been making. For example, if the person interviewed traveled from their work to the store and from the store to home, the first trip was taken from their work to the store and the second trip was taken from the store to

their home. Through this method, each stop along the person's overall journey is included in the results. In the case of telephone surveys, a trip was also defined as more than one block from the person's original location.

2.10.1 Telephone Survey

A telephone survey of over 300 Brandon residents was completed in May and June of 2005. The survey included questions on trips taken between 3:30 and 6:00 p.m. the previous day. A copy of the full telephone survey is included under separate cover.

The telephone survey was conducted from a phone list compiled by random selection. Surveyors telephoned numbers from the list and completed interviews from 9:00 a.m. to 9:00 p.m. on Wednesdays, Thursdays and Fridays. The interviewee was a person in the household who was over the age of 16 and had made a trip the previous day between the hours of 3:30 and 6:00 p.m.

The surveyor asked the interviewee about their previous day's trips between the specified hours, as well as general information such as whether they were the driver or passenger, how many people were in the vehicle and the purpose of the trip. If the survey was conducted during the evening (between 6:00 and 9:00 p.m.) the surveyor asked the interviewee about trips made that afternoon. A summary of the telephone survey results is provided below, and the detailed results are included under separate cover.

Although the telephone survey was conducted for residents aged 16 and older, the ages of those surveyed are consistent with 2001 census data obtained for the City of Brandon. In terms of gender, the telephone sampling had a higher percentage of females (57%) than males (43%) due to the time of the surveys and the fact that, as a rule in Manitoba, more females answer the phones than males. The data is accurate within a margin for error of plus or minus five percent, 19 times out of 20.

Using random sampling techniques for the telephone survey, it was anticipated that all 34 zones in Brandon would be appropriately surveyed during the telephone survey (the zone system is discussed in Section 4.2). However, because some zones are industrial, commercial or located on the outskirts of town, there are a number of zones that were not sampled or made up a low percentage of the sampling.

Direct comparisons, with the exception of travel mode, between Statistics Canada information and the results of the telephone survey were not possible due to the differences

between data collection methods and objectives employed during the census and the telephone survey. Information on peak period travel obtained from the phone survey included:

- 69.9 percent of respondents make one to two trips in the peak hour.
- 52.3 percent of travelers are alone in their vehicle during their initial peak hour trip.
- 72.5 percent of initial trips are less than 10 minutes long.
- 89.1 percent of initial trips were made by private vehicle. In comparison, census data for the study area indicates 79 percent of the total employed labour force over the age of 15 utilizes a private vehicle.
- Most reported choosing a travel route because they always used it, followed by it being the shortest route.
- Most trips were for business/work or pleasure/personal business.

2.10.2 Traffic Intercept Survey

A traffic intercept survey was conducted in Brandon over a period of four days (Wednesdays and Thursdays) in July 2005. Vehicles were randomly flagged down between 3:30 and 6:00 p.m., the interview was completed and the driver continued on. Vehicles were stopped and drivers interviewed at five different locations, as indicated below and illustrated in Figure 2.12:

- Northbound vehicles on PTH 10 (18th Street) south of Trans Canada Highway 1,
- Southbound vehicles on Highway 1A (1st Street North) south of Trans Canada Highway 1,
- Westbound vehicles on PR 344 (Richmond Avenue East) west of 17th Avenue East,
- Southbound vehicles on PTH 10 (18th Street) south of PTH 110 By-pass, and
- Westbound vehicles on Highway 1A (Victoria Avenue) west of the Brandon city limits.

A total of 364 surveys were completed over the four-day survey period. On each day, two surveyors and one supervisor were present at two of the five locations. Three locations were surveyed twice and the remaining two locations were surveyed once. The three locations that were surveyed over two days have the three highest daily traffic volumes of

the count locations. A summary of the traffic intercept survey results is provided below, and the detailed results are included under separate cover.

The one-way traffic volumes recorded between 3:30 and 6:00 p.m. at each of the survey locations are listed below in Table 2.9.

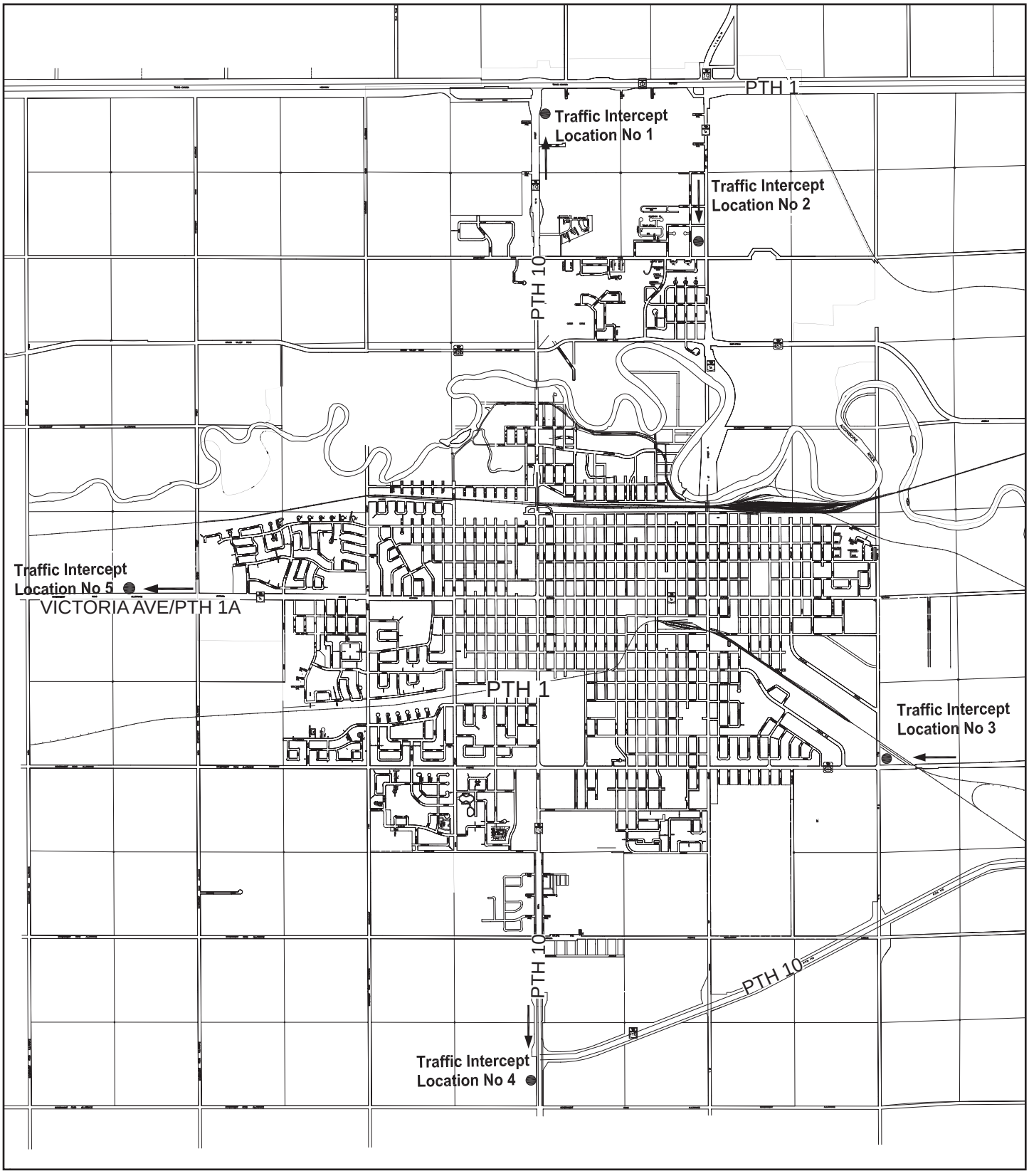


FIGURE 2.12:
TRAFFIC INTERCEPT SURVEY LOCATIONS

Table 2.9: Traffic Volumes Recorded During the Survey Period (3:30 to 6:00 p.m.)

Survey Location	Wednesday, July 6, 2005	Thursday, July 7, 2005	Wednesday, July 13, 2005	Thursday, July 14, 2005
PTH 10 Northbound	--	1,067 vehicles	--	1,050 vehicles
Highway 1A Southbound	--	--	875 vehicles	948 vehicles
PR 344 Westbound	555 vehicles	--	--	--
PTH 10 Southbound	694 vehicles	--	753 vehicles	--
Highway 1A Westbound	--	591 vehicles	--	--

Some of the information on peak period travel obtained from the traffic intercept survey included:

- Most people travel alone in their vehicle.
- Most trips were for business/work or pleasure/personal business.
- The most commonly reported street travelled was 18th Street, followed by 1st Street, Victoria Avenue, and Richmond Avenue (two-thirds of responded noted using at least one of these streets).
- The three most common destinations included the zones in the vicinity of Brandon Shoppers Mall, the Corral Centre, and Superstore.

The results of the traffic intercept survey do not accurately represent the ratio of large trucks that passed each survey location. This is partially due to space limitations at the survey locations. For example, at the PTH 10 northbound survey location, vehicles were directed into an abandoned parking lot in order to complete the survey, however; the turns were tight and trucks had difficulties manoeuvring in and out of the lot. Trucks were sampled at all locations in order to gather some data from the drivers, but the number of trucks sampled should not be used to determine the total number of trucks. This is particularly true at the PR 344 westbound survey locations where there is very heavy truck traffic due to the industrial nature of the adjacent areas.

The survey data accurately reflects the movement of vehicles within Brandon for the hours under research. The survey results represent the driving habits of citizens who travel during the specified times and at the survey locations.

3.0 PUBLIC PARTICIPATION

Public consultation was undertaken in order to allow affected stakeholders the opportunity to provide commentary regarding the direction of the study. Consultation with the public included residents, MLA's, and local municipal and provincial politicians. The process included a project website, two public open houses, two workshops and a public display.

3.1 Project Website

Information about the Brandon Area Road Network Development Plan was available on a project website. The website was hosted by MMM and links to the site were available from the City's website, the MIT website, and the MMM website. Information posted included a summary of the project and material used at the public consultation sessions, along with results.

The City monitored activity on the website (monitoring was unavailable for visitations through the MIT website link for those who directly entered via MMM's website) from March 2006 to the conclusion of the project. Site visits via the City link ranged from nine to 46 "hits" per week, averaging 22. A total of 754 hits were recorded for the 34 weeks the site hits were monitored by the City. Peak visitation occurred after the public displays at Brandon Shoppers Mall and City Hall, suggesting that the public displays were an effective method of providing information to the public.

3.2 Public Open House

An Open House was held in Brandon on June 22, 2005 at the Royal Oak Inn. Approximately 26 people attended, including local staff. The Open House was advertised in the Wheat City Journal and the Brandon Sun. In addition, direct invitations were sent to 75 stakeholders including neighbouring municipalities, MLA's, and residents who had previously indicated their interest in transportation issues.

Participants at the Open House had the opportunity to review information including the study objectives, existing and future transportation networks, and existing and future land use maps. Staff from MIT, the City of Brandon, and the consultant team was available to answer questions. A mapping exercise was conducted that allowed participants to place a dot and comment directly on a map at locations of particular interest to them

(see Appendix B). A comment sheet was provided to obtain feedback from participants on their transportation concerns both inside and outside the City of Brandon. Six comment sheets were completed; four Brandon residents, one RM of Cornwallis resident, and one RM of Wallace resident.

Participants were asked to identify the main existing and future transportation issues within the City of Brandon. The issues identified centered on increased traffic volumes and congestion on arterial routes such as 18th Street, Victoria Avenue and Richmond Avenue. The need for more public transit on 18th Street was also noted.

Participants were also asked to identify specific locations with existing transportation issues within the City of Brandon. Several intersections were identified, including 18th and Richmond, 1st and Richmond, 17th and Richmond Avenue, 18th and Kirkcaldy, and 18th and Braecrest. Lack of traffic control on Richmond East past 1st Street and sequencing of traffic signals along major routes such as Victoria Avenue, Aberdeen Avenue, 18th Street and downtown streets was also mentioned.

Participants were then asked to identify the main existing and future transportation issues in the area within a 60-kilometre radius of the City of Brandon. Safety issues at the intersection of PR 468 and PR 457 were identified, as well as heavy traffic volumes on PTH 1A west of Brandon, to and from Shilo during commute times, and along Victoria and Richmond to and from the Maple Leaf plant. Traffic volumes, access and intersections along PTH 110 and PTH 1 (Trans Canada Highway) were identified as concerns. In addition, the overall quality and condition of the Provincial Highway Network was identified as a concern. The lack of scheduled air service at Brandon Airport was also identified as a concern.

Participants were also asked to identify specific locations with existing transportation issues in the area within a 60-kilometre radius of the City of Brandon. The intersection of PTH 1 (Trans Canada Highway) and PTH 34 at Austin (outside study area) was identified as having safety issues. It was suggested that PTH 10 from Brandon to Riding Mountain Park should be upgraded to a four-lane divided facility.

Additional comments from the participants were solicited regarding other areas of interest or concern. Comments included support for long range planning such as 18th Street and Eastern By-pass upgrades, the desire to have traffic signal sequencing on major routes throughout the City, and the lack of scheduled air service for Brandon.

3.3 Public Workshop

A Public Workshop was held in Brandon on Wednesday, October 26, 2005. The Workshop attracted a total of 35 attendees plus 10 Consultant and Steering Committee team members. Just over a third of the attendees also attended the Public Open House held in June 2005. Several local municipal and provincial politicians participated in the Workshop. Three quarters of attendees were from Brandon, with the balance from six area towns and RM's. All attendees reported that they found the Workshop useful and educational. Approximately 80 percent of participants noted that they attended the Public Workshop due to the direct invitation and eight percent attended due to a media advertisement.

Participants were asked to identify areas of the transportation network within the study area that they felt were "working well" or "not working well" with respect to efficiency, safety, environment, condition of roads, traffic and intersection capacity, and alternative transportation. Areas that a number of the participants felt fell under the category of "working well" included:

- Efficiency: Installation of traffic circles and roundabouts; actuated left-turning signals; intersection of 18th Street and Victoria Avenue and twinning of PTH 1 and completion of Eastern By-pass.
- Safety: Advanced warning signals and signing of City streets.
- Alternative Transportation: Transit system and multi-use pathways.

Areas that a number of the participants felt fell under the category of "not working well" included:

- Efficiency: Lack of signal synchronization.
- Safety: Interference of traffic on Lori Road (Braecrest Drive east of 1st Street) with dangerous goods movement. Pedestrian and traffic conflicts at various intersections such as 34th Street and Victoria Avenue, 34th Street and Rosser Avenue and 1st Street and Victoria Avenue due to geometry.
- Condition of roads: Lack of funding.
- Traffic and intersection capacity: Design, congestion and safety of bridges on 18th Street and access and access management on 18th Street.

- Alternative Transportation: Bus service to Monterey Estates.

The workshop participants were also asked to propose solutions or actions that would achieve the goal of a transportation network within the study area with respect to the above-mentioned categories. A summary of the proposed solutions or actions and their respective impacts can be found in Appendix B. Solutions or actions drawing the most recommendation included:

- Synchronization of traffic signals and use of current technologies impacting efficiency and the environment.
- Construction of Western By-pass in the southwest part of the City of Brandon.
- Completion of PTH 110 (Eastern By-pass) to improve efficiency, safety and traffic and intersection capacity.
- Paving of PR 340 from Shilo to Wawanesa.
- Reconstruct intersection of PTH 1 and PTH 5 to accommodate truck traffic turning for the Midwest Plant at Carberry impacting traffic and intersection capacity.
- Enforce regulations regarding designated trucking routes, livestock trucks are impacting the environment.

3.4 Public Display

A public display was set up at the Brandon Shoppers Mall from Friday, February 3, 2006 through Tuesday, February 7, 2006. The display consisted of two summary boards describing the project as well as two information booklets for people to review. Comment sheets were provided for people to fill out and deposit at the display or send in later. Team staff members were available to provide information and answer questions at the Shoppers Mall display on Friday evening, Saturday morning, Monday evening, and Tuesday morning.

Once the display was removed from the Shoppers Mall, it was set up in the lobby of City Hall for a two-week period from Thursday, February 9, 2006 through Thursday, February 23, 2006.

