BUILDING A STRONG FOUNDATION HAMILTON

Hamilton

City of Hamilton

Airport Employment Growth District

FINAL REPORT

Transportation Master Plan

June 2011

DILLON CONSULTING

EXECUTIVE SUMMARY

By 2031, planned growth in the Hamilton Airport Employment Growth District (AEGD) is expected to reach over 28,000 employees. The Hamilton AEGD Transportation Master Plan (TMP) was undertaken to prepare a transportation strategy that would suitably accommodate these employment projections and the City of Hamilton's long-term vision.

The specific objectives of the study included:

- Preparing a transportation strategy that supports development of the AEGD;
- Identifying problems or opportunities and related alternative solutions to transportation issues anticipated for a 2031 horizon;
- Identifying and protecting future transportation corridors;
- Integrating policies, programs, funding and infrastructure needs;
- Identifying preliminary cost estimates for transportation infrastructure improvement projects; and
- Developing a Transportation Master Plan for the AEGD to satisfy Phases 1 & 2 of the Municipal Class Environmental Assessment process.

The AEGD is located southwest of the City of Hamilton Urban Area, encircling the Hamilton International Airport (HIA). The study area is characterized primarily by existing agricultural and rural residential lands.

A recommended land use plan (Hybrid Prestige / Light Industrial Business Park) for the AEGD was established which included four different land use types:

- Prestige Business Park
- Light Industrial
- Airside Industrial
- Airport-Related Business

The preferred Land Use Option proposed for the AEGD lands provided approximately 759 net hectares of employment land to serve the needs to 2031 and 1,271 to serve the demands beyond 2031. The AEGD will be developed in three development phases to coincide with water, wastewater, and transportation infrastructure development phasing.

As a result of the development phasing three horizons are utilized within this TMP:

- Horizon Year 2021 generally represents land areas that currently have sufficient water and wastewater servicing capacity (Phase 1 of Secondary Plan Area and potentially some of the Council Directed Additional Lands[1]);
- Horizon Year 2031 is used as the TMP's final horizon (Phase 2 of Secondary Plan Area + Council Directed Additional Lands); and
- At some time beyond 2031, the full build-out of the development will include the entire Secondary Plan Area and Council Directed Additional Lands as well as an Additional Study Area. The full build-out was included for future consideration to represent development of the entire AEGD study area (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area)

The Council Directed Additional Lands would be expected to develop prior to the 2031 horizon. For analysis purposes, the Ancaster Christian Reform Church lands were assumed to be developed by 2021 and the Smith Farm by 2031.

Existing roads within the AEGD study area are primarily two and four lane arterial and collector roadways, with the exception of provincial Highway 6. Transit service within the study area is currently limited. Cycling, pedestrian, and trail facilities are also limited due to barriers and/or missing trail connections.

The Existing Transportation Network was assessed as part of Phase 1 of the AEGD study and no deficiencies were identified. A number of planned transportation improvements for roads, transit, cycling, and goods movement were considered within this study.

The City of Hamilton's AM Peak Hour EMME/2 Model was used to determine the travel demand needs and phasing for the Secondary Plan Area and Council Directed Additional Lands between 2009 and 2031, and for the period beyond including the Additional Study Area. Problem areas were identified and addressed through the development of four possible network alternatives for the AEGD's Secondary Plan Area + Council Directed Additional Lands + Additional Study Area.

- Do Nothing Alternative
- Alternative #1 – 6-Lane Dickenson Road with Enhanced Road Grid

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[1] The Council Directed Additional Lands are two properties that were identified separately from the Secondary Plan Area and Additional Study Area. These properties include the Ancaster Christian Reform Church and the Smith Farm. These two properties are referred to as Council Directed Additional Lands throughout this report.

- Alternative #2 – 4-Lane Dickenson Road with Multi-Use Trail Connections
- Alternative #3 – 6-Lane Dickenson Road with Multi-Use Trail Connections

All identified AEGD network alternatives were examined for the 2031 horizon year and a point beyond (i.e. full development of the Additional Study Area) using Synchro traffic software. This was done to assess network operations, using the level-of-service (LOS) measurement. In addition to traditional signalized intersections analysis, roundabout feasibility was also examined for major intersections within the AEGD.

Specific transportation goals identified for the AEGD network included:

- Achievement of a 20% reduction in auto kilometres travelled by the year 2031, compared to the 2001 baseline;
- Achievement of a 12% transit mode share by 2031; and
- Provision of facilities for alternative modes of transportation (i.e. walking and cycling).

Consistent with the Municipal Class EA process, the proposed network alternatives were evaluated according to a number of criteria related to transportation service, cost, engineering, socio-economics, cultural environment, and natural environment factors.

Based on these criteria, Alternative #2 – 4-Lane Dickenson Road with Multi-Use Trail Connections was ranked the highest of all alternatives and was chosen as the preferred network alternative.

In order to achieve the preferred road network alternative, a number of infrastructure improvements were identified and a transportation strategy was developed.

- Network recommendations were identified within the study area for:
  - new and expanded roadways;
  - typical cross-sections;
  - “greenway” provisions for future stormwater or greywater systems;
  - roadway improvements; and
  - other transportation-related infrastructure (e.g. Employment Supportive Centres and integrated transit facilities, cycling lanes, and a pedestrian and trails network).
- Transit recommendations identified the development of local and regional transit initiatives to provide high quality service to the AEGD area.

- Transportation Demand Management (TDM) measures and guidelines were recommended for the AEGD.
- Cycling/Pedestrian/Trails networks were developed to provide multi-modal connections throughout the AEGD.
- Potential Truck Routes were identified based on the need for goods movement between the study area and major goods movement destinations. These findings were consistent with those of the Truck Route Master Plan.

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1.0 INTRODUCTION

1.1 Background

Vision 2020 is Hamilton's long term vision for a strong, healthy, sustainable future shared by local government, citizens, business, groups and organizations. It provides detailed information on the City of Hamilton's Sustainable Community Initiative. Guiding principles for transportation planning within Hamilton have been outlined by the City's 2007 Transportation Master Plan which identifies that in 2020, the City of Hamilton's transportation system will:

- ✓ Offer safe and convenient access for individuals to meet their daily needs.
- ✓ Offer a choice of integrated travel modes, emphasizing active transportation, public transit and carpooling.
- ✓ Enhance the livability of neighbourhoods and rural areas.
- ✓ Encourage a more compact urban form, land use intensification and transit-supportive node and corridor development.
- ✓ Protect the environment by minimizing impacts on air, water, land and natural resources.
- ✓ Support local businesses and the community's economic development.
- ✓ Operate efficiently and be affordable to the City and its citizens.

Previous Official Plan Amendments to the Regional Municipality of Hamilton-Wentworth, Town of Ancaster and the Township of Glanbrook Official Plans identified the need to respond to future growth and to recognize the importance of the John C. Munro Hamilton International Airport (HIA) as an employment node. Additionally, the Growth Related Integrated Development Strategy (GRIDS) identified the AEGD as one of the main areas to address the City's need for employment lands to the year 2031 (for a definition of GRIDS and other technical terms used in this TMP, refer to the *Glossary of Terms* at the end of this report).

By 2031 planned growth in the Hamilton Airport Employment Growth District (AEGD) is expected to reach over 28,000 employees. The Hamilton AEGD Transportation Master Plan was undertaken to prepare a transportation strategy that would suitably accommodate these employment projections and the City of Hamilton's long-term vision.

This report presents the analyses and evaluations undertaken to determine the transportation system required to support the development of the Hamilton Airport Employment Growth District.

1.2 AEGD Vision and Objectives

The Vision and Objectives for the AEGD were developed based on results of a Community Liaison Committee (CLC) Visioning Workshop held on January 20, 2009. The overall Vision for the AEGD was identified as follows:

> *"The employment area is vibrant and visually appealing and the natural and cultural heritage resources in the area have been preserved and used to establish a distinct character for the area. It is a working community that attracts a range of airport related and other businesses providing both conventional and knowledge-based services. The environmental footprint of the area has been managed through a range of sustainable design techniques and the character of the surrounding land uses have been protected through appropriate land use transitions and transportation planning."*

A major goal of the Vision is to attract technologically advanced industries into the AEGD, such as industries with a long-term vision in the carbon neutral and energy sectors. To achieve this goal, numerous attractive aspects of the AEGD must be emphasized including, its excellent working environment, the economic value added from modern transportation connections, the number and sizing of lots, an excellent regional employee pool, and nearby housing choices.

1.3 Municipal Class EA Process

The Municipal Class Environmental Assessment process, identified in ***Figure 1***, has been followed for the AEGD Transportation Master Plan Study. Master Plans must address at least the first two phases of the Class EA process. The study has been carried out according to the guidelines set out in Section A.2.7 Master Plans of the Municipal Engineers Association (MEA) Class Environmental Assessment document (October 2000, as amended in 2007).

Approach #2 of the Master Planning process from the Municipal Engineers Association (MEA) document was used as a guide for the AEGD Transportation Master Plan Study. This was a fully coordinated approach to land use and infrastructure planning and the process is well suited to long range planning for a significant geographical area, such as the AEGD. Approach #2 requires the preparation of a master plan document following the completion of Phases 1 and 2 of the EA process. The use of Approach #2 for the preparation of the AEGD Transportation Master Plan provides a broad process where the level of investigation, consultation and documentation are sufficient to fulfill the requirements for Schedule B projects. The assessment within the master plan satisfies Phases 1 and 2 of the Class EA process for Schedule B projects identified within the Transportation Master Plan. Schedule C projects require the completion of Phases 3 and 4 prior to implementation. This Transportation Master Plan provides the basis for future investigations for specific Schedule C projects identified herein.

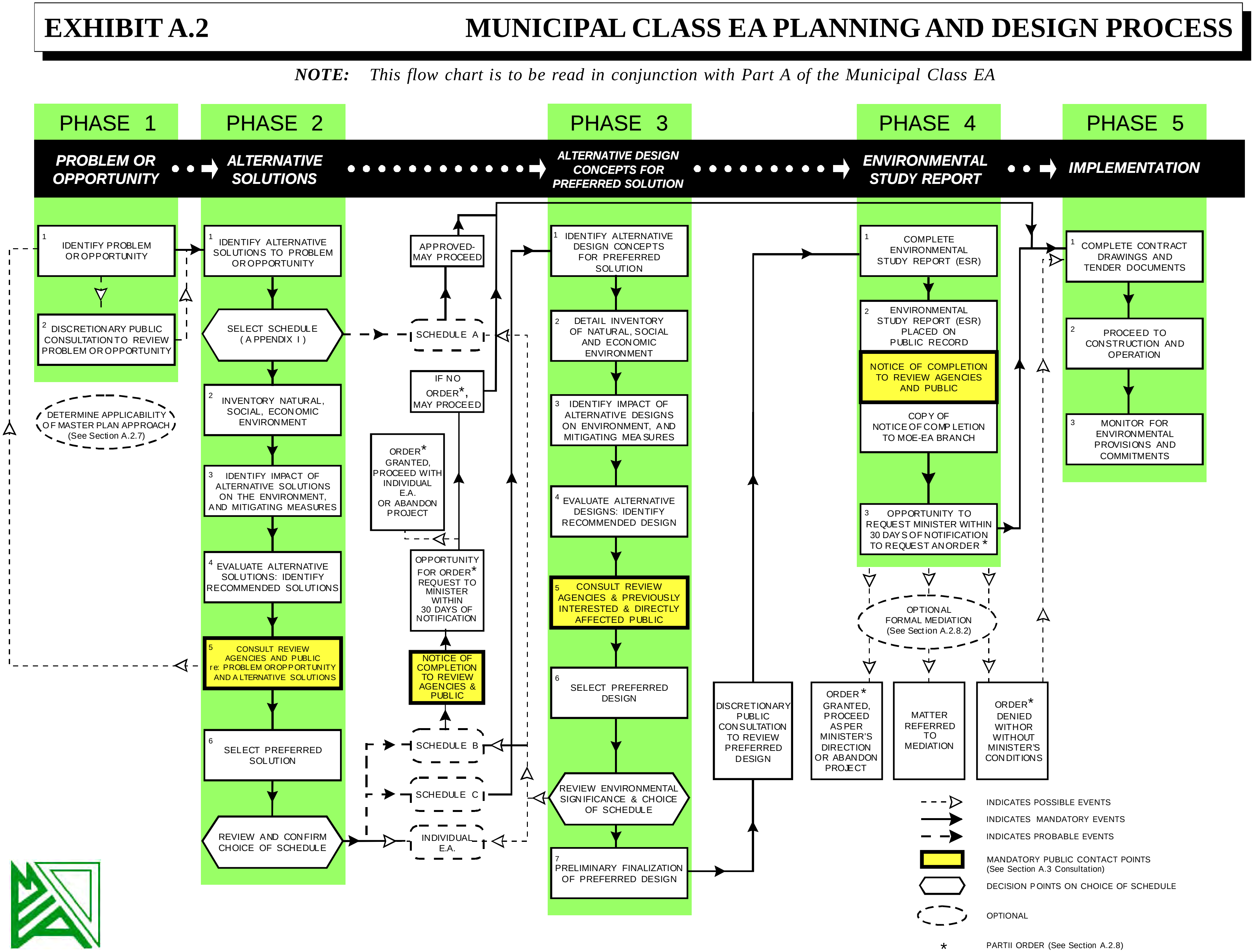
This Transportation Master Plan Report has been prepared to document the process.

1.4 Study Objectives

This study presents a transportation system to guide the transportation infrastructure and strategic policies of the AEGD area up to the 2031 planning horizon year. The specific objectives of the study included:

- Preparing a transportation strategy that supports development of the AEGD;
- Identifying any problems or opportunities and related alternative solutions to transportation issues to 2031;
- Identifying and protecting future transportation corridors;
- Integrating policies, programs, funding and infrastructure needs;
- Identifying preliminary cost estimates for transportation infrastructure improvement projects;
- Developing a Transportation Master Plan for the AEGD; and
- Satisfying Phases 1 & 2 of the Municipal Class Environmental Assessment process.

Figure 1 Municipal Class Environmental Assessment Process



1.5 Scope of Work

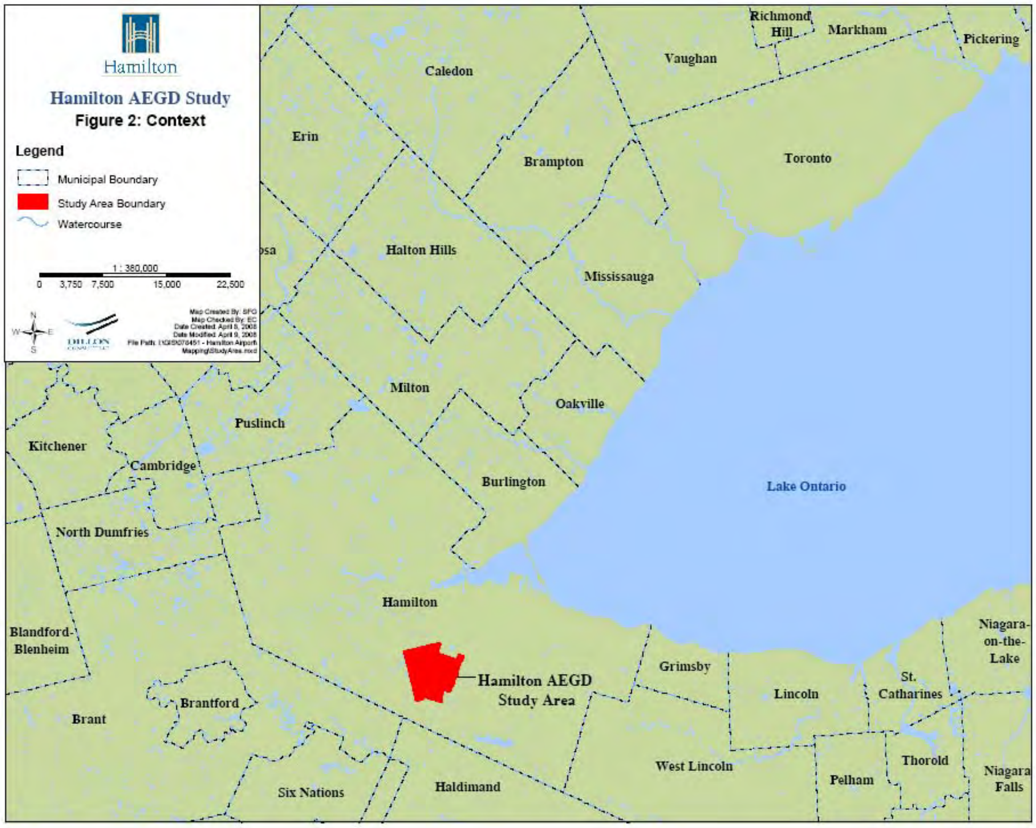
The study consisted of the following major tasks:

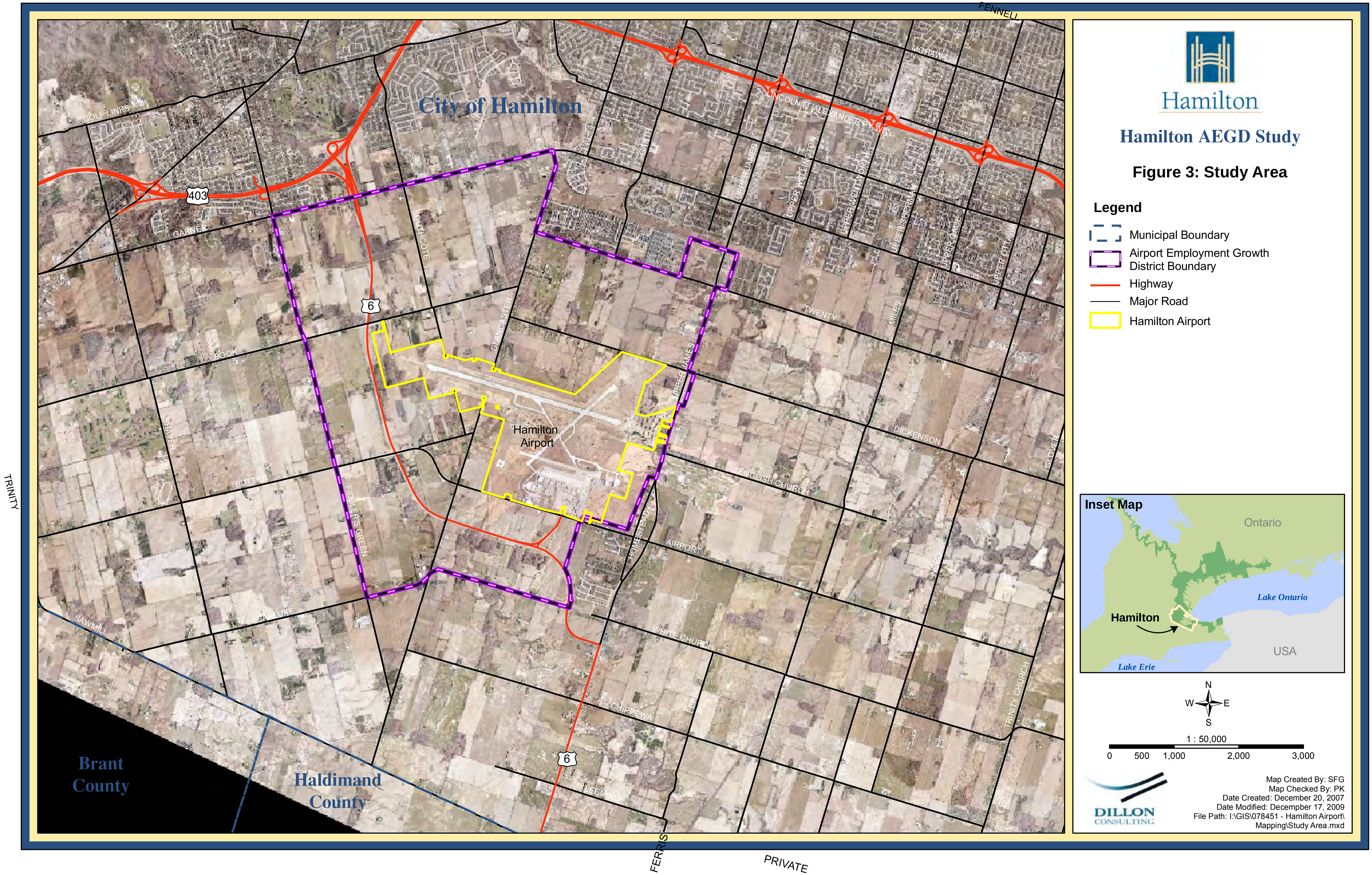
- Developing a sub-area transportation model for the AEGD area incorporating relevant studies/documentation;
- Assessing transportation infrastructure requirements for the area;
- Undertaking operational modelling to determine more detailed impacts to the study area roadway network;
- Developing a Transportation Master Plan for the AEGD area;
- Identifying key road links, required transit routes, cycling routes and other infrastructure requirements;
- Identifying problems, concerns, deficiencies and required improvements with the cycling and pedestrian networks;
- Identifying transportation demand management objectives and required policies;
- Developing an Implementation Plan, including financing requirements, for all works; and
- Considering and refining opportunities and issues related to the proposed Niagara-to-GTA Corridor, the Red Hill Valley Parkway, and connections between the Port and the Airport.

1.6 Study Area

The City of Hamilton is located in the southwestern portion of the Greater Golden Horseshoe (GGH) and the Airport Employment Growth District is located southwest of the City of Hamilton Urban Area (see ***Figure 2***). The study area is bounded by Garner Road and Twenty Road West in the north, Upper James Street in the east, White Church Road and Carluke Road in the south, and Fiddler's Green Road in the west. ***Figure 3*** illustrates the study area.

Figure 2: AEGD in Context




Hamilton
Hamilton AEGD Study
Figure 3: Study Area
Legend
Municipal Boundary
Airport Employment Growth District Boundary
Highway
Major Road
Hamilton Airport
Inset Map
Ontario
Lake Ontario
Hamilton
USA
Lake Erie
N
W
E
S
1 : 50,000
0
500
1,000
2,000
3,000
DILLON CONSULTING
Map Created By: SFG
Map Checked By: PK
Date Created: December 20, 2007
Date Modified: December 17, 2009
File Path: I:\GIS\078451 - Hamilton Airport\Mapping\Study Area.mxd
City of Hamilton
Hamilton Airport
Brant County
Haldimand County
403
6
6
FENNELL
MOHAWK
LINCOLN M. ALEXANDER PKWY
GOLF LINKS
GARNER
SOUTHCOTE
GLANCASTER
UPPER JAMES
UPPER WELLINGTON
UPPER WENTWORTH
UPPER SHERMAN
UPPER GAGE
UPPER OTTAWA
TWENTY
MILES
ROOK
SHAVER
BUTTER
FIDDLER'S GREEN
DICKENSON
ENGLISH CHURCH
GLOVER
HOMESTEAD
AIRPORT
NEBO
SAWMILL
CARLUKE
WHITE CHURCH
CHIPPEWA
FERRIS
TRINITY CHURCH
LEEMING
TRINITY
PRIVATE

1.7 Land Use

1.7.1 Planning Framework

In 2006, the preferred growth scenario developed for the Growth Related Integrated Development Strategy (GRIDS) identified the AEGD as one of the main areas to address the City's need for employment lands to the year 2031. Similarly, the Growth Plan for the Greater Golden Horseshoe (2006) encourages municipalities to designate and preserve lands within settlement areas in the vicinity of existing airports "as areas for manufacturing, warehousing, and associated retail, office and ancillary facilities, where appropriate"[2].

The study area falls under the jurisdiction of the former Region of Hamilton-Wentworth Official Plan, the former Town of Ancaster Official Plan and the former Township of Glanbrook Official Plan, the Rural Official Plan (Council adopted, pending Ministerial approval) and the Urban Official Plan (Council adopted, pending Ministerial approval). Most of the lands in the study area, with the exception of the Airport lands and the Airport Business Park, have rural (Regional Official Plan) or agricultural (Local Official Plans) designations.

In order to respond to future growth and to recognize the importance of the John C. Munro Hamilton International Airport (HIA) as an employment node, the City of Hamilton prepared Official Plan Amendments to the Regional Municipality of Hamilton-Wentworth, Town of Ancaster and the Township of Glanbrook Official Plans to identify a Special Policy Area. The Special Policy Area is centred around the Airport Employment Growth District and the HIA. These amendments were approved by the Ontario Municipal Board (OMB) decision on September 25, 2006. The OMB decision noted that a planning review process must be undertaken in order to consider the lands subject to the amendments for an urban designation. The required studies included analysis of the amount of land required for the AEGD, the nature of the proposed land uses, infrastructure needed (particularly transportation, stormwater and water/wastewater), provisions required to maintain the airport functions, and the cost and method of financing the employment district[3].

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[2] Government of Ontario, Ministry of Public Infrastructure Renewal, *Places to Grow: Growth Plan for the Greater Golden Horseshoe* (2006).

[3] Ontario Municipal Board, *Minutes of Settlement OMB Case No. PL050686* (September 25, 2006)

1.7.2 Existing Land Use

The study area falls within the former municipalities of Ancaster and Glanbrook, bounded by Fiddler's Green Road in the west, White Church Road and Carluke Road in the south, Upper James Street in the east, and Twenty Road and Garner Road in the north.

The study area is characterized primarily by agricultural and rural residential lands. Two major defining features of the area are the HIA and the existing Airport Business Park. ***Figure 4*** contains photographs of some of the existing uses in the study area.

Figure 4: Airport, Industrial and Residential Uses

The remainder of the study area is primarily occupied by farms and agricultural operations. However, within the rural area are a number of clusters of rural residential lots. The larger rural residential clusters are located to the west of the airport along Butter Road, Southcote Road and Book Road, to the north of the airport along Glancaster Road, Dickenson Road and Twenty Road, to the east of the airport along Upper James Street, and to the south of the airport along Airport Road. Many of the homes, especially to the west of the airport, are situated on large estate lots.

Immediately adjacent to the study area boundary are a number of established residential areas. The Mount Hope area is located at the crossroads of Airport Road and Homestead Drive, southeast of the airport. The area is characterized by new and old homes and a very small commercial core. The area directly adjacent to the northern boundary of the study area along Twenty Road is characterized primarily by clusters of large residential lots, many in close proximity to new subdivisions.

The study area also contains two churches along the south side of Garner Road, a secondary school at Garner Road and Glancaster Road and a golf course south of Twenty Road and east of Glancaster Road.

In 2002 the City of Hamilton commenced the Civic Gateway Design Study to create a sense of pride for residents and visitors to the City. The study identified Highway 403 and Highway 6 Interchange, within the study area, as a potential site for a gateway feature. The preference is to have buildings or structures as gateway features, rather than signs. In addition, the scale and design of these features should suit the development type; that is, a sleek, professional design for Prestige Business Park areas (described below in Section 2.0).

1.7.3 Population and Employment Projections

In 2006, the City of Hamilton had a population of 504,000. According to the City's Urban Official Plan and the Growth Plan for the Greater Golden Horseshoe, between 2001 and 2031 the population is expected to increase by approximately 150,000 people, or 30%, totaling 660,000. During the same period, employment is expected to increase from 210,000 to 300,000, a 42% increase.

From a land use perspective, the AEGD study area is divided into a "Secondary Plan Area" to be developed up to the horizon year of 2031, and an "Additional Study Area" for future consideration at some point beyond 2031. In addition, two properties referred to as "Council Directed Additional Lands" were identified separately. These properties include the Ancaster Christian Reform Church and the Smith Farm. These properties are expected to be developed prior to the 2031 horizon.

Within the AEGD, the average density encouraged is 37 employees per net hectare of developable land. The total employment projection for the Secondary Plan Area is over 28,000 employees.

The employment projections for the Additional Study Area include an additional 20,000 employees for future consideration. No increase in population is expected, as there is no residential growth planned for the AEGD.

Based on these growth projections, the AEGD has the potential to be a catalyst for employment growth and economic development.

2.0 COORDINATION WITH LAND USE, SERVICING AND STORMWATER MANAGEMENT

A recommended land use plan for the AEGD was determined in the previous stage of the AEGD study in coordination with the development of three master plans (i.e. servicing, stormwater and transportation).

After careful evaluation, a preferred option was selected that included a combination of land use types (Option 3: Hybrid Prestige/ Light Industrial Business Park). Within this option, land use was categorized into four different land use types. These are described briefly below.

Prestige Business Park

Lands designated as Prestige Business Park are located for the most part on either side of major arterial roads in the eastern portion of the study area. These areas will provide a focus on corporate and office settings and will attract a broad range of industries.

Light Industrial

Industrial lands are located east of Southcote, between Garner Rd. and Dickenson Rd. between Twenty Road and Dickenson Road and along the eastern edge of Fiddler's Green Road, south of Book Road. Permitted uses on light industrial lands include manufacturing, warehousing and communication and high technology activities. Light Industrial lands will also permit uses that support industry including conference and convention centres, trade schools, commercial rental establishments, etc.