A total of 17 comment sheets were completed through the public displays. The majority (94 percent) of participants were from within the City of Brandon with one respondent from a neighbouring municipality.

Respondents were asked, "What are the major transportation problems within the City of Brandon?" Access, pedestrian accommodation, safety, public transit and speed were the most frequent responses. As well, participants were afforded the opportunity to include detailed problems within the City and these were noted as the poor condition of the roadways and congestion on the bridges. Further, participants were asked to list any particular locations within Brandon that they felt have transportation issues. The most frequently listed locations were 18th Street North, the 18th Street Bridge and the Corral Centre access entering/exiting 18th Street.

The questionnaire asked participants to name the main transportation problems outside of the City but within the 60-kilometre study area. The main areas of concern were safety, speed and goods movement. Participants were also asked to list any particular locations within the study area outside of Brandon that they felt have transportation issues. The most frequent suggestion was to upgrade PTH 10 to a four-lane divided facility north and south of Brandon.

3.5 Stakeholder Workshop

The second workshop was held in May 2006 and attendance was approximately 25 people. Topic stations facilitated by project team members allowed participants to provide input on four topic areas including: Alternative Transportation Modes, Goods Movements, Traffic and Access Management, and Future Road Networks. Presentation boards including the results of previous consultation sessions, surveys, and research were available for review prior to the workshop. Materials related to the topic areas under discussion at this event were also provided.

The evening started with a presentation including background information on the four topic areas to help educate participants and to assist facilitators in guiding the group discussions. Participants were able to take part in three of the four group discussions. In addition to roundtable discussions, participants also had the opportunity to complete a survey sheet with additional comments. The most frequent proposed actions with respect to each of the four topic areas were:

- Alternative Transportation: Ensure access for disabled persons on transit buses; provide pick-up and drop-off locations for taxis at venues such as the Corral Centre or Clinic and ensure that development accommodates transit and all transportation forms are included in master plan.

- Goods Movement: Relocate all rail outside of City to near the airport, which would also remove rail transport of dangerous goods; ensure more efficient use of rail lines; complete Eastern and Western By-passes and consider outside economics such as the Western By-pass to accommodate potash development at St. Lazare.

- Access and Traffic Management: Improve signal synchronization and install speed humps and the required advisory signage.

- Future Roadway Needs: Complete the Eastern and Western By-pass routes while closing 1st Street, 18th Street, Victoria Avenue and Richmond Avenue to heavy truck traffic.

3.6 Final Open House

A final Open House was held in Brandon on April 3, 2007 in the lobby of City Hall in Brandon. Approximately 25 people attended, including local staff. The Open House was advertised in the Community Edition of the Brandon Sun. In addition, direct invitations were sent to 175 stakeholders including neighbouring municipalities, MLA's, and residents who had previously indicated their interest in transportation issues.

Participants at the Open House had the opportunity to review information including the study objectives, process, and recommendations. Staff from MIT, the City of Brandon, and the consultant team was available to answer questions. A presentation was held to describe the study process, objectives and recommendations as well as afford participants an open forum for discussion.

A mapping exercise was conducted that allowed participants to place a colour coded dot directly on a map showing the infrastructure investments recommended by the study. Participants were asked to prioritize the recommended projects into short, mid and long-term categories. The Open House participants categorized the recommended upgrades provided by the study as follows:

- Short-term priorities:

- Completion of the Eastern By-pass.
- Upgrading of 18th Street North, from PTH 1 to Kirkcaldy Drive, to a four lane divided roadway.
- Intersection reviews at 13th Street and Park Avenue, 1st Street and Richmond Avenue and 17th Street East and Richmond Avenue.

- Mid-term priorities:
  - Upgrading of PTH 10, from Brandon to Minnedosa, to a four lane divided roadway.
  - Upgrading of 1st Street North, from PTH 1 to Kirkcaldy Drive, to a four lane divided roadway.
  - Upgrading of Victoria Avenue, from 34th Street to PTH 1 at Kemnay, to a four lane divided roadway.
  - Improvements to PR 340 east of Brandon

- Long-term priorities:
  - Construction of the Western By-pass
  - Upgrading of PTH 10, south of Brandon, to a four lane divided roadway.

A comment sheet was provided to obtain feedback from participants regarding the preliminary recommendations of the study as well as recommend additional projects believed to be necessary within the study area. Four comment sheets were completed; three Brandon residents and one RM of Cornwallis resident.

Participants were asked to share their thoughts regarding the preliminary recommendations of the study presented at the Open House. Respondents stated that the study was a valid, necessary exercise and a positive effect on Handi-Transit has already been seen.

Participants were also asked to state their agreement or disagreement with any particular recommendations of the study as well as make note of any additional recommendations or projects not listed; none were noted in either case.

Additional comments solicited from the Open House participants included positive reinforcement of the study and its objectives as well as the desire to see the completion of the Eastern By-pass as a top priority, traffic signal controls at the intersection of 13th Street and Park Avenue and a timely completion of the study in order to commence the recommended projects.

3.7 Presentation to Council

In conjunction with the final open house, a presentation to Council on the report's findings and recommendations was presented on October 23, 2007. Councilors were given the opportunity to make comments and request clarifications prior to completing the final report.

4.0 TRANSPORTATION MODEL

Long-range transportation planning studies typically forecast traffic volumes for a 20-year horizon period. In the case of an examination of a small area, manual forecasts may be used, however, when examining a larger area such as a citywide study and beyond, computer-based transportation planning models are generally used. This allows the study team to examine what-if scenarios more readily and provides a base condition that can then be used by the road authority in the future to update traffic forecasts. One of the requirements for this study was to develop such a model; information on the modelling process and outcome are provided in this section.

4.1 GIS Road Network

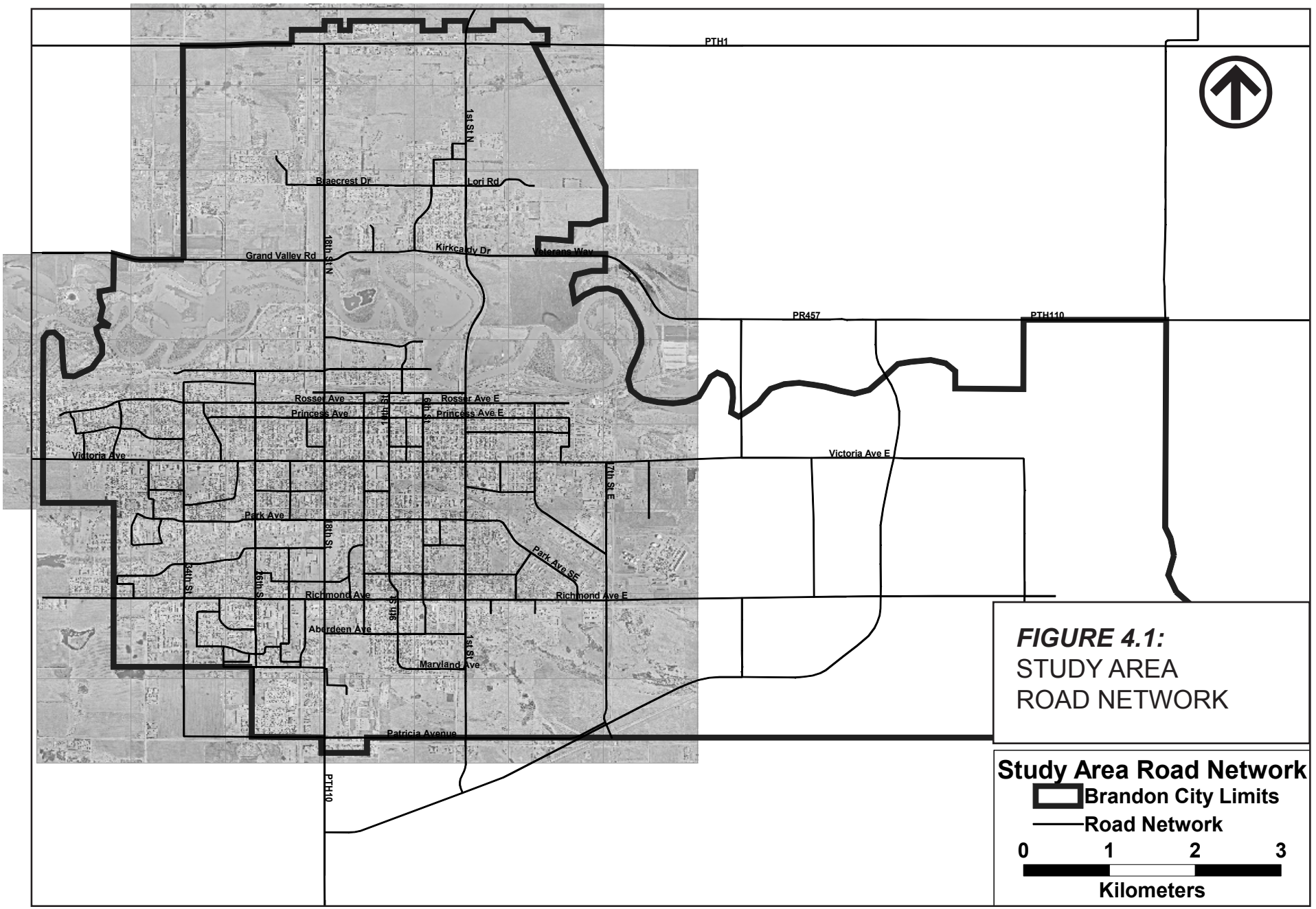
TransCAD Transportation GIS Software was the software used in the development of the road network model. TransCAD Version 4.7 is a geographic information system (GIS) designed for planning, managing, and analyzing the characteristics of transportation systems.

A GIS file of the City of Brandon and surrounding area road network was obtained from MIT. Citywide models often focus on arterial and higher-level roadways only. For the purpose of this project the GIS road network was extended to collector and higher-level roadways; some local roads were included as 'connector' links, which assisted in modelling traffic movements. In conjunction with the Steering Committee, the GIS road network was updated to include accurate road attributes such as speed limits, road condition, surface type, classification etc. For the model, the study area road network, illustrated in Figure 4.1, focused on the portion within the City of Brandon. External network links and zones are included to address trips in/out/through Brandon on the provincial road network; however, these do not extend to the entire 60 kilometre study radius, in part due to a lack of origin-destination information for the various communities within the 60 kilometre radius.

4.2 Zone System

A zone system was developed in conjunction with the Steering Committee for the transportation model and is illustrated in Figure 4.2. The zone system consists of 41 geographic areas defined by common land uses such as agriculture, residential, retail and

commercial areas and separated by “natural boundaries” such as rives, expressways, arterials, and rail lines. An additional seven nodes surround the City of Brandon and act as external zones for vehicles entering, exiting, or passing by/through Brandon on the Provincial highway system. Each zone has its own centroid for which all production and attraction data pertaining to that zone originates.


PTH1
1st St N
Braecrest Dr
Lori Rd
18th St N
Grand Valley Rd
Kirkcaldy Dr
Veterans Way
PR457
PTH110
Rosser Ave
Rosser Ave E
Princess Ave
Princess Ave E
10th St
13th St
Victoria Ave
Victoria Ave E
17th St E
Park Ave
18th St
Park Ave SE
24th St
19th St
Richmond Ave
Richmond Ave E
9th St
Aberdeen Ave
1st St
Maryland Ave
Patricia Avenue
PTH10
FIGURE 4.1:
STUDY AREA
ROAD NETWORK
Study Area Road Network
Brandon City Limits
Road Network
0 1 2 3
Kilometers

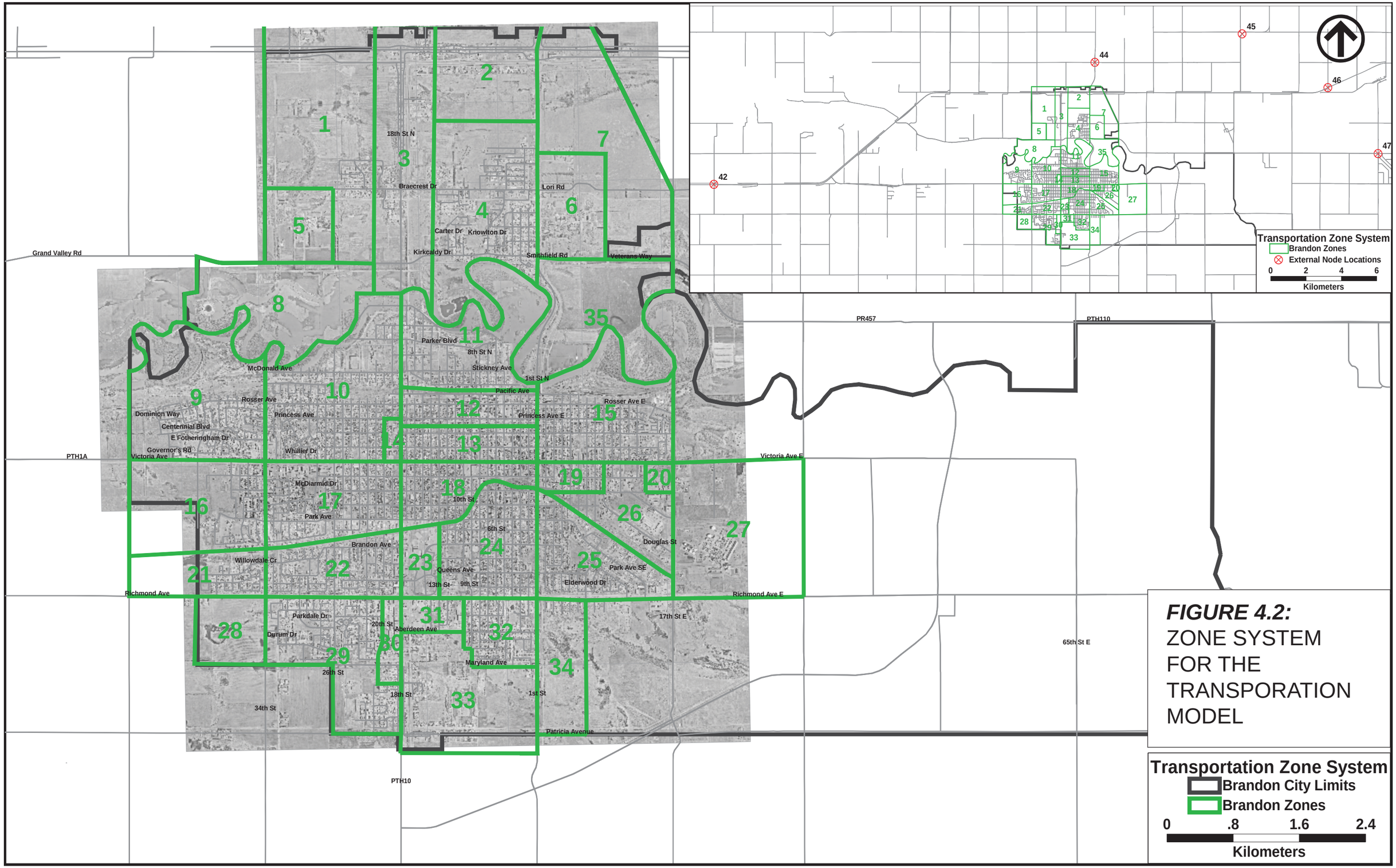


FIGURE 4.2:
ZONE SYSTEM FOR THE TRANSPORATION MODEL

4.3 Transportation Modeling Process

The Brandon and Area transportation forecast/assignment model followed a sequential three-step procedure. Land use and division of the study region into zones determined the foundation of the model. The three steps of the forecasting model are:

- Trip generation, which estimates the volume and location of vehicular trips originating or destined to each of the transportation zones. Vehicular trip generation is comprised of two components; trip production and trip attraction. Trip generation is a function of land uses, household demographics and other socio-economic factors.

- Trip distribution, which matches origins with destinations using a gravity model to forecast balanced productions and attractions at each zone. In addition to the gravity model, a friction factor matrix was employed to model between zone origin and destination.

- Traffic assignment, which represents the key element in the travel demand forecasting process as it predicts the flows of vehicles along each of the roadways within the street network.

Detailed information regarding each step of the forecasting model can be found in Appendix C. The modelling process included current year assignments and related peak hour level of service on road links (required for calibration purposes) as well as 20 year forecast volume assignments for the peak hours based on the existing road network and proposed roadway changes.

4.4 Horizon Year Trip Assignment

4.4.1 Development Trends

A 20-year horizon for the road network model was used based on the study terms of reference. Brandon and Area development assumptions for the road network model were derived from a study of the Brandon and Area Planning District Development Plan, Year 2005. Reference Maps 6a-6d “Residential Priority Infill Areas” [4], as well as discussions with Economic Development Brandon, and Provincial and City staff formed the basis for

determining the locations of development and redevelopment in Brandon over the next 20 years.

Single Family Residential, Duplex, Multi-Family and Mobile Home construction data provided by the Brandon and Area Planning District was analyzed to estimate the expected yearly growth of dwelling units within Brandon [5]. Table C.3, attached in Appendix C, summarizes historical building trends within Brandon and formed the basis for estimating total residential development for the 20-year horizon.

4.4.2 20-Year Development Assumptions

4.4.2.1 Residential Infill Areas

Reference maps identifying "Residential Priority Infill Areas" published in the Brandon and Area Planning District Plan, Year 2005, were the primary source for identifying locations of residential infill growth for the 20-year horizon period [5]. Using historically averaged single family residential building permit issuance rate of approximately 78 per year, it is expected that approximately 1,560 new single family residential units will come online over the next 20 years (approximately 40 percent of all expected new dwelling units). Using the current residential land density of 5 units per acre, and assuming a split of dwelling unit types (single family, duplex, multifamily, mobile home), approximately 2,000 dwelling units were estimated to occupy the infill areas noted in the Brandon and Area Development Plan were noted and are displayed in Figure 4.3. Detailed infill assumptions can be found for each of the proposed development areas in Appendix C.

RESIDENTIAL (250 ac)/
COMMERCIAL/RETAIL (150 ac)–
NORTH HILL BLACK
PROPERTIES

FORMER
BMHC
MENTAL
HEALTH
CENTRE
159 ac

FUTURE
RESIDENTIAL
120 ac

18TH STREET

GRAND VALLEY ROAD

KIRKCALDY DRIVE

ROSSER AVENUE

1ST STREET

DWELLING UNIT/
POTENTIAL LAND
INFILL
609 ac

VICTORIA AVENUE

RESIDENTIAL
43 ac

RESIDENTIAL
52 ac

RESIDENTIAL
16 ac

34TH STREET

RICHMOND AVENUE

RESIDENTIAL
52 ac

21 ac
RESIDENTIAL

26TH

RESIDENTIAL

76 ac

42 ac

RESIDENTIAL
150 ac

LOCATION
OF
INDUSTRIAL
GROWTH
310 ac

LOCATION
OF
INDUSTRIAL
GROWTH
380 ac

FIGURE 4.3:
FORECAST AREA DEVELOPMENT
(AREAS BASED ON THE BADP DEVELOPMENT PLAN)

Brandon City Limits

Development Areas

0 .3 .7 1.0 1.3 1.7
Kilometres

4.4.3 Horizon Year Traffic Assignment without Road Improvements

The Brandon and Area Road network model was updated using the development assumptions listed in Appendix C and the traffic reassigned to include expected traffic and development growth throughout the network. No road network or road capacity improvements were made in this model, as the objective was to identify trends and locations of future traffic congestion in order to identify locations of possible road improvements.

Daily forecast 2026 traffic assignments (combined existing and expected growth) throughout the Brandon and Area road network are based on the existing road network assuming no road or lane capacity improvements are made over the 20-year timeframe. Figures attached in Appendix C, illustrate the a.m. and p.m. peak hour daily forecast 2026 traffic assignments (combined existing and expected growth) throughout the Brandon and Area road network.

Figures illustrating: 1) the a.m. and p.m. peak hour volume/capacity (V/C) ratios and expected level of service for road links within the study area with forecast traffic volumes, and 2) the existing roadway network and link capacities for forecast Year 2026 traffic for the a.m. and p.m. peak hour periods can be found in Appendix C.

4.4.4 List of 20-Year Road Network Improvements

The comparison between the level of service for the current year (2006) and forecast year (2026) shows clearly that roadway modifications are required in Brandon to accommodate anticipated traffic growth.

A number of road network improvements were identified for inclusion in the Year 2026 traffic assignment model based on the results of the Year 2026 traffic assignment without any changes from the current road system, and through discussions with the Steering Committee. The road network improvements included in the “with improvements” scenario include:

- Construction of the remainder of PTH 110 (Brandon Eastern Access) and its connection to PTH 1,

- Decommissioning of Provincial Road 468 (currently connecting Brandon By-pass to the Trans-Canada Highway) as the designated By-pass linkage at the east end of the roadway,
- Upgrade Victoria Avenue West of 34th Street to a four lane divided roadway to PTH 1,
- Upgrade 1st Street from PTH 1 to Rosser Avenue and from the Brandon By-pass to Richmond Avenue East to a four lane divided roadway,
- Upgrade 18th Street from PTH 110 (Brandon Eastern Access) to Aberdeen Avenue to a four lane divided roadway,
- Upgrade all of 18th Street as a four lane divided roadway,
- Upgrade Richmond Avenue as a four lane undivided roadway from 34th Street to 26th Street,
- Upgrade 34th Street to a four lane undivided roadway from Park Avenue to Richmond Avenue,
- Extend Maryland Avenue to 34th Street as a two lane undivided roadway,
- Construction of Clare Avenue on the North Hill – two lanes undivided, and
- Upgrade PTH 10 from PTH 1 to Minnedosa and from Aberdeen Avenue to PTH 2 (south junction) to a four lane divided roadway.

Further, a separate long-range plan to upgrade PTH 1 to an expressway/core route standard was completed in 2002. The recommended design solution involves the construction of Parclo AB interchanges at relocated intersections 18th Street (west junction PTH 10) and 1st Street (east junction PTH 10) as well as the reconstruction of approximately five kilometres of PTH 1.

4.4.5 Traffic Assignment Results

The Brandon and Area Road network model was updated to include likely roadway upgrades and the resultant increase in vehicular capacity. The Year 2026 forecast land use

development was reassigned and examined to identify how the road link upgrades would modify and change traffic patterns throughout the road network.

The forecast 20-year traffic assignments for 24-hour volumes, and forecast 20-year a.m. and p.m. peak hour traffic assignments can be found in Appendix C.

Figure 4.4 illustrates the p.m. peak hour V/C ratios and expected level of service for road links within the study area with forecast traffic but without anticipated improvements to the road network and associated link capacities. Conversely, Figure 4.5 illustrates the p.m. peak hour V/C ratios and expected level of service for road links within the study area with forecast traffic and anticipated improvements to the road network and associated link capacities. Detailed expected V/C ratios and LOS (Year 2026) maps for the a.m. and p.m. peak hour periods can be found in Appendix C.

The analysis with the assumed road upgrades reduces the number of links at or over capacity, especially along 1st and 18th Streets and along PTH 1. A level of service of D is considered acceptable for peak hour conditions in urban areas as attaining a level of service of C can be cost prohibitive. Generally, road links in Figure 4.5, which are at a LOS of E or F (and in some cases D), are typically experiencing higher traffic volumes within the model due to their designation as zone connectors. The road links at or below a level of service E are:

- Rosser Avenue between 1st Street and Douglas Street,
- Princess Avenue between 1st Street and Douglas Street,
- Douglas Street between Lorne Avenue and Rosser Avenue,
- 34th Street between Aberdeen Avenue and Richmond Avenue,
- 26th Street between Rosser Avenue and McDonald Avenue, and
- McDonald Avenue between 26th Street and 18th Street.

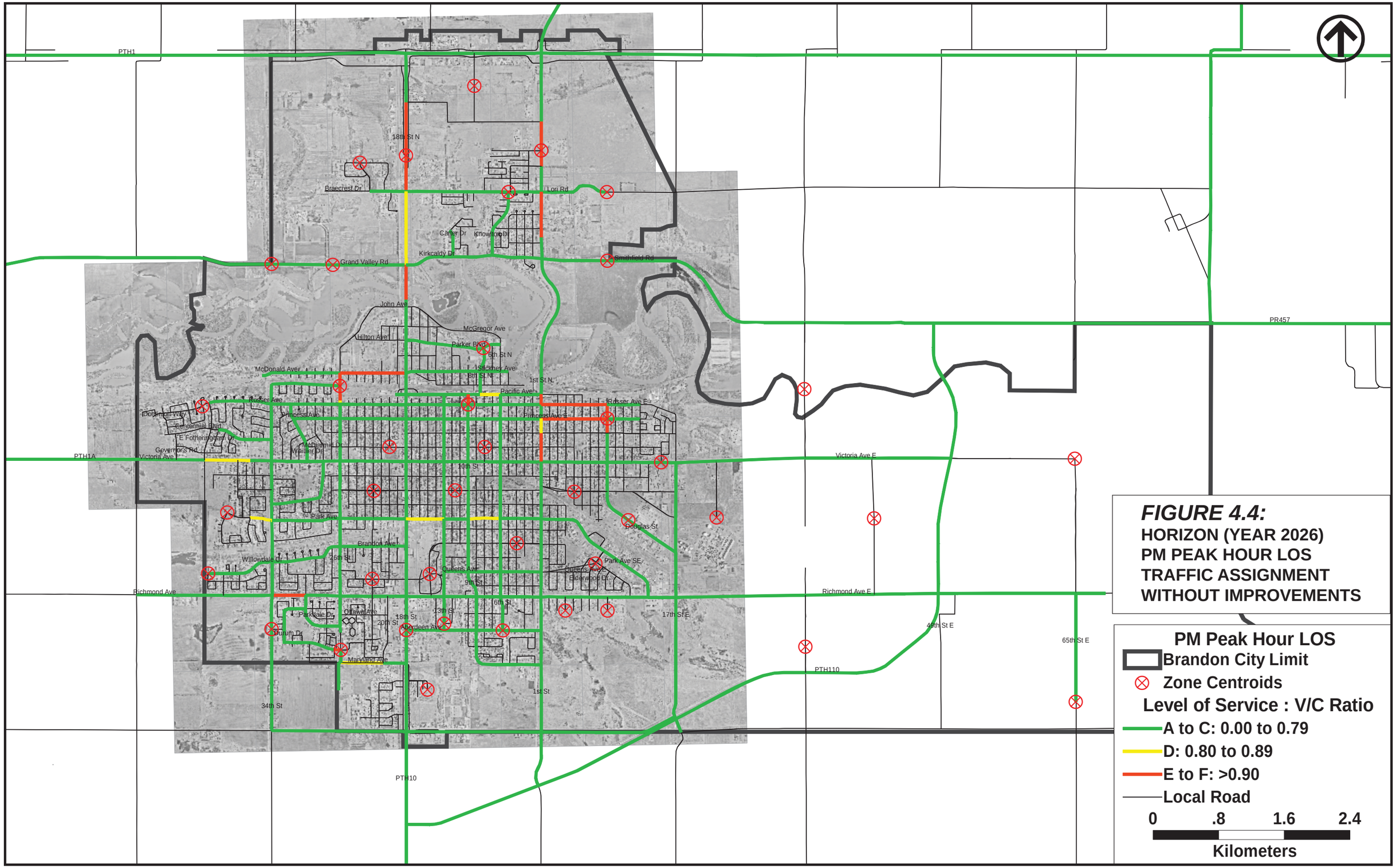


FIGURE 4.4:
HORIZON (YEAR 2026)
PM PEAK HOUR LOS
TRAFFIC ASSIGNMENT
WITHOUT IMPROVEMENTS

PM Peak Hour LOS

- Brandon City Limit
- Zone Centroids

Level of Service : V/C Ratio

- A to C: 0.00 to 0.79
- D: 0.80 to 0.89
- E to F: >0.90
- Local Road

0 .8 1.6 2.4

Kilometers

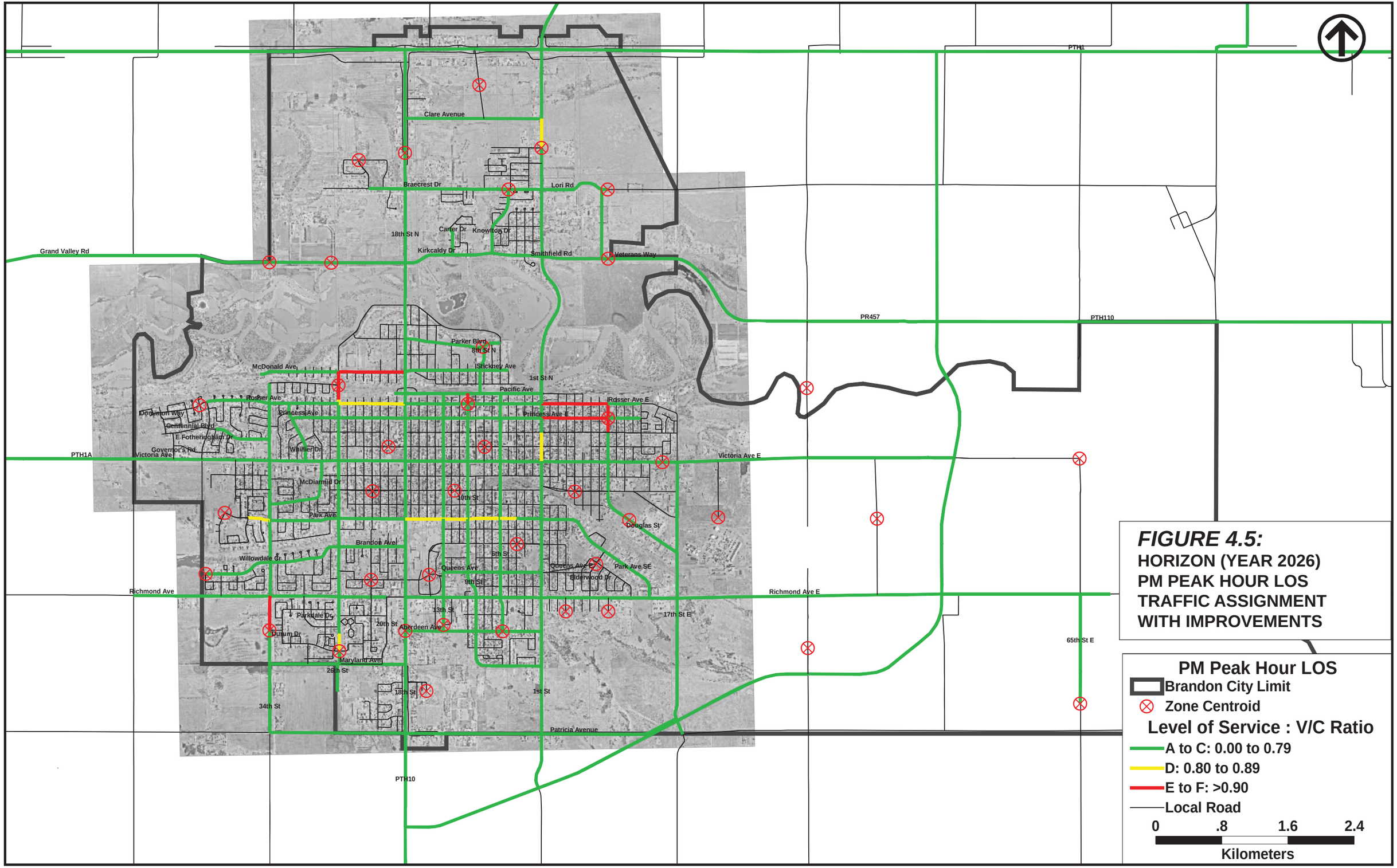


FIGURE 4.5:
HORIZON (YEAR 2026) PM PEAK HOUR LOS TRAFFIC ASSIGNMENT WITH IMPROVEMENTS

PM Peak Hour LOS

- Brandon City Limit
- Zone Centroid

Level of Service : V/C Ratio

- A to C: 0.00 to 0.79
- D: 0.80 to 0.89
- E to F: >0.90
- Local Road

0 .8 1.6 2.4

Kilometers

4.5 Scenario Comparison

The three traffic assignment scenarios (existing conditions, Year 2026 land use without changes to the road system, and Year 2026 land use with changes to the road system) were compared under p.m. peak hour traffic assignments in terms of vehicle-kilometres travelled (VKT), average travel speed (km/hr), total vehicle-hours of travel, and percent of road links at various LOS values for the roads classes as collectors or higher.