Airside Industrial

Lands designated as Airside Industrial require direct "airside" access to the airport and are located adjacent to the existing and future runway aprons of the John C. Munro Hamilton International Airport. Airside Industrial uses permit warehousing, transportation terminals, research and development, office, communication establishment, fuel storage, and airport catering services. Airport-related industrial uses will also be permitted, such as airport transportation and cargo services, airport waste processing facilities, airport waste transfer facilities, and utility activities benefiting from proximity to airport services.

Airport-Related Business

Airport-Related Business lands are located in the southern part of the study area, bounded by White Church Road in the south, Butter Road in the north, and Highway 6 in the west. Permitted uses on these lands include hotels, motels, convention centres, restaurants and catering services, commercial storage facilities, automobile rental, leasing and servicing, gas stations, taxi terminals, places of entertainment and recreation and financial institutions.

The preferred option was further refined based on comments received from various City departments, stakeholders and agencies over the course of the study. Recommendations were also incorporated from the Airport Zoning Option 3 and Airport Market Analysis and Land Needs Reports prepared by LPS AVIA (draft July 10th, 2009, revised July 24th, 2009).

The proposed distribution of the AEGD lands in the preferred Land Use Option provided approximately 799 net developable hectares (702 hectares of urban area expansion plus 97 hectares of existing urban area) in the Secondary Plan Area (which includes the Council Directed Additional Lands) with an additional 472 net developable hectares within the Additional Study Area, for a total of 1,271 net developable hectares under the following assumptions:

- The net developable area includes the areas currently designated Airport Business Park, which is located within Hamilton's Urban Boundary, as shown in Schedule E of the Urban Official Plan;
- Future Airport Lands are set aside for future airport expansion, as forecasted by the LPS Avia report ;
- A 20% gross to net ratio was applied to account for future infrastructure, including roads, stormwater management systems, laneways, walkways, parks, etc.

Land use distribution for net developable areas is shown in detail below in ***Table 1***.

Table 1: Land Use Areas of the Refined Preferred Option

Land Use Areas of the Refined Preferred Option		
Net Developable Area	**Hectares**	**Acres**
Airside Industrial	121	300
ARB: Airport-Related Business	126	311
Light Industrial	406	1,002
PBP: Prestige Business Park	618	1,526
Total Net Developable Area (1)	**1,271**	**3,140**

(1) Calculations based on remaining developable land
(80% Net-to-Gross Conversion Factor- assumption for planning purposes only)

The Secondary Plan Area calculation includes the "Council Directed Additional Lands" (i.e. the Ancaster Christian Reform Church and the Smith Farm). The Ancaster Christian Reform Church is located at the southwest corner of Fiddler's Green Road and Garner Road. A development concept plan has been prepared for this property, which retains the existing church building and allows for future expansion.

The Ancaster Christian Reform Church encompasses 15.8 hectares (39.04 acres) and for the purposes of this study is considered a Prestige Business Park land use.

The Smith Farm is located immediately south of Book Road. It is bounded by Southcote Road to the east, Smith Road to the west, and the Airport to the south. To maintain consistency with adjacent lands it was divided into a northern and southern portion. The land use types and net developable areas for these portions are as follows:

- Smith Property North (Prestige Business Park): 6.40 hectares (15.82 acres); and
- Smith Property South (Airside Industrial): 17.70 hectares and (43.75 acres).

The Council Directed Additional Lands are shown in ***Figure 5***.

Development Phasing

As described in the Secondary Plan, the AEGD is intended to provide employment lands to serve the needs to 2031 and beyond. By considering the potential for employment land and infrastructure needs beyond 2031, the City is able to ensure orderly and coordinated development of the Airport Employment Growth District beyond 2031 by preventing the establishment of new land uses in the interim which might create land use conflicts and compromise the long-term vision for the district. This long-term perspective also allows the City to invest wisely in the water, wastewater and transportation infrastructure which is required to service lands to 2031 and, when it is justified, be able to cost-effectively upgrade this infrastructure to serve development beyond 2031.

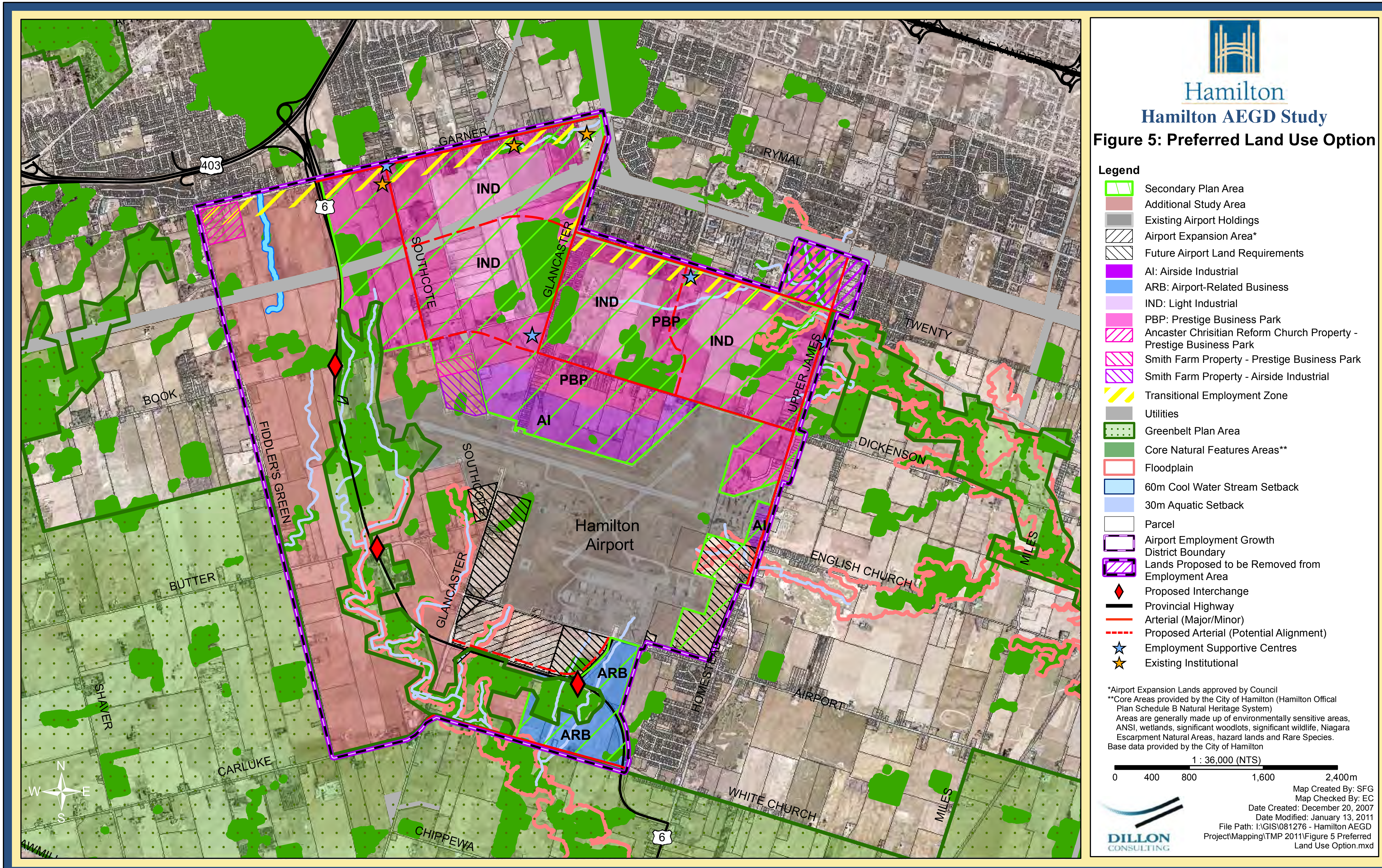
As a result of the development phasing three horizons are utilized within this TMP:

- Horizon Year 2021 generally represents land areas that currently have sufficient water and wastewater servicing capacity (Phase 1 of Secondary Plan Area and potentially some of the Council Directed Additional Lands[4]);
- Horizon Year 2031 is used as the TMP's final horizon (Phase 2 of Secondary Plan Area + Council Directed Additional Lands); and
- At some time beyond 2031, the full build-out of the development will include the entire Secondary Plan Area and Council Directed Additional Lands as well as an Additional Study Area. The full build-out was included for future consideration to represent development of the entire AEGD study area (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area)

The Council Directed Additional Lands would be expected to develop prior to the 2031 horizon. For analysis purposes, the Ancaster Christian Reform Church lands were assumed to be developed by 2021 and the Smith Farm by 2031.

Figure 5 below shows the preferred land use option for the Secondary Plan Area, the Council Directed Additional Lands and the Additional Study Area. To provide additional context, the employment forecast for the Secondary Plan Area and Council Directed Additional Lands includes over 28,000 employees (24,000 in the urban expansion area and 4,000 in the existing urban area). The employment forecast for the Additional Study Area, provided for future consideration, is an additional 20,000 employees.

[4] The Council Directed Additional Lands are two properties that were identified separately from the Secondary Plan Area and Additional Study Area. These properties include the Ancaster Christian Reform Church and the Smith Farm. These two properties are referred to as Council Directed Additional Lands throughout this report.


Hamilton
Hamilton AEGD Study
Figure 5: Preferred Land Use Option
Legend
Secondary Plan Area
Additional Study Area
Existing Airport Holdings
Airport Expansion Area*
Future Airport Land Requirements
AI: Airside Industrial
ARB: Airport-Related Business
IND: Light Industrial
PBP: Prestige Business Park
Ancaster Chrisitian Reform Church Property - Prestige Business Park
Smith Farm Property - Prestige Business Park
Smith Farm Property - Airside Industrial
Transitional Employment Zone
Utilities
Greenbelt Plan Area
Core Natural Features Areas**
Floodplain
60m Cool Water Stream Setback
30m Aquatic Setback
Parcel
Airport Employment Growth District Boundary
Lands Proposed to be Removed from Employment Area
Proposed Interchange
Provincial Highway
Arterial (Major/Minor)
Proposed Arterial (Potential Alignment)
Employment Supportive Centres
Existing Institutional
*Airport Expansion Lands approved by Council
**Core Areas provided by the City of Hamilton (Hamilton Offical Plan Schedule B Natural Heritage System)
Areas are generally made up of environmentally sensitive areas, ANSI, wetlands, significant woodlots, significant wildlife, Niagara Escarpment Natural Areas, hazard lands and Rare Species.
Base data provided by the City of Hamilton
1 : 36,000 (NTS)
0 400 800 1,600 2,400m
Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: January 13, 2011
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP 2011\Figure 5 Preferred Land Use Option.mxd
DILLON CONSULTING
IND
IND
IND
IND
PBP
PBP
AI
AI
ARB
ARB
Hamilton Airport
GARNER
RYMAL
TWENTY
DICKENSON
ENGLISH CHURCH
AIRPORT
WHITE CHURCH
CHIPPEWA
CARLUKE
BUTTER
BOOK
SHAVER
FIDDLER'S GREEN
SOUTHCOTE
GLANCASTER
UPPER JAMES
HOMESTEAD
MILES
403
6
N
E
S
W

2.1 Hamilton International Airport

An integral part of the development for the AEGD is John C. Munro Hamilton International Airport itself. Based on current projections, the number of annual air passengers moving through HIA is expected to increase from approximately 545,000 to over 9 million by 2031[5].

Growth in annual passenger volume will be coupled with growth in cargo, which is expected to increase more modestly at approximately 2.5% annually. In conjunction with the development of the AEGD, this growth will place unprecedented pressure on the Airport and surrounding region to improve access to transportation. Implications for the AEGD are discussed in a later section of this report.

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[5] LPS Avia Report

3.0 EXISTING CONDITIONS

The following section describes the existing transportation infrastructure, services and programs in place in the AEGD.

3.1 Roads

The existing roads within the AEGD study area are primarily two lane and four lane arterial and collector roadways with the exception of Highway 6, which is a provincial highway.

The primary east-west corridor within the study area is Garner Road/Rymal Road, which connects Centennial Parkway with the AEGD. In the south, White Church Road extends easterly providing connections to the Niagara Region. Both roads are basic two-lane cross-sections within the study area with posted speed limits of 60 km/hr. Traffic signals are provided at the following locations:

- On Garner Road at the intersections of Fiddler's Green Road, Southcote Road and Glancaster Road;
- On Book Road at the intersections of Fiddler's Green Road and Highway 6;
- On Upper James Street at the intersections of Twenty Road, the Mountain Transit Centre turn-off, Airport Road and White Church Road; and
- At the intersection of Twenty Road and Garth Street.

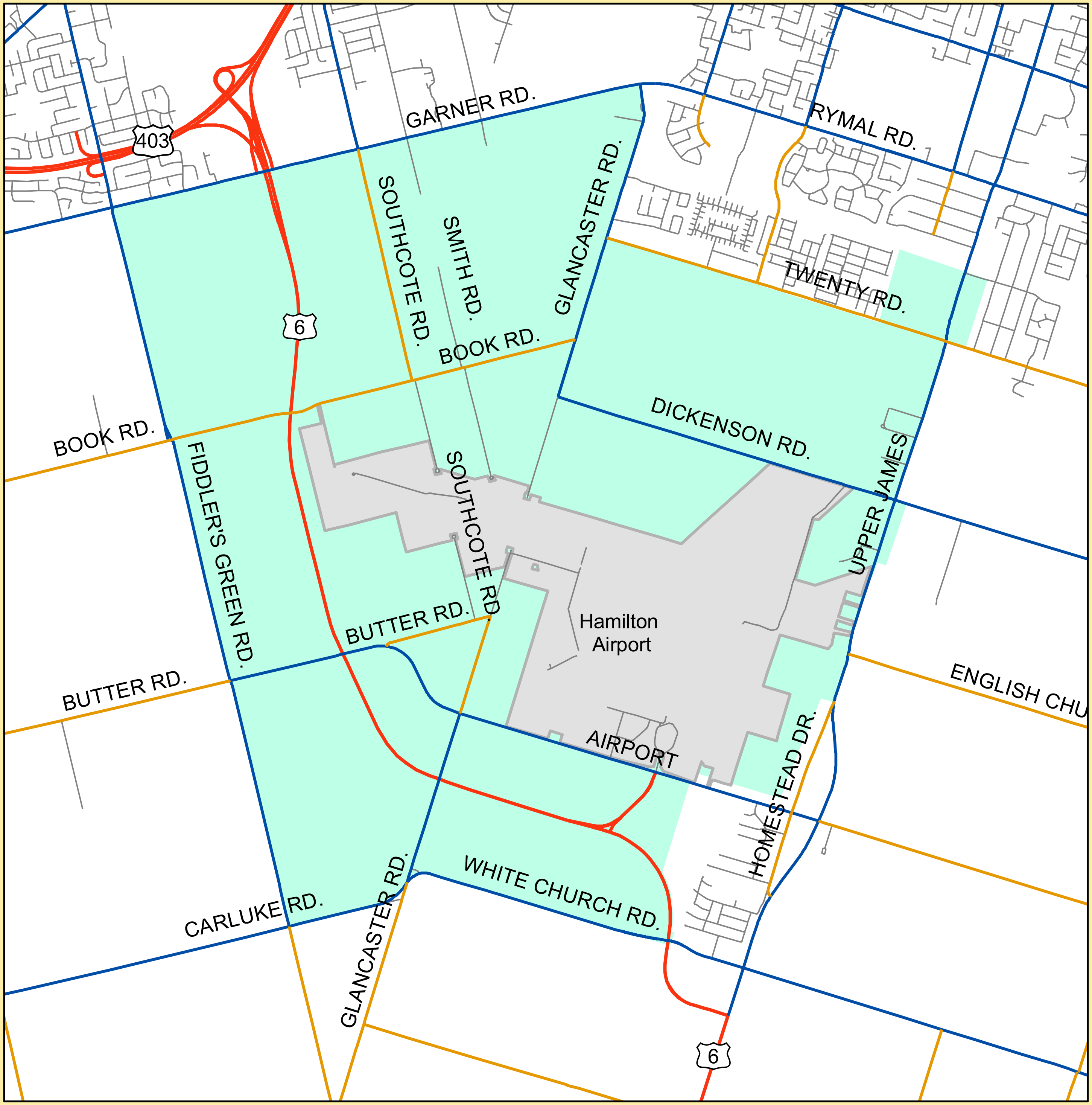
Longer distance trips are accommodated on Highway 6, a two-lane provincial highway, which connects to Highway 403 and provides access between Hamilton and the GTA in the north. Highway 6 also provides access to Brantford and southwestern Ontario in the west. In addition, the Lincoln Alexander Parkway and Red Hill Valley Parkway provide connections to the Niagara and GTA regions via the QEW. Primary access to the Lincoln Alexander Parkway and the Red Hill Valley Parkway is via Upper James Street.

The primary north-south arterial and collector roads providing access into and out of the study area are: from west to east, Fiddler's Green Road, Highway 6, Southcote Road, Glancaster Road, and Upper James Street. Many north-south roads are discontinuous owing to geographic and transportation barriers; namely, the Hamilton International Airport. Exceptions are Fiddler's Green Road, Highway 6 and Upper James Street.

A summary of roadway characteristics is identified in ***Table 2*** and illustrated on ***Figure 6.***

Table 2: Summary of Roadway Characteristics

Direction	Roadway	Number of Lanes	Cross Section	Posted Speed	Classifications
North South	Highway 6	Two	Rural	80 km/hr	Highway
	Upper James Street	Four	Rural	70-80 km/hr	Arterial
	Fiddler's Green Road	Two	Rural	70 km/hr	Arterial
	Glancaster Road	Two	Rural	60-80 km/hr	Arterial/Collector
	Southcote Road	Two	Rural	50 km/hr	Collector
	Homestead Drive	Two	Rural	50 km/hr	Collector
	Smith Road	Two	Rural	50 km/hr	Local
East West	Rymal Road/Garner Road	Two	Rural	60 km/hr	Arterial
	Airport Road	Two	Rural	50-60-80 km/hr	Arterial/Collector
	White Church Road	Two	Rural	60 km/hr	Collector
	Carluke Road	Two	Rural	70 km/hr	Arterial
	Dickenson Road	Two	Rural	60 km/hr	Arterial
	Twenty Road	Two	Rural	60 km/hr	Collector
	Book Road	Two	Rural	60 km/hr	Collector
	Butter Road	Two	Rural	80 km/hr	Arterial/Collector



Hamilton

Hamilton AEGD Study

Existing Road Network
Figure 6

Legend

- Provincial Highway
- Arterial
- Collector
- Local
- Hamilton Airport
- Airport Employment Growth District

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Kilometers
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3.2 Cycling / Pedestrian / Trails

3.2.1 Cycling

The City's cycling infrastructure consists of on-street and off-street facilities. On-street routes are comprised of bike lanes, signed bike routes, and paved shoulders. Off-street facilities are in the form of multi-use paths.

Designated Bike Lanes are bikeways where cyclists share the roadway with motor vehicle traffic (mostly low volumes). Cautionary on-street routes are designated bikeways where cyclists share the roadway with low to moderate motor vehicle traffic volumes.

Designated Bike Lanes are on-street bikeways where a portion of the roadway is dedicated to cycling traffic through signage, pavement marking and/or physical barriers.

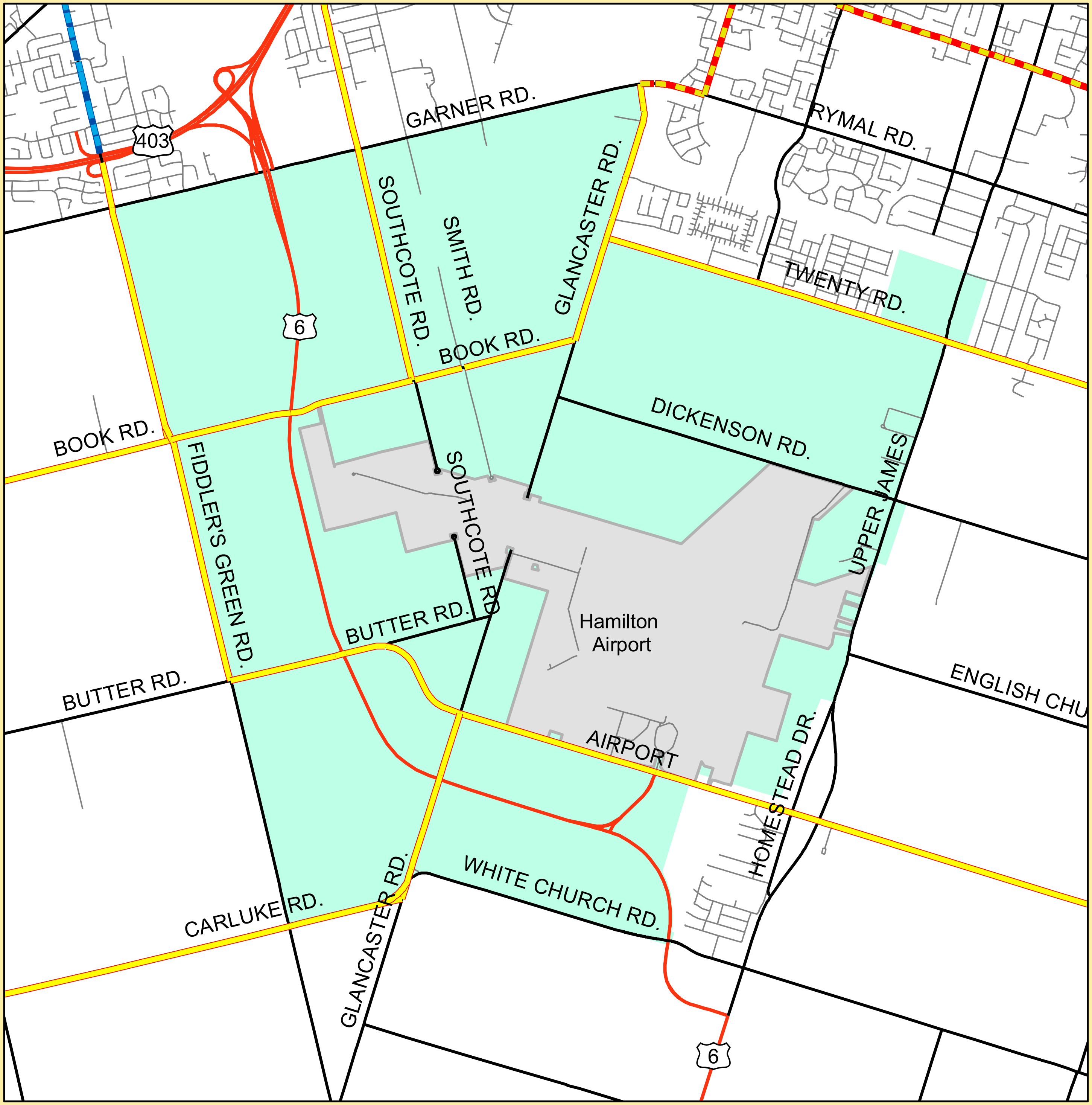
Multi-use Paths are off-street facilities, both paved and unpaved, are designated for cyclist and pedestrian usage. The existing cycling network within the AEGD study area is shown on ***Figure 7***.

The cycling facilities within the AEGD study area provide good north/south and east/west connectivity to the rest of the cycling infrastructure in the City through on-street bike routes. However, to achieve the City's targeted 15 percent cycling/walking modal split in the long term, a much broader network of cycling lanes/trails and comprehensive policies and strategies is required.

Hamilton

Hamilton AEGD Study

Cycling Facilities
Figure 7



Legend

- On-Street Bike Route
- Cautionary On-Street Bike Route
- Signed Bike Route/ Bike Lane
- Provincial Highway
- Major Road
- Minor Road
- Hamilton Airport
- Airport Employment Growth District

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3.2.2 Pedestrians

The City of Hamilton's Urban Official Plan (OP) policy for Integrated Transportation Networks is to achieve a high standard of connectivity and establish pedestrian links in areas of high pedestrian activity and vehicular traffic[6].

The City's Urban Official Plan sets a number of additional principles for pedestrian networks and for designing pedestrian streets that were considered when conducting this study. Some of these broader principles include:

- Distinctly separating vehicular, pedestrian and cycling traffic to the fullest extent possible;
- Reducing motor vehicle traffic in areas of high pedestrian activity;
- Discouraging the placement of objects which will impede pedestrian movements; and
- Promoting the continuous improvement and expansion of the active transportation network.

The City's Transportation Master Plan[7] also identifies a number of objectives and goals of the Pedestrian Strategy. They are to:

- Facilitate efficient, safe, and enjoyable travel for commuters and other pedestrians through expansion and improvement of the network of on-street pedestrian facilities;
- Promote recreational walking and active transportation through the development of off-street facilities;
- Improve the quality and extent of pedestrian and bicycle infrastructure;
- Encourage shorter average distances between home, work and other major destinations; and
- Ensure the bicycle and pedestrian friendliness of new development.

Pedestrian access in the AEGD is currently limited due to barriers or absence of trail connections. These "missing links" need to be identified and opportunities assessed to establish strong pedestrian linkages in potentially high pedestrian traffic areas, such as near Employment Supportive Centres (see **Section 9.2.3**), transit stops and future trail networks.

[6] City of Hamilton Urban Official Plan (2009), Section C-4, pp.5-6.

[7] City of Hamilton Transportation Master Plan (2007). Chapter 7.

3.2.3 Trails

Recreational trails are currently limited within the study area. The only existing trail near the AEGD study area is a multi-use path to the south-east of Airport Road called the Chippewa Trail that runs in a north-east direction[8].

The Hamilton Recreational Trails Master Plan identifies a comprehensive, multi-purpose trail system that connects natural areas to Hamilton's urban destinations. Within the Trails Master Plan, key features such as the Greenbelt, natural environment areas, the Hydro easement and land use connectivity are discussed as important recreational and environmental opportunities for trail usage. Within the Greenbelt Plan itself, and as identified in the Trails Master Plan, linkages between ecosystems and provincial parks or public lands should be promoted[9].

As highlighted in the Trails Master Plan, Hydro corridors are recognized as being important to providing modal interconnections across agricultural lands that link urban and rural areas; and it is recognized that opportunities may exist to use these corridors as recreational trails[10].

The Trails Master Plan also outlines a design concept that provides for:

- Integration of the existing trails system;
- Integration of on-street and off-street trail systems to better address broader transportation and land use planning objectives;
- Creation of new multi-use recreational trails; and
- Design standards and classifications to be applied to development and management in accordance with trail use and character of the built and natural environments through which the trail passes.

These policies were considered when identifying growth opportunities for trails within the AEGD.

3.3 Transit

Existing transit service within the study area is limited. At the time the study was initiated, transit service in the AEGD was upgraded from airport service provided by

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[8] Hamilton Recreational Trails Master Plan

[9] City of Hamilton Trails Master Plan (2007), p.24.

[10] City of Hamilton Trails Master Plan (2007), pp.11 & 39.

Trans-Cab service. The latter was a demand responsive shared-ride taxi operated service that had proven to be successful in cost-effectively connecting residents of areas not dense enough to warrant bus service with main transit lines. The Hamilton Street Railway (HSR), in collaboration with Blue Line Taxi, provided the service in the urban portions of Glanbrook.

The service was an extension of HSR's route 27-Upper James, which provides north-south service along Upper James Street/James Street to downtown Hamilton. All trips using Trans-Cab were to be made to and from the designated Trans-Cab transfer point at HSR's Mountain Transit Centre, located on Upper James Street/former Highway 6, just south of Dickenson Road.

In 2002, Trans-Cab services between the Mountain Transit Centre and the Airport were replaced with a shuttle service as a one-year pilot project. The existing Trans-Cab service in Glanbrook was upgraded to a conventional transit service, with the extension of the 27-Upper James route to the airport. However, the service was discontinued following the completion of the pilot project as a cost cutting measure in 2003 due to low ridership (only 40-50 trips per day).

Access to transit services is limited for the approximately 1,500 employees within the Airport Business Park (ABP), as transit services continue to be provided through the Trans-Cab program. The Airport and surrounding industrial areas have a 24 hour per day, 7 day per week demand for transit services, which does not work well with conventional transit services.

Access to Route 27 is available within 530 metres of the Airport Business Park. This is a longer walk to transit than the industry guideline of a 400 metre walking distance. However, the service does fall within a coverage range that is acceptable for industrial parks. There are no paved sidewalks or trails that link the Airport Business Park to the Mountain Transit Centre along Upper James Street.

Other routes that provide service near the study area include Route 16, Route 35, Route 34, Route 43 and Route 44.

Route 16 – Ancaster provides service primarily along Wilson Street between Ancaster Business Park and Meadowlands. Hamilton Street Railway (HSR) plans to modify this route so that it provides direct service between Ancaster and McMaster University. There is also a morning eastbound and afternoon westbound routing that connects Wilson Street to Garner Road, along Fiddler's Green and Amberly Boulevard.

Service on Route 16 is provided Monday to Friday between 5:00 AM and 7:00 PM (with extended operating hours until 10:00 PM on Thursdays and Fridays). On Saturdays, service is provided between 8:30 AM and 10:00 PM. There is no Sunday service. During weekdays, buses generally run at 30 minute frequencies during the peak periods and one hour frequencies during off-peak times. On Saturdays, service is provided at one hour frequencies.

Route 35 – College provides service from downtown Hamilton to St. Elizabeth Village via West Fifth, stopping at Mohawk College, and providing clock-wise and counter-clockwise loop service along Rymal Road and Garth Street.

Service on Route 35 is provided Monday to Saturday between 5:00 AM and 1:00 AM and between 5:30 AM and 12:00 AM on Sundays. On weekdays, buses generally run on 15 minute frequencies during peak periods, 20 minute frequencies during the midday, and 30 minute intervals during evenings. On Saturdays, service is provided at either 20 minute or 30 minute frequencies and on Sundays, buses generally run on 30 minute frequencies.

Route 34 – Upper Paradise, provides north-south service between downtown Hamilton and Glancaster Loop, near the corner of Glancaster Road and Rymal Road on the edge of the AEGD study area.

Service on Route 34 is provided Monday to Friday between 5:30 AM and 12:30 AM, between 7:00 AM and 12:00 AM on Saturdays, and between 7:00 AM and 11:30 PM on Sundays. On weekdays buses generally run on 15 minute frequencies during peak periods, and 30 minute frequencies during off peak and late evening periods. On Saturdays, buses generally run on 30 minute intervals and on Sundays on one hour frequencies.

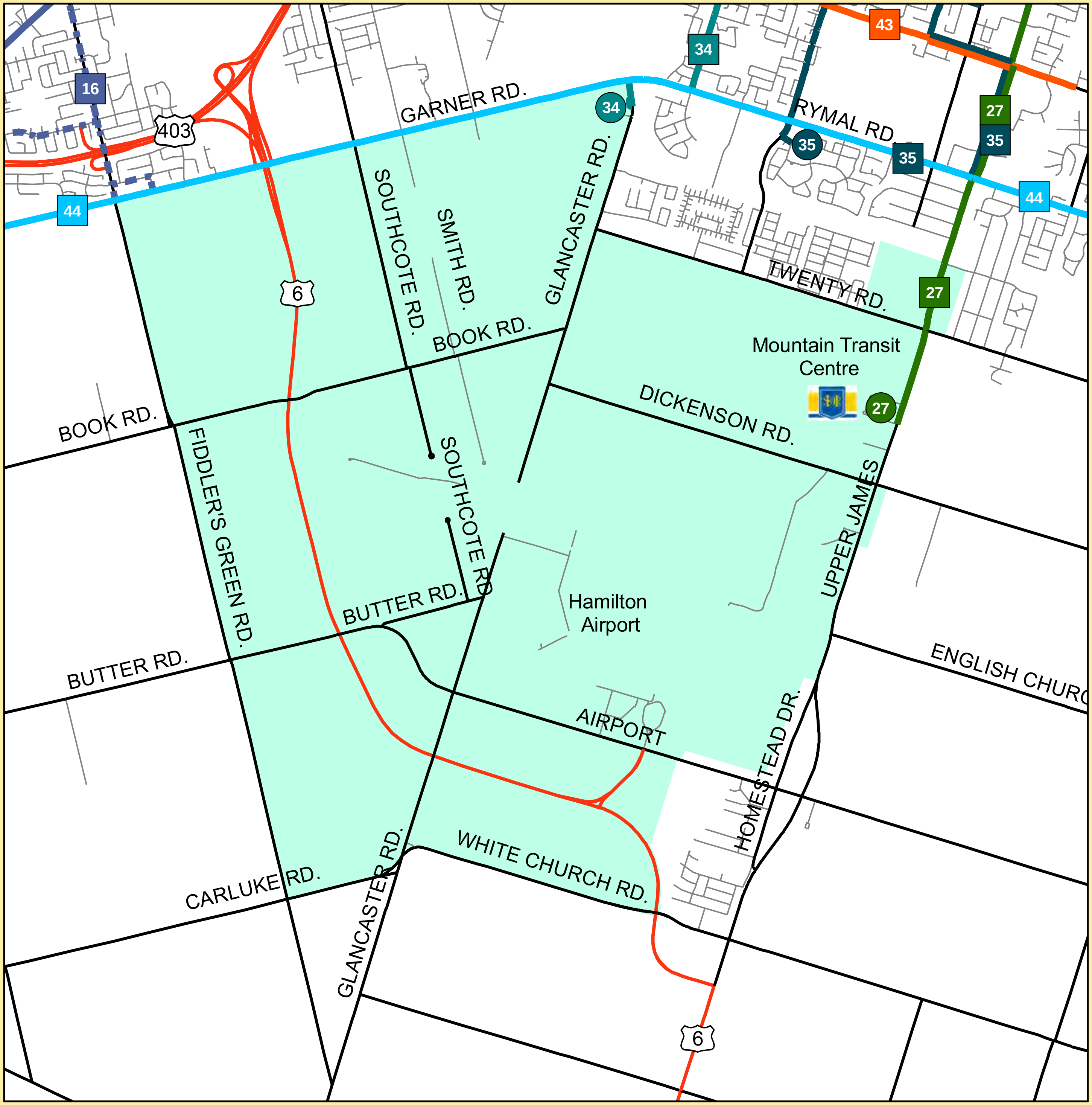
Route 43 – Stone Church provides east-west service along Stone Church Road between Highbury Drive and Martindale Crescent. Service on Route 43 is provided Monday to Friday between 5:00 AM and 1:00 AM and on Saturdays between 6:00 AM and 7:00 PM. There is no Sunday service. Weekday service is provided on 30 minute frequencies throughout most of the day, with one hour frequencies for later evening service. On Saturdays, buses generally run on 30 minute intervals.

Route 44 – Rymal is a new route introduced in September, 2009. It provides east-west service along Garner Road and Rymal Road, connecting Centennial Park with Redeemer College and Wilson Street. Service on Route 44 is provided on weekdays only between 5:30 AM and 6:30 PM on 30 minute intervals. This route may potentially form part of the future S-Line of the B-L-A-S-T rapid transit system (see **Section 4.4.1**).

In September, 2009 Route 20 – A-Line Express was introduced. It provides north-south service between downtown Hamilton and the Hamilton International Airport. The route also stops on the Fennell Campus of Mohawk College. The route only runs on weekdays during peak periods.

All routes are planned to connect into the future rapid transit network by 2035.

The existing transit services in and surrounding the AEGD are illustrated below in ***Figure 8***.



Hamilton

Hamilton AEGD Study

Figure 8
Transit Facilities

Legend

- Route 16-Ancaster Limited Service
- Route 16-Ancaster
- Route 27-Upper James
- Route 34-Upper Paradise
- Route 35-College
- Route 43-Stone Church
- Route 44-Rymal/Garner
- X Route Destination
- Provincial Highway
- Major Road
- Minor Road
- Hamilton Airport
- Airport Employment Growth District

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3.4 Goods Movement

3.4.1 Truck Routes and Load Restrictions

The existing truck route network within the AEGD consists of the roads listed below in ***Table 3*** and illustrated in ***Figure 9***. Heavy truck traffic must comply with the posted load restrictions within the AEGD. However, specified users needing access to the Hamilton Airport are able to travel within the district by way of Fiddler's Green Road, Butter Road, and Airport Road.

Table 3: Existing Truck Routes

Full Time Truck Routes:

- Highway 6;
- Garner Road;
- Carluke Road;
- White Church Road; and
- Upper James Street

Truck Routes for Specified Users:

- Fiddler's Green Road from Garner Road to Carluke Road;
- Airport Road from Butter Road to Upper James Street; and
- Butter Road from Airport to Fiddler's Green Road

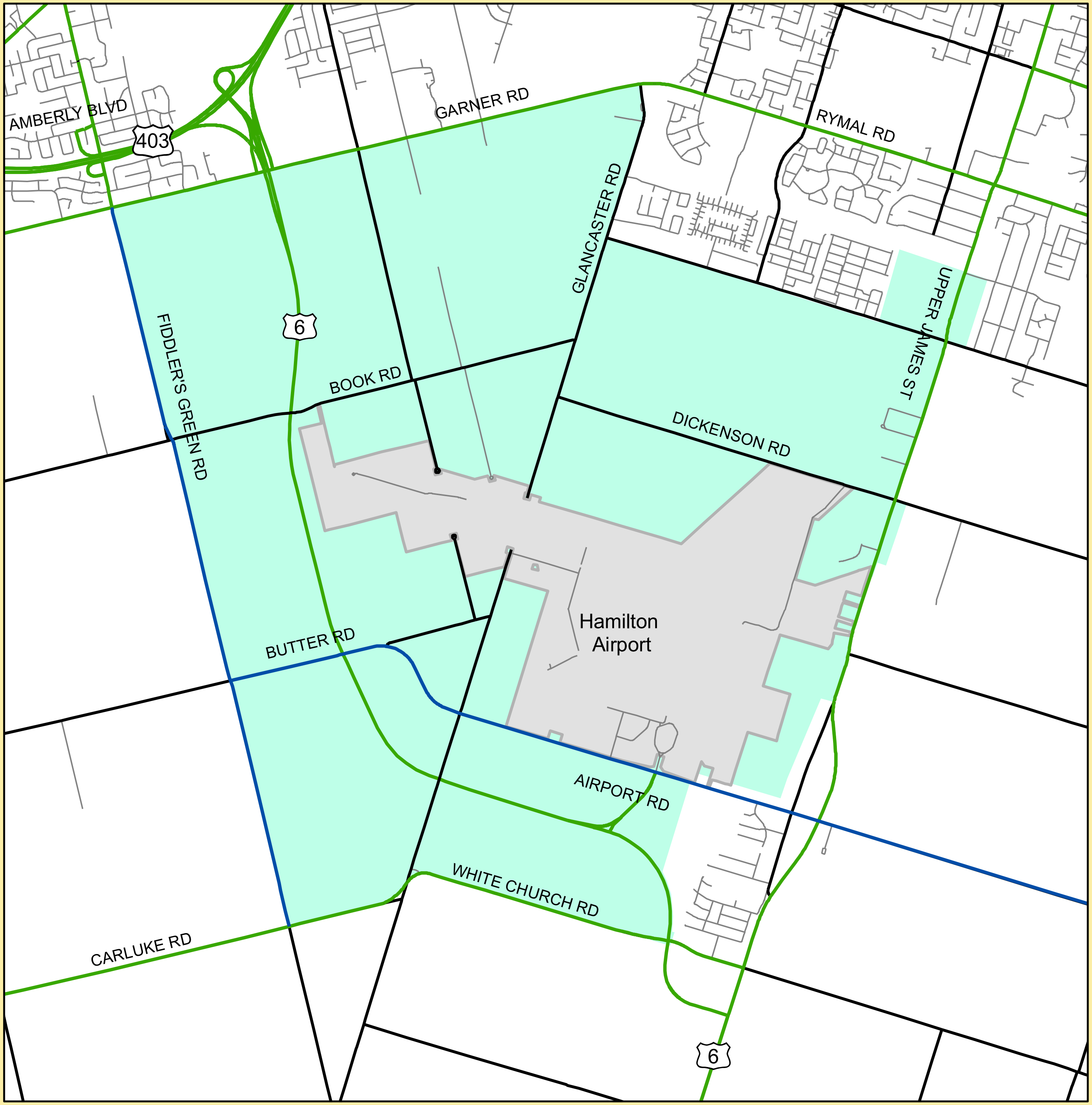
Roadways with Load Restrictions:

- Twenty Road;
- Dickenson Road;
- Airport Road;
- Homestead Drive;
- White Church Road;
- Carluke Road;
- Butter Road;
- Book Road;
- Fiddler's Green Road;
- Glancaster Road;
- Southcote Road; and
- Smith Road.

In April 2010, the City of Hamilton completed a Truck Route Master Plan Study. The study purpose was to improve the efficient movement of goods in Hamilton with minimal impacts to the community and environment. The truck route system proposed within the AEGD was developed in coordination with the City's Truck Route Master Plan.

3.4.2 Hamilton Goods Movement Study

The Hamilton Goods Movement Study (completed in 2005) formed part of the City's Growth Related Integrated Development Strategy (GRIDS), which was adopted by Hamilton City Council in 2003. The Hamilton Goods Movement Study was undertaken by the City with participation from industry and senior levels of government.



Hamilton

Hamilton AEGD Study

Figure 9
Existing Truck Routes

Legend

- **Full Time Truck Route**
- **Truck Route for Specified Users**
- Major Road
- Minor Road
- Hamilton Airport
- Airport Employment Growth District

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Key recommendations as they relate to the AEGD planning area are to:

- Resolve freight bottlenecks including short term measures such as improving signage for truck routes to and from major industrial areas, to and from the port and to and from the airport. The Truck Route Master Plan Study will be recommending that the City of Hamilton follow a primarily "Permissive" truck route signing plan.
- Re-examine specifications for truck routes within the City to ensure that clearances are appropriate for traffic entering and leaving the Port area. This would involve more routine operation of oversized loads from the port to eastbound and westbound destinations.
- Establish policies to accommodate 24-hour freight operations in the port, airport, and rail freight facilities.

Several strategic infrastructure related items were also identified including:

- Creating an east-west link connecting the Highway 6 extension from the airport to the Red Hill Valley Parkway or east of the City. This project was identified as a Schedule C Class EA;
- Working with the Ontario Ministry of Transportation (MTO) to address Highway 403 congestion between the QEW and Highway 6 North;
- Evaluating, in conjunction with the Province, the need and justification for a Niagara to GTA Corridor, including alternatives that would connect Hamilton directly to Highway 401.

The strategic infrastructure recommendations are identified on ***Figure 10***.

3.4.3 Niagara-to-GTA Corridor Planning and Environmental Assessment Study

Recent studies emphasize that additional transportation capacity is required through the Niagara Peninsula and Greater Toronto Area to accommodate future growth. An Environmental Assessment Terms of Reference (ToR) for the Niagara to GTA Transportation Corridor was approved by the Minister of the Environment in June 2006. The purpose of the Study is "to address existing and future anticipated transportation capacity deficiencies (transportation problems and opportunities) within the corridor by providing additional capacity for a 30 year planning horizon and beyond".

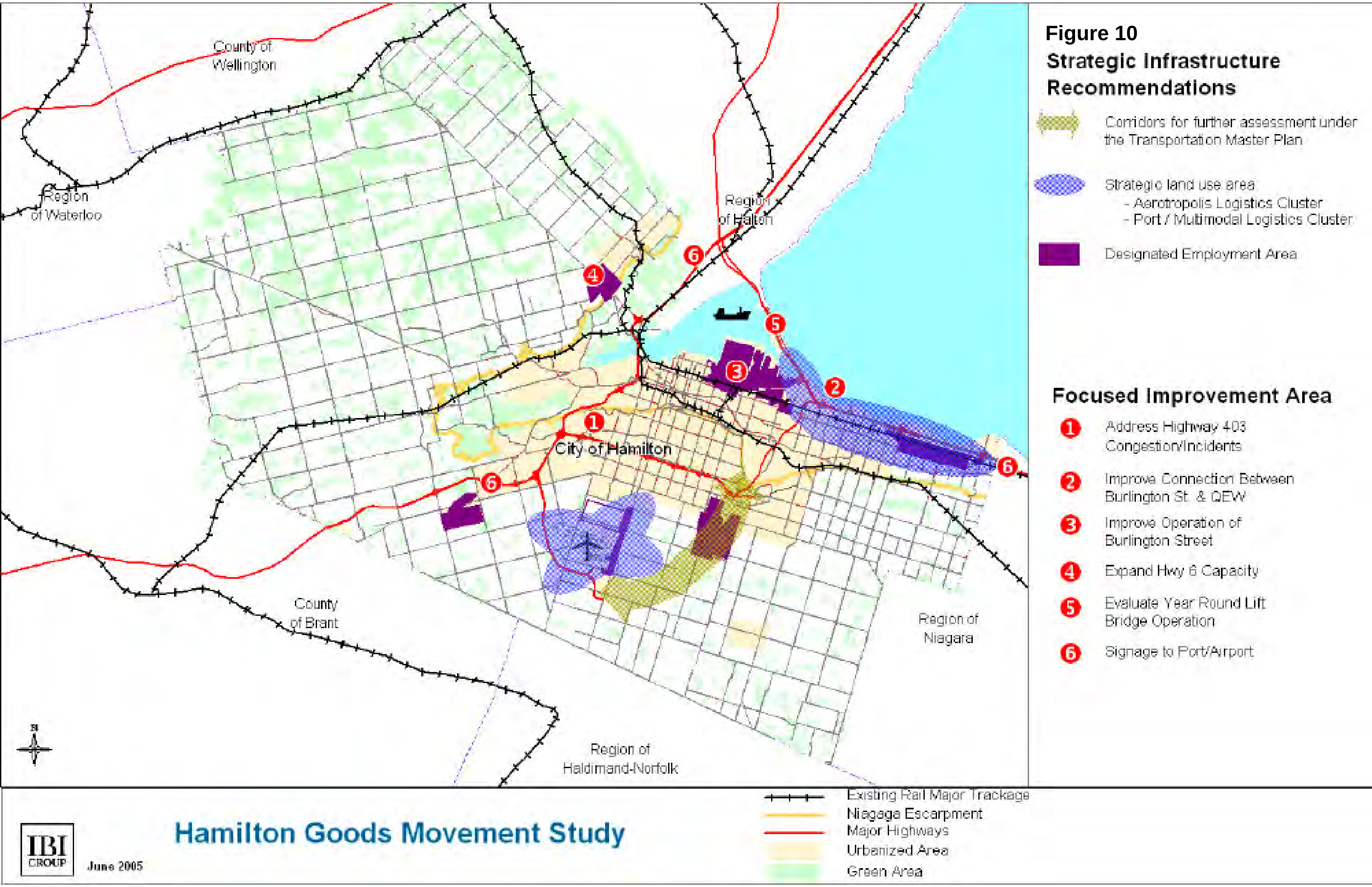


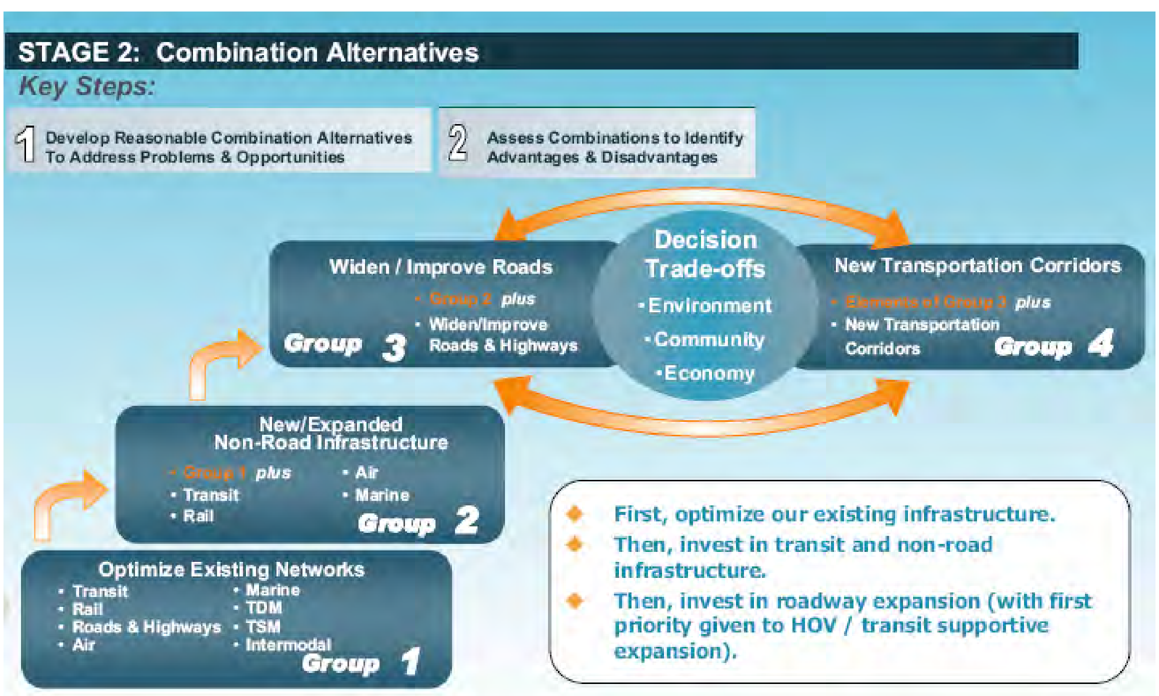
Figure 10
Strategic Infrastructure Recommendations

Although still in progress, the study has come to a number of conclusions related to goods movement in and near the AEGD study area. These include acknowledgement that:

- there are limited opportunities for a modal shift from truck to rail;
- there are limited opportunities for a modal shift from truck to marine;
- there is increased capacity to accommodate increased goods movement by marine;
- there are limited opportunities for a modal shift from truck to air; and
- there is sufficient capacity to accommodate increased goods movement by air, given the strategic location of Hamilton International Airport.

According to public open house material presented in November, 2009, the most promising alternative includes a combination of solutions that includes three key steps. The first step (Group 1) is to optimize the current transportation network, including transit, rail, air, and roads in order to fully utilize existing infrastructure. Once complete, the next step (Group 2) is to invest in expanding or developing new non-road infrastructure (i.e., transit, rail, marine and air). The final step (Group 3 and Group 4) is to widen or improve roads through expansion (with the priority given to HOV lanes), or through the development of new transportation corridors.

The diagram presented below outlines these three key steps.



Source: Niagara-to-GTA Corridor Planning and Environmental Assessment Study

Many principles in this Transportation Master Plan are supported by the Niagara-to-GTA Corridor Planning and Environmental Assessment Study findings, including those described above.

Further discussion related to goods movement opportunities in the AEGD is included in **Section 9.5**.

4.0 EXISTING NETWORK ASSESSMENT

4.1 Road Network

The primary east-west roads in the study area include Garner Road/Rymal Road, White Church Road, Dickenson Road, Twenty Road, Butter Road and Book Road. The primary north-south routes in the study area are Fiddler's Green Road, Highway 6, Southcote Road, Glancaster Road, and Upper James Street.

4.2 Existing Traffic Volumes

As part of Phase 1 for the AEGD, the City of Hamilton provided existing traffic data for the study area. Existing AM and PM peak hour turning movement volumes and Average Annual Daily Traffic (AADT) volumes for various intersection and roadway links were utilized. Both the peak hour turning movement volumes and AADT volumes provided were obtained for 2008.

Existing roadway turning movement figures and AADT volume from the Phase 1 report are included in **Appendix A**.

4.3 Roadway Safety

Roadway safety was considered as a component of the AEGD Infrastructure Report (dated May 2008), completed in Phase 1 of the Hamilton Airport Growth Employment District Study. At that time a 2005-2006 Annual Safety Report was available. The report is a summary of statistical data associated with traffic collisions within the City of Hamilton between 2005 and 2006. This report is produced by the City of Hamilton annually.

The data presented in the report is based on collisions involving motor vehicles that were investigated by Hamilton Police Services on the roadway transportation system within the Hamilton municipal boundaries, excluding provincial highways. The report did not identify any section in the AEGD as having a higher than average collision rate. Accordingly, the report did not recommend any roadway improvements within the study area from a safety perspective.

4.4 Planned Transportation Improvements

The *2007 Hamilton TMP* identified various infrastructure improvements to be made within the AEGD up to the 2021 horizon year. These projects were primarily associated with the urbanization of rural roadways within the study area. At the time of writing, an Environmental Assessment (EA) for Garner Road was being conducted. The proposed improvements for the AEGD are illustrated in ***Table 4***.

Table 4: Hamilton TMP Proposed Road Infrastructure Improvements within AEGD[11]

Road Name	From	To	Description	Anticipated Timing
Garner Road	Fiddler's Green Rd	Glancaster Road	Road Widening	2012-2021
Garth Street	Twenty Road	Dickenson Road	New Road	>2021
Twenty Road	Glancaster Road	Upper James Street	Two-way left turn lane	2012-2021

Note: Infrastructure improvements in the *2007 Hamilton TMP* may extend beyond the AEGD study area.

In addition, in 2006 the City of Hamilton initiated ROPA 9 (Amendment No.9 to the Region of Hamilton-Wentworth Official Plan) Transportation Master Plan study, to assess the transportation needs of the Rymal Road Planning Area. As part of the solutions, the approved ESR recommended the construction of a new four lane arterial road (Trinity Church Arterial Corridor) instead of the northerly extension of the existing Trinity Church Road.

This new north-south road alignment starts from the Red Hill Valley Parkway exit ramp at Stone Church Road, traversing southerly, crossing Rymal Road and intersecting Twenty Road. Further study is needed to identify how this road will continue south of Twenty Road to connect with the AEGD road network. This study may be influenced by the Niagara–to-GTA Corridor Study currently being undertaken by the Ministry of Transportation.

The Red Hill Valley Parkway is a recently completed four-lane freeway that is part of the municipal highway system, connecting the Lincoln M. Alexander Parkway (LINC) with the Queen Elizabeth Way (QEW) at the west of Centennial Parkway-QEW interchange,

In addition, within the AEGD planning area, improvements have been identified for the following roadways:

- Dickenson Road;
- Glancaster Road from Garner Road to Twenty Road; and
- Garth Street Extension from Twenty Road to Dickerson Road.

These improvements were all incorporated into the modelling work undertaken for the AEGD TMP.

[11] 2007 Hamilton TMP, Road Network Strategy, May 2007, p.25-29

4.4.1 Transit Opportunities

The AEGD provides the opportunity for implementation of both local and regional transit access given its strategic location within the City of Hamilton and its proximity to the provincial Highway 403 corridor. This section describes some of these opportunities.

Rapid Transit

The City of Hamilton conducted a Rapid Transit Feasibility Study in November 2007 to investigate rapid transit and the feasibility of implementing rapid transit routes in the City. These rapid transit plans would form the Hamilton "B-L-A-S-T" rapid transit system.

In 2008, Metrolinx released its final transportation strategy which identified the potential for Bus Rapid Transit (BRT) or Light Rail Transit (LRT) along two major corridors in Hamilton: the Upper James Street corridor extending from downtown to the airport (A-Line); and a corridor connecting McMaster University with Centennial Parkway (B-Line). The A-Line and B-Line are included in the first 15 years of Hamilton's Rapid Transit plans.

Beyond the 15-year horizon, the Metrolinx draft Regional Transportation Plan also identified three additional rapid transit corridors in Hamilton:

- The T-Line, a Mohawk Road route from Meadowlands to Centre Mall;
- The S-Line, a Centennial Parkway/Rymal Route; and
- A proposed L-Line, connecting downtown with Waterdown and the proposed BRT corridor along Dundas Street.

In the context of the AEGD, the southern portion of the A-Line will terminate within the study area. Routing of the A-Line has been analyzed in this study along with other local bus-based routes within the AEGD. Currently there exists an A-Line Express route that runs between downtown Hamilton and Hamilton International Airport. Introduced in September 2009, the route is one of the MoveOntario 2020 Quick-Win projects, recommended by Metrolinx.

Inter-Regional Transit

Municipal and inter-regional transit services are being considered as transportation alternatives within the context of the Niagara-to-GTA Corridor Planning and Environmental Assessment Study. Available information suggests that transportation alternatives include improved inter-regional bus or rail service connecting the Greater Toronto and Hamilton Area with other identified "urban growth centres", such as St.

Catharines, Oakville and Burlington. Connections would potentially be provided by one or all of GO Transit, VIA Rail, Greyhound, and Coach Canada.

4.4.2 Cycling Network

In the summer of 2009 a new Cycling Master Plan for the City of Hamilton, titled *Shifting Gears 2009*, was approved by Council. Its purpose is to guide the development and operation of Hamilton's Cycling Infrastructure for the next twenty years.

The proposed cycling facilities (***Figure 11***) identified in *Shifting Gears* that fall within the AEGD study area provide some north/south and east/west connectivity to the rest of the cycling infrastructure in the City through on-street bike routes and multi-use trails.