Table 4.1: Scenario Comparison

Criteria	2006 Base Model	2026 Model Without Road Improvements	2026 Model With Road Improvements
Percentage of Links at LOS C or Better	98.5%	95%	97%
Percentage of Links at LOS D or Lower	1.5%	5%	3%
Percentage of Links at LOS E or Lower	0%	3.5%	1.5%
Average Travel Speed (km/hr)	68.5	67.8	70.4
Vehicle-Kilometres Travelled	84,642	112,603	110,156
Total Vehicle-Hours	1,248	1,687	1,632

The three columns of Table 4.1 address forecast LOS on the road links in the model. The number of road links at LOS D or lower increases from 1.5 to 5 percent in the forecast year where no road improvements are included. This reduces to three percent with the road improvements added to the model. If only links at or above congestion levels are looked at, the change from the base model to 2026 goes from none, to over 3 percent, however, this is reduced to 1.5 percent with the proposed road improvements. Although there is an increase in links that offer a LOS that is less than desirable, it is not necessarily cost effective to achieve LOS C or better in all cases. It is not always feasible to maintain a desirable LOS as a City grows. It should also be noted that this only addresses road links and not the LOS of intersections themselves, however, as road link LOS values decrease, typically, so do the intersection LOS values.

The average link speed is forecast to decrease modestly, however, the proposed road improvements forecasts an improvement in speeds. It should be noted that the relatively high average travel speed is a reflection of the inclusion of highway links outside of the

urban portion of the study area where speed limits are in the 80 – 100 km/hr range. Much of the improved travel speed is also attributed to improvements in the highway system (e.g., upgrades along PTH 1, completion of PTH 110). In examining urban links, there is a drop in forecast travel speed in the "without improvements" scenario from 68.5 km/hr to 67.8 km/hr. The "with improvements" scenario is slightly higher, at 70.4 km/hr, than existing conditions.

The vehicle-kilometres travelled is a reflection of growth in the City, as well as longer average travel lengths as development extends beyond the existing developed area. The reduction in the "with improvements" scenario is again primarily a function of the improvements in the highway system, especially PTH 110.

The total vehicle-hours of travel in the afternoon peak hour increases due to new growth resulting in additional trips on the network, average trip lengths increasing, and reductions in LOS as volumes increase.

5.0 ISSUE IDENTIFICATION

5.1 Study Inputs

The study has determined a number of issues and concerns for the transportation network within the study area. These issues and concerns have been determined through:

- An environmental scan, which included a condition analysis of the City and Provincial road network, a collision data and safety review, and telephone and traffic interrupt origin-destination surveys. The environmental scan outlined the current transportation system and conditions while providing a level of detail regarding travel in the Brandon area.

- Public consultation in the form of two Open House meetings, a public display kiosk at Brandon Shoppers Mall and City Hall and two workshops involving both the public and invited stakeholders. Information from the study was presented to the public for their input and comment.

- A transportation planning model, which forecast a 20 year horizon operational deficiencies with respect to road links and intersections. The model provided an opportunity for the study team to examine what-if scenarios more readily and provided a base condition that can then be used by the road authority in the future to update traffic forecasts.

5.2 Issue Identification

The issues identified through the environmental scan, public consultation and transportation planning model were classified into six theme groups:

- Alternative Transportation and Environmental Considerations,
- Safety,
- Route Classification and Goods Movement,
- Access and Traffic Management,
- Future Roadway Needs, and
- Traffic and Intersection Capacity.

A number of issues were found to occur in more than one theme group.

5.2.1 Alternative Transportation and Environmental Considerations

Alternative transportation and environmental considerations related to several issues were raised during the public consultation aspect of the study, including:

- Interference of traffic with dangerous goods movement, and pedestrian and traffic conflicts at various intersections such as 34th Street and Victoria Avenue, 34th Street and Rosser Avenue and 1st Street and Victoria Avenue, oftentimes due to geometry.

- Lack of bus service to Monterey Estates.

- Access for disabled persons on transit buses.

- Provide pick-up and drop-off locations for taxis at venues such as the Corral Centre or at various Clinics throughout the City.

- Ensure that development accommodates transit and all modes are included in the transportation master plan.

5.2.2 Safety

The environmental scan of historical collision data, a detailed safety review (submitted under separate cover) and public consultation determined transportation concerns within the City of Brandon as well as on the surrounding roadways within the study area.

Collision data was obtained for key Provincial highway links outside the City of Brandon within the 60 km radius. The majority of the road segments experienced collision rates below the MIT threshold of 1.5 collisions per MVKT. One exception is PR 457, which experienced collision rates of 3.11 and 1.63 for the sections from PTH 1A to 110W and 110E to PR 340, respectively. These segments of PR 457 exceeded the MIT threshold and thus warrant further review.

Collision data, within the City of Brandon, was examined to determine the frequency, severity and collision rates at 17 intersections for which data from 1996 to 2002 was available. The safety review determined that only one of the intersections studied, 18th Street at Victoria Avenue, had a collision rate of 1.67 per MVE, which is above the MIT threshold of 1.5 collisions per MVE. The review also determined that there were no fatalities recorded in the last seven years of data at the intersections examined and driver error was the primary cause of collisions.

Safety concerns raised during the public consultation portion of the study included pedestrian-vehicle conflicts at several intersections within Brandon, lack of traffic control and truck traffic accommodations.

5.2.3 Route Classification and Goods Movement

Stakeholders concerns with respect to route classification and goods movement include the volume of truck traffic in and through the City and the accommodation of dangerous good movements. Specific issues raised by stakeholders who participated in the workshop in May 2006 with respect to route classification and goods movement included:

- Relocating all rail outside of City to near the airport, thereby reducing travel delays within the City.

- Ensure more efficient use of rail lines.

- Locate truck routes away from residential areas.
- Completion of Eastern and Western By-passes to accommodate truck movements, thereby reducing truck traffic within the City.

5.2.4 Access and Traffic Management

Access and traffic management are the manner in which local, regional, or provincial authorities control the interface between the road network and the adjoining properties. Depending on the roadway type, access to the adjacent land uses, typically through a driveway, can be plentiful and individual, such as in a residential area, or joint and occasional, such as in an urban commercial area.

Various comments were submitted regarding access and traffic management from participants at both the open houses and workshops. Frequent concerns included:

- The lack of signal synchronization and use of current technologies.
- Installation of speed humps and the required advisory signage.
- Location of private approaches along major routes that impact congestion and safety.

5.2.5 Traffic and Intersection Capacity

Traffic and intersection capacity deficiencies were identified through public consultation and the transportation model forecast. Participants from the open houses, public display and workshops identified congestion and heavy traffic volume areas at numerous locations within the study area.

Using the transportation forecast model, deficiencies were identified through the forecast road link LOS for Year 2026 conditions in terms of road cross-section needs or a need for new road linkages. However, the other area that must be addressed in the future is intersections. Intersections that will need to be monitored, to determine possible operational or geometric modifications, were identified through discussions with the Steering Committee, and examining critical road links in the model.

A number of road links are forecast to be near, at, or above, the available capacity by the Year 2026, based on assumed land use growth levels and patterns, or are links deemed important to address goods movement activity.

In examining Figures 4.4 and 4.5 (Year 2026 LOS without road improvements), other links are identified as being at LOS D or lower, however, these are likely due to local or collector links being used as a zone centroid.

A wide variety of control options and a number of new signals have been installed in the last 10 years. It was suggested that there is a need to develop a new coordination plan for traffic control signals in the City. A number of older controllers without pedestrian actuation may be providing more green time for certain phases than may otherwise be required to only accommodate vehicular traffic.

5.2.6 Future Roadway Needs

Future needs of the roadway network within the study area, as determined from public consultation and transportation planning model, include:

- Completion of the Eastern and Western By-pass routes while closing 1st Street, 18th Street, Victoria Avenue and Richmond Avenue to heavy truck traffic.
- Upgrading of PR 340 from Shilo to Wawanesa as an asphalt surface treated roadway.
- Upgrading of the following road links to four-lane divided roadways:
  - PTH 10, north and south of Brandon.
  - 18th Street North, from PTH 1 to Kirkcaldy Drive.
  - Victoria Avenue, from 34th Street to PTH 1 at Kemnay.

6.0 STRATEGY DEVELOPMENT

The purpose of this section is to present the strategies that will be used to address the theme issues identified in Section 5. These strategies are derived through careful consideration of the issues and concerns that have been raised and reflect current practice in the transportation planning industry for dealing with the issues and concerns that have been identified.

Again, stemming from the public consultation, transportation modelling and environmental scan aspects of the study, six major themes have been identified for strategy development. The six themes identified include:

- Alternative Transportation and Environmental Considerations,
- Safety,
- Route Classification and Goods Movement,
- Access and Traffic Management,
- Future Roadway Needs, and
- Traffic and Intersection Capacity.

These themes are similar to the topic areas presented at the stakeholder and public workshops in October 2005 and May 2006 but have been focused to encompass issues of significant concern.

6.1 Alternative Transportation and Environmental Considerations

From the issue identification process it was determined that there is a need and desire to encourage increased transit ridership and to promote other means of transportation as a way to reduce traffic congestion and to promote environmental stewardship. The following three strategies are proposed to address these issues/concerns:

- Transit development to encourage transit ridership. This includes transit signal priority systems to increase transit efficiency and speed, as well as future development considerations (e.g., location of collector streets, higher density development along or near potential transit routes, pedestrian system to connect origins and destinations to transit routes) for transit accessibility in planned

residential developments. Transit development will address the lack of bus service and ensure that development accommodates transit.

- Development of a multi-use trail system to ensure adequate infrastructure for pedestrians and bicyclists. The City has identified existing and future paths and trails (as recommended in the Greenspace Master Plan completed in 2002, attached in Appendix H). A multi-use trail system ensures that development accommodates all modes in the transportation master plan.

- Ensuring sufficient sidewalk accessibility (e.g., provision of sidewalks in areas where pedestrian activity is likely, provision of adequate pararamps, pedestrian refuges, etc. at intersections) for pedestrians to encourage and accommodate pedestrian traffic throughout the City of Brandon. Sufficient sidewalk accessibility ensures access for disabled persons and reduces pedestrian-vehicle conflicts.

6.2 Safety

From the Issues Identification, it was determined that safety of the traveling public is a concern. A review of collision statistics and a detailed safety review were undertaken to determine safety issues. The goal of road safety is to reduce the number of potential conflicts, thus minimizing collisions and subsequent damage, injuries or deaths on the road network. The following strategies are recommended to address safety concerns:

- Creating and implementing traffic calming guidelines that include a “combination of physical features that reduce the negative effects of motor vehicle use, alter driver behaviour and improve conditions for non-motorized street users” as defined by the Institute of Transportation Engineers. Two types of traffic calming measures exist, one that seeks to control the volumes along a particular roadway / network and the other which seeks to control the speed. A detailed comparison of both traffic calming types, and policies in other jurisdictions can be found in Appendix E.

- Modifying truck and dangerous goods route designations. Modifying truck route designations will alleviate through truck traffic within the City of Brandon while modifying dangerous goods truck routes will reduce potential contamination. Both modifications reduce potential conflicts with other motorists using the road network.

- Implementing a comprehensive access and traffic management strategy in which local or provincial authorities control the interface between the road network and the

adjoining properties. Detailed information regarding access management strategies and existing policies within the study area are attached in Appendix E.

- Performing intersection reviews to determine locations on the City and Provincial road network to determine geometric and/or operational deficiencies, and the necessary mitigation measures.

- Implementing mitigation measures to address items identified from road safety reviews. A safety review and recommendations were provided as part of the study under separate cover.

- Updating road classifications to allow the road network to perform efficiently and safely from both traffic operations and road safety perspectives. This objective is achieved by the designation and operation of roadways to their intended purposes.

- Reviewing, in detail, road segments exceeding MIT's collision rate threshold of 1.5 incidents to determine site-specific mitigation measures. In general terms, the availability of multi-lane divided highways and left and right-turn lanes can be effective mitigation measures.

6.3 Route Classification and Goods Movement

Efficient route classification and goods movement involves a strategy that provides a road system that locates trucks on appropriate routes in order to minimize congestion, delay and conflict with other road users. The proposed strategy involves:

- Modifying truck and dangerous goods route designations. Modifying truck route designations will alleviate through truck traffic within the City of Brandon while modifying dangerous goods truck routes will reduce potential contamination. Both modifications reduce potential conflicts with other motorists using the road network.

- Updating road classifications to allow the road network to perform efficiently and safely from both traffic operations and road safety perspectives.

6.4 Access and Traffic Management

A successful access and traffic management strategy incorporates a comprehensive strategy in which local or provincial authorities control the interface between the road

network and the adjoining properties. The recommended strategy for access and traffic management involves the following components:

- Utilizing smart growth principles focusing on providing alternative modal choices and transportation planning for future development. The City should continue to encourage modal alternatives when reviewing development proposals. Detailed information regarding smart growth principles, strategies and other items to consider can be found in Appendix E.

- Developing a traffic impact study guideline for the City of Brandon to assess the impacts of a new or changed development on the existing and proposed transportation system. Traffic impact studies should also suggest transportation system improvements to mitigate any negative affects of increased travel demand caused by the development. Background information regarding traffic impact study guideline creation as well as a proposed Traffic Impact Study Guideline for the City of Brandon is included in Appendix D.

- Implementing a comprehensive access and traffic management strategy in which local or provincial authorities control the interface between the road network and the adjoining properties. Common measures include allowing median openings at targeted locations such as public street intersections or approaches serving major developments, traffic signal control at appropriate spacing, combining approaches for multiple properties, encouraging cross-easement agreements, etc. Detailed information regarding access management strategies and existing policies within the study area are attached in Appendix E.

- Synchronizing traffic signals through a coordinated set of timing plans in order to create smooth traffic flow. Ideally, a coordinated signal system would allow vehicles to travel through the study road network with the fewest stops at intersections, while minimizing delay for side streets.

6.5 Traffic and Intersection Capacity

The transportation planning model was used to assess and determine where capacity was required to accommodate current and future traffic demand. Access and traffic management strategies outline above will preserve capacity thereby extending the life of the existing road system. This strategy involves recommendations previously described,

including synchronization of traffic signals, intersection reviews and upgrades, reviewing the possible impacts of planned developments, and a traffic count monitoring program.

- Update signal controllers would offer MIT greater flexibility in setting coordination plans and add vehicular capacity to the corridors in the plan. It is recognized that MIT is not in favour of additional pedestrian actuation due to additional user complaints regarding waiting for a "walk" signal indication; however, MIT recognizes the importance of accommodating all road users, especially in the diverse urban environment.

- The traffic signal controls located along PTH 1, 1st Street, 18th Street, Victoria Avenue and Richmond Avenue are all under the jurisdiction of MIT. Currently, all four streets are controlled by a single coordination plan, which is approximately 10 years old. MIT hope to prepare an updated traffic synchronization coordination plan in 2007. Some intersections are actuated, some are semi-actuated, and five have pedestrian buttons.

- Updating road classifications to allow the road network to perform efficiently and safely from both traffic operations and road safety perspectives. This objective is achieved by the designation and operation of roadways to their intended purposes.

6.6 Future Roadway Needs

The road network should meet the future transportation and economic needs of the study area. This strategy involves numerous recommendations, such as:

- Upgrading of critical routes to four lane divided facilities to create positive impacts on transportation safety, goods movement, access management and capacity.

- Conducting a traffic count program to monitor operations at key intersections that may need upgrades within the horizon year time frame and review whether adjustments to traffic control measures may be required.

- Additional items described above, including:

    - Modifying truck and dangerous goods route designations.

    - Synchronizing traffic signals.

    - Implementing a comprehensive access and traffic management strategy.

- Developing a traffic impact study guideline for the City of Brandon.
- Utilizing smart growth principles.
- Updating road classifications.
- Performing intersection reviews.
- Implementing project recommendations stemming from road safety reviews.

- Updating road classifications to allow the road network to perform efficiently and safely from both traffic operations and road safety perspectives. This objective is achieved by the designation and operation of roadways to their intended purposes.