Figure 11: *Shifting Gears* Proposed Cycling Network Improvements within AEGD

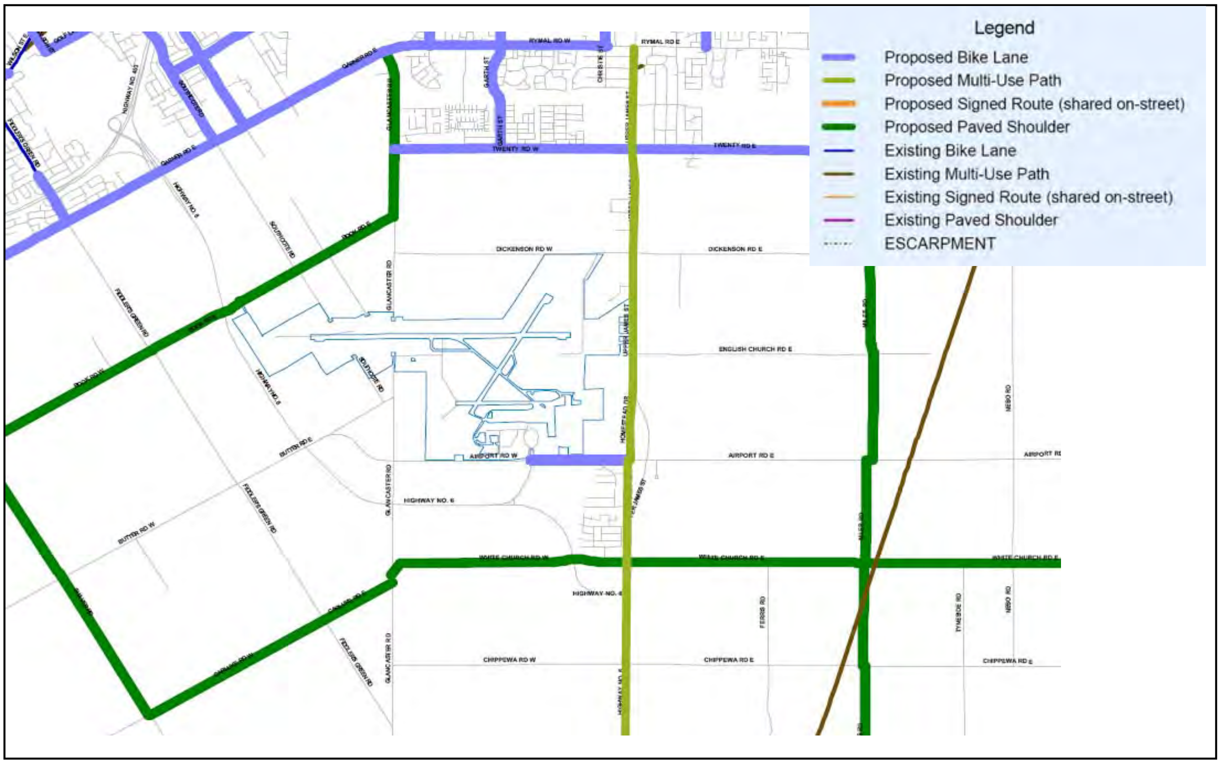


Table 5 below identifies the proposed improvements, which were incorporated into the development of the AEGD cycling network.

Table 5: *Shifting Gears* Proposed Cycling Network Improvements within AEGD

Location	From	To	Description
Upper James Street	Twenty Road	White Church Rd	Construct paved multi-use trail
Airport Road	Airport Access	Upper James Street	Bike lane with road reconstruction
Twenty Road	Glancaster Road	Upper James Street	Bike lane with road reconstruction
Glancaster Road	Book Road	Garner Road	Construct paved shoulder
Carluke Road	Fiddler’s Green Road	Glancaster Road	Construct paved shoulder
White Church Rd	Glancaster Road	Upper James Street	Construct paved shoulder
Book Road	Fiddler’s Green Road	Glancaster Road	Construct paved shoulder
Garner Road	Fiddler’s Green Road	Glancaster Road	Bike lane with road reconstruction

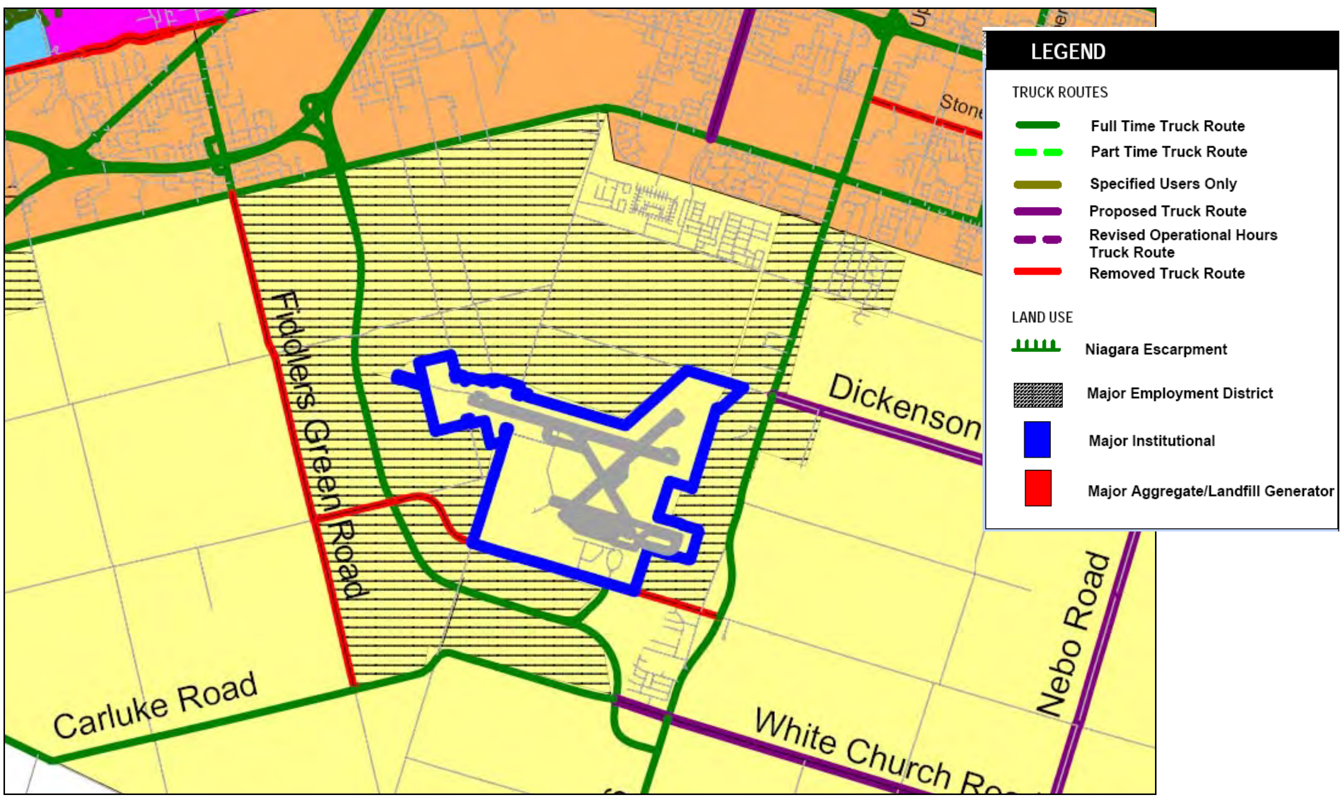
Note: Infrastructure improvements in the *2009 Shifting Gears* study may extend beyond the AEGD study area.

4.4.3 Truck Route Network

At the time of writing, the City of Hamilton was finalizing a Truck Route Master Plan Study which included a comprehensive review of the existing truck route system throughout the City of Hamilton. Three truck route alternatives had been assessed under the Municipal Class EA process, for the Truck Route Master Plan

The Truck Route Study was at the review stage; however a preferred alternative had been identified. The preliminary preferred truck route network alternative, for the area surrounding the AEGD is shown in ***Figure 12***. Under the preliminary preferred alternative a number of existing truck routes would no longer be truck routes including: Fiddler's Green Road, Butter Road and Airport Road. Highway 6, Upper James Street, Carluke Road, Garner Road and Rymal Road are identified as Full Time Truck Routes. Dickenson Road, White Church Road and Nebo Road are identified as Proposed Truck Routes.

Figure 12: Preliminary Preferred Truck Route Network Alternative



Source: Truck Route Study. Alternative 3: Preferred Truck Route Network Map

4.5 Traffic Analysis

A base year EMME/2 model (2004 MRC) was used for existing traffic analysis. It was reviewed for accuracy within the study area and additional detail added for consistency with the zone system. Changes made included the addition of Highway 6 (Highway 403 to Upper James Street) and the Red Hill Valley Parkway to reflect the opening of these two facilities.

The transportation model roadway network used to carry out the existing conditions assessment is illustrated in ***Figure 13***. By the time subsequent (i.e. future) analysis was carried out, a more up-to-date base year model was made available by the City (2005 IBI model). This change does not impact the existing conditions results.

Analysis of the existing transportation conditions was carried out using the most recent traffic counts. Trafficware's Synchro software was used to determine level of service. No significant transportation issues (e.g. signalization or road widening requirements) were identified for the existing conditions of the AEGD study.

An inventory of the existing roadway infrastructure was undertaken to determine roadway lane geometry, intersection control, intersection lane configurations and posted speed limits. The inventory is illustrated in ***Figure 14***.

Revisions were incorporated into the transportation model base year. The resulting traffic volumes are illustrated in ***Figure 15***.

A review of the model outputs and available AADT traffic counts indicates that all screenlines are operating within acceptable capacity limits. Highway 6 carries the highest number of peak hour peak direction traffic at approximately 600 vehicles per hour per lane. Upper James Street in the vicinity of the AEGD carries approximately 1050 vehicles per hour over two lanes.

The City-wide Hamilton Transportation Master Plan established transportation policy guidelines that include planning for the provision of transportation level of service (LOS) 'D' and stable operating conditions for the road network. The LOS is dependent on the adjacent land uses, spacing of intersections and access control and signalization. For this study, arterial road volume demands of approximately 700 vehicles per hour per lane were considered to approach capacity limits. For collector roads, the volume threshold was deemed to be lower given the collector function and lack of access control. For complete LOS descriptions please refer to **Appendix B**.

FREE FLOW SPEED & TOTAL ROAD CAPACITY (1 WAY)

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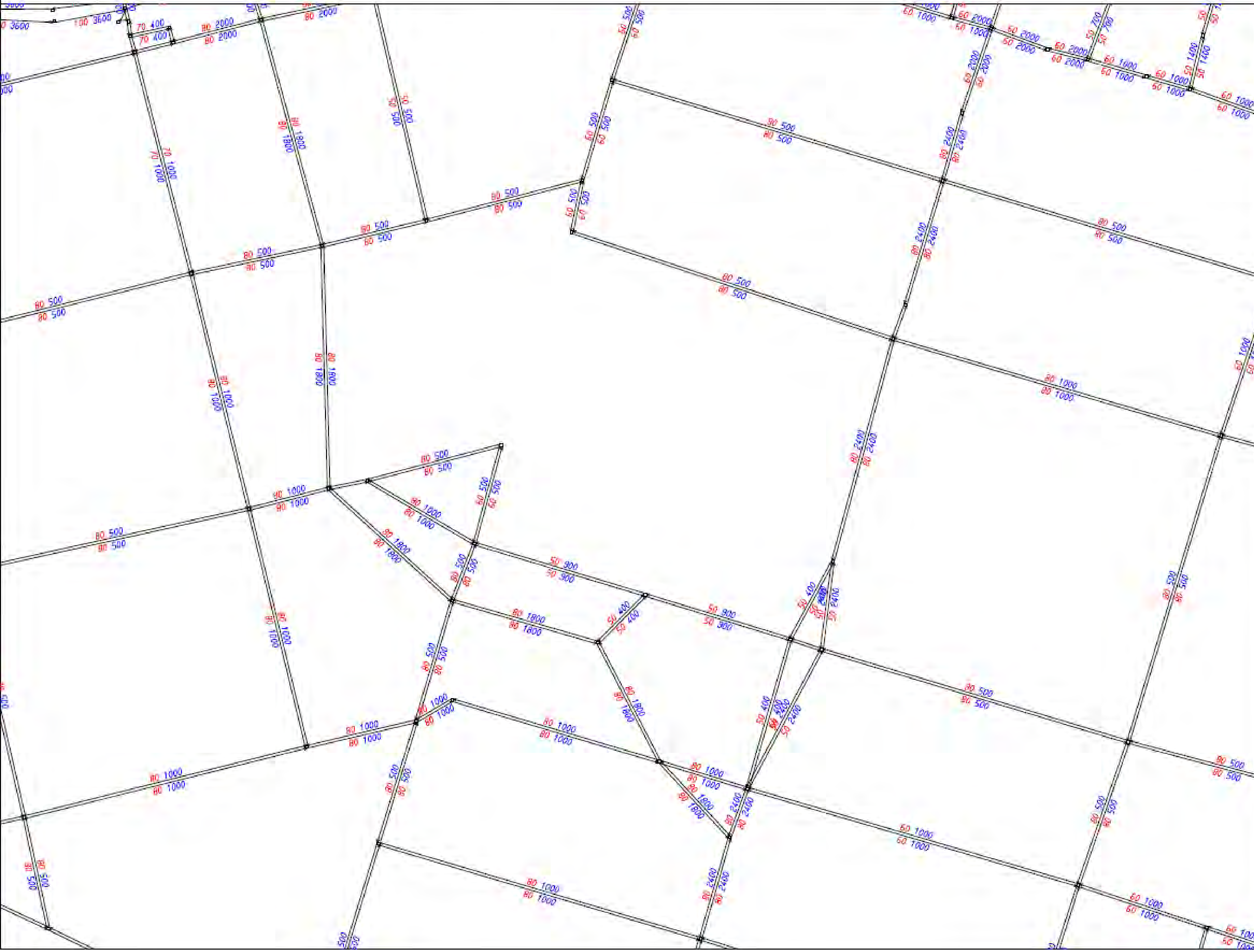
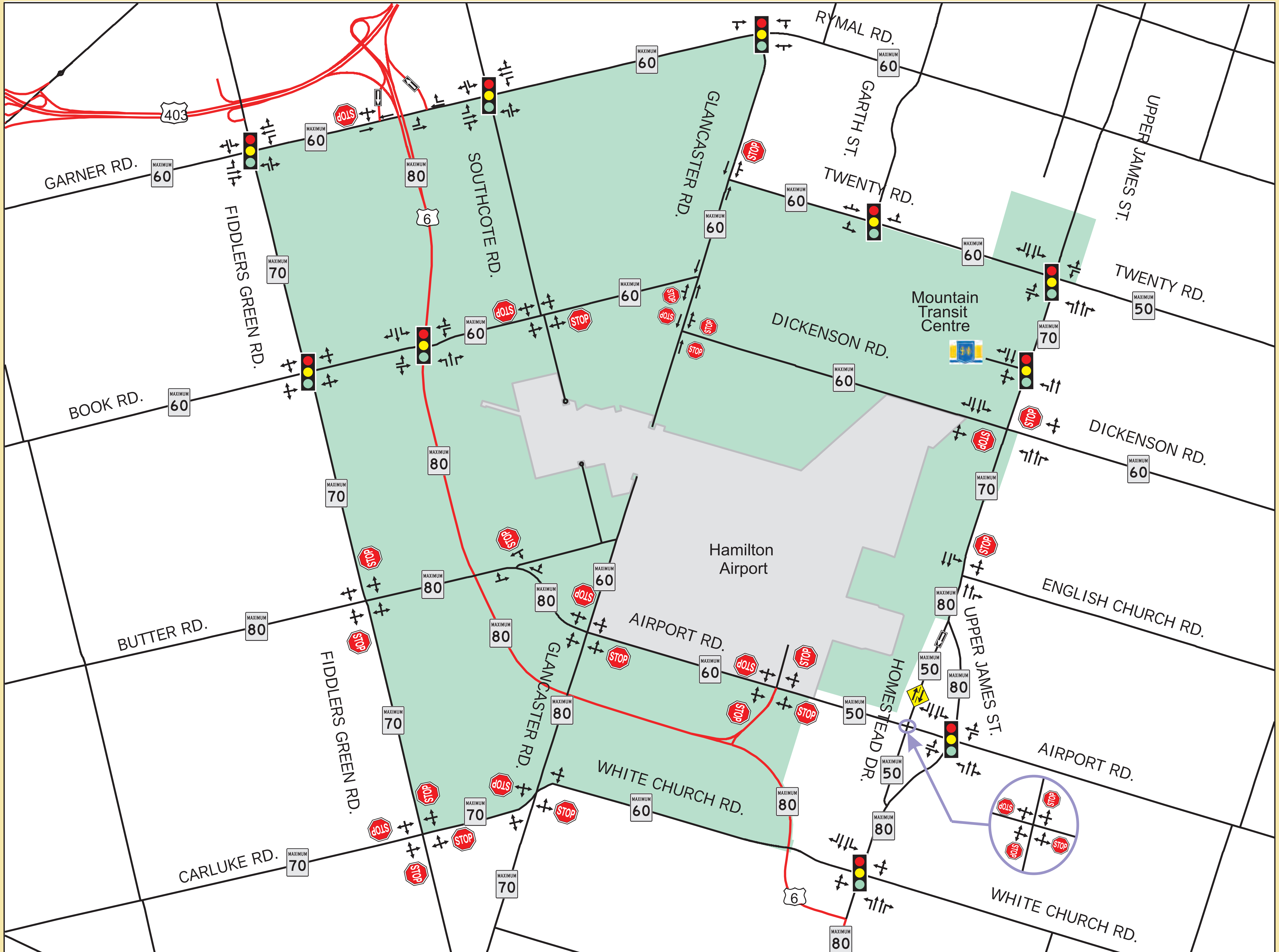


LINKS:
mod=c
&!ci=1
&!cj=1

LAYERS:
Capacity
Speed

Figure 13
2004 Base Year
Link Attributes

WINDOW:
581526/ 776136
592193/ 784136



Hamilton

Hamilton AEGD Study

Figure 14

Existing Intersection Control and Lane Configurations

LEGEND:

- Existing Lane Configuration (at intersection)
- Existing Traffic Signal
- Existing Stop Sign
- Provincial Highway
- Major Road
- Hamilton Airport
- Airport Employment Growth District

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AUTO VOLUMES

emme/2

LINKS:
all

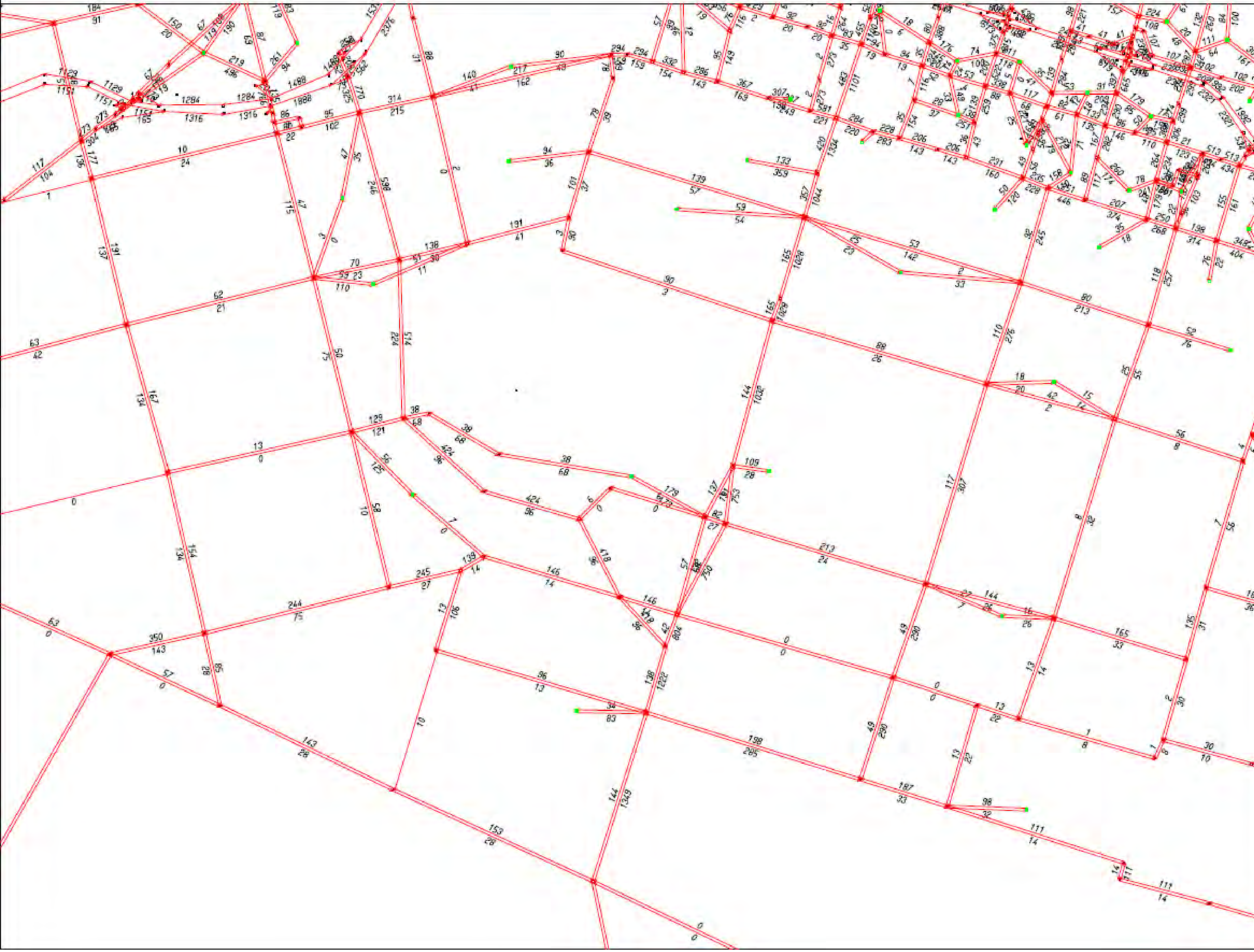


Figure 15
2004 Base Auto Volumes

WINDOW A:
579086/ 773159
595416/ 785407

4.5.1 Screenline Analysis

A comparison of simulated volumes and capacity across a number of screenlines was completed for the 2006 existing scenario to help understand network deficiencies across screenlines. ***Figure 16*** illustrates the screenlines that were used in this analysis.

Volume to capacity (v/c) ratios in excess of 0.85 were used as indicators of potential problems. ***Table 6*** provides a summary of the v/c ratios at the various screenlines.

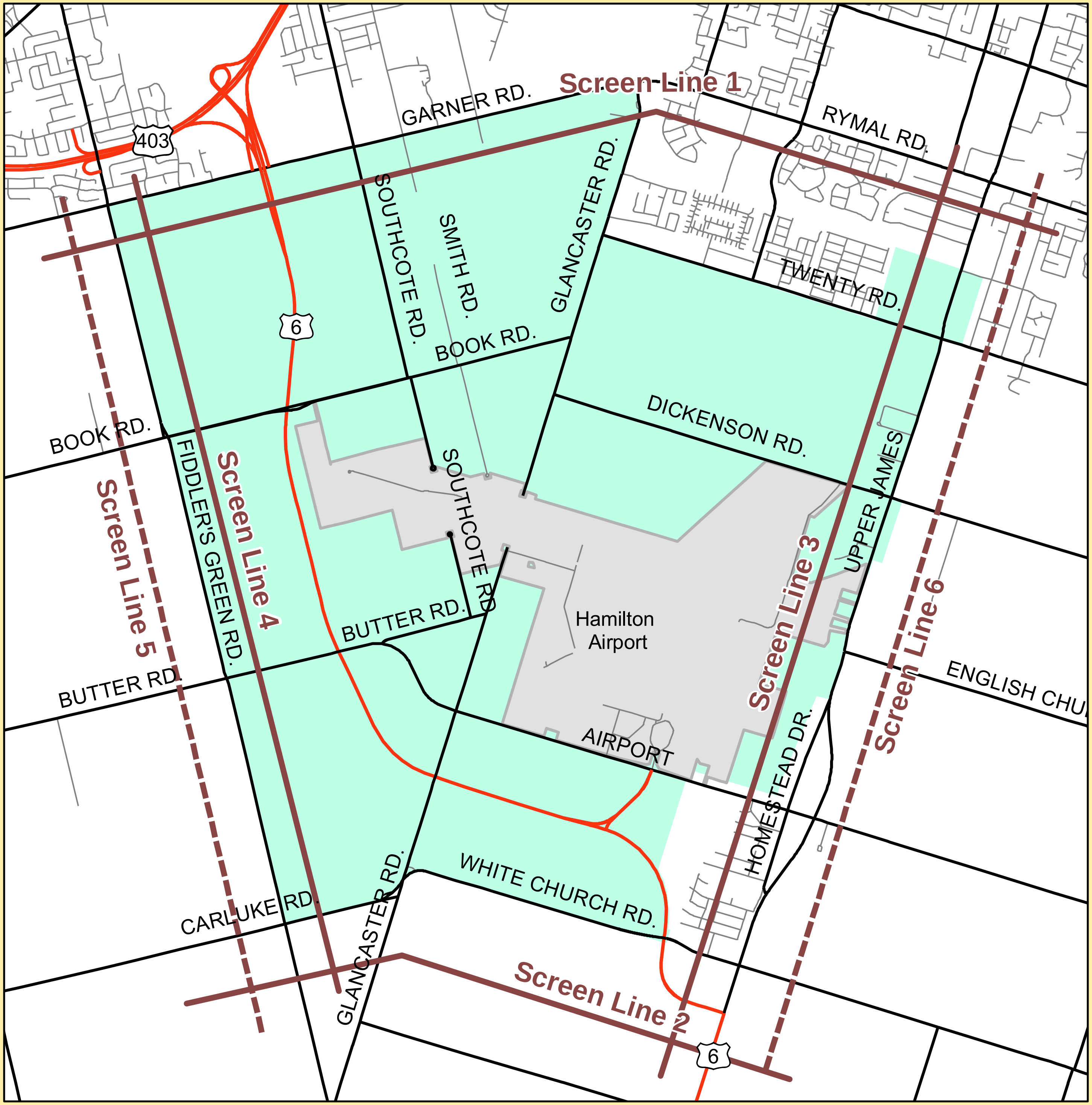
Table 6: Screenline Summary

EMME2 Model - 2006	NB Volume	NB V/C	NB Lanes	SB Volume	SB V/C	SB Lanes	2-Way Volume	2-Way V/C
Volumes at Screen Line 1	2020	0.35	7	859	0.15	7	2879	0.25
Volumes at Screen Line 2	1386	0.36	4	161	0.03	4	1547	0.16
	EB Volume	**EB V/C**	**EB Lanes**	**WB Volume**	**WB V/C**	**WB Lanes**	**2-Way Volume**	**2-Way V/C**
Volumes at Screen Line 3	564	0.1	7	1553	0.23	7	2117	0.17
Volumes at Screen Line 4	383	0.1	4	598	0.15	4	981	0.12
Volumes at Screen Line 5	120	0.03	4	329	0.08	4	449	0.06
Volumes at Screen Line 6	435	0.09	7	663	0.13	7	1098	0.11

Under existing (2006) conditions, there are no capacity deficiencies on any of the screenlines.

5.0 DEMAND FORECASTING MODEL DEVELOPMENT FOR THE AEGD

Transportation network analysis was undertaken using the City of Hamilton's AM Peak Hour EMME/2 Model and a Traffix model developed to determine travel demand needs and phasing between 2009 and 2031. The Traffix sub-area model was developed to more accurately estimate transportation demands within the AEGD study area.



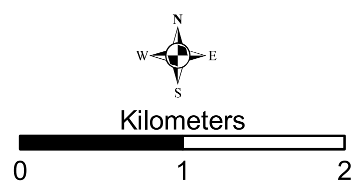
Hamilton

Hamilton AEGD Study

Figure 16
AM Peak Hour
Screenline Volumes
(2006 EMME2 Model)

Legend

- Provincial Highway
- Major Road
- Minor Road
- Screen Line 1 - 4
- Screen Line 5 & 6
- Hamilton Airport
- Airport Employment Growth District



5.1 Synopsis of Future Model

To create a future sub-area model scenario for the Hamilton Airport Employment Growth District, Dillon obtained the following information from the City of Hamilton:

- EMME/2 Network for 2031 (IBI 2005 base model);
- AM peak hour auto trip matrices for 2031;
- AM peak hour total person trip matrices for 2031;
- City of Hamilton population data for 2031; and
- City of Hamilton employment data for 2031.

An AM Peak Hour EMME/2 model was used for the analysis of the AEGD; however a PM Peak Hour model was not available for this study.

The model contained the most up-to-date information about the Red Hill Valley Parkway, the Trinity Church Corridor, and the North Glanbrook Industrial Park. These roadways were accounted for in the 2005 EMME/2 model as with other city-wide development plans listed earlier.

The 2031 EMME/2 model was used to forecast full build-out conditions (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). This is despite the expectation that the development of the Additional Study Area would only occur beyond 2031. This approach was taken because a 2040 model (or later) was not available; however, with appropriate modifications to the EMME/2 model, this facilitated identification of the full infrastructure requirements within the study area. The 2031 horizon represents an estimate of specific transportation needs for the Secondary Plan Area (including the development of the Council Directed Additional Lands), scaled back from the above-noted full build-out of lands for future consideration (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area).

In order to bridge the gap between the EMME/2 model (used for regional analysis) and Synchro (used for operational analysis), a Traffix software model of the AEGD area was developed. While the EMME/2 model more accurately depicted future travel demands on higher-level roadways, such as Highway 403 and Highway 6, it is was deemed too coarse to estimate traffic demands on roadways within the AEGD.