6.7 Quick Reference to Issues and Strategies

Table 6.1 shows each issue as well as their respective strategies and general recommendations that are being proposed to address the issue. Alternative funding options that could be considered for the recommendations and strategies stated below are found in Appendix E.

Table 6.1: Study Issues and Related Strategies

Issues	Strategies	Recommendations
Alternative Transportation and Environmental Considerations	Transit development	Transit signal priority
		Future development considerations
	Adequate multi-use trail system	Greenspace planning and development
	Ensure sidewalk accessibility	Intersection reviews and upgrades
Safety	Minimize traffic related conflicts	Traffic calming guidelines
		Truck route classification modifications
		Dangerous goods route modifications
		Access management strategy
		Intersection reviews and upgrades
		Safety review project recommendations
		Update roadway classifications
Route Classification and Goods Movement	Provide a road system that locates trucks on appropriate routes	Truck route classification modifications
		Dangerous goods route modifications
		Update roadway classifications
Access and Traffic Management	Minimize traffic related conflicts and ensure appropriate access	Smart growth principles
		Traffic impact study policy
		Access management strategy
		Synchronization of traffic signals
Traffic and Intersection Capacity	Efficient road network that meets future traffic growth and operation	Synchronization of traffic signals
		Intersection reviews and upgrades
		Traffic count monitoring program
Future Roadway Needs	Roadway network that meets future traffic and economic needs	Twinning of critical routes
		Traffic count monitoring program
		Dangerous goods route modifications
		Truck route classification modifications
		Traffic impact study policy
		Access management strategy
		Smart growth principles
		Synchronization of traffic signals
		Intersection reviews and upgrades
		Safety review project recommendations

7.0 RECOMMENDATIONS

7.1 Alternative Transportation and Environmental Considerations

7.1.1 Transit Priorities

Brandon Transit currently operates a downtown terminal that provides a convenient point for transfers between routes. A diamond lane has also been implemented on a portion of 18th Street southbound. Other features that should be considered include:

- Encouraging higher densities in new residential developments along potential transit routes.
- Ensuring collector road patterns in new developments that would place most residences within 400 metres walking distance of a potential transit route.
- Examining transit signal priority along arterial roads in conjunction with future traffic signal upgrades planned by MIT.
- Extension of transit operating hours, including:
  - Regular and Handi Transit operation from 6:00 a.m. to midnight, Monday through Saturday.
  - Handi Transit service from 9:00 a.m. to 5:00 p.m., Sundays and holidays.
  - An additional two hours of peak demand Handi Transit service.

7.1.2 Greenspace and Smart Growth Considerations

A future transportation plan for the City of Brandon and surrounding 60 kilometre area should accommodate safe and efficient pedestrian and cyclist movement. This has been addressed by long term goals previously set out by the City and thus, future greenspace requirements should reflect the City's Greenspace Master Plan prepared in 2002 (attached in Appendix H).

As well, utilizing smart growth principles focusing on providing alternative modal choices and transportation planning for future development is recommended. The City should continue to encourage modal alternatives when reviewing development proposals. Detailed

information regarding smart growth principles, strategies and other items to consider can be found in Appendix E.

7.2 Safety

7.2.1 Safety Improvement Projects

A general safety review was undertaken, focusing on major roadways within the City for which historical collision information was available. In general terms, the findings suggest the following programs that should be addressed in the short term:

- Addition of, or extension of, left and right turn lanes.
- Replacement of signage that has lost useable reflectivity, and in some areas, additional signage.
- Ensuring lighting levels meet current guidelines.
- Provision of sidewalks where pedestrian activity is expected to occur.
- Improved pedestrian amenities near the soccer complex.
- Consistency in the 18th Street cross-section.
- Review of the extent of crossing protection required at the CPR at-grade crossing.
- Inconsistent intersection configurations along Park Avenue.
- Lack of sidewalks, bus pads and transit stops along 18th Street between Maryland Avenue and Richmond Avenue.

Details on locations and specific needs are included as part of a separate report prepared for the City and MIT entitled Brandon Area Road Network Development Plan Safety Review.

7.3 Route Classifications and Goods Movement

7.3.1 Functional Classifications

Material presented during the consultation sessions with stakeholders identified proposed changes in road classification, as illustrated in Figure 7.1. Existing road classifications for

the City of Brandon and MIT roadways are illustrated in Figures 2.5 and 2.6, respectively. Two types of classification changes are shown; changes to existing road classifications and possible new road network links in planned development areas (illustrated in Figure 4.3).

Classification modifications are based on predicted traffic volumes and thus potential upgrades or downgrades should be based on traffic monitoring results of arterial routes in the network. In some cases, such as Aberdeen Avenue, the recommendation is contingent upon the City of Brandon's Development Services Division reviewing Residential Development within the southeast portion of the City to determine if there is a need or warrant to downgrading.

City of Brandon Classifications:

Roads recommended for further review include:

- Aberdeen Avenue, 10th to 18th Streets, from local to collector status: the street currently functions as a collector, including providing access to a retail centre at 18th Street at Aberdeen.
- Aberdeen Avenue, 1st to 10th Streets, from collector to local status: the street serves a residential community and the City has implemented traffic calming features in the area to control speeds and volumes.
- 6th Street, Richmond Avenue to Aberdeen Avenue, from collector to local status: with the reclassification of Aberdeen Avenue, the collector status would terminate at a local street.

Recommended changes to existing classifications include:

- 49th Street East, PTH 110 to Patricia Avenue, from collector to local status: the street currently functions as a collector, however upon completion of the Eastern Access it is to be downgraded to a local street.
- Maryland Avenue, 26th Street to 34th Street, from local to collector: with increased residential development this portion of Maryland Avenue will be upgraded to collector street status.

- 42nd Street, Park Avenue to Victoria Avenue: upon completion of the Park Avenue connection with 42nd Street, both Park Avenue and 42nd Street are to be classified as collector streets.

- 50th Street, Rosser Avenue to Victoria Avenue: upon completion of the Rosser Avenue connection with 50th Street, both Rosser Avenue and 50th Street are to be classified as collector streets.

- McDonald Avenue, 26th Street to 34th Street, from collector to local: further extension of the street is not anticipated in the future and thus the street should be downgraded to local status.

- PTH 110, PTH 10 to PR 457, from arterial/feeder to expressway/core route: upon completion of the Eastern By-pass, PTH 110 will be reclassified as an expressway/core route.

Provincial Highway Classifications through Brandon:

Figure 7.1 shows the existing Strategic Highway System being developed by MIT. However, MIT has recently announced that construction of the Brandon Eastern By-pass (PTH 110) and the new Assiniboine River Bridges on 18th Street (PTH 10) has been approved. Therefore, it is recommended that upon completion of these projects, the future Strategic Highway Network within Brandon be changed to reflect the following (also shown in Figure 7.1):

- Brandon Eastern Access (PTH 110) be changed from Feeder designation to Core designation,

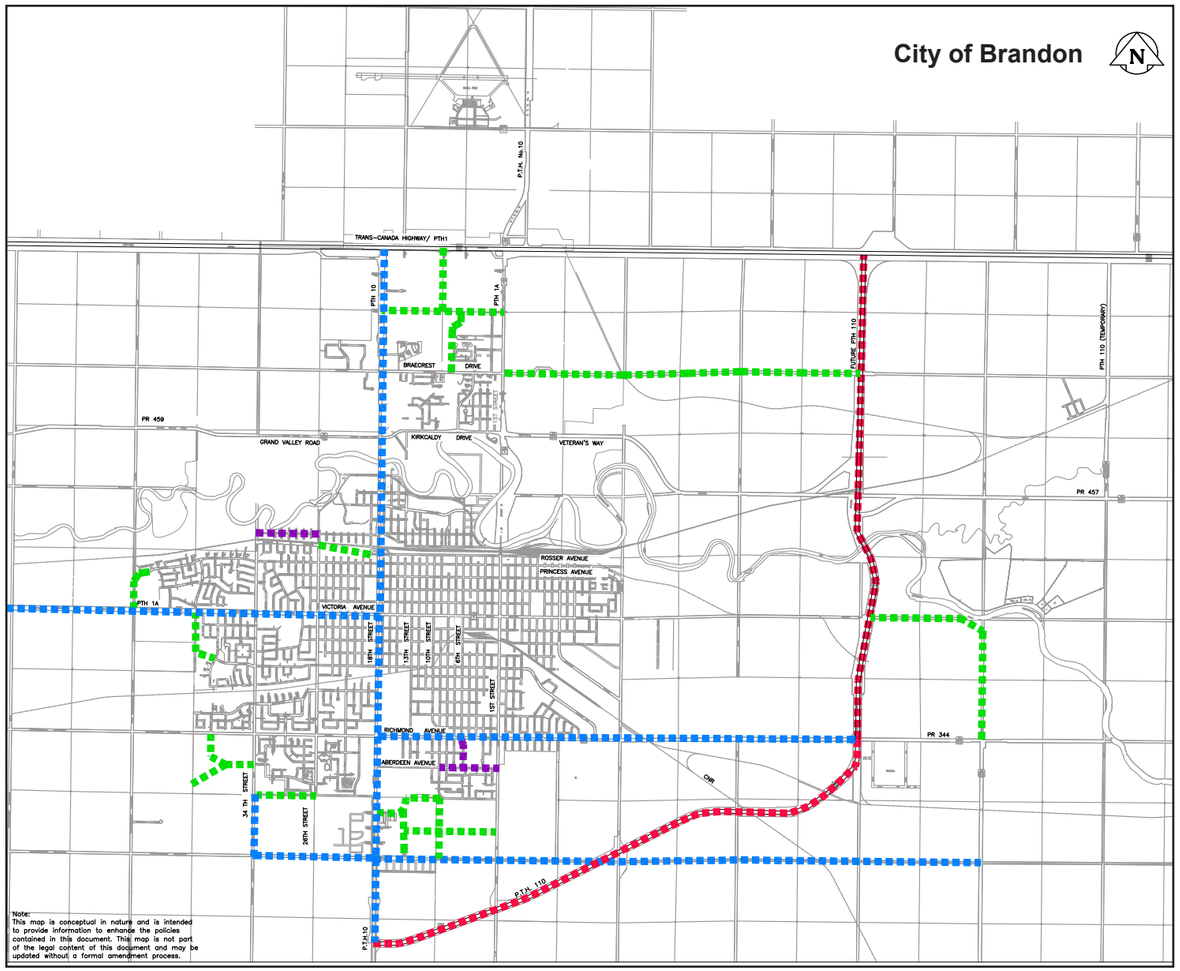
- 18th Street (PTH 10) be changed from Auxiliary/Core designation to Feeder designation,

- PTH 1A (1st Street) from Richmond Avenue to PTH 1 (Trans-Canada Highway) be changed from Core/Feeder designation to Auxiliary designation, and

- Temporary Brandon Eastern Access (PR 457 and PR 468) be changed from Feeder designation to Auxiliary designation.

Effective immediately:

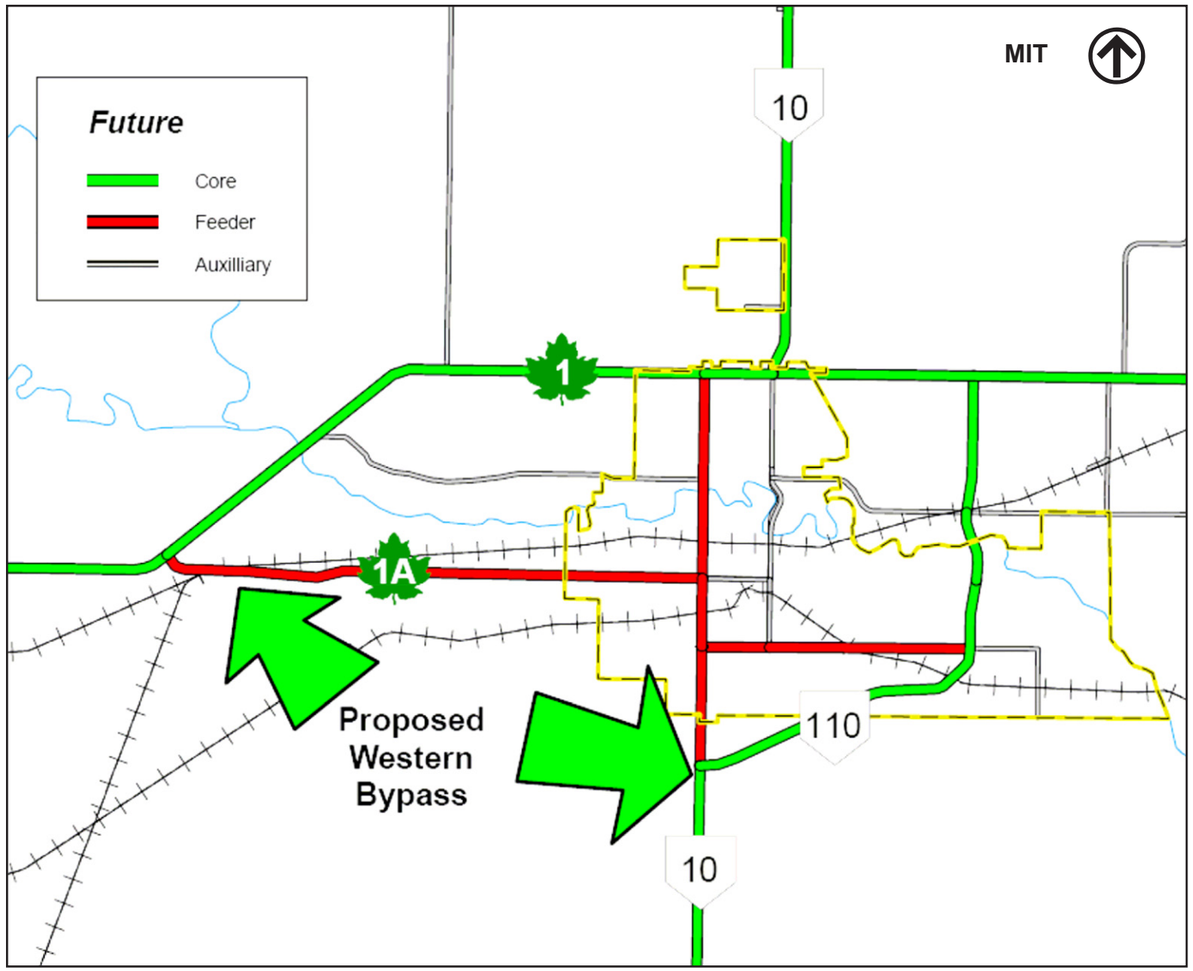
- Richmond Avenue (PR 610) from 18th Street to PTH 110 be changed to the Feeder designation, and
- PR 610 (Richmond Avenue) from PTH 110 easterly be changed to the Auxiliary designation.



Source: City of Brandon

LEGEND

- Expressway / Core Route
- Arterial / Feeder Route
- Collector



Source: MIT

LEGEND

- Proposed Core Route
- Proposed Arterial / Feeder Route
- Proposed Collector
- Proposed Downgrading From Collector to Local

FIGURE 7.1:
PROPOSED ROAD CLASSIFICATIONS

7.3.2 Dangerous Goods and Truck Route System

Recommended changes to the truck route network and the dangerous goods route reflect the proposed changes to the major road network as well as feedback from the consultation process. The most significant change is the recommendation to complete the eastern access, to change the eastern access truck route to the planned future alignment (the northerly extension of PTH 110) from the current temporary alignment. When this occurs, the designated truck route for PTH 10 for trucks travelling to/from north of Brandon to/from south of Brandon or to/from PTH 1 should be identified as using the future by-pass route. The classification of PTH 110 is then suggested to change from a feeder to a core route. Under this scenario, non-truck traffic would continue to use the current through-town route to provide access to businesses along the route. The modifications to the dangerous goods route network to reflect the revised truck routing are shown in Figure 7.2.

The information discussed in Section 2.5, coupled with the fact that most truck operations are located in southeast Brandon, reinforces the importance of PTH 110 (the Eastern Access) and the need to complete the access with the planned connection at PTH 1 (approximately in line with the extension of 49th Street, compared to the current temporary connection at the extension of 81st Street). The completion of this link, with its enhanced geometric connections with PTH 1, is expected to shift some truck traffic from the "through town" routes to the by-pass. Highway commercial, truck-type development along the corridor will be beneficial to realize the fullest possible diversion to this route. With this change, it is recommended that the following road links be downgraded and/or removed in the future upon further goods movement studies as designated truck routes:

- 1st Street, between PTH 1 and Victoria Avenue,
- Victoria Avenue, between 18th Street and 1st Street,
- Veteran's Way, between PTH 110 and former PTH 110, and
- Veteran's Way, between 1st Street North and PTH 110.