The Traffix model used the same trip generation within the AEGD as the EMME/2 model; however the model contained additional traffic zones to provide more detail within the study area. As a result, the Traffix model is considered to more accurately represent arterial and collector roadways within the AEGD. The EMME/2 model is considered to more accurately reflect demands on higher-level roadways within the study area (e.g. Highway 6).

5.2 Sub-Area Model for the AEGD

In order to accurately represent the AEGD study area within the EMME/2 model, the six traffic zones that made up the AEGD and adjacent zones were sub-divided into 13 sub-zones to provide a more detailed evaluation of the AEGD transportation network. This is illustrated in ***Figure 17***.

The sub-area model developed for the AEGD used Hamilton's 2031 EMME/2 model network (2005 IBI) as a starting point. To obtain more detailed trip tables, the origins and destinations from the initial trip table were split in accordance with the distribution of population and employment estimated in the AEGD sub zones as shown in ***Table 7.***

Table 7: EMME/2 AEGD Sub-Area Employment (Secondary Plan Area + Council Directed Additional Lands + Additional Study Area)

Original Zone Number	Sub-Area Zone Number	Area Description	Original Employment (2031 Model)	AEGD Sub-Area Employment ((includes Secondary Plan Area + Council Directed Additional Lands + Additional Study Area)	Included in AEGD?
2645	2645	Glancaster Airport Northwest	7,168	2,511	Yes
	6002	Airport Butter West		5,169	Yes
2647	2647	Garth Dickenson North	666	8,124	Yes
2649	2649	Hamilton International Airport	10,932	n/a*	Yes
	5001	Glancaster Airport Northeast		3,326	Yes
	5002	Upper James Airport		1,083	Yes
	5003	Airport South		5,507	Yes
	5004	Homestead		0	No
2681	2681	Northwest of AEGD	1,344	0	No
	6003	Garner Book Northwest		5,929	Yes
2682	2682	Southcote North	3,918	10,669	Yes
2683	2683	Southwest of AEGD	5,256	0	No
	6001	Fiddler's Green Southwest		6,092	Yes
Employment Total			**29,284**	**48,410**	

* Airport trips based on passenger volumes, not employment figures (see Section 5.3.2 below)

PLOT MATRIX: M001: CELLS

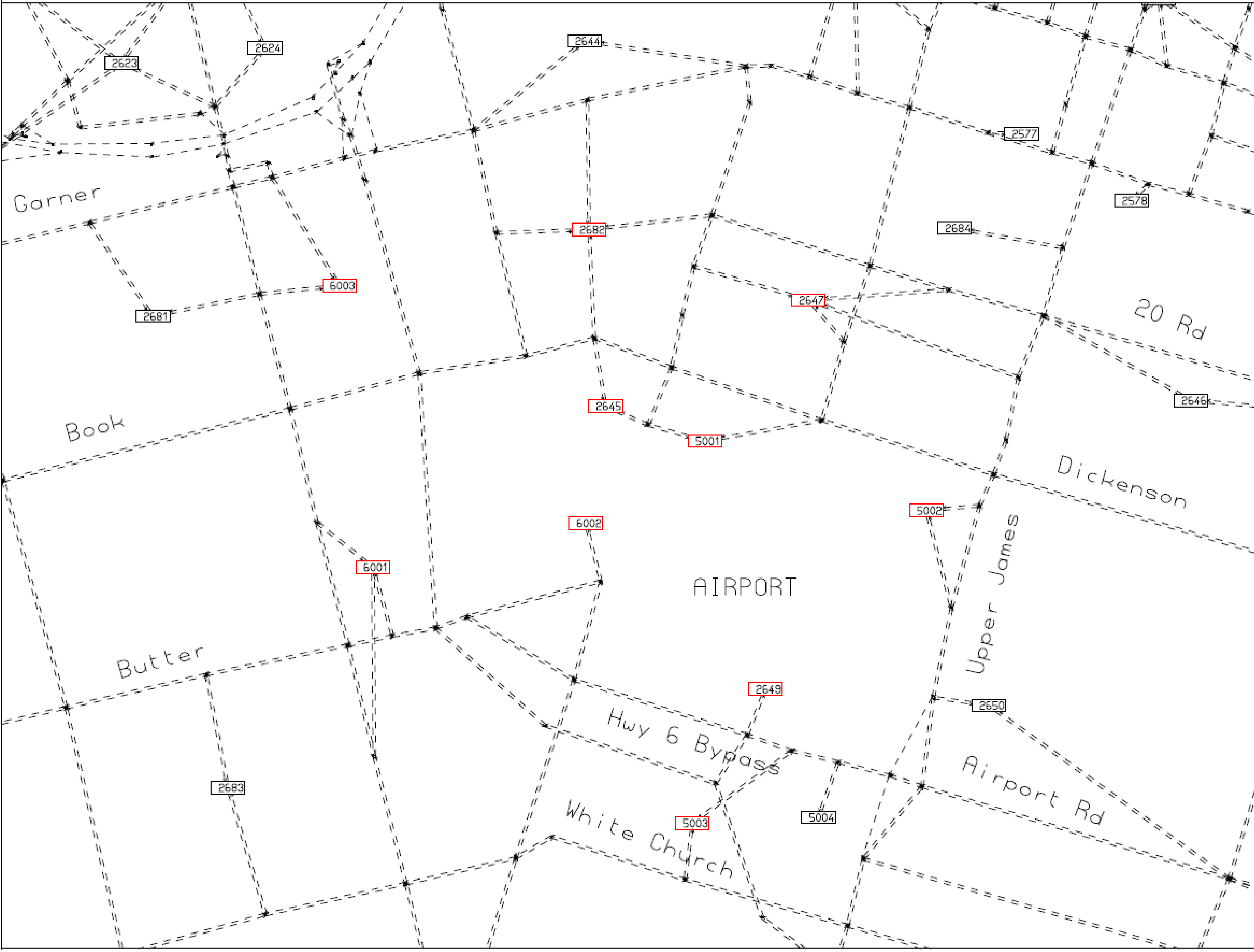
VALUE FOR ORIGIN

emme/2

PLOT MATRIX:
mo01: cells

LINKS:
all

Figure 17
EMME/2 AEGD Sub Area Zones



2649 AEGD Zones
2684 Other Zones

WINDOW A:
580705/ 777304
591339/ 785280

5.3 Trip Generation

5.3.1 AEGD Area

A number of steps were followed in order to generate employment trips within the AEGD study area. These included defining trip generators within each of four land use types in the AEGD, measuring size of development for each land use type in each sub-zone, and calculating number of auto trips generated within each sub-zone.

Employment densities for the AEGD were established as follows:

- Prestige Business Park – 39 employees per net hectare;
- Light Industrial – 24 employees per net hectare;
- Airside Industrial – 36 employees per net hectare; and
- Airport-Related Business – 81 employees per net hectare.

Based on each of the four defined land use categories, specific ITE Trip Generation Rates (7th Edition) were chosen to represent developments likely to be present within each. A sensitivity analysis was performed to establish a weighted average trip rate for each land use type based on the target employment densities. This base trip rate was then adjusted in order to achieve the desired mode split targets within the AEGD.

The following assumptions were made in the trip generation calculations:

- Auto Travel Reductions – An adjustment to meet the City of Hamilton target of reducing auto kilometres traveled by 20% from 2001 figures, including:
  - Auto trips reduced 20% in model compared to traditional ITE trip generation values;
  - People living closer to places of employment;
  - Promote shifting to other modes such transit, bicycling, and walking; and
  - Elimination of unnecessary trips through practices such as trip chaining.
- 12% Transit Mode Share – Assumed 12% transit mode split in accordance with the City of Hamilton's transit goals.
- Effects of TDM Measures – Assumed modest effects due to implementation of TDM measures, primarily based on peak hour spreading and increased car pooling.
  - Peak hour spreading was taken into account by reducing the total number of trips during the peak hour by 2%.
  - The vehicle occupancy rate was nominally increased from 1.21 to 1.24 to account for car-pooling.

The effects of the above-noted adjustments are shown in ***Table 8*** which denotes the AEGD trip generation rates developed and adopted for the EMME/2 AEGD sub-area model. For further discussion on the development of the trip generation rates, please refer to **Appendix C**.

Table 8: EMME/2 AEGD Developed Trip Generation Rates (AM Peak Hour)

Land Use Type	Auto Trip Rates	
	In	Out
Airside Industrial	0.90	0.54
Airport-Related Business	0.48	0.09
Light Industrial	0.37	0.15
Prestige Business Park	0.33	0.04

5.3.2 Hamilton International Airport

As discussed in **Section 2.1** passenger and cargo levels at the Hamilton International Airport (HIA) are expected to increase significantly by 2031. Forecasted levels are discussed in more detail below.

Passengers

In 2008, Hamilton International Airport handled 545,800 passengers and 103,428 tons of air cargo[12]. By 2031, it is anticipated that the annual passenger volume will increase to 9.4 million passengers[13].

Cargo

A modest increase of 2.5% in annual cargo growth is expected to occur at Hamilton International Airport. This annual growth rate would increase air freight from 103,400 tonnes in 2008 to 178,100 tonnes in 2030. ***Table 9*** below displays the expected increase in air freight between 2008 and 2030.

[12] John C. Munro Hamilton International Airport, *Annual Report*, 2008

[13] *LPS Avia Report*, 2009

Table 9: Projected Annual Passenger Volume and Cargo Tonnage

Year	Annual Passenger Numbers	Annual Tonnes of Cargo
2008	545,800	103,428
2021	2,400,000	137,042
2026	4,800,000	154,172
2030	9,400,000	178,059

LPS Avia's May 2009 *Airport Market Analysis and Land Needs* report identifies a number of key patterns regarding Hamilton International Airport:

- Hamilton Airport has a large number of operations by all-cargo flights in relation to its total tonnage.
- Cargo is largely high priority courier/express traffic.
- Domestic traffic is very large (Purolator and Cargojet).
- Modest trans-border volumes (e.g. volumes crossing the US-Canada border) and limited traffic from international destinations.

Parking

Parking considerations within the HIA lands are not part of the AEGD study area and are addressed in the 2009 LPS Avia report. It is assumed internal circulation and parking will remain the responsibility of the HIA. Parking opportunities within the AEGD have been considered and discussed in **Section 11.5**.

Airport Trip Generation

Since airports are mainly driven by passenger and cargo volumes as opposed to employment, a more customized trip generation process was used. Typical ITE trip generation rates were initially examined, but proved inadequate due to the lack of data contained. Alternatively, the *ITE Airport Trip Generation (1998)* paper was utilized to develop the number of trips generated from the Hamilton International Airport. A detailed description is provided in **Appendix C**.

As part of the HIA trip generation, the cargo component was also examined. When compared to the increase of passenger traffic volumes to 2030, cargo volumes will only attain a modest increase (as shown in **Table 9**) and will result in less traffic volume growth as compared to the effects of increased passenger traffic.

The HIA Tradeport access is not forecasted to require extensive infrastructure investment to accommodate future volumes. However, consideration should be given to providing access for cargo activity (which includes employee access) that is separate from a primary passenger access. It would make practical sense to connect an HIA Tradeport access to Airport Road in future.

5.4 Trip Distribution

The existing EMME/2 trip matrices were "re-balanced" using the revised trip end totals within the study area. Refer to **Appendix C** for further information.

5.5 Auto Assignment

The auto assignment was performed using EMME/2's standard equilibrium assignment and Tangent volume delay functions. Refer to **Appendix C** for further information.

5.6 Model Results

The model was run to establish the anticipated demand on the study area network. The AEGD future scenario represented a 2031 network including approximately 48,000 jobs and 9.4 Million annual passengers at the Hamilton International Airport.

Once the forecasted AEGD land use and employment were developed, the model was run to obtain traffic volume forecasts for the purpose of evaluating development alternatives (see **Section 7.1**). However, through ongoing discussions with the City of Hamilton, land use and employment numbers were refined to reflect the desired development within the AEGD. These refinements, in turn, affected the number of trips generated within the study area.

As a result, the forecasted traffic volumes from the final land use iteration differ slightly when compared to the previous volumes presented at AEGD open house events. The differences are generally minor in nature and do not affect the conclusions drawn from the evaluation of alternatives.

Figures 18 and ***19*** represent the AM peak hour total volumes and volume to capacity ratios respectively for the AEGD scenario. This model run represents a "worst-case" scenario for transportation infrastructure in the AEGD as it includes the Secondary Plan Area + Council Directed Additional Lands + Additional Study Area lands, which are unlikely to be built-out until well beyond the 2031 horizon.

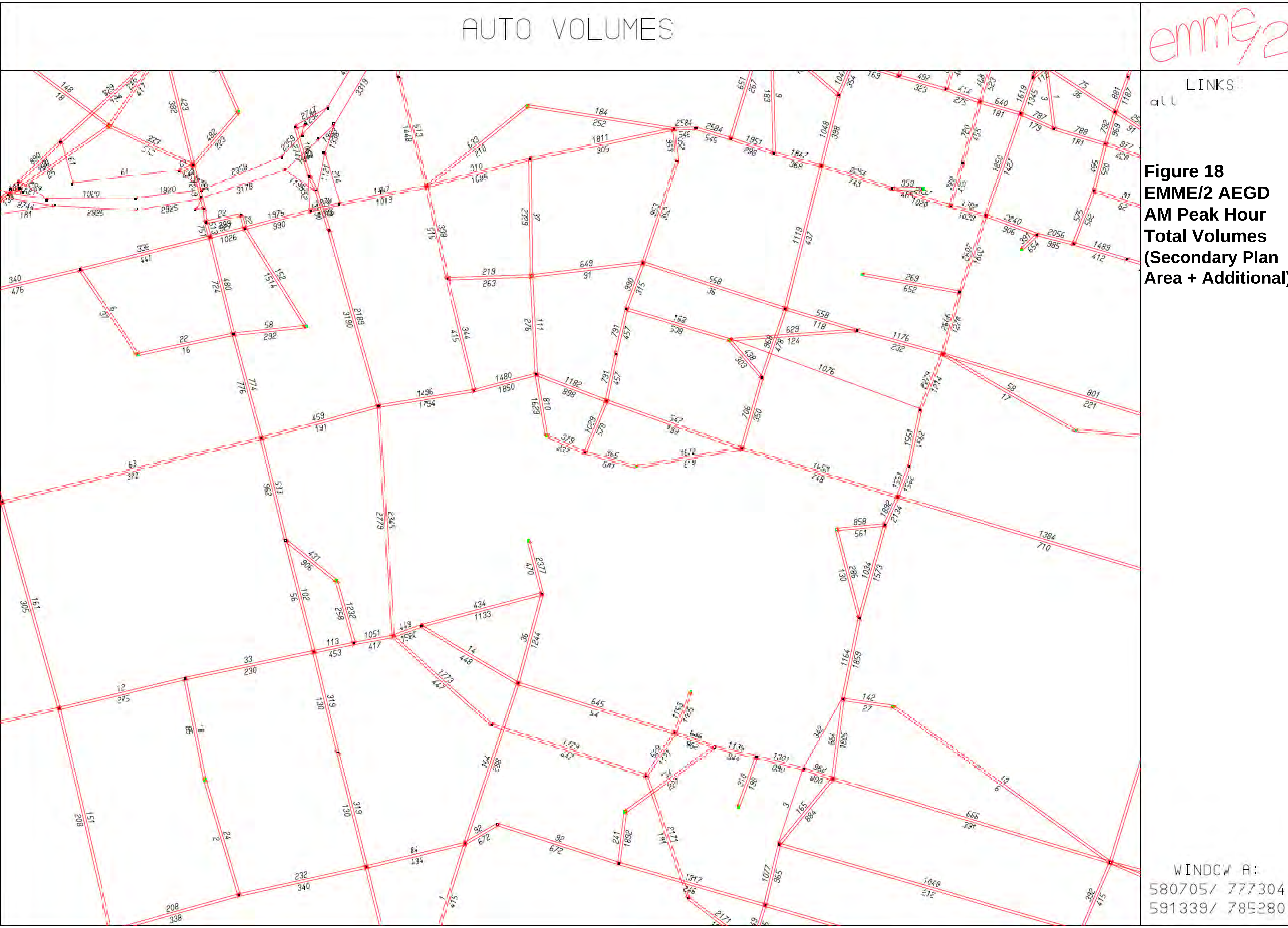


Figure 18
EMME/2 AEGD AM Peak Hour Total Volumes (Secondary Plan Area + Additional)

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

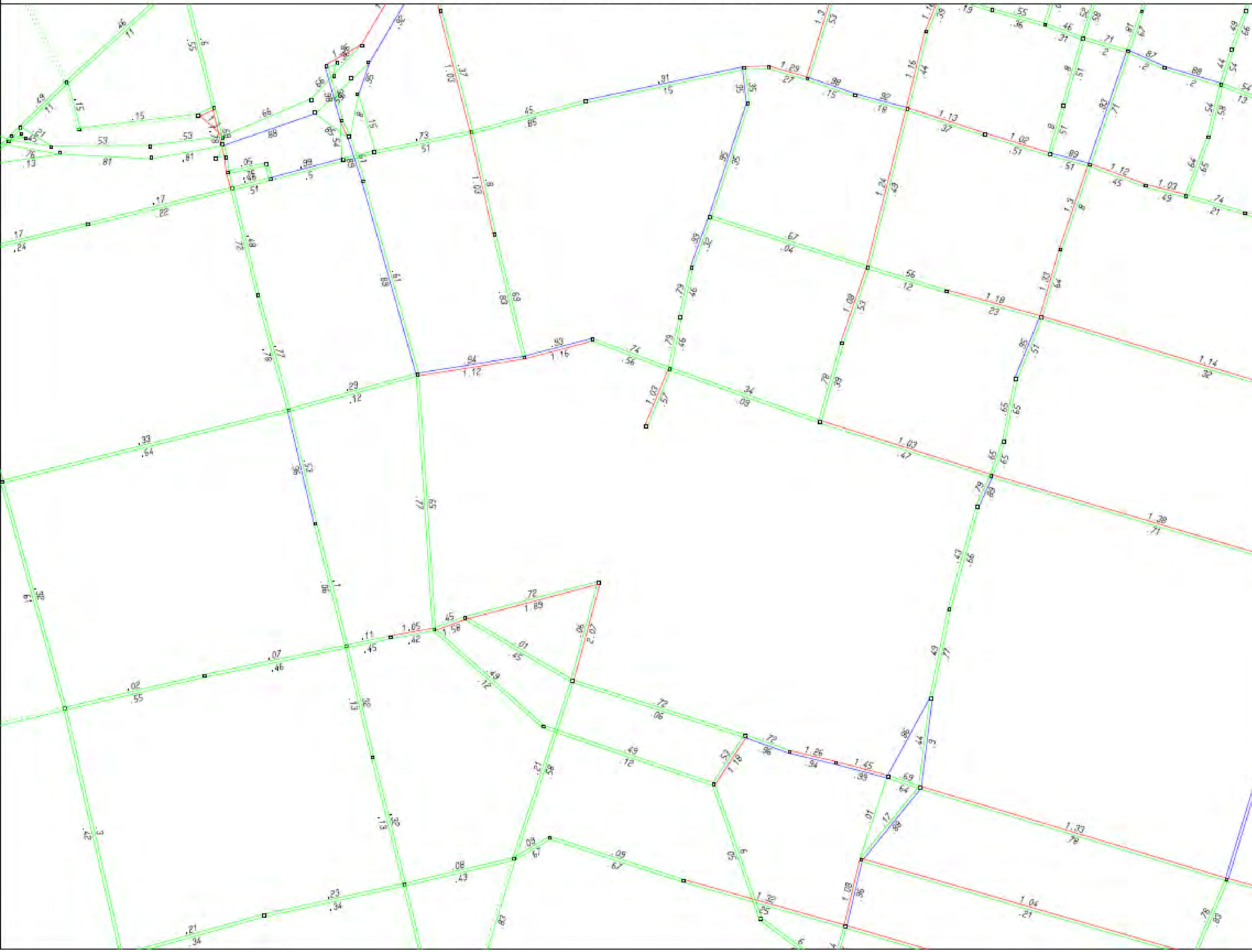


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Figure 19 EMME/2 AEGD AM Peak Hour Volume to Capacity Ratios (Secondary Plan Area + Additional)

WINDOW A:
580705/ 777304
591339/ 785280

5.7 Description of Problem

A number of capacity constraints are anticipated for roadway links in the horizon beyond 2031, when the full build-out of the AEGD is anticipated to be complete (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). The constraints identified in the EMME/2 modelling included:

- East-west connectivity within the AEGD;
- Limited access to Highway 6 at Fiddler's Green Road, Book Road, Butter Road, and Hamilton International Airport access road; and
- The location of the Hamilton International Airport.

This demand can be accommodated by additional road capacity, transit service improvements, and TDM.

In order to address the identified problem areas within the AEGD, several alternatives were identified and assessed. The "Do Nothing" alternative was considered and evaluated. It was determine that the "Do Nothing" alternative does not support the forecasted AEGD growth and increased travel demands projected within the study area. Three other alternatives (listed below), in addition to the "Do Nothing" alternative, were developed for the study area to address the major problem areas.

- **Alternative #1 – 6-Lane Dickenson Road with Enhanced Road Grid**
  - Additional road connections through hydro easement
  - Other new collector road links
  - 6-lane Book/Dickenson roads from Highway 6 to Upper James Street
- **Alternative #2 – 4-Lane Dickenson Road with Multi-Use Trail Connections**
  - Additional multi-use trail connections through hydro easement
  - 6-lane Book Road from Highway 6 to Smith Road
  - 4-lane Dickenson Road from Smith Road to Upper James Street
- **Alternative #3 – 6-Lane Dickenson Road with Multi-Use Trail Connections**
  - Additional multi-use trail connections through hydro easement
  - 6-lane Book/Dickenson roads from Highway 6 to Upper James Street

A more detailed description of each alternative is presented in **Appendix C**. Further analysis and the methodology for choosing the preferred alternative is outlined in **Section 7**.

6.0 OPERATIONAL MODELLING ANALYSIS

This section outlines the findings of an assessment of future corridor traffic operations in the Hamilton AEGD. This was carried out in conjunction with the long-range modelling analysis presented in **Section 5**.

Once the EMME/2 modeling for the full build-out (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area) was completed, results were analyzed to identify infrastructure required. Infrastructure projects forecasted were set to coincide with the phasing of other engineering services (e.g. water and wastewater) to the AEGD.

Three time horizons were used for analysis:

- Secondary Plan Area, Phase 1 + Council Directed Additional Lands (2021 Horizon)
- Secondary Plan Area, Phase 2 + Council Directed Additional Lands (2031 Horizon)
- Full Build-out (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area) (Beyond 2031)

To accommodate land use refinements made throughout the study and to provide more detail within the AEGD, a transportation model was constructed using Dowling Inc.'s Traffix software to replicate the EMME/2 full build-out trip generation (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). The Traffix model was utilized to provide additional modelling flexibility to reflect the preferred land use strategy and phasing with greater detail.

Four alternatives were examined for each of the study horizons (2021, 2031 and 'beyond 2031'):

- Do Nothing Alternative – Use existing roadways with no additional improvements identified
- Alternative #1 – 6-Lane Dickenson with Enhanced Road Grid
- Alternative #2 – 4-Lane Dickenson with Multi-Use Trail Connections
- Alternative #3 – 6-Lane Dickenson with Multi-Use Trail Connections

In all cases, the major transportation constraints to address were east-west movement in the network and limited mobility through the connectivity "barrier" created by Hamilton Airport in the centre of the AEGD.

The analysis within the AEGD was completed for the following key intersections:

- Garner Road & Southcote Road
- Twenty Road & Southcote Road
- Twenty Road & Glancaster Road
- Twenty Road & Garth Street
- Twenty Road & Upper James Street
- Glancaster Road & Collector 6N
- Upper James Street & Collector 7E
- Book Road & Fiddler's Green Road
- Book Road & Southcote Road
- Dickenson Road & Glancaster Road
- Dickenson Road & Garth Street
- Dickenson Road & Upper James Street
- Butter Road & Fiddler's Green Road
- Glancaster Road & Airport Road
- Glancaster Road & White Church Road

Highway 6 is a Provincial Highway located within the AEGD that connects to Highway 403 at its northern limit and Upper James Street at its southern limit. Upper James Street is a major north-south arterial roadway located on the east side of the AEGD. The timing and exact location for the Trinity Church Corridor has not yet been established. For modelling purposes, the Trinity Church Corridor was assumed to be located near Highway 6 / Upper James Street with a connection to the Red Hill Valley Parkway (see **Appendix C**). The Trinity Church Corridor was included in all traffic analyses to more accurately reflect what the City's transportation infrastructure by 2031. If such a connection is not in place by the 2031 horizon there will not be a major impact to AEGD traffic. This is discussed further in **Section 6.3**.

6.1 Traffic Volumes

Traffic volumes and distributions from EMME/2 were duplicated in Traffix under full build-out conditions (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). Modeling on a regional scale, using EMME/2, provided a coarse overview of the expected demand in the study area; however, the level of detail was limited to regional and higher-level roadways. Traffix was utilized to take into consideration a more detailed analysis of the AEGD study area roadways.

In the case of the AEGD model, adjustments were made at both corridor and intersection levels to compensate for the coarseness of the regional transportation model. Local trip patterns were heavily influenced by the EMME/2 model's "centroid connector" locations (e.g. point on roadway system where generated trips were added).

In the EMME/2 model, each zone's generated trips access the network via several roadway links connecting to the zone centroid. In reality, traffic is generally dispersed amongst a number of local and collector roads rather than concentrated onto a centroid access point. This characteristic of the EMME/2 model tended to result in a greater degree of traffic fluctuation and variability along a corridor, especially in the northeast quadrant of the AEGD model.

In order to address some of the EMME/2 model "coarseness", centroid connections in the Traffix model were generally placed at access points consistent with proposed collector roadways within the study area. Due to the high demands on major arterials and the high degree of network connectivity of this development, trips were reassigned along various corridors and at intersections to maximize usage along parallel collector roads.

The City only maintains an AM Peak model in EMME/2. To provide a snapshot of PM peak constraints, a model was established by reversing AM peak traffic volumes (e.g. northbound volumes become southbound, left turns become opposing right turns, etc.) and applying a PM volume adjustment factor based on trip generation. This step was carried out in order to determine overall order of magnitude infrastructure needs for the AEGD road system. PM traffic volumes were not used to carry out detailed operational analysis.

6.2 Traffic Operations

Corridor traffic operations were evaluated using Trafficware's Synchro (Version 6) analysis software package. This allowed operations and capacity to be assessed at the intersection level, using the level-of-service (LOS) measurement.

For the purposes of operational analysis, lane configurations for the three proposed road network alternatives were analyzed. The traffic signal timings and phases were then optimized to represent the best case for each proposed scenario. ***Figures 20*** to ***22*** denote the LOS Synchro analysis for each of the three proposed alternatives for the full build-out (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area) during AM Peak.

The City of Hamilton has a policy in place to consider roundabouts at intersections that are being considered for traffic signals. In addition to the traditional signalized intersection LOS analysis, the use of roundabouts was also considered within the AEGD.

A roundabout evaluation was performed on the key AEGD intersections (listed above) using the US Federal Highway Administration (FHWA) methodology. Based on the average delay at key intersections, a LOS rating was assigned to each intersection and compared to the signalized option. Intersections with an improved LOS roundabout rating over the signalized option were considered viable. ***Figures 23*** to ***25*** illustrate viable roundabout locations and their associated LOS compared to the signalized LOS for the full build-out (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area (Beyond 2031)) for AM Peak.

The LOS analysis for both traditional intersections and roundabouts is based on high-level volume forecasts from the EMME/2 and Traffix – transportation models developed for the AEGD. The LOS at specific intersections and for critical movements should be examined at a more detailed phase of study when more accurate information is available about land use plans. At such a stage, more detailed assessments can be carried out to ensure that City of Hamilton standards are met for geometric design (e.g. number of turning lanes, etc.) and other criteria. Analysis required to determine mitigation for all LOS issues (i.e. LOS E or F) was beyond the scope and level of detail of this transportation master plan.

Additional information on Synchro analysis is provided in **Appendix B.**

Figure 20 - Alternative #1 LOS Analysis (Secondary Plan Area + Additional)

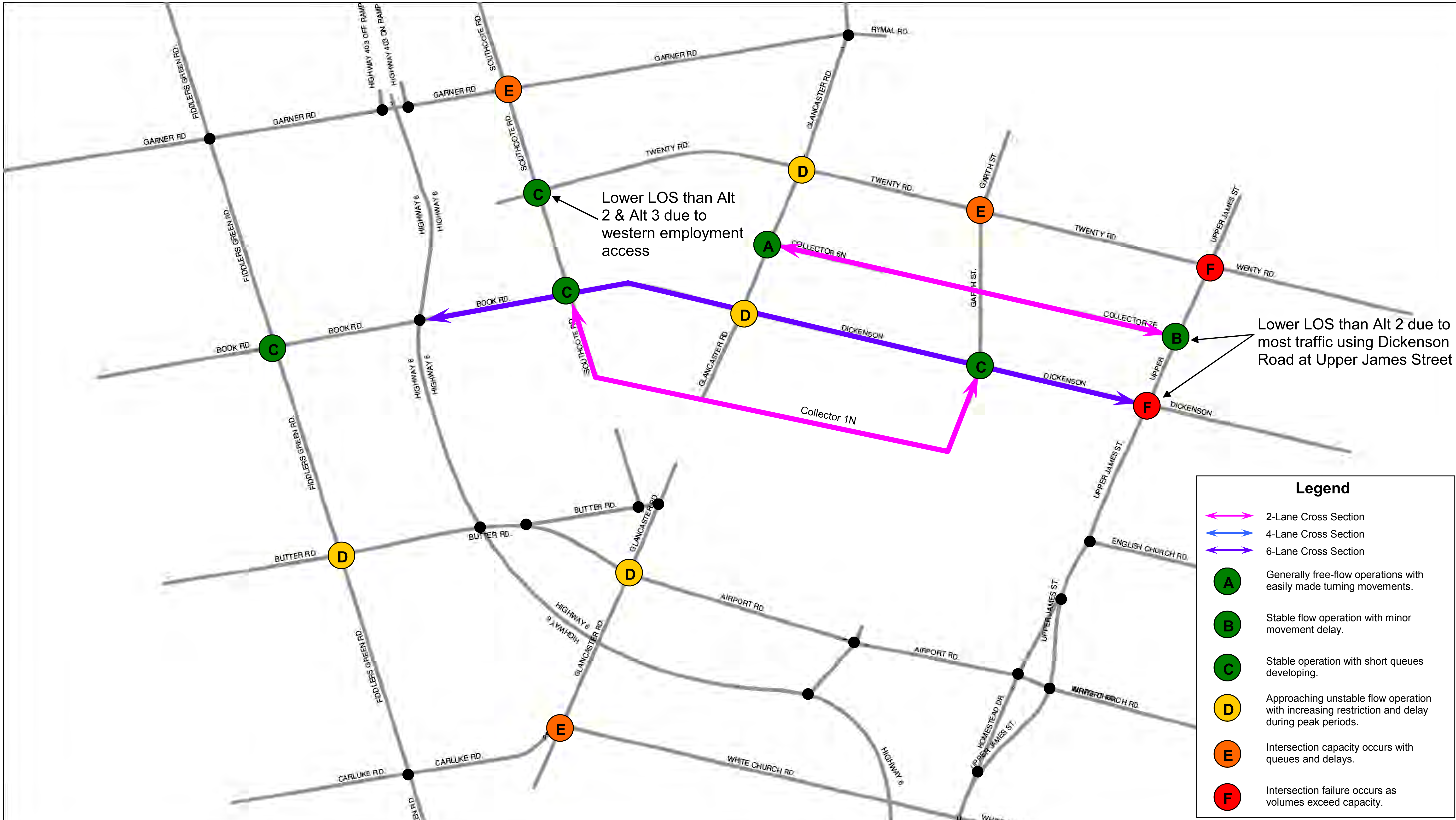


Figure 21 – Alternative #2 LOS Analysis (Secondary Plan Area + Additional)

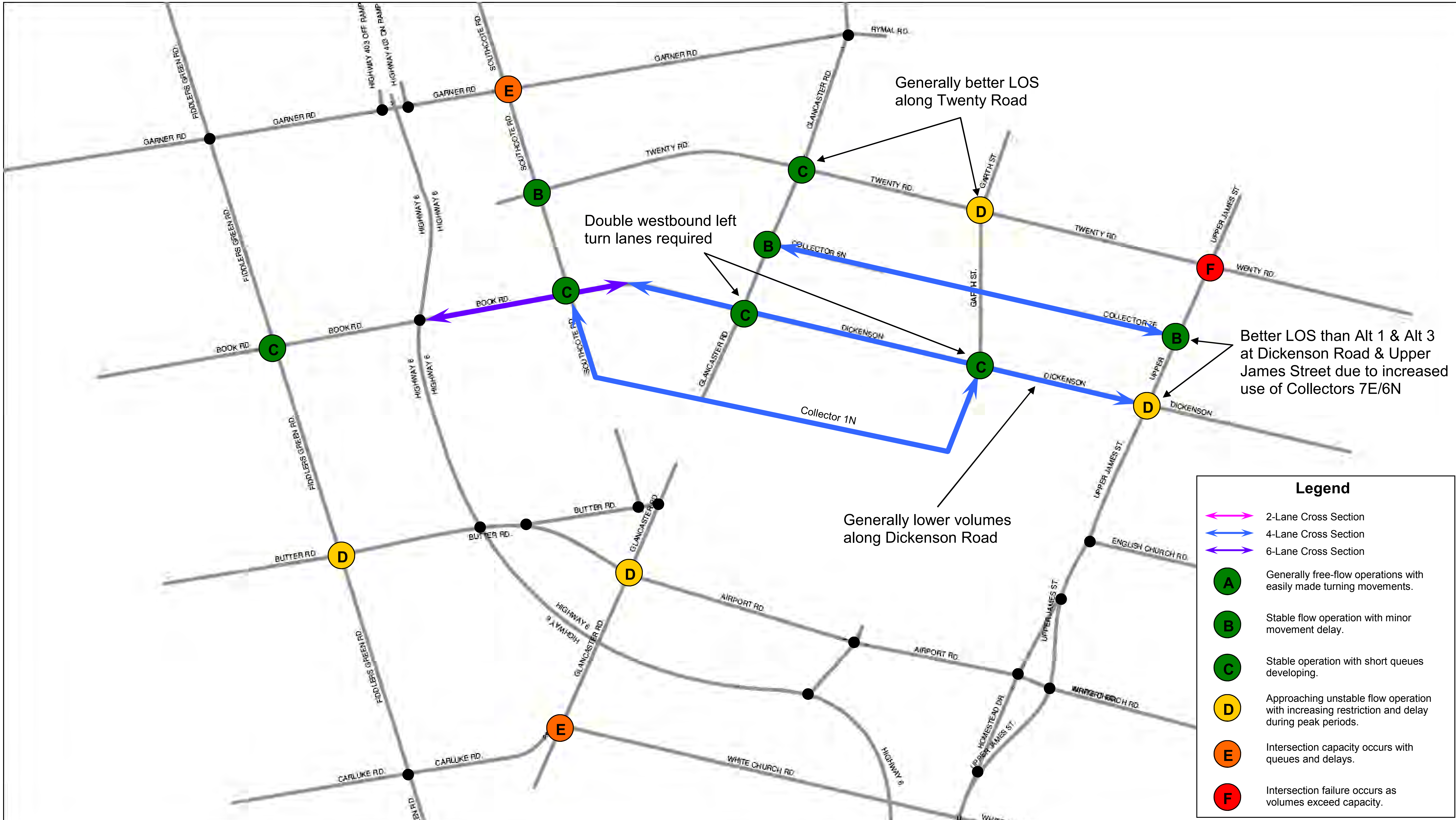


Figure 22 – Alternative #3 LOS Analysis (Secondary Plan Area + Additional)

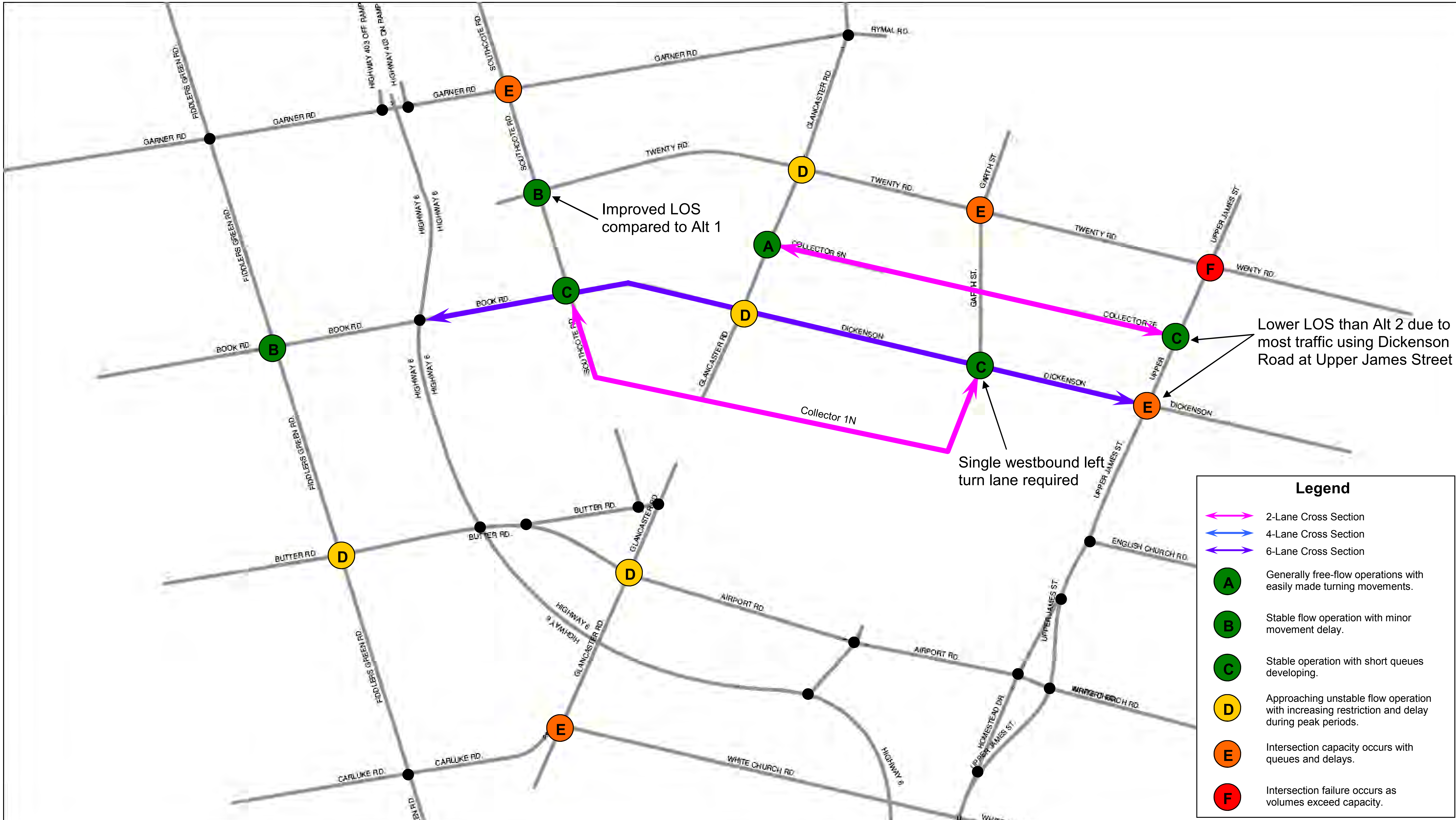


Figure 23 – Alternative #1 Roundabout Analysis (Secondary Plan Area + Additional)

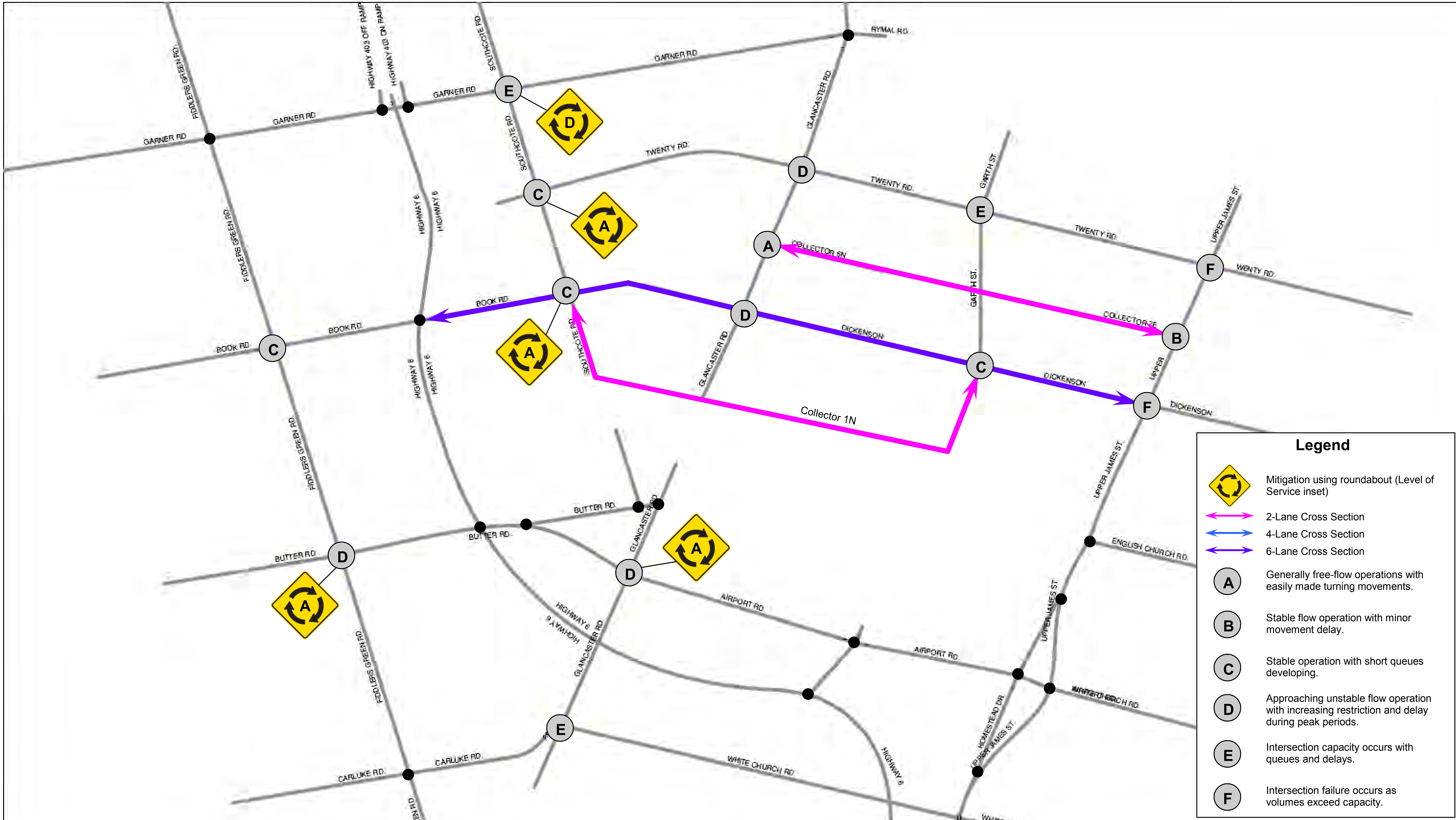


Figure 24 – Alternative #2 Roundabout Analysis (Secondary Plan Area + Additional)

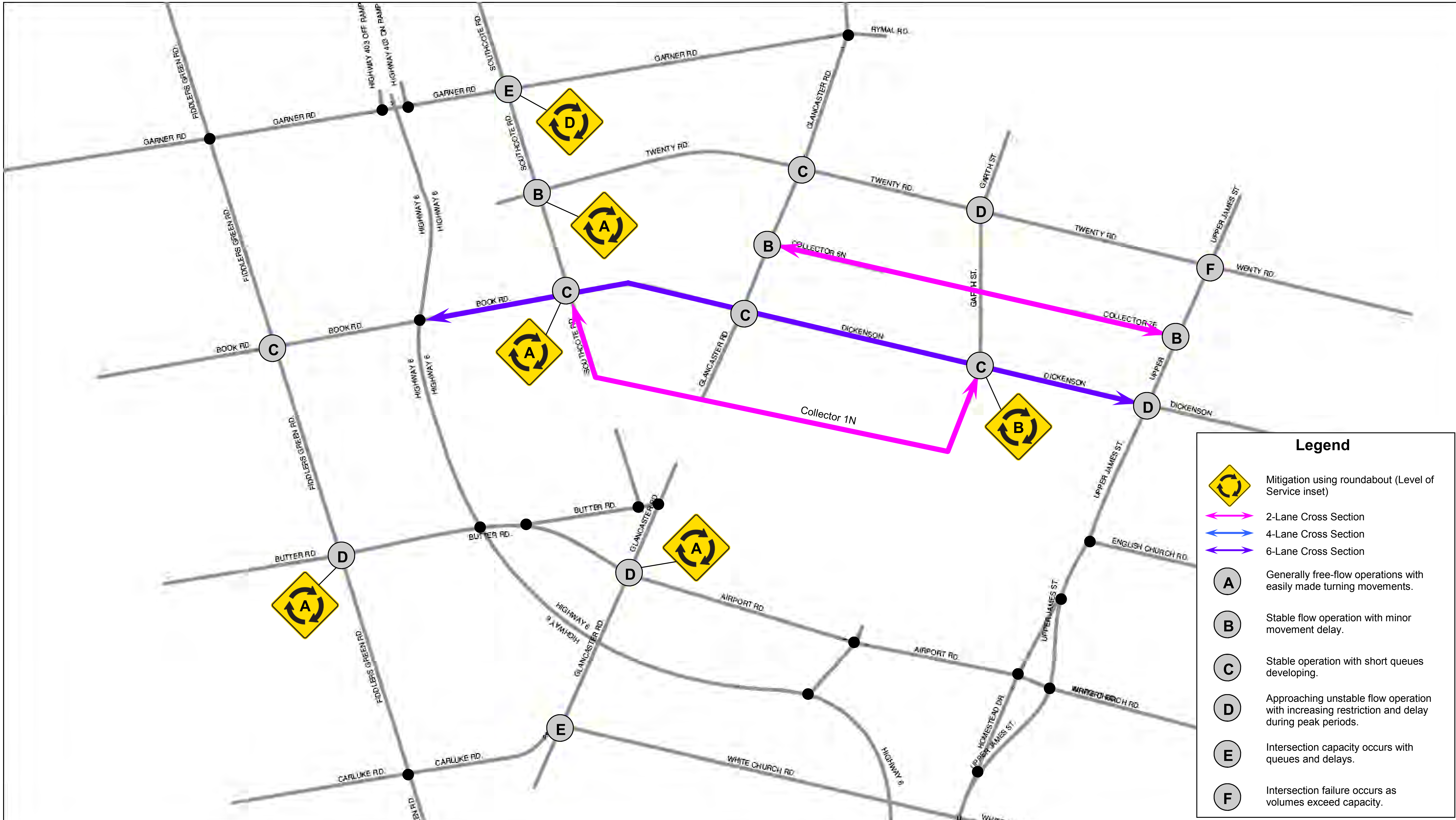
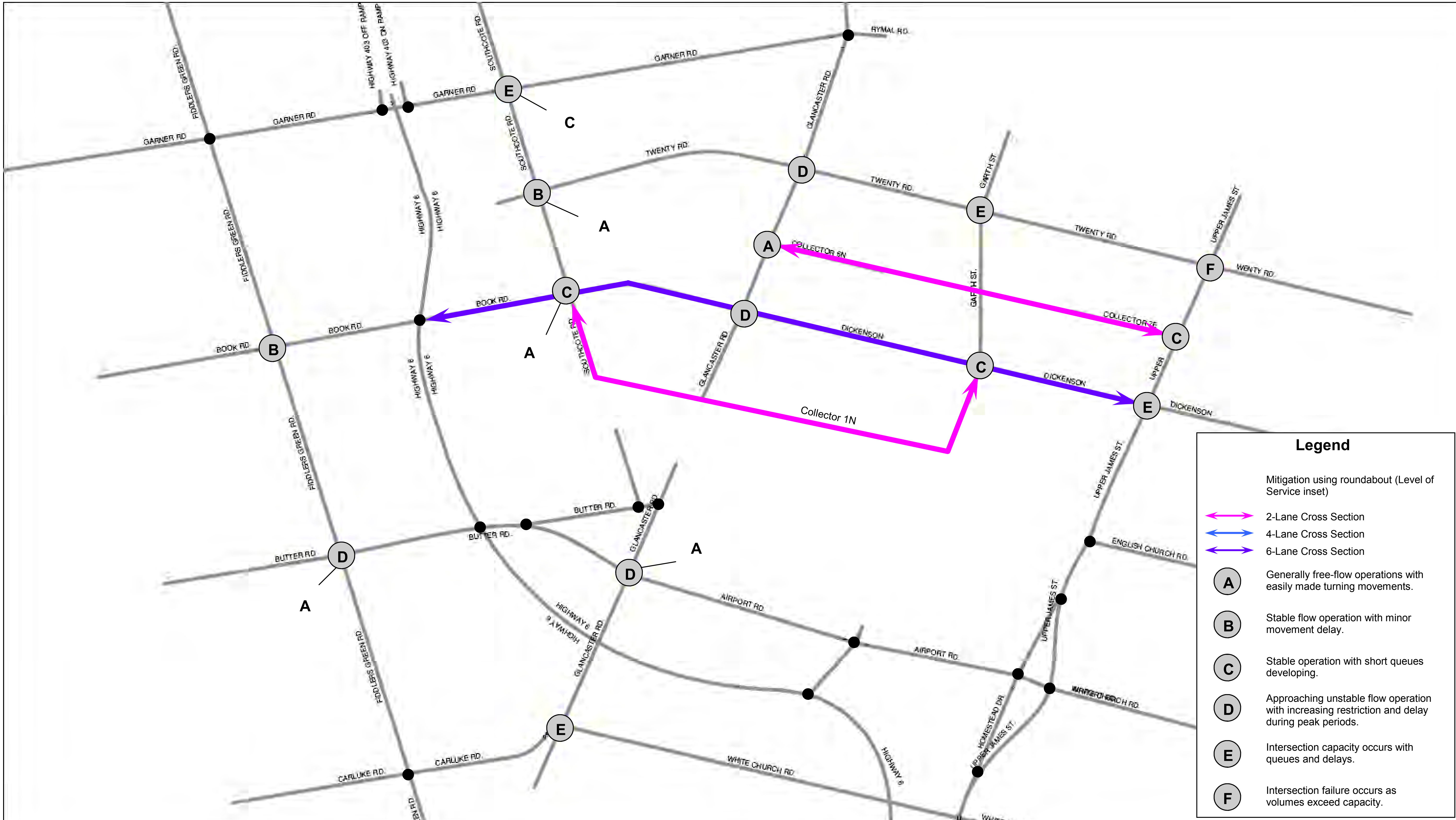


Figure 25 – Alternative #3 Roundabout Analysis (Secondary Plan Area + Additional)



6.3 Summary of Findings

The "Do-Nothing" scenario was not capable of accommodating the level of development anticipated and did not provide the land access required for the AEGD. The following findings are based on the analysis of the three other alternatives:

- The road network in the northeast quadrant of the study area will be nearing capacity by the full build-out of the AEGD lands (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). Traffic volumes in this area should be monitored throughout the development of the AEGD.
- East-west movement in the northeast and north-south movement around airport lands is critical to providing access and mobility within the study area.
- Due to the partial interchange at Garner Road and Highway 6, most traffic accessing the northeast portion of the AEGD will utilize the future interchange at Book Road and Highway 6. In order to accommodate demand at this critical link, increased capacity on Book Road will be required between Highway 6 and Smith Road by full build-out of the area. Six lanes were found to be necessary by the build-out of the AEGD (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). However, this should be monitored.
- There is minimal access to Highway 6 for vehicles travelling from north of the AEGD to employment areas located adjacent to White Church Road in the south. Glancaster Road between Airport Road and White Church Road will be a critical connection to this area.
- As airport passenger volumes increase, so will related traffic, and mobility to reach the airport will become more critical. The primary access off of Highway 6 is the preferred means of reaching the airport. However, the modeling exercise noted very high volume demand along Airport Road passing through the Homestead area. Potential issues arising from this demand will have to be addressed as development occurs at the airport and in the southern portion of the study area.
- By the completion of the Secondary Plan Area and Council Directed Additional Lands (2031 Horizon), the intersection of Upper James Street and Twenty Road is projected to be the intersection with the worst LOS (see **Appendix A**) in the AEGD. Critical AM peak movements in the southbound right, southbound through, and northbound left are the primary cause of this poor intersection performance. Alternative #2 provides a LOS 'E', which is the best possible rating compared to other alternatives. This does not meet the City of Hamilton's minimum design LOS 'D'. A high transit mode split was factored in. If motorists do not shift to other, less congested corridors the City should pursue other mitigation measures along Upper James Street to shift vehicular traffic away from this corridor.
- Highway 6 is a major transportation corridor that traverses the AEGD connecting Highway 403 in the northwest and Upper James Street in the southeast.

Modelling results indicate that Highway 6 *may* need six lanes of capacity by the 2031 horizon year, particularly along the critical link between Highway 403 and Book Road, which provides access to employment areas in the northeast of the AEGD. Demands along the Highway 6 corridor should be monitored throughout the development of the AEGD and infrastructure improvements coordinated with the MTO.

- The Trinity Church Connection to the southeast of the AEGD, as modelled, primarily serves employment lands along White Church Road. Modelling results indicated the majority of trips from the Red Hill Valley Parkway (RHVP) to the AEGD accessed the study area via Upper James Street and the Lincoln Alexander Parkway, not the Trinity Church Connection. The Trinity Church Connection to the RHVP was only considered as a supporting transportation corridor, not a primary route.

The analysis outlined above was carried out at a high-level. It is recommended that the above findings be confirmed through more detailed traffic impact assessments as development within the AEGD proceeds.

7.0 2031 NETWORK ASSESSMENT

As presented in **Sections 5.1** and **5.2**, the traffic demands associated with the planned development in the AEGD were initially forecast using an EMME/2 sub-area model developed based on the City of Hamilton's AM Peak Hour model. This forecast allowed for a high-level assessment of broader issues based on estimated arterial and collector road capacity.

The high-level EMME/2 analysis encompassing the full build-out (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area) identified the following constraints:

- Capacity constraints were forecasted on corridors to/from the east of the AEGD. In particular, the Dickenson Road, Twenty Road, and Airport Road corridors were identified as likely requiring future improvements such as widening.
- A significant portion of trips on Highway 403 westbound, East of Highway 6, are destined to the AEGD. A more detailed review should be undertaken of traffic forecasted on Highway 403 westbound to determine whether any operational issues might arise.
- While Highway 6 within the AEGD is forecasted to operate within available capacity, timing of improvements (e.g. widening) and interchange construction at Book Road, Butter Road, and the airport access will have to be assessed in greater detail and coordinated with the MTO.
- Corridors accessing the Lincoln Alexander Parkway to the north of the AEGD study area, including Garth Street and Upper James Street, should be considered for improvements to address potential capacity issues.
- Fiddler's Green Road, south of Garner Road is forecasted to receive a significant proportion of traffic destined for the AEGD and was identified as likely requiring future improvements such as widening.

The above-noted constraints were incorporated into the development of transportation network alternatives.

7.1 Proposed Network Alternatives

7.1.1 Methodology

The AEGD land use plan was used as a basis for the development of transportation network alternatives. The objective was to provide a well connected, multi-modal transportation network capable of providing a high level of service to the AEGD lands for the movement of people and goods. The network was developed to make movements to, from and within the industrial park an easy experience as a result of a variety of transportation options.

Specific transportation goals were identified for the AEGD network, based on transportation targets identified in the City-wide Transportation Master Plan, including:

- Achieving a 20% reduction in vehicle kilometres traveled by the year 2031, compared to the 2001 baseline;
- Targeting a 12% transit mode share by the year 2031; and
- Providing facilities for alternative modes of transportation (i.e. cycling, walking)

In order to meet the transportation goals, the future road network was designed to serve transit, pedestrian and cycling trips as well as auto trips and goods movement. A "grid" road network pattern was selected to address transit service and pedestrian and cyclist connectivity, as well as vehicular accessibility.

Network considerations took into account a strong focus on transit and pedestrian connections in order to meet mode share targets detailed in the transportation goals for the study area. All roadways incorporate pedestrian and cycling facilities, in addition to a system of multi-use and recreational trails.

7.1.2 Derivation of Roadway Network Alternatives

Consistent with the requirements of the Municipal Class EA process, a number of alternatives were developed and assessed against evaluation criteria to determine the preferred transportation network alternative.

For the transportation network, a "Do Nothing" alternative was considered. This alternative represents the existing roadway network, with no improvements or additions. As the forecasted employment growth within the study area will significantly increase travel demands, the "Do Nothing" alternative (shown in ***Figure 26)*** was found to be insufficient to support these increased demands.