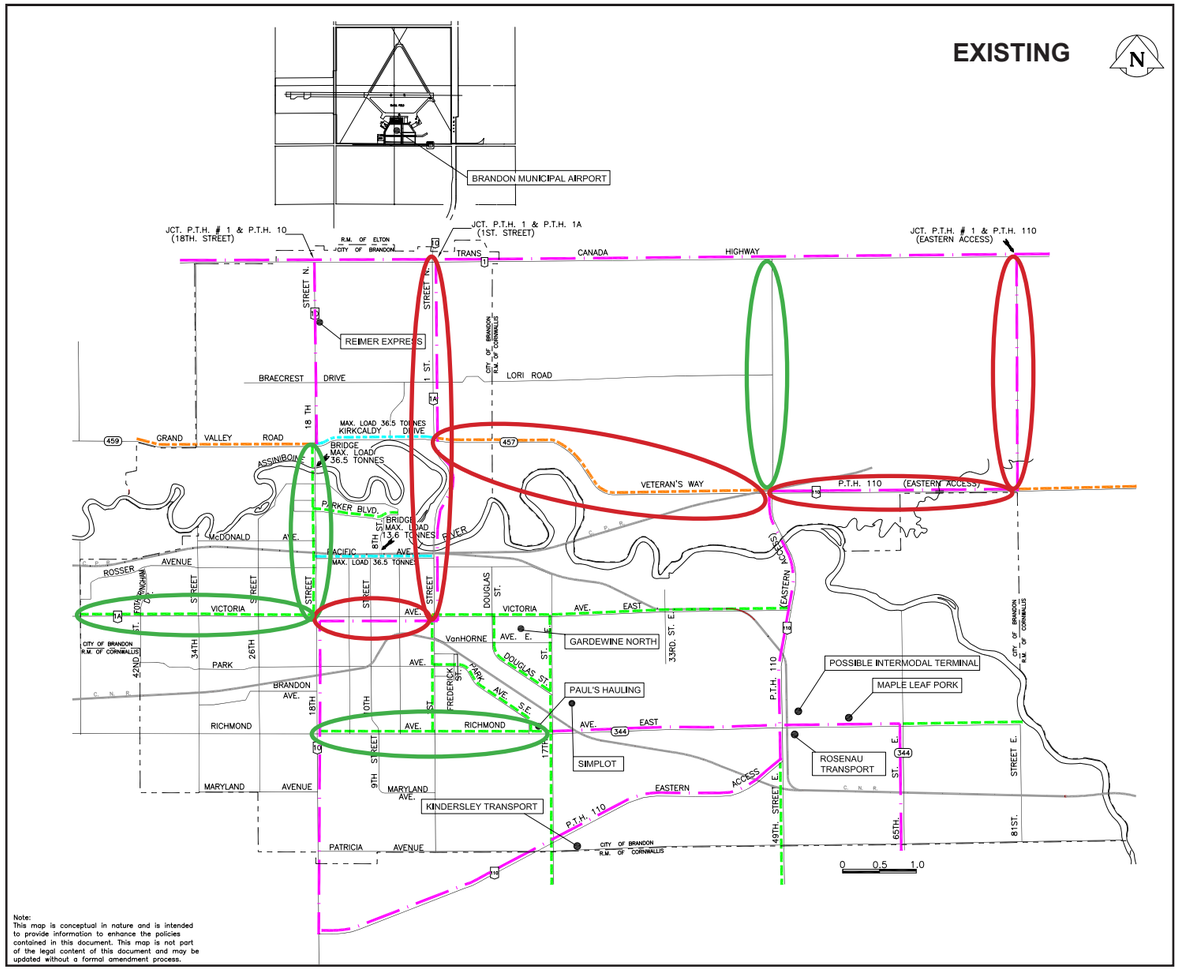
These changes force non-Brandon truck traffic to make use of PTH 110, but would still allow trucks to use these routes if they are making a pick-up/delivery within the City. The desired intent is to remove through truck traffic from the city, however since there are still shipping destinations within Brandon, there will still remain some degree of truck traffic

traveling within the City. Remaining truck traffic in Brandon will consist of terminal-to-terminal traffic, shuttling of trailers and deliveries/pick-ups.

Jurisdictional control of the truck route system within the City of Brandon is planned to undergo change regarding auxiliary and feeder routes, shown in Figure 7.3. Discussions should occur regarding auxiliary routes and a possible shift from MIT control to the City in the near future, while transfer of selected feeder routes could be discussed in the long term. These modifications are dependant on a number of factors; primarily adequate funding for suggested road upgrades.

Figure 7.3 offers a comparison of the existing truck route system with the recommended modifications within the study area.

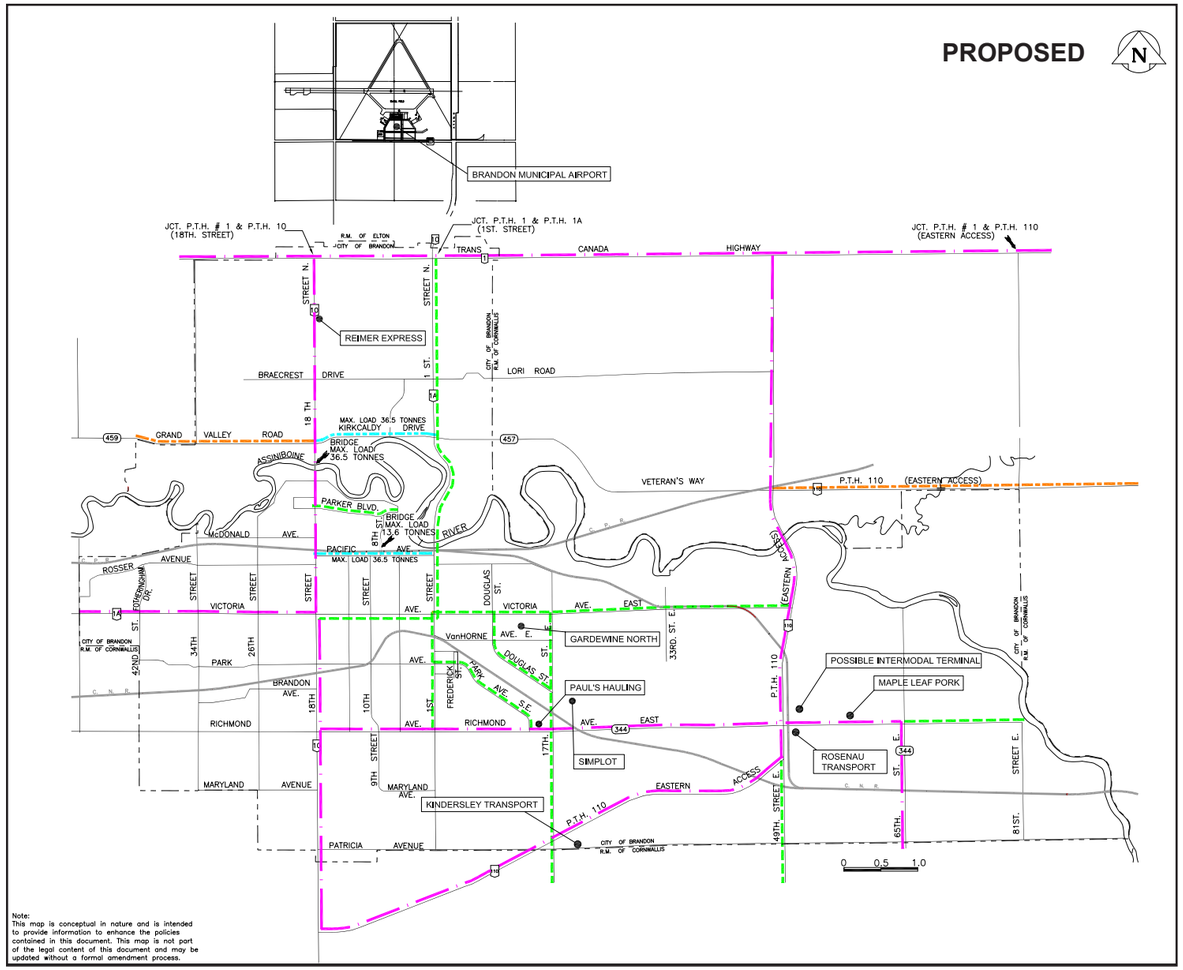
EXISTING



Note:
This map is conceptual in nature and is intended to provide information to enhance the policies contained in this document. This map is not part of the legal content of this document and may be updated without a formal amendment process.

Source: City of Brandon

PROPOSED



Note:
This map is conceptual in nature and is intended to provide information to enhance the policies contained in this document. This map is not part of the legal content of this document and may be updated without a formal amendment process.

Source: City of Brandon

LEGEND

- CITY AND HIGHWAY TRUCK ROUTES – CLASS A1 — GVW 56,500kg
- HIGHWAY TRUCK ROUTES – CLASS B1 — GVW 47,630kg
- CITY RESTRICTED TRUCK ROUTES – CLASS A — GVW 36,500kg
- RTAC PROVINCIAL TRUCK ROUTES — GVW 62,500kg
- RAILWAYS
- PROV. TRUNK HIGHWAY
- PROV. ROAD
- CITY OF BRANDON LIMITS

EFFECTIVE: JAN./ 76
REVISED: 1979, 1989, 1993, 1997.

- TRUCK ROUTES TO BE REMOVED/DOWNGRADED
- TRUCK ROUTES TO BE ADDED/UPGRADED
- TRUCKING CENTRE ●

LEGEND

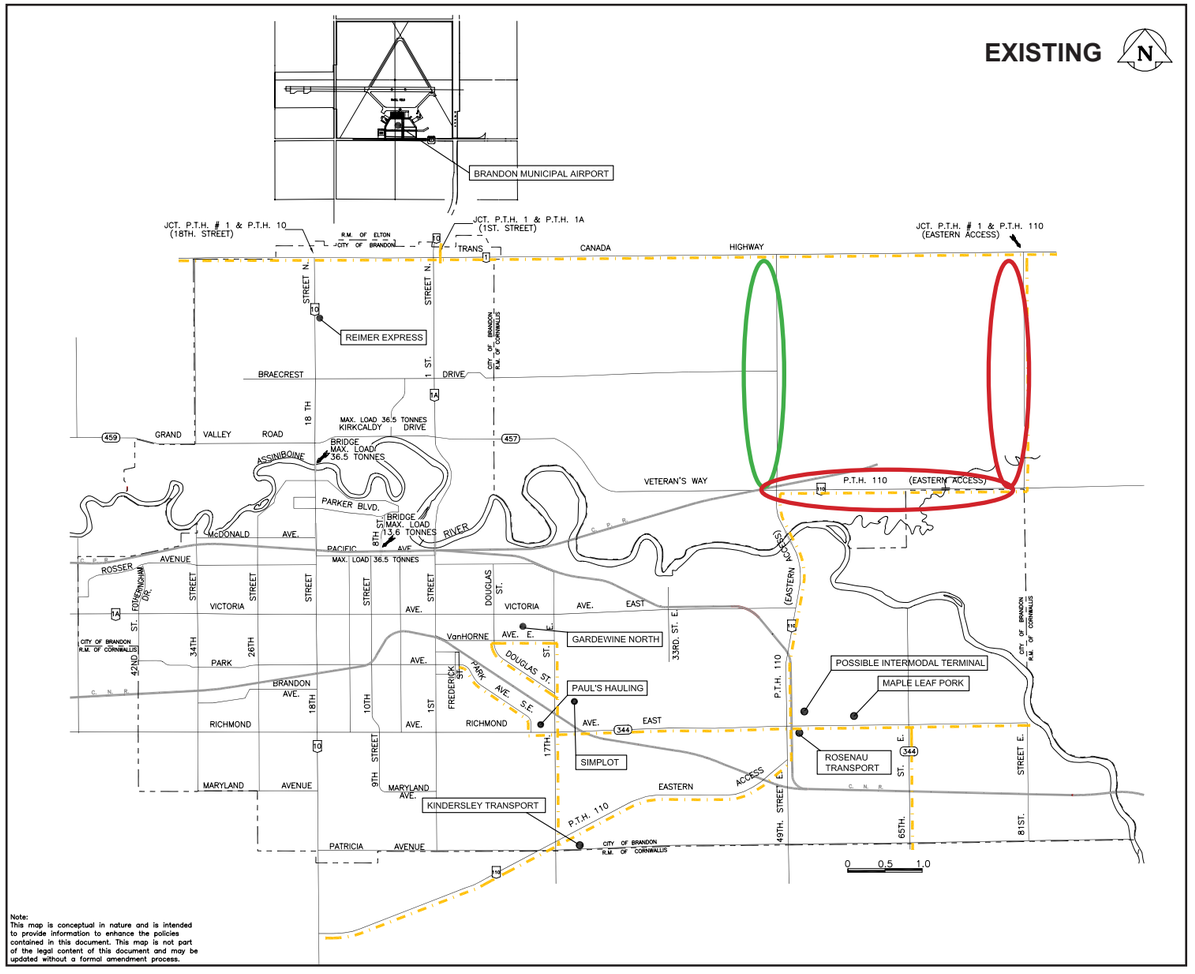
- CITY AND HIGHWAY TRUCK ROUTES – CLASS A1 — GVW 56,500kg
- HIGHWAY TRUCK ROUTES – CLASS B1 — GVW 47,630kg
- CITY RESTRICTED TRUCK ROUTES – CLASS A — GVW 36,500kg
- RTAC PROVINCIAL TRUCK ROUTES — GVW 62,500kg
- RAILWAYS
- PROV. TRUNK HIGHWAY
- PROV. ROAD
- CITY OF BRANDON LIMITS

EFFECTIVE: JAN./ 76
REVISED: 1979, 1989, 1993, 1997.

- TRUCKING CENTRE ●

FIGURE 7.3:
CITY OF BRANDON TRUCK ROUTES AND TRUCKING COMPANY LOCATIONS

EXISTING



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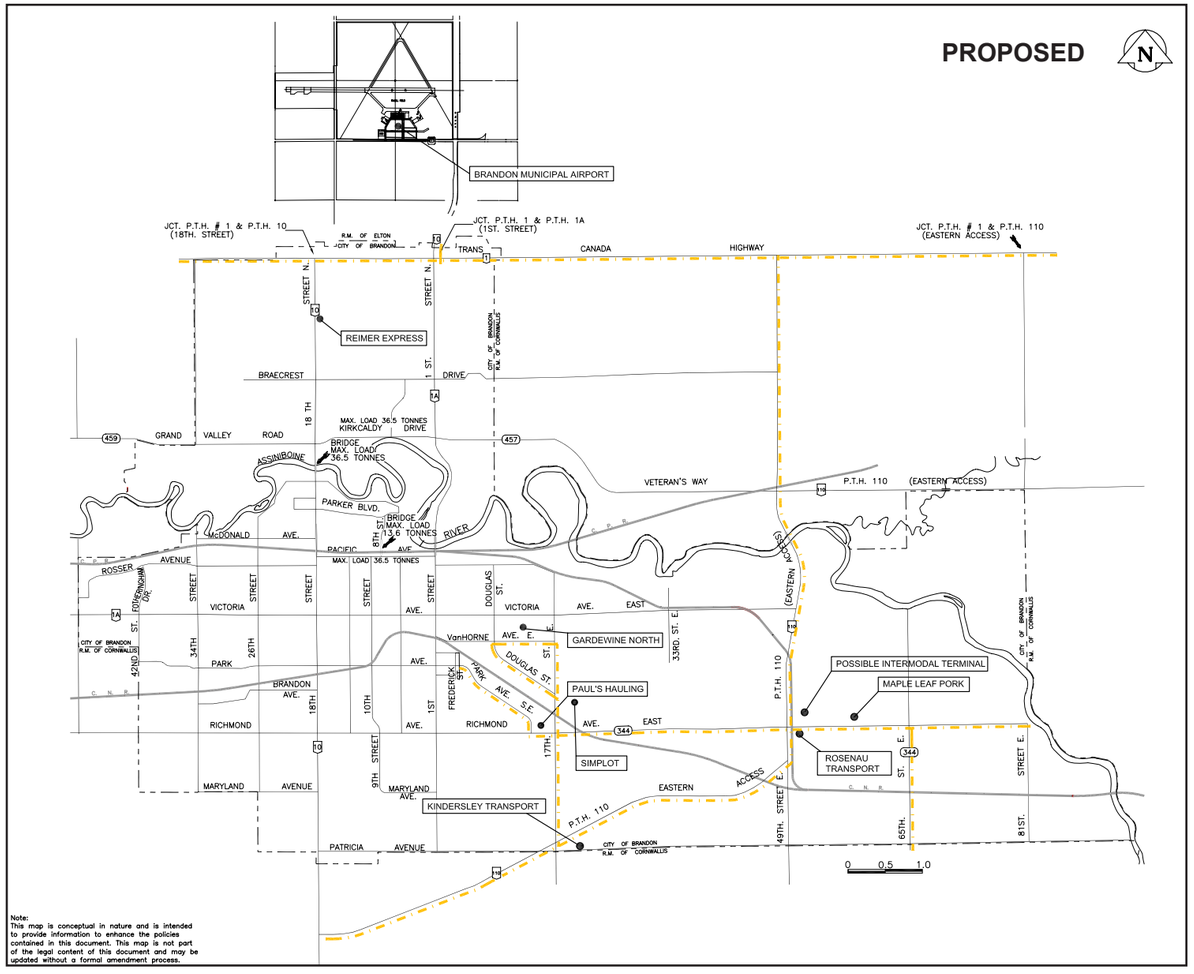
Source: City of Brandon

PROPOSED



Note:
This map is conceptual in nature and is intended to provide information to enhance the policies contained in this document. This map is not part of the legal content of this document and may be updated without a formal amendment process.