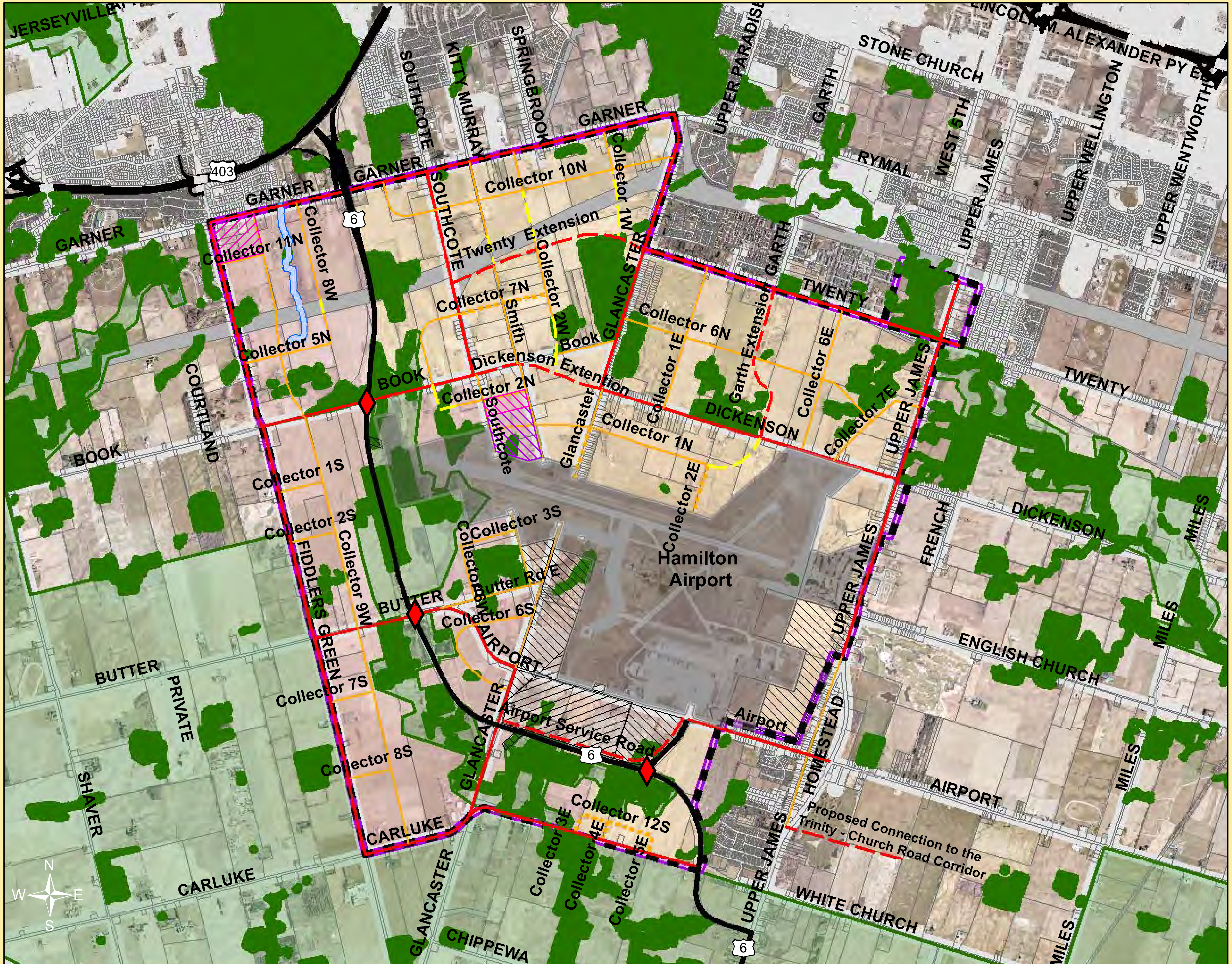
Three additional alternatives were developed that address the high-level transportation capacity issues identified using EMME/2 for the full build-out horizon (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). The first alternative assessed was "***Alternative 1: 6-Lane Dickenson Road with Enhanced Road Grid***". This alternative included a base road network with additional road connections through the Hydro easement as well as other collector road links. This alternative also included a 6-lane cross-section along Dickenson Road (from Highway 6 to Upper James Street) and 2-lane cross-sections on proposed east-west collector roadways located directly north (Collector 6N) and south (Collector 1N) of Dickenson Road. Alternative 1 is shown in ***Figure 27***.

The second alternative considered was "***Alternative 2: 4-Lane Dickenson Road with Multi-use Trail Connections***". This alternative included a base road network with multi-use trail connections in lieu of roadway connections through the Hydro easement and fewer other collector road links (i.e. "fused grid" model). This alternative also included a 4-lane cross-section along Dickenson Road (from Southcote Road to Upper James Street) and 4-lane cross-sections on proposed east-west collector roadways located directly north (Collector 6N) and south (Collector 1N) of Dickenson Road. Alternative 2 is shown in ***Figure 28***.

The third alternative assessed was "***Alternative 3: 6-Lane Dickenson Road with Multi-use Trail Connections***". This alternative included a base road network with multi-use trail connections replacing some of the roadway connections in the northwest corner of the study area, as with Alternative 2. Alternative 3 also included a 6-lane cross-section along Dickenson Road (from Highway 6 to Upper James Street) and 2-lane cross-sections on proposed east-west collector roadways located directly north (Collector 6N) and south (Collector 1N) of Dickenson Road, as in Alternative 1. Alternative 3 is shown in ***Figure 29***.

Generally, the differences in network configurations between the alternatives occur in two primary locations:

1) North-south across the hydro easement in the northwest AEGD; and
2) The east-west movements in the northeast AEGD.



Hamilton

Hamilton AEGD Study

Figure 26: Do Nothing

Legend

- Proposed Interchange
- Provincial Highway
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area
- Additional Study Area
- Ancaster Christian Reform Church Property - Prestige Business Park
- Smith Farm Property - Prestige Business Park
- Smith Farm Property - Airside Industrial
- Existing Airport Holdings
- Airport Expansion Area*
- Future Airport Land Requirements
- Greenbelt Natural Heritage System
- Core Natural Features Areas**
- 60m Cool Water Stream Setback
- Parcel
- Hydro Corridor
- Airport Employment Growth District Boundary

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

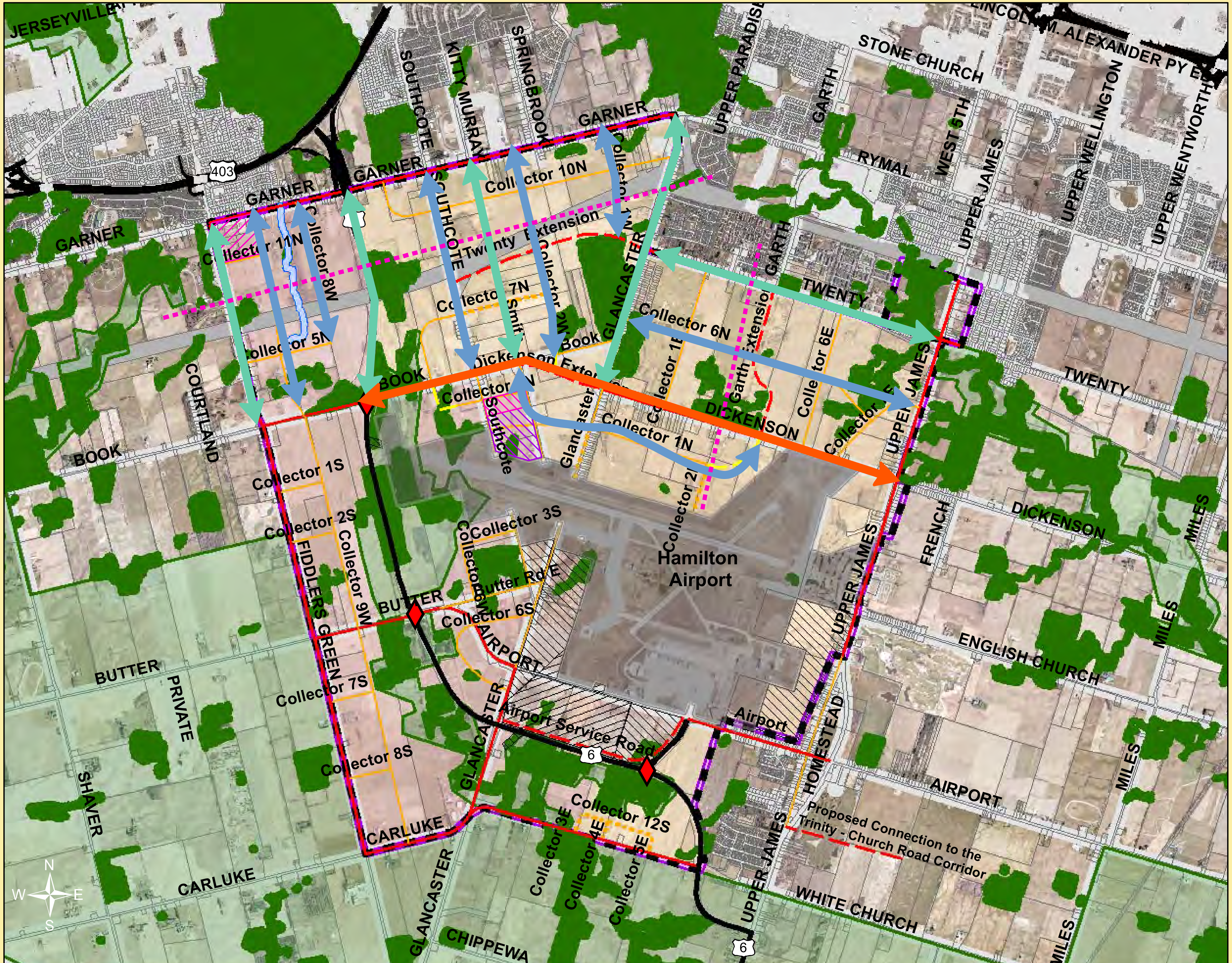
DILLON CONSULTING

Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: January 13, 2011
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP - Final Figures May 2010
Figure 26: Do Nothing.mxd

Hamilton

Hamilton AEGD Study

Figure 27: Alternative #1 Six Lane Dickenson Road with Grid Connectivity (Secondary and Additional)



Legend

- Proposed Interchange
- Provincial Highway
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area, Potential Roadway Projects
- 2 - Land Corridor
- 4 - Land Corridor
- 6 - Land Corridor
- Lane Screenline
- Secondary Plan Area
- Additional Study Area
- Ancaster Chrisitian Reform Church Property - Prestige Business Park
- Smith Farm Property - Prestige Business Park
- Smith Farm Property - Airside Industrial
- Existing Airport Holdings
- Airport Expansion Area*
- Future Airport Land Requirements
- Greenbelt Natural Heritage System
- Core Natural Features Areas**
- Floodplain
- 60m Cool Water Stream Setback
- Parcel
- Hydro Corridor
- Airport Employment Growth District Boundary

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: January 13, 2011
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP - Final Figures May 2010
Figure 27 Alternative 1 - 6 Lane Dickenson Road with Enhanced Road Grid.mxd

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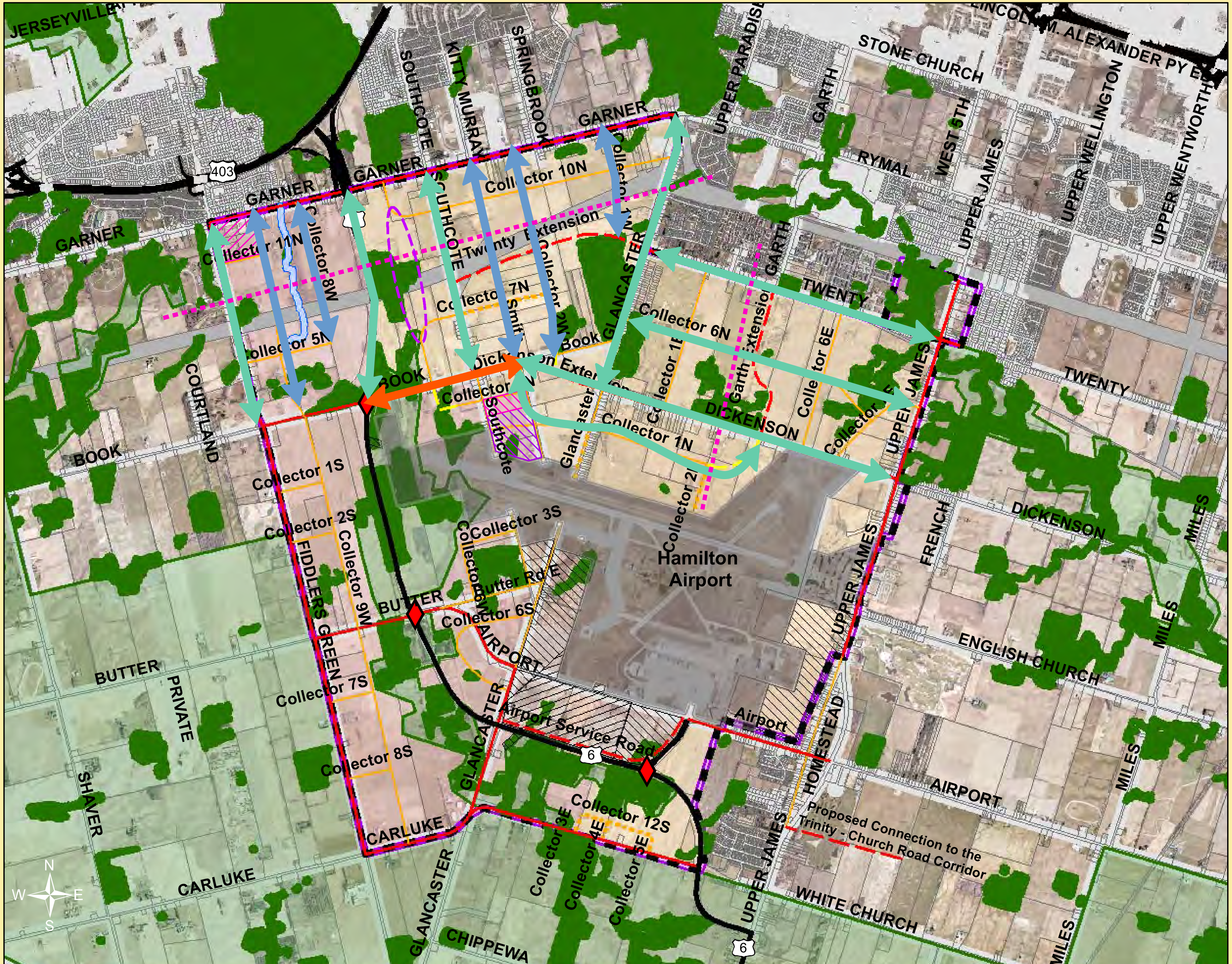

Hamilton

Hamilton AEGD Study

Figure 28: Alternative #2 Four Lane Dickenson Road With Pedestrian Connectivity (Secondary and Additional)

Legend

- Proposed Interchange
- Provincial Highway
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area, Potential Roadway Projects
- 2 - Land Corridor
- 4 - Land Corridor
- 6 - Land Corridor
- Pedestrian Corridor
- Lane Screenline
- Secondary Plan Area
- Additional Study Area
- Ancaster Chrisitian Reform Church Property - Prestige Business Park
- Smith Farm Property - Prestige Business Park
- Smith Farm Property - Airside Industrial
- Existing Airport Holdings
- Airport Expansion Area*
- Future Airport Land Requirements
- Greenbelt Natural Heritage System
- Core Natural Features Areas**
- Floodplain
- 60m Cool Water Stream Setback
- Parcel
- Hydro Corridor
- Airport Employment Growth District Boundary

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: January 13, 2011
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP - Final Figures May 2010
Figure 28 Alternative 2 - 4 Lane Dickenson Road with Multi-Use Path Connections

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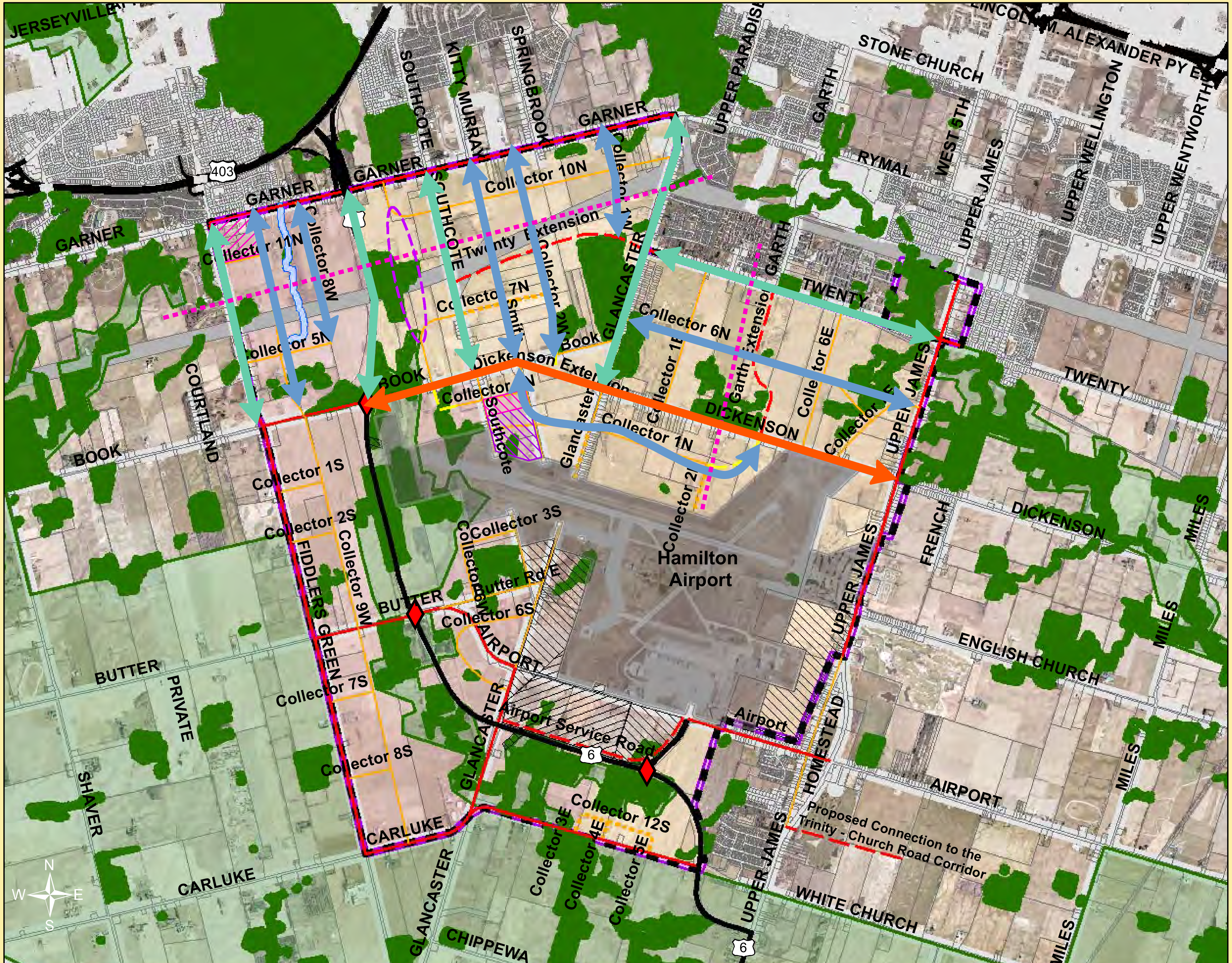

Hamilton

Hamilton AEGD Study

Figure 29: Six - Lane Dickenson Road with Pedestrian Connectivity (Secondary and Additional)

Legend

- Proposed Interchange
- Provincial Highway
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area, Potential Roadway Projects
- 2 - Land Corridor
- 4 - Land Corridor
- 6 - Land Corridor
- Pedestrian Corridor
- Lane Screenline
- Secondary Plan Area
- Additional Study Area
- Ancaster Chrisitian Reform Church Property - Prestige Business Park
- Smith Farm Property - Prestige Business Park
- Smith Farm Property - Airside Industrial
- Existing Airport Holdings
- Airport Expansion Area*
- Future Airport Land Requirements
- Greenbelt Natural Heritage System
- Core Natural Features Areas**
- Floodplain
- 60m Cool Water Stream Setback
- Parcel
- Hydro Corridor
- Airport Employment Growth District Boundary

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: April 29, 2010
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP - Final Figures May 2010
Figure 29 Six Lane Dikenson Road with Pedestrian Connectivity.mxd

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In order to facilitate comparison of the number of lanes between alternatives, two screenlines were identified, as shown in ***Figures 27, 28, and 29***. Under pre-development conditions, there are 12 existing lanes traversing the aforementioned screenlines. In the full build-out (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area), the screenlines contain the following number of lanes:

- Do Nothing Alternative – 12 lanes
    - East-West Roadways – 4 lanes
    - North-South Roadways – 8 lanes
- Alternative #1 – 42 lanes
    - East-West Roadways – 14 lanes
    - North-South Roadways – 28 lanes
- Alternative #2 – 42 Lanes
    - East-West Roadways – 16 lanes
    - North-South Roadways – 26 lanes
- Alternative #3 – 40 Lanes
    - East-West Roadways – 14 lanes
    - North-South Roadways – 26 lanes

7.1.3 Evaluation of Proposed Network Alternatives

Consistent with the Municipal Class EA process, the three network alternatives were evaluated according to a number of criteria related to transportation service, cost, engineering, socio-economics, cultural environment and natural environment. The evaluation criteria employed in assessing the AEGD alternatives were developed using those developed for the City of Hamilton TMP Study as a guide.

The evaluation of the AEGD alternatives was carried out by assessing each of the proposed alternatives against the evaluation criteria, and comparing them against one another in order to determine which alternative was most closely aligned with the AEGD Vision and the transportation goals and objectives for the AEGD TMP. The latter were derived from the City of Hamilton TMP goals and objectives. The evaluation criteria and the proposed alternatives were presented to the Community Liaison Committee (CLC) and to the general public during the Phase 2 Public Consultation Sessions.

Transportation Service: This assessment involved a comparison of the level of service (LOS) for auto modes on primary routes, including arterial and collector roadways, within the study area for all alternatives. This was measured quantitatively using the standard LOS values A (very good) through F (poor).

Another component of the assessment considered future transit service opportunities, including routes and facilities within the study area, under the various alternatives. These were compared quantitatively by comparing number of service routes provided, as well as qualitatively for overall pedestrian access and connectivity.

The efficient movement of goods and people will depend on access to the surrounding roadway network, both within the study area (for land access) and beyond the study area (for Regional, Provincial, National and International connections). The alternatives were assessed according to the quantity and quality of access provided.

Sustainable transportation principles and the accommodation of non-auto modes were assessed. This criterion was based on the overarching objectives from the City of Hamilton TMP to increase non-auto modes, promote and encourage cycling and walking, and provide facilities and programs to build active communities.

Optimum use of transportation infrastructure capacity was assessed according to the modelled capacity results for the various alternatives.

Cost: The cost assessment compared the capital costs associated with transportation network improvements for each alternative. Road improvement costing was based on benchmark costs and typical roadway cross-sections. Unit prices were selected according to typical market values for the study area. The benchmark costs contain typical engineering and construction contingency allowances. Estimates took into consideration the costs typically associated with earthworks, underground servicing, utility servicing, street and traffic lighting, structures, roadworks and amenities, and drainage. In addition, transit capital costs and landscaping costs were considered where appropriate.

Engineering: The assessment of engineering compared the compatibility of each alternative with eco-industrial design principles. As a component of the AEGD study, eco-industrial directions were established for the AEGD Secondary Plan. The vision for eco-industrial design, as it related to transportation was to achieve a multi-modal, walkable, transit accessible, transportation system with efficient goods movement. These criteria assessed how well each alternative met the eco-industrial principles and vision.

Socio-Economics & Cultural Environment:

Potential impacts on existing area businesses and residences were assessed based on existing mapping. A comparison was made between the current roadway ROW provisions, as per the Official Plan, and the proposed ROWs required to accommodate future traffic demands within the AEGD. This comparison was undertaken to determine the impact, in terms of land mass, of additional ROW land requirements on the existing parcels of land adjacent to the proposed roadway widenings and/or new roadways. GIS was used to estimate the area of impact (i.e. difference between AEGD ROW area and existing Official Plan ROW area) on specific existing land use categories for each alternative (e.g. x hectares impact on existing residential land use, y impact on existing commercial land use, etc.)

Potential impacts on build heritage and archaeology were considered as part of the EA evaluation criteria. As part of the Phase 1 AEGD Study, Archaeological Services Inc. (ASI) was contracted by Dillon Consulting to conduct a Stage 1 archaeological assessment for the AEGD study area. The study included a review of previous archaeological research, physiography, and land use history for the study area. Background research was completed to identify any archaeological sites in the study area and to assess its archaeological potential. Built/Cultural Heritage Resources were also studied during Phase 1 of the AEGD Study. Heritage Management Resource Consultants, Unterman McPhail Associates, were retained by Dillon Consulting to complete this assessment, which included a cultural heritage landscape inventory within the AEGD study area. The results from this assessment were considered for the EA evaluation. With reference to both the archaeology and built heritage studies, completed in Phase 1 of the AEGD study, Built Heritage Features (BHF) and Cultural Heritage Units (CHU) were measured quantitatively along the alternative network differences. Information from this assessment was used to evaluate the network alternatives.

The network alternatives were assessed for consistency with planned land uses, City-wide Transportation Master Plan, AEGD Vision, etc. These background studies and documents were referred to during the planning and design of the various network alternatives and qualitatively assessed for the EA evaluation of the alternatives.

Impact on human health, including air quality, noise, was incorporated into the assessment. Potential for improvement to modal choices was also assessed for the alternatives considered. Again, this was a qualitative assessment based on the modes and infrastructure selected for the network alternatives.

Natural Environment:

As part of the AEGD Phase 2 study, a review of the identified natural heritage features on the subject site was conducted. The purpose of this review was to confirm the presence of features identified in natural environment database searches and to make preliminary determinations of the sensitivity of these features. Analysis of the aquatic features in the AEGD was completed as part of the Sub-watershed Study and Stormwater Management Plan. The data collected for these studies were incorporated during the development of the network alternatives. Estimates of the total area of naturally significant or sensitive features impacted by the network alternatives were measured (using GIS) and compared.