Source: City of Brandon

LEGEND

- DANGEROUS GOODS ROUTES
- RAILWAYS
- PROV. TRUNK HIGHWAY
- PROV. ROAD
- CITY OF BRANDON LIMITS

EFFECTIVE: JAN./ 76
REVISED: 1979, 1989, 1993, 1997.

- TRUCKING CENTRE
- DANGEROUS GOODS ROUTES TO BE REMOVED
- DANGEROUS GOODS ROUTES TO BE ADDED

LEGEND

- DANGEROUS GOODS ROUTES
- RAILWAYS
- PROV. TRUNK HIGHWAY
- PROV. ROAD
- CITY OF BRANDON LIMITS

EFFECTIVE: JAN./ 76
REVISED: 1979, 1989, 1993, 1997.

- TRUCKING CENTRE

FIGURE 7.2:
CITY OF BRANDON DANGEROUS GOODS ROUTE NETWORK

7.4 Access and Traffic Management

7.4.1 Access Management Strategy for the Brandon Area

The following four strategies are recommended for access management within the Brandon Area:

1. **Develop a high-level access management strategy** for highways and arterial streets within and around the City of Brandon that identifies the degree of access control (and location) for each roadway type. This strategy should be published in a major planning document. The City of Brandon policies should be coordinated with MIT to ensure a coordinated approach from an urban and rural highways perspective.

2. **Develop a roadway system** that includes both existing and planned/proposed facilities. Inventory each facility and its roadway type, which would have a corresponding degree of access management associated with it. Develop a roadway classification system that allows for an appropriate range of access depending on the intended function of each type of road system.

3. **Regulate the placement of new driveways**, including their location, number per block, and design. In situations where driveways already exist, work to consolidate them and update their design as redevelopment occurs.

4. **Consolidate parking lots and site developments** by incorporating connect in between individual parking lots through cross easement agreements as redevelopment occurs with internal circulation, reduced highway/arterial access, and access to side streets.

As the Brandon Area Planning District Development Plan already has some access management policies, portions of these strategies are already in existence.

Strategies 1 and 2 have already been initiated in previous studies and supplemented with this Road Network Development Plan. Section 4.0 of this document identifies the existing major roadway network within and around Brandon while Section 7.0 presents the planned/proposed major roadway network. The figures in these sections illustrate the location of routes (existing and proposed) where access management should be a priority, primarily along core and feeder highways and arterial streets.

Strategies 3 and 4 would require an update to the existing City of Brandon Design Standards and Guidelines and could include topics such as:

- Median openings on arterial roads would be limited to public street intersections and major adjacent developments where sufficient spacing exists to adjacent median openings to provide adequate storage lanes for turning traffic.

- Median openings that accommodate left turns would provide for sufficient storage to accommodate the forecast 95th percentile queue, with a minimum of 15 metres.

- All-directional intersections along urban arterial roads would ideally occur at intervals of no less than 200 metres (400 metres preferred), with traffic signals considered at every second intersection. Access to adjacent lands would ideally occur via the intersecting roads on arterial streets.

- The minimum distance between an approach and an intersecting urban roadway would be six metres, with 15 metres separation from rail rights-of-way, measured along the property line.

- The minimum distance between approaches on a collector or arterial roadway should be 50 metres (15 metres in residential areas) measured along the property line, with no approach closer than three metres from an adjoining property line.

- No internal aisles on adjacent development shall be allowed within six metres of the road right-of-way, with a minimum of 24 metres required for commercial uses greater than 3,000 square metres of building area.

- Exit approaches along divided major roadways shall be situated such that exiting traffic is able to enter the left turn lane at the end of the forecast 95th percentile queue.

- Joint use approaches will be provided whenever technically feasible to facilitate access management, with cross-access agreements between the adjacent property owners. Such cross-access agreements may not be voided without the written consent of the applicable road authority, the City of Brandon or MIT. The City of Brandon and MIT should encourage these types of agreements whenever practical.

The consultant team suggestions for modifications to the current parking standards are attached in Appendix G.

7.4.2 Provincial Access Management

MIT has an adopted access management process as part of the Transportation Planning Policy: TP 1/98, A Highway Functional Classification System for Rural Provincial Highways in Manitoba (attached in Appendix G). It defines various road classifications and functions, provides general design standards, and guidance on access and land use control.

The Province is currently in the midst of modifying its classifications system, with a shift to functional classifications based on economic sustainability criteria, as discussed elsewhere in this report. Suggesting changes to the Province's system is beyond the scope of this study.

Access management should be coordinated on the core routes that enter the City to ensure consistent treatment of access management requirements between the City and Provincial routes.

7.5 Traffic and Intersection Capacity

7.5.1 Traffic Impact Study Policy

The recommendation for developing a traffic impact study guideline for the City of Brandon is based on a need to assess the impacts of a new or changed development on the existing and proposed transportation system. This allows the road authority a mechanism to assess if off-site transportation modifications are needed, and who is responsible for the modifications. If the road authority is responsible for some of the works, it allows for the works to be progressed. A proposed Traffic Impact Study Guideline for the City of Brandon is included in Appendix D.

7.5.2 Traffic Calming Strategy

The following traffic calming strategies are recommended for the City of Brandon as they have low implementation costs, require little educational outreach, and modify traffic movements/driver behaviour in a way the City can effectively manage and plan. The strategies are methods that have been identified in the literature as being effective, low cost and easily manageable. Prior to implementing traffic calming measures, traffic engineering reviews should be undertaken to assess which traffic calming measures are needed to mitigate traffic issues identified by area residents. Additional detailed information with regards to traffic calming strategies may be found in Appendix E of this plan.

The following is a brief list of traffic calming measures that have proven to be effective in medium-sized cities and could be considered for future use in the City of Brandon:

- Volume control measures:
  - Partial closures and diagonal diverters on local streets.
  - Right-in/right-out islands and raised medians along collector streets.
- Speed control measures:
  - Speed tables on local residential streets; speed tables are longer (in the direction of travel) than speed humps, they can be used in combination with raised crosswalks and textured pavements for additional benefits while allowing for easier snow removal and driver manoeuvrability.
  - Bulb-outs/chokers and center island narrowing along local or collector streets; bulb-outs/chokers would be most appropriate on collector streets that permit on-street parking (the bulb-out would then occupy the parking lane and provide protection for parked vehicles) while the center island narrowing would be most appropriate on collector streets that do not permit parking and have one travel lane in each direction.

7.5.3 Roundabouts

The City has built two roundabouts and has been pleased with their operational performance, driver understanding, and public acceptance. The City should continue the use of roundabouts at any collector – collector intersection where they are technically feasible as an alternative to traffic signal control.

Roundabouts have been shown to reduce collisions at intersections where stop signs or signals were previously installed for traffic control. Roundabouts create a safer intersection for several reasons:

- Eliminating red light running – a roundabout is designed to allow for continuous traffic flow without requiring vehicles to stop, and thus eliminates the concern of drivers accelerating to make it through an amber or red light.

- Reduced potential of serious collisions – since vehicles travel in the same direction due to the circular design of roundabouts, head-on and intersection 90 collisions are eliminated.

- Reduced traffic speeds – vehicles must yield prior to entering a roundabout and thus are forced to slow down while traveling through the roundabout.

7.5.4 Traffic Signal Controls

It is recommended that a signal synchronization program be implemented to improve the efficiency of traffic flow within the study area. The traffic signal controls located along PTH 1, 1st Street, 18th Street, Victoria Avenue and Richmond Avenue are all under the jurisdiction of MIT. Currently, the loop of 1st Street, 18th Street, Richmond Avenue and Victoria Avenue, is controlled by a single traffic control coordination plan, which is approximately 10 years old. MIT hope to prepare an updated coordination plan in 2007. Some intersections are actuated, some are semi-actuated, and five have pedestrian buttons (Richmond Avenue at 6th and 13th Streets, Victoria Avenue at 8th, 9th, and 10th Streets). A number of intersections are not included in the coordination plan (18th Street at Aberdeen Avenue, Parker Boulevard, Kirkcaldy Drive, the Corral Centre, and PTH 1, PTH 1 at PTH 10 (18th Street), 1st Street at Kirkcaldy Drive and PTH 1).

The wide variety of control options, and a number of new signal installations in the last 10 years suggests that the planned new coordination plan is desirable. A number of older controllers without pedestrian actuation may result in more green time for certain phases than may otherwise be required to only accommodate vehicular traffic. Updated controllers should offer MIT greater flexibility in setting coordination plans and add vehicular capacity to the corridors in the plan. It is recognized that MIT is not in favour of additional pedestrian actuation due to additional user complaints regarding waiting for a “walk” signal indication, however, MIT recognizes the importance of accommodating all road users, especially in the diverse urban environment. Any concerns with inappropriate use or misunderstanding of designed operations by pedestrians must be mitigated through a continued education program.

It is recommended that updated turning movement traffic counts be collected at the MIT-controlled traffic signals and that the timing/phasing/coordination plans be updated. This may require updated controller units. Pedestrian actuation is recommended, especially on

routes without regular pedestrian activity, in order to maximize the green time available for the major route.

7.6 Future Roadway Needs

7.6.1 Intersections

The following intersections should be examined at the operational level to determine possible operational or geometric modifications. These locations would also be appropriate for a traffic count program every three to five years to update the LOS analysis to identify the timing for modifications. The intersections below are ranked as short-term, beyond short-term, and development-driven locations. City and MIT staff, on a year-to-year basis, would determine the exact timing for specific intersection reviews.

Intersections identified for review in the short-term include:

- 1st Street and Victoria Avenue,
- 13th Street and Park Avenue,
- 17th Street East & Richmond Avenue,
- 18th Street and Cumberland Avenue (access to Monterey Estates),
- 18th Street and Maryland Avenue,
- 18th Street and Patricia Avenue,
- 34th Street and Victoria Avenue, and
- 34th Street and Richmond Avenue (planned for a possible roundabout).

Intersections identified for review beyond the short-term include:

- 1st Street and Veteran's Way,
- 1st Street and Richmond Avenue,
- 18th Street and Braecrest Drive,
- 18th Street and Kirkcaldy Drive,

- 18th Street and Park Avenue,
- Knowlton and Kirkcaldy Drive, and
- Richmond Avenue and PTH 110.

Intersections identified as being development-driven include:

- 1st Street and Clare Avenue, and
- 18th Street and Clare Avenue.

7.6.2 Road Upgrades

The following road links are forecast to be near, at, or above, the available capacity by the Year 2026, based on assumed land use growth levels and patterns, or are links deemed important to address to accommodate truck activity:

- 1st Street, four lane divided (4LD) from PTH 1 to PTH 110,
- 18th Street, four lane divided (4LD) from PTH 1 to PTH 110,
- Park Avenue, 4th to 18th Streets intersection configurations,
- Richmond Avenue, 26th to 34th Streets as 4LD roadway,
- Victoria Avenue, 34th Street to west City limit as 4LD roadway,
- Eastern leg of PTH 110 (Brandon By-pass) from PR 457 to PTH 1,
- PTH 10, PTH 1 to PTH 16 as 4LD roadway,
- Clare Avenue, 1st to 18th Streets as a two lane collector (timing will be development-driven), and
- Maryland Avenue, 20th to 34th Streets as a two lane collector (timing will be development-driven).

Of these, the upgrade to a four lane divided facility is estimated to be required in the 10 to 15 year time frame for 18th Street, however, actual timing will be dependant on the rate of traffic growth. The upgrade to 18th Street is forecast to delay the need to upgrade 1st

Street based on forecast redistribution of traffic to make use of the added capacity. However, this will need to be confirmed through the traffic monitoring program.

For year 2026 LOS without road improvements, other links are identified as being at LOS D or lower, however, these are likely due to local or collector links being used as a zone centroid.

7.7 Program Implementation Plan

Recommendations stemming from the results of this study are based on assumptions and priorities at the present time. Implementation of any recommendations should be based upon actual monitored traffic, budgetary considerations, growth patterns and infrastructure failure.

Many of the items discussed in this report are based on current traffic information and 20-year forecasts, which are in turn based on a number of assumptions. Actual trigger points should be based on traffic volumes and not points in time. As such, it is suggested that a routine traffic count program be undertaken at major intersections, especially traffic signal controlled locations, to determine if adjustments to signal phasing/timing is needed, or if geometric modifications are required. Counts every three to five years should suffice.

Accommodating safe and efficient pedestrian and cyclist movement addresses long term goals previously set out by the City and should reflect the City's Greenspace Master Plan prepared in 2002 (attached in Appendix H).

It is also recommended that collision data for the road network links and intersections be collected to identify areas and locations that can be addressed with informed policy decisions and program options to improve safety.

7.8 Recommended Upgrades

Recommended projects have been categorized, in Tables 7.1 and 7.2, by the six issues identified based on input received through the environmental scan, transportation planning model and consultation exercises. Each recommendation has been categorized to indicate which issues will be addressed by implementation of the project.

The prioritized recommendation list was based on the results of the environmental scan, traffic forecasts and level of service estimates, safety review, input from the consultation process (e.g., attendees of the final open house in April 2007 were asked to identify project

timing, and comments from earlier consultation exercises also noted project priorities in some cases), and input from the Steering Committee.

Projects that are considered able to be undertaken within annual operating budgets, or with administrative policy change, are shown in Table 7.1. Table 7.2 includes specific recommendations for various locations and road links within the study area.

Table 7.1: Recommendations: Policies and Strategies

Recommendation	Alt. Trans.[1]	Safety	Route Class./ Goods Move.	Access Man.	Capacity	Roadway Needs
Truck/Dangerous Goods Route Changes		✓	✓		✓	✓
Traffic Calming Guidelines		✓				
Reassessment of Road Jurisdictions		✓	✓		✓	✓
Update Roadway Classifications		✓	✓		✓	✓
Traffic Impact Study Policy				✓	✓	✓
Access Management Strategy		✓		✓	✓	
Smart Growth Principles	✓			✓	✓	✓
Synchronization of traffic signals	✓			✓	✓	✓
Transit signal priority study/implementation	✓					
Extended hours of operation for Transit	✓					
Conceptual design of Western By-Pass			✓		✓	✓
Modifications to Parking Standards				✓		
Traffic count monitoring program		✓	✓	✓	✓	✓
Intersection reviews and upgrades *	✓	✓	✓	✓	✓	✓
Safety review project recommendations *	✓	✓	✓	✓	✓	

* Relates to investigative studies. The detailed studies may result in the identification of higher cost capital upgrade requirements.

[1] Table headings: Alt. Trans. = Alternate Transportation and Environmental Concerns; Route Class./ Goods Move. = Route Classification and Goods Movement; Access Man. = Access and Traffic Management.

Table 7.2: Recommendations: Road Link Upgrades and Improvements

Recommendation	Alt. Trans.[1]	Safety	Route Class./ Goods Move.	Access Man.	Capacity	Roadway Needs
18th Street (PTH 10): CPR Overpass (Daly)		✓			✓	✓
18th Street (PTH 10): Bridge Twinning at Assiniboine River (Thompson)			✓		✓	✓
Richmond Avenue: Roundabout at 34th Street		✓			✓	
PTH 1: Phase 1 – Service Roads		✓		✓	✓	✓
PTH 1: Phase 2 and 3 – Interchanges at 18th Street and 1st Street		✓	✓	✓	✓	✓
PTH 1A: CPR Underpass at Kemnay		✓	✓			✓
PTH 10: Forrest By-pass	✓	✓	✓	✓		✓
PTH 110: Eastern By-Pass Completion		✓	✓		✓	✓
Proposed Western By-pass		✓	✓		✓	✓
Upgrades to 4-lane Divided						
1st Street (PTH 1A): PTH 1 to Braecrest Drive		✓			✓	✓
1st Street (PTH 1A): Braecrest Drive to Kirkcaldy Drive		✓			✓	✓
1st Street (PTH 1A): Richmond Avenue to PTH 110					✓	✓
Victoria Avenue (PTH 1A): 34th Street to 50th Street		✓	✓	✓	✓	✓
Victoria Avenue (PTH 1A): 50th Street to Proposed Western By-pass			✓		✓	✓
18th Street (PTH 10): PTH 1 to Braecrest Drive		✓	✓	✓	✓	✓
18th Street (PTH 10): Braecrest Drive to Assiniboine River		✓	✓	✓	✓	✓
18th Street (PTH 10): Maryland Avenue to Patricia Avenue		✓	✓		✓	✓
18th Street (PTH 10): Patricia Avenue to PTH 110		✓	✓		✓	✓
Richmond Avenue: 26th Street to 34th Street			✓	✓	✓	✓
PTH 10: Brandon to PTH 25		✓	✓		✓	✓
PTH 10: PTH 25 to Minnedosa		✓	✓		✓	✓
PTH 10: PTH 110 to South Jct. PTH 2		✓	✓		✓	✓

[1] Table headings: Alt. Trans. = Alternate Transportation and Environmental Concerns; Route Class./ Goods Move. = Route Classification and Goods Movement; Access Man. = Access and Traffic Management.

7.9 Project Prioritization and Cost Estimates

Recommended projects have been categorized in Tables 7.3, 7.4 and 7.5 into short, mid and long-term planning horizons based on input received through the environmental scan, transportation planning model and consultation exercises. In addition, some projects have been identified as 'beyond horizon year' if they are expected to occur beyond the 20-year study horizon.

The prioritized recommendation list was based on the results of the environmental scan, traffic forecasts and level of service estimates, safety review, input from the consultation process (e.g., attendees of the final open house in April 2007 were asked to identify project timing, and comments from earlier consultation exercises also noted project priorities in some cases), and input from the Steering Committee.

Table 7.3 identifies projects that are considered 'lower cost', which can be undertaken within annual operating budgets, or with administrative policy changes. Tables 7.4 and 7.5 include higher cost items that require programming and budgeting in the capital budget process. Figure 7.4 offers a graphical representation of the recommended lower and major capital cost upgrades to the study area road network.

Three recommended projects are not categorized in this manner as they are 'development driven' based on future residential development in Brandon, and hence are not identified in Tables 7.3, 7.4 and 7.5. These include:

- Clare Avenue (1st Street to 18th Street),
- Maryland Avenue (26th Street to 34th Street), and
- Lark Street (Braecrest Drive to Clare Avenue).

These are links identified through the development review component of this study, but should not be considered as a definitive list of development-driven roadway projects that may occur in the future.

Preliminary class D cost estimates, shown in Table 7.3, 7.4 and 7.5, were prepared for the recommended road network upgrades. Preliminary cost estimates have been based on typical unit costs per metre of roadway, excluding land costs, taxes, utility relocations and engineering. It should be noted that costs are based on 2007 rates and are subject to change.

Many of the items recommended, such as changes in classifications, intersection modifications (determined as part of an operational review of the intersection), and updating of the traffic signal control coordination plans do not lend themselves to easily identifiable cost estimates, therefore a yearly allowance is identified.

Table 7.3: Prioritized Recommendations: Lower Cost Items

Recommendation	Short-Term	Mid-Term	Long-Term	Beyond Horizon Year	Prelim. Cost Estimate
Truck/Dangerous Goods Route Changes	✓	✓	✓	✓	OP/AD[1]
Update Roadway Classifications	✓	✓	✓	✓	OP/AD
Reassessment of Road Jurisdictions	✓			✓	OP/AD
Traffic Calming Guidelines	✓	✓	✓	✓	OP/AD
Traffic Impact Study Policy	✓	✓	✓	✓	OP/AD
Access Management Strategy	✓	✓	✓	✓	OP/AD
Smart Growth Principles	✓	✓	✓	✓	OP/AD
Synchronization of traffic signals	✓				$100,000
Transit signal priority study/implementation	✓				$100,000
Extended hours of operation for Transit	✓				$300,000/yr
Conceptual design of Western By-pass	✓				$200,000
Modifications to Parking Standards	✓				OP/AD
Traffic count monitoring program	✓	✓	✓	✓	$10,000/yr
Intersection reviews and upgrades *	✓	✓	✓	✓	As required
Safety review project recommendations *	✓	✓	✓	✓	As required

[1] OP/AD indicates a project that can be undertaken with an operational budget or administrative policy change.

* Relates to investigative studies. The detailed studies may result in the identification of higher cost capital upgrade requirements.

Note: The above recommendations relate to Provincial roadways that are classed as Core routes, or roadways within the City of Brandon itself.

The first item is identified as an on-going item in that changes to the truck/dangerous goods routes is contingent on certain roadway upgrades/additions being completed.

Table 7.4: Prioritized Recommendations: Major Capital Upgrades

Recommendation	Short-Term (to 2012)	Mid-Term (to 2019)	Long-Term (to 2026)	Beyond Horizon Year
Urban Upgrades				
18th Street (PTH 10): Twin Structures at Assiniboine River (Thompson Bridge)	$17,000,000			
18th Street (PTH 10): CPR Overpass (Daly Overpass)			$20,000,000	
Richmond Avenue: Roundabout at 34th Street	$500,000			
Rural Upgrades				
PTH 1: Phase 1 – Service Roads	$5,000,000	$5,000,000		
PTH 1: Phase 2 – Interchange at 18th Street		$20,000,000	$20,000,000	
PTH 1: Phase 3 – Interchange at 1st Street			$15,000,000	$15,000,000
PTH 1A: CPR Underpass at Kemnay	$2,500,000	$2,500,000		
PTH 10: Forrest By-pass	$5,000,000			
PTH 110: Eastern By-pass Completion	$30,000,000			
Proposed Western By-pass				TBD [1]
Total	$60,000,000	$27,500,000	$55,000,000	TBD

[1] TBD: To Be Determined

Note: The above recommendations relate to Provincial roadways that are classed as Core routes, or roadways within the City of Brandon itself.

The PTH 1 upgrade to an expressway standard is shown as three components, and as multi-term projects due to the total cost and the staging needs for implementation. In this case, the external service roads must be constructed prior to work proceeding on PTH 1 itself.

Further, although outside the 20-year scope of this study, the completion of the Western By-pass should be taken under consideration as a long-term road link upgrade to alleviate through truck traffic within Brandon. Therefore, the necessary accommodations for right-of-way protection/acquisition, environmental considerations and land use planning should be undertaken to prepare for this project.

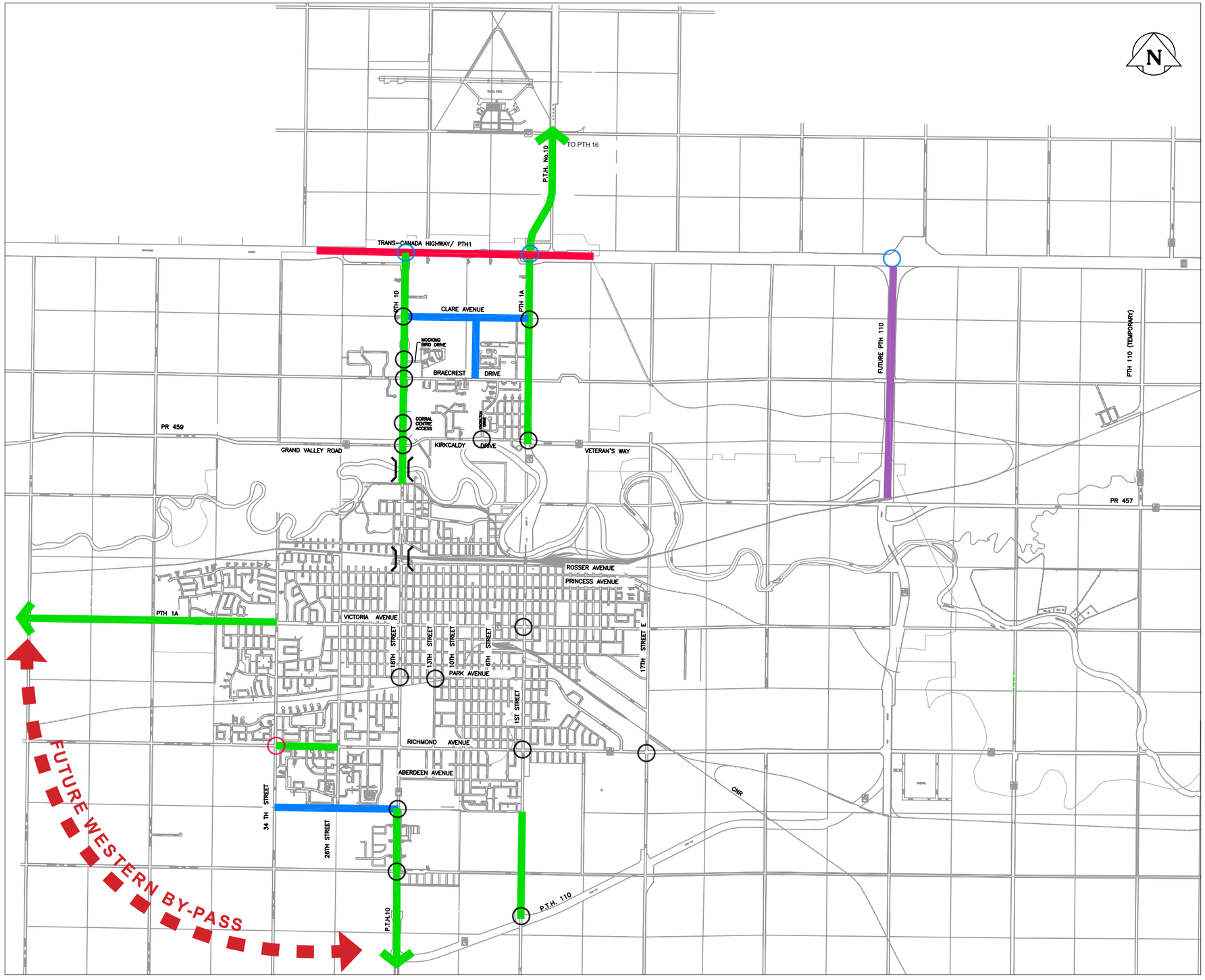
Upgrades to 1st and 18th Streets between PTH 1 and the Assiniboine River are split into two components as the northern portion is tied to the planned upgrade to PTH 1.

Table 7.5: Prioritized Recommendations: Major Capital Twinning (4-lane Divided)

Recommendation	Short-Term (to 2012)	Mid-Term (to 2019)	Long-Term (to 2026)	Beyond Horizon Year
Urban Twinning (4-lane Divided)				
1st Street (PTH 1A): PTH 1 to Braecrest Drive			$5,000,000	
1st Street (PTH 1A): Braecrest Drive to Kirkcaldy Drive		$2,000,000		
1st Street (PTH 1A): Richmond Avenue to PTH 110			$4,000,000	
Victoria Avenue (PTH 1A): 34th Street to 50th Street		$3,000,000		
Victoria Avenue (PTH 1A): 50th Street to Western By-pass				TBD [1]
18th Street (PTH 10): PTH 1 to Braecrest Drive			$5,000,000	
18th Street (PTH 10): Braecrest Drive to Assiniboine River		$2,000,000		
18th Street (PTH 10): Maryland Avenue to Patricia Avenue	$3,000,000			
18th Street (PTH 10): Patricia Avenue to PTH 110			$3,000,000	
Richmond Avenue: 26th Street to 34th Street		$1,000,000		
Rural Twinning (4-lane Divided)				
PTH 10: Brandon to PTH 25	$25,000,000			
PTH 10: PTH 25 to Minnedosa			$40,000,000	
PTH 10: PTH 110 to South Jct. PTH 2		$40,000,000		
Total	$28,000,000	$48,000,000	$57,000,000	TBD

[1] TBD: To Be Determined

Note: The above recommendations relate to Provincial roadways that are classed as Core routes, or roadways within the City of Brandon itself.



LEGEND

IDENTIFIED MAJOR IMPROVEMENT PROJECTS

- ONGOING INTERSECTION REVIEWS
- INTERCHANGE
- ROUNDABOUT
- TWIN BRIDGES
- UPGRADE TO 4 LANE DIVIDED
- UPGRADE TO EXPRESSWAY
- UPGRADE TO CORE ROUTE

DEVELOPMENT DRIVEN PROJECTS

- DEVELOPMENT REVIEW

Manitoba

CITY OF BRANDON MANITOBA

MMM GROUP

Source: City of Brandon

PROJECT TITLE

Brandon Area Road Network Development Plan

FIGURE 7.4: RECOMMENDED UPGRADES

8.0 CONCLUSIONS

The following conclusions are offered:

1. That as the City address future transit service improvements, the measures noted in Section 7.1.1 are considered.

2. That the smart growth principles noted in Section 7.1.2 be incorporated when reviewing future development proposals.

3. That the City and MIT undertake the short-term safety initiatives identified in Section 7.2.1.

4. That the traffic calming strategy identified in Section 7.5.2 be considered when volume and/or speed control measures are deemed required.

5. That the City adopt changes to the City's Truck and Dangerous Goods Route Network identified in Section 7.3.

6. That the City adopts the access management guidelines set out in Section 7.4.

7. That modifications noted in Section 7.4.1 be incorporated into the City's current parking standards.

8. That the traffic impact study policy outlined in Section 7.5.1 and included in Appendix D be adopted by the City and applied to any future development applications.

9. That the City adopts the road classification system, and related design standards, in Section 7.3.

10. That the City and MIT conduct detailed operational reviews at the intersections noted in Section 7.6.1, selecting two to five intersections per year to examine.

11. That the City and MIT implement road link improvements as noted in Section 7.6.2.

12. That the alternative funding options discussed in Appendix E be examined in detail by City administration to determine if they are applicable. The funding options focus on incorporating off-site development improvements on a site-by-site basis, transportation assessments, and impact fees.

13. That a traffic count monitoring program be established to: monitor operations at key intersections that may need upgrades within the horizon year time frame; and review whether adjustments to traffic signal phasing or timing may be required.

14. That traffic control modifications planned by MIT occur within the next two years.

15. That roundabouts continue to be considered at collector – collector intersections if technically feasible as an alternative to traffic signals.

16. That the City ensures the traffic model is updated on a regular basis and maintained for future traffic recommendations.

9.0 REFERENCES

[1] Caliper Corporation, Travel Demand Modelling with TransCAD 4.8, 2005.

[2] Caliper Corporation, Travel Demand Modelling with TransCAD 4.8, 2005.

[3] Caliper Corporation, Travel Demand Modelling with TransCAD 4.8, 2005.

[4] Information on residential permit trends provided by the Brandon and Area Planning District, 2005.

[5] Brandon and Area Planning District Development Plan, Reference Maps 6a-6d "Residential Priority Infill Areas," 2005.