The specific criteria used in the evaluation are shown in ***Table 10*** - Evaluation of Proposed Network Alternatives**.**

Table 10: Evaluation of Proposed Network Alternatives

	Criteria	Do Nothing Alternative	Alternative 1	Alternative 2	Alternative 3
		Existing Conditions *(Existing Transportation Network and Facilities)*	**6 lane Dickenson Road with Enhanced Road Grid** *(6 lanes on Dickenson, 2 lanes on Collector 1N and Collector 6N)*	**4-lane Dickenson Road with Multi-use Trail Connections** *(4 lanes on Dickenson, 4 lanes on Collector 1N and Collector 6N)*	**6 lane Dickenson Road with Multi-use Trail Connections** *(6 lanes on Dickenson, 2 lanes on Collector 1N and Collector 6N)*
Transportation Service	Transportation Level of Service - auto level of service (LOS) on primary routes	Existing capacity of arterial and collector roadways not sufficient to meet forecasted traffic demands. Peak direction v/c>2.0 / LOS F for majority of arterials and collectors. **RANK: 4**	LOS for arterials ranges from C to D for Dickenson, B to F for Upper James Street and C to D for Southcote Road. Collectors have good LOS **RANK: 3**	LOS for arterials ranges from B to C for Dickenson, C to E for Upper James Street and A to E for Southcote Road. Collectors have good LOS **RANK: 1**	LOS for arterials ranges from C to D for Dickenson, B to F for Upper James Street and B to C for Southcote Road. Collectors have good LOS **RANK: 2**
	Transit routing options	Very limited transit facilities and service provided. (6 existing surface routes) **RANK: 4**	All alternatives provide similar options for transit routing (6 existing surface routes, 4 extensions to existing surface routes, 5 news surface routes and proposed Rapid Transit Service). All alternatives provide similar passenger accessibility. **RANK: 1**	All alternatives provide similar options for transit routing (6 existing surface routes, 4 extensions to existing surface routes, 5 news surface routes and proposed Rapid Transit Service). All alternatives provide similar passenger accessibility. **RANK: 1**	All alternatives provide similar options for transit routing (6 existing surface routes, 4 extensions to existing surface routes, 5 news surface routes and proposed Rapid Transit Service). All alternatives provide similar passenger accessibility. **RANK: 1**
	Ability to efficiently move goods and people	Poor ability to move goods and people due to lack of primary routes and limited transit service. **RANK: 4**	All alternatives provide sufficient arterial and collector access to developable lands. Highway 6 access is available in all alternatives **RANK: 1**	All alternatives provide sufficient arterial and collector access to developable lands. Highway 6 access is available in all alternatives **RANK: 1**	All alternatives provide sufficient arterial and collector access to developable lands. Highway 6 access is available in all alternatives **RANK: 1**
	Support of Sustainability Principles / Improvement to Non-Auto Modes	Does not include any improvements to non-auto modes. Limited existing cycling and pedestrian facilities. Approx. 22 km of On-street Bike Routes. **RANK: 4**	Accommodates all modes (e.g. enhanced grid through Hydro easement permits all modes). Approx. 30 km of Bike Lanes, 22 km of Multiuse Trail, 12 km of Signed On-Street Bike Route, and 30 km of Sidewalk. **RANK: 3**	Promotes alternative transportation through enhanced cycling and walking connections within certain areas (e.g. "fused grid" with pedestrian/ cyclist-only connections across some Hydro easements). Approx. 30 km of Bike Lanes, 22 km of Multiuse Trail, 12 km of Signed On-Street Bike Route, and 30 km of Sidewalk. **RANK: 1**	Promotes alternative transportation through enhanced cycling and walking connections within certain areas (e.g. "fused grid" with pedestrian/ cyclist-only connections across some Hydro easements). Approx. 30 km of Bike Lanes, 22 km of Multiuse Trail, 12 km of Signed On-Street Bike Route, and 30 of km Sidewalk. **RANK: 1**
	Optimal Use of Transportation Infrastructure Capacity	Demands are beyond capacity of existing transportation infrastructure. **RANK: 4**	Connectivity for auto is provided beyond transportation capacity needs. **RANK: 3**	More optimal use of road connections. **RANK: 1**	More optimal use of road connections. **RANK: 1**
Cost	Capital Costs	No additional costs. **RANK: 1**	Transportation Engineering Costs including Roads, Transit, Trails and Landscaping. Property not included. **$375 Million** **RANK: 2**	Transportation Engineering Costs including Roads, Transit, Trails and Landscaping. Property not included. **$370 Million** **RANK: 2**	Transportation Engineering Costs including Roads, Transit, Trails and Landscaping. Property not included. **$369 Million** **RANK: 2**

	Criteria	Do Nothing Alternative	Alternative 1	Alternative 2	Alternative 3
Engineering	Compatibility with Eco-industrial Design Principles (e.g. stormwater treatment, "green infrastructure")	Rural road cross-sections with limited to no pedestrian / cycling facilities for sustainable modes. Stormwater run-off by traditional rural ditches. Incorporates little to no "green infrastructure". **RANK: 4**	Stormwater run-off greater with more paved surfaces Grid pattern for all modes with better division of traffic across the hydro easement through grid collector road network. More transit route/ connection options with a well connected network. **RANK: 3**	Stormwater run-off equal in alternatives 2 & 3, as paved surface area is equivalent Grid pattern for most of the road network and all of the pedestrian and cycling facilities. Encourages cycling and walking and increases safety by providing pedestrian connections. **RANK:1**	Stormwater run-off equal in alternatives 2 & 3, as paved surface area is equivalent Grid pattern for most of the road network and all of the pedestrian and cycling facilities. Encourages cycling and walking and increases safety by providing pedestrian connections. **RANK: 1**
Socio-Economic & Cultural Environment	Potential Impact on Existing Area Businesses and Residences	Existing businesses and residences will be impacted by low/ inadequate transportation level of service. **RANK: 4**	6-lane impact on Dickenson is higher. Predominant land uses affected include agricultural, open space, residential, golf course, some mixed use and commercial. Overall 108 net hectares of land parcels affected beyond Official Plan provisions (including 28 net hectares of residential land) **RANK: 2**	4-lane impact on Dickenson is lower. Predominant land uses affected include agricultural, open space, residential, golf course, some mixed use and commercial. Overall 105 net hectares of land parcels affected beyond Official Plan provisions(including 28 net hectares of residential land) **RANK: 1**	6-lane impact on Dickenson is a higher impact. Predominant land uses affected include agricultural, open space, residential, golf course, some mixed use and commercial. Overall 104 net hectares of land parcels affected beyond Official Plan provisions(including 27 net hectares of residential land) **RANK: 2**
	Potential impacts on built heritage, archaeology	No additional impact on built heritage / archaeology 0 BHF, 0 CHU **RANK: 1**	Numerous sites of potential archeological significance identified within the study area subject to further investigation during subsequent phases of planning (Stage 2 archeological assessments needed). Potential impacts on built heritage (e.g. farm complexes, residences, cemeteries) and cultural landscapes identified which will require subsequent study. 10 BHF, 2 CHU **RANK: 4**	Numerous sites of potential archeological significance identified within the study area subject to further investigation during subsequent phases of planning (Stage 2 archeological assessments needed). Potential impacts on built heritage (e.g. farm complexes, residences, cemeteries) and cultural landscapes identified which will require subsequent study. 9 BHF, 2 CHU **RANK: 2**	Numerous sites of potential archeological significance identified within the study area subject to further investigation during subsequent phases of planning (Stage 2 archeological assessments needed). Potential impacts on built heritage (e.g. farm complexes, residences, cemeteries) and cultural landscapes identified which will require subsequent study. 9 BHF, 2 CHU **RANK: 2**
	Consistency with Planned Land Uses, City-wide Transportation Master Plan, Airport Employment Growth District Vision, etc.	Is not consistent with Transportation Master Plan/ AEGD Vision. Does not provide for sustainable transportation modes or for the overall efficient movement of people or goods. **RANK: 4**	6-lane Dickenson is less consistent with urban design goals/vision for AEGD / TMP / OP. Less supportive of sustainable transportation alternatives. **RANK:3**	4-lane cross-section on Dickenson is more consistent with Prestige Business Park planned along Dickenson. Supports pedestrian, transit and cycling modes. (AEGD Vision and TMP / OP goals) **RANK:1**	6-lane Dickenson is less consistent with urban design goals/vision for AEGD / TMP / OP. Less supportive of sustainable transportation alternatives than Alternative 2. **RANK:2**

Criteria		Do Nothing Alternative	Alternative 1	Alternative 2	Alternative 3
	Relative Impact on Human Health (e.g. Air Quality, Noise, Improvement to Mode Choice, etc.)	Increased congestion on majority of arterial / collector roadways will increase noise and reduce air quality. Does not improve pedestrian and cycling mode choice. **RANK: 4**	Increased congestion on Collector 7E and 1N reduce overall Air Quality. Air Quality impact is higher for 6-lane cross-section of Dickenson. Noise impacts are lower with increased congestion on Collectors 7E and 1N. All alternatives provide equal improvement to pedestrian and cycling mode choice. **RANK: 2**	Lower congestion across road network reduces overall impact on Air Quality. Air Quality impact is lower for 4-lane cross-section of Dickenson. Noise Impacts are higher with lowered congestion rates on Collectors 7E and 1N. All alternatives provide equal improvement to pedestrian and cycling mode choice. **RANK: 1**	Increased congestion on Collector 7E and 1N reduce overall Air Quality. Air Quality impact is higher for 6-lane cross-section of Dickenson. Noise impacts are lower with increased congestion on Collectors 7E and 1N. All alternatives provide equal improvement to pedestrian and cycling mode choice. **RANK: 2**
Natural Environment	Potential Impacts on Natural Environment Including Terrestrial, Aquatic and Environmentally Sensitive Areas	No additional impact on natural environment. **RANK: 1**	All alignments avoid natural environment areas to extent possible. Similar-sized areas would be impacted (38 net hectares beyond Official Plan provisions). **RANK: 2**	All alignments avoid natural environment areas to extent possible. Similar-sized areas would be impacted (36 net hectares beyond Official Plan provisions). **RANK: 2**	All alignments avoid natural environment areas to extent possible. Similar-sized areas would be impacted (36 net hectares beyond Official Plan provisions). **RANK: 2**
Transportation		**RANK: 4**	**RANK: 3**	**RANK: 1**	**RANK: 2**
Cost		**RANK: 1**	**RANK: 2**	**RANK: 2**	**RANK: 2**
Engineering		**RANK: 4**	**RANK: 3**	**RANK: 1**	**RANK: 1**
Socio-Economic & Cultural Environment		**RANK: 4**	**RANK: 3**	**RANK: 1**	**RANK: 2**
Natural Environment		**RANK: 1**	**RANK: 2**	**RANK: 2**	**RANK: 2**
Overall Rank		**RANK: 4**	**RANK: 3**	**RANK: 1**	**RANK: 2**

8.0 TRANSPORTATION SYSTEM POLICIES FOR THE AEGD

A number of infrastructure improvements were identified as part of the analyses undertaken. In addition to these improvements, this document presents a series of considerations and recommendations to guide the development of the AEGD transportation system to 2031.

8.1 Guiding Principles

The 2007 Hamilton Transportation Master Plan (TMP) outlines the City's transportation objectives and guiding principles for the development of its transportation networks, policies, and programs. The Statement of Transportation Objectives and Guiding Principles, as illustrated in the Master Plan, is shown in ***Table 11.***

Table 11: Statement of Transportation Objectives and Guiding Principles

In 2020, the City of Hamilton's transportation system will:	
Objective 1 Principle 1(a) Principle 1(b) Principle 1(c)	**Offer safe and convenient access for individuals to meet their daily needs** Transportation facilities and services should be safe, secure and barrier-free Each transportation mode should have an acceptable level of service Non-travel alternatives and shorter trips should be encouraged
Objective 2 Principle 2(a) Principle 2(b) Principle 2(c)	**Offer a choice of integrated travel modes, emphasizing active transportation, public transit and carpooling** Alternatives to single-occupant vehicle travel should be practical and attractive Transportation facilities and services should be continuous and seamlessly integrated The health benefits of active lifestyles should be recognized and promoted
Objective 3 Principle 3(a) Principle 3(b)	**Enhance the livability of neighbourhoods and rural areas** Transportation facilities should reflect and complement their community context Noise and other undesirable impacts of traffic on residential areas should be minimized
Objective 4 Principle 4(a) Principle 4(b) Principle 4(c)	**Encourage a more compact urban form, land use intensification and transit-supportive node and corridor development** Investment in transit-supportive land uses should be encouraged by quality public transit services and facilities Transportation facilities should meet current needs while remaining adaptable to those of the future Zoning, urban design and parking management strategies should minimize land consumed by automobile travel
Objective 5 Principle 5(a) Principle 5(b) Principle 5(c)	**Protect the environment by minimizing impacts on air, water, land and natural resources** The use of greenspace for new infrastructure should be minimized Transportation technologies and behaviours should reduce energy consumption and air emissions The impacts of surface water runoff from transportation facilities should be minimized

In 2020, the City of Hamilton's transportation system will:	
Objective 6 Principle 6(a) Principle 6(b)	**Support local businesses and the community's economic development** The efficiency of goods movement to, from and within the city should be maximized Businesses and institutions should remain accessible to employees and visitors
Objective 7 Principle 7(a) Principle 7(b) Principle 7(c)	**Operate efficiently and be affordable to the City and its citizens** Maximum value should be extracted from existing facilities and services Decisions should take into account the life-cycle costs of transportation facilities and services Transportation funding opportunities involving other governments, the private sector and individual users should be considered

Source: 2007 City of Hamilton Transportation Master Plan

8.2 Travel Targets

The 2007 Hamilton TMP set a number of transportation targets for the short- and long-term period. These are described under four main transportation policy themes, which are reflected in the AEGD TMP study. These are:

- Promote a Strong and Vibrant Economy;
- Build Liveable Communities;
- Provide a Balanced Transportation Network; and
- Improve Public Transit.

The targets are based on proposed policy directions set out in the TMP as well as the Official Plan. In the long-term, the target is to reduce overall vehicle use by 20 percent from existing (2001) levels. The transportation targets are illustrated in ***Table 12.***

Table 12: Transportation Targets (2007 Hamilton TMP)

	Current Situation (based on 2001 data)	Potential Near Term Scenario (based on a goal of reducing auto vehicle-kilometres by 10% compared to 2001)	Potential Long Term Scenario (based on a goal of reducing auto vehicle-kilometres by 20% compared to 2001)
Estimated daily vehicle kilometres of travel by Hamilton residents	4.8 million km	4.3 million km	3.8 million km
Share of daily trips made by single-occupant drivers	68%	58%	52%
Share of daily trips made by using municipal transit	5%	9%	12%
Share of daily trips made by using walking or cycling	6%	10%	15%
Annual transit rides per capita (City-wide) (1)	40	60	80-100

Source: 2007 City of Hamilton Transportation Master Plan

One of the challenges for the AEGD area is that transportation mode targets reflect the entire City, which averages out higher mode share areas in the downtown and other more developed parts of the City, with lower mode share areas such as traditional industrial parks and more rural areas. The latter are generally characterized by low density, single use development with minimal cycling, pedestrian, and transit demand and typically less infrastructure/ related services.

Currently, industrial parks in the City of Hamilton only achieve 3% transit mode share and the existing transit mode share for the AEGD area is estimated at 2%. Increasing this to 12% is anticipated to be one of the biggest transportation challenges for the AEGD. It will require a comprehensive and multi-faceted approach that will involve:

- Promoting public transit's early introduction into the AEGD, adopting high transit service levels and ensuring broad service coverage;
- Establishing key nodes and links as high density, transit supportive and pedestrian friendly areas (defined as Employment Supportive Centres in the AEGD Secondary Plan) and corridors; and

- Improving the roadway system and facilities including pedestrian and cycling infrastructure;
- Reducing the community's dependence on single occupant automobile travel; and
- Introducing innovative parking policies to increase the attractiveness of non-auto modes.

8.3 Roads

The AEGD road network adheres to the key objectives and supporting strategies identified by the 2007 Hamilton TMP. These objectives and supporting strategies include:

- Focussing road improvements on goods movement corridors; and
- Enhancing access to employment lands.

Consistent with these objectives and strategies, the AEGD TMP promotes a strategy of maximizing the efficiency of the proposed "grid" road network in order to promote pedestrian, cyclist and vehicular connectivity and to minimize extraneous travel.

The 2007 Hamilton TMP identifies key areas of infrastructure improvement within the city based on:

- Committed/planned road widenings to accommodate growth;
- Upgraded and expanded road links serving employment and growth areas; and
- Recognition of need to provide efficient access to business parks and employment areas.

The roadway infrastructure recommended to support development of the AEGD is aligned with these commitments.

8.4 Goods Movement

The 2007 Hamilton TMP addresses goods movement policies. These recommended policies include:

- Relieve congestion and improve access to Port and Airport facilities;
- Maintain, protect and enhance the existing goods movement network to support the economic development strategy;
- Avoid residential development in the airport vicinity; and

- Clearly define land uses adjacent to transportation corridors to facilitate location of transportation-dependent industry and commerce enterprises close to network access points with minimum intrusion on other uses.

Lands in the vicinity of the John C. Munro Hamilton International Airport represent a major goods movement generator within the study area and the City of Hamilton. An ongoing Hamilton Truck Route Study has identified a number of ‘full-time truck routes’ adjacent to the AEGD that are consistent with the proposed land use plans and transportation network. The proposed ‘full-time truck routes’, as well as goods movement connections to the Hamilton Port and major corridors are illustrated in ***Figure 30.***

8.5 Parking Policy

The city-wide TMP Parking Policy Paper (Development of Policy Papers for Phase Two of the Transportation Master Plan for the City of Hamilton) provides parking policy recommendations. The following policies should be implemented in the AEGD:

- Adopt off-street parking policies, including required parking ratios established through zoning, that attempt to balance the need to supply sufficient parking to support business while avoiding excess parking supply that can discourage transit use;
- Improve parking options and related incentives for transit and active transportation modes;
- Consider shared parking options where appropriate.
- Minimize any negative impacts of parking on urban design and pedestrian activity.
- Collect Parking Fees – Funds collected from parking fees are to be implemented back into multi-modal transportation improvements (e.g. transit, trails, etc.)
- Limit Long Stay Parking – In transit hubs and activity centres, where high-quality alternative modes are in place (e.g. BRT/transit), limit long stay parking
- Address Parking Demand – Use time restrictions and pricing to address parking demand issues
- Create Parking Incentives – Use high-quality preferential parking locations and discounted rates for carpools, car-sharing (e.g. company vehicles shared for site work), motorcycles/scooters
- Consider Lot Locations – Consider provisions for park-and-ride, commuter lots, and shared parking facilities, and
- Promote Transportation Management Association (TMA) membership within the AEGD (see **Section 8.6.1** for additional detail).

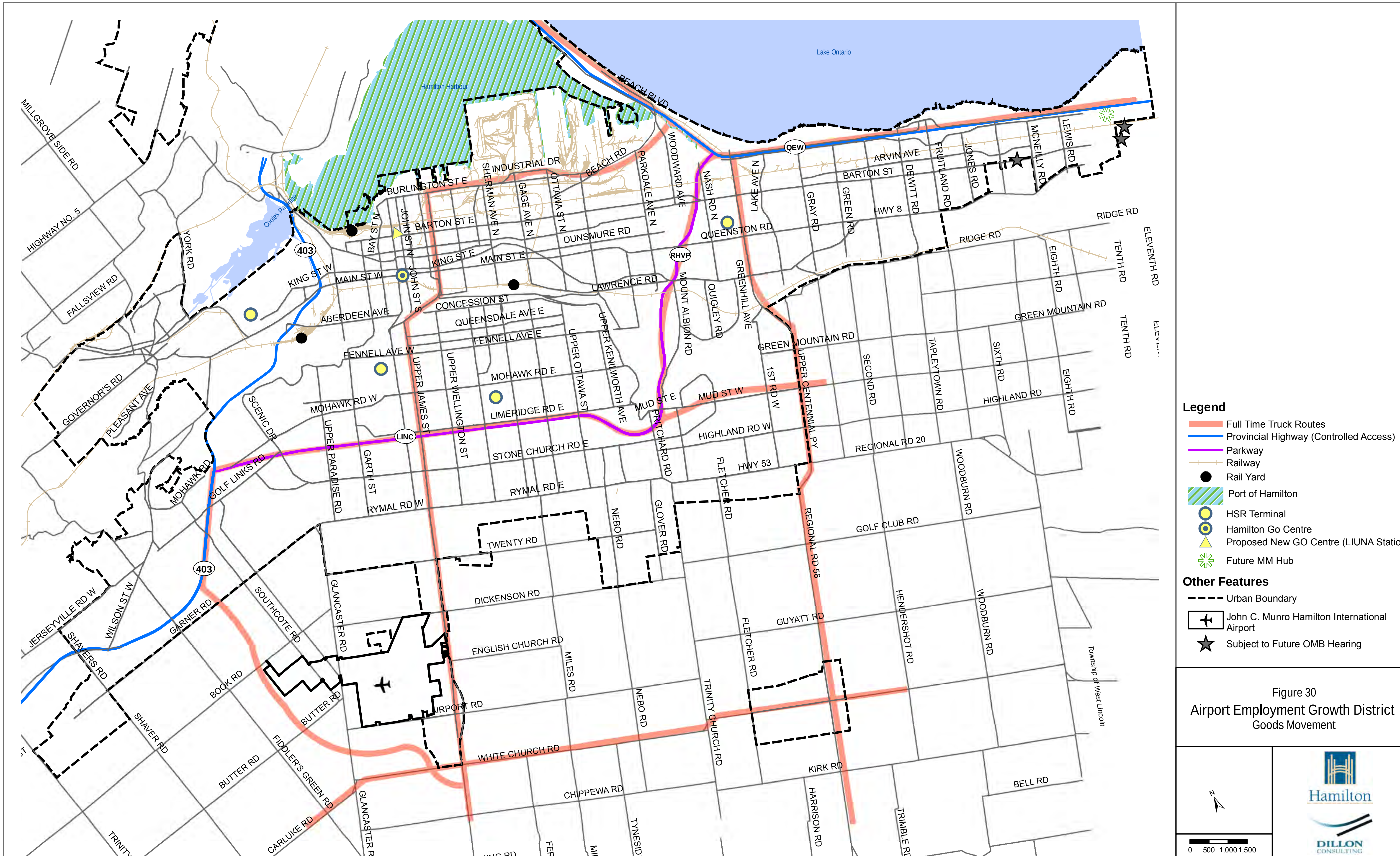


Figure 30
Airport Employment Growth District
Goods Movement

May 2010

Planning and Economic Development Department

8.6 Transportation Demand Management (TDM)

The Transportation Demand Management Policy Paper (Development of Policy Papers for Phase Two of the Transportation Master Plan for the City of Hamilton) identifies two types of objectives for TDM.

1. **System objectives**, which are higher level transportation goals:

   - Reduce single-occupant vehicle trips, increase walking, cycling, transit and/or carpooling trips;
   - Control growth in traffic volumes, congestion and parking demands;
   - Shift transportation demand to off-peak hours; and
   - Improve air quality and preserve efficient goods movement.

2. **Program objectives** that could include the following general outcomes:
   - Establish public awareness and support for sustainable travel options;
   - Promote practical, user-oriented information about sustainable travel options to residents, employers and institutions;
   - Provide tools and assistance to partners who are undertaking their own TDM measures; and
   - Encourage employers and educational institutions to support commuter options for their employees and/or students.

In addition, the City of Hamilton Urban Official Plan states, as an Integrated Transportation Network Policy Goal, that Transportation Demand Management measures may include:

a) provision of active transportation features including secure bicycle storage facilities and pedestrian and cycling access to the road network;

b) support of transit through reduced parking standards for some land uses where appropriate and making provisions for car-sharing spaces through the site plan process where feasible and appropriate; and

c) other measures detailed in the 2007 Hamilton Transportation Master Plan.

These policies should also be applied in the AEGD.

8.6.1 Transportation Management Associations

The use of Transportation Management Associations (TMAs) is recommended for TDM programming, policy input and demand analysis. TMAs should also be used for the following TDM initiatives:

- Promote carpooling to the AEGD using the *Smart Commute Carpool Zone* website (located at www.carpoolzone.ca). This successful initiative is a free program run by Metrolinx in partnership with numerous local municipalities. It facilitates use by individuals who reside in Ontario to create a profile and search for other commuters to share a ride to/from work.
- Require employers within the AEGD to join the *Smart Commute Hamilton Transportation Management Association*, which entitles member organizations to participate in a discounted public transit ticket scheme, as well as gain access to a variety of survey, mapping and other useful analysis tools which aim to increase employee productivity and morale, while reducing absenteeism as a result of improved health and wellness. Member organizations also gain a more leveraged 'voice' on transportation matters as they potentially relate to items such as parking, traffic congestion, shuttle bus implementation, public transit services, etc.

8.6.2 Implementation

Many TDM measures identified above cannot be required of land developers through the traditional planning application process. It is assumed that, within the AEGD, each development site and associated parking area will either be sold or rented to a private company/organization. Each would be responsible for aspects such as parking management, bicycle infrastructure, shower/change room facilities, work hours, etc.

In some organizations, a 'Facility Management' representative could address items such as bicycle infrastructure, a system of allocating parking permits, designating reserved 'priority' parking spaces for carpool/vanpool vehicles, implementing a shuttle bus system, and so on. In other instances, a 'Human Resources' representative may be best – particularly for initiatives such as flexible work hours, guaranteed ride home schemes, car-pool matching, subsidized transit passes, and the like.

Ultimately, the responsibility to implement TDM measures lies with senior managers within the individual companies/organizations in the AEGD. The City should promote participation in a Transportation Management Association for all companies/ organizations within the AEGD to further TDM objectives for this area.

8.7 Transit

There are challenges and opportunities to improve transit service in the AEGD area. The following additional policies should be applied in the AEGD:

- Establish a distance of 400 metres to a transit stop to provide good transit access for employees which would also benefit transit riders in adjacent areas;
- Implement a Zone Bus Strategy whereby areas within the study area are sectioned into a number of predefined zones. Users of the service call a dispatcher. A bus is dispatched and a driver designs a flexible route; bringing each passenger to their destination or transferring them to the closest rapid transit corridor.
- Create "main transit corridors" where the majority of transit service is concentrated. Upper James Street, Rymal Road/Garner Road and Southcote Road /Dickenson Road are good candidates.
- Make enhanced transit stops into transit-oriented destinations not just transfer points. These stops should be surrounded by ancillary land uses, consistent with the Employment Supportive Centres identified in the Secondary Plan for the AEGD (e.g. restaurants, coffee shops and other such amenities).
- Link Park and Ride/ Carpool Lots with GO Bus and/or HSR transit routes.
- Employ a different cost strategy to fixed routes in the AEGD, e.g. a zone bus with employer strategy whereby employers contribute to a certain Revenue Cost ratio set by the City, employers pay a proportion of the operating cost, which can be recovered through transit passes, etc. Such service should be designed around start/stop times of fitting employers.
- Plan for transit priority measures such as queue jumps or exclusive transit lanes for the future rapid transit service on Rymal Road/Garner Road, and the current A-Line BRT-lite service along the Upper James Street corridor. Transit priority measures should also be considered for regular bus service on major roads.

These policy recommendations should be implemented in the early stages of development within the AEGD for increased success in achieving the high transit modal share target (12%).

8.8 Cycling/Pedestrians/Trails

The 2007 Hamilton Transportation Master Plan identifies the need to promote and encourage walking and cycling 'through the provision of facilities and programs' in order to help build active communities and reduce the dependence on single occupant vehicle travel, including the "associated infrastructure costs, air quality, safety and congestion programs" that arise with an over-reliance on automobile travel.

The goal is to provide the incentives (i.e. via the proper infrastructure) to increase the mode share for cycling and walking to 15 percent (city-wide) as recommended in the 2007 Hamilton TMP.

To achieve the objectives of the Hamilton TMP, the following cycling policies are recommended:

- Promote cycling and provide links to existing and planned cycling infrastructure, and encourage developers to provide bicycle storage/ bicycle parking facilities at each site.
- Encourage area employers to provide on-site shower facilities to promote cycling/ walking to work
- Ensure bicycle racks and/or secure bicycle storage areas are provided at building entrances and weather protected where possible. Bicycle parking/racks should be connected to primary bicycle trail routes with surfaces appropriate for cycling.
- Curb cuts should be provided at bicycle route connections to the street.
- Design transit facilities with consideration given to cycling, for example, the inclusion of areas to park and lock bicycles

To ensure adequate pedestrian movement and comfort the following recommendations should be considered:

- Site planning should provide for ease and continuity of pedestrian movement and a high-quality, barrier-free pedestrian environment.
- Distinctive paving patterns and materials are encouraged at highly visible areas, entrance areas and major routes between parking and building entrance to promote pedestrian safety and assist in site orientation.
- Pedestrian connections at all major intersections shall be defined with differentiated paving materials and appropriate curb cuts.
- Waiting areas, such as at building entrances, should provide shade, be wind protected and have some seating.

In addition, the following recommendations to the multi-use trail system should be considered for the AEGD:

- The trail system should accommodate a wide range of functions including providing a continuous and safe pedestrian and cycle route that is incorporated throughout the area.
- The trail system should be comprised of off-road and on-road facilities.

- The trail system will link to the City's trails network and will offer an alternative mode of travel for commuters and recreational users.
- The trail system may utilize the Natural Areas and the Greenbelt Natural System Area.
- The off-road routes may be aligned with natural features.
- Trail heads should be located in public open space along the Greenbelt Natural System Area with road frontage.
- Trail development standards shall comply with the City of Hamilton's Recreational Trails Master Plan.

8.8.1 Cycling/Trails Design Guidelines

The design of cycling bikeways in the City is guided by the new Shifting Gears 2009 document. The document presents recommended guidelines for the uniform design of bikeways throughout the City based on adopted basic bikeway guidelines, recommended by the Transportation Association of Canada, Ontario Ministry of Transportation and other agencies, and modified to suit local circumstances.

Four basic types of bicycle facilities are included:

- **Signed Bike Routes** – Signed Bike Route facilities are shared roadways where cyclists and motorists share the same travel lanes whether side by side or single file. These types of facilities are signed for bicycles, and different roadway treatments can be done to increase the level of comfort for cyclists.
- **Reserved Bike Lanes** – Bike lanes are urban on-street facilities with a portion of the roadway or shoulder designated by signing, pavement markings and/or physical barriers as a bicycle only lane.
- **Multi-use Recreational Trails** – Multi-use recreational trails are physically separated from the roadway by an open space or barrier, or a separate right-of-way can be designated for trails. These trails can be designated for cyclists only, but more typically are shared with pedestrians, inline skaters, etc. These off-street facilities can be incorporated in urban or rural areas.
- **Paved Shoulders** – Paved shoulders are a roadway treatment that is typically reserved for rural areas.

9.0 DEVELOPING A TRANSPORTATION STRATEGY

The transportation strategy for the AEGD placed emphasis on the principles identified in the 2007 Hamilton TMP. The AEGD is mostly a greenfield development and, as such, a significant portion of the required transportation infrastructure is new. This section focuses on infrastructure improvements for the road network, preliminary transit service design, a TDM strategy, cycling/pedestrian/trails networks, and a goods movement strategy.

9.1.1 AEGD Roadway Network Improvements

A number of roadway improvements and recommendations were identified within the AEGD study area to support the recommended road network and meet the forecasted transportation demand. ***Figure 31*** shows the proposed road network, including roadway classifications. ***Figure 32*** shows the recommended right-of-ways (ROWs) and number of lanes required to support development of the full build-out horizon (i.e. Secondary Plan Area + Council Directed Additional Lands + Additional Study Area).

9.1.2 Roadway Classifications

A roadway classification system was developed for the AEGD. The preferred road network consists of a provincial highway (Highway 6), surrounded by a grid of urban arterial and collector roadways.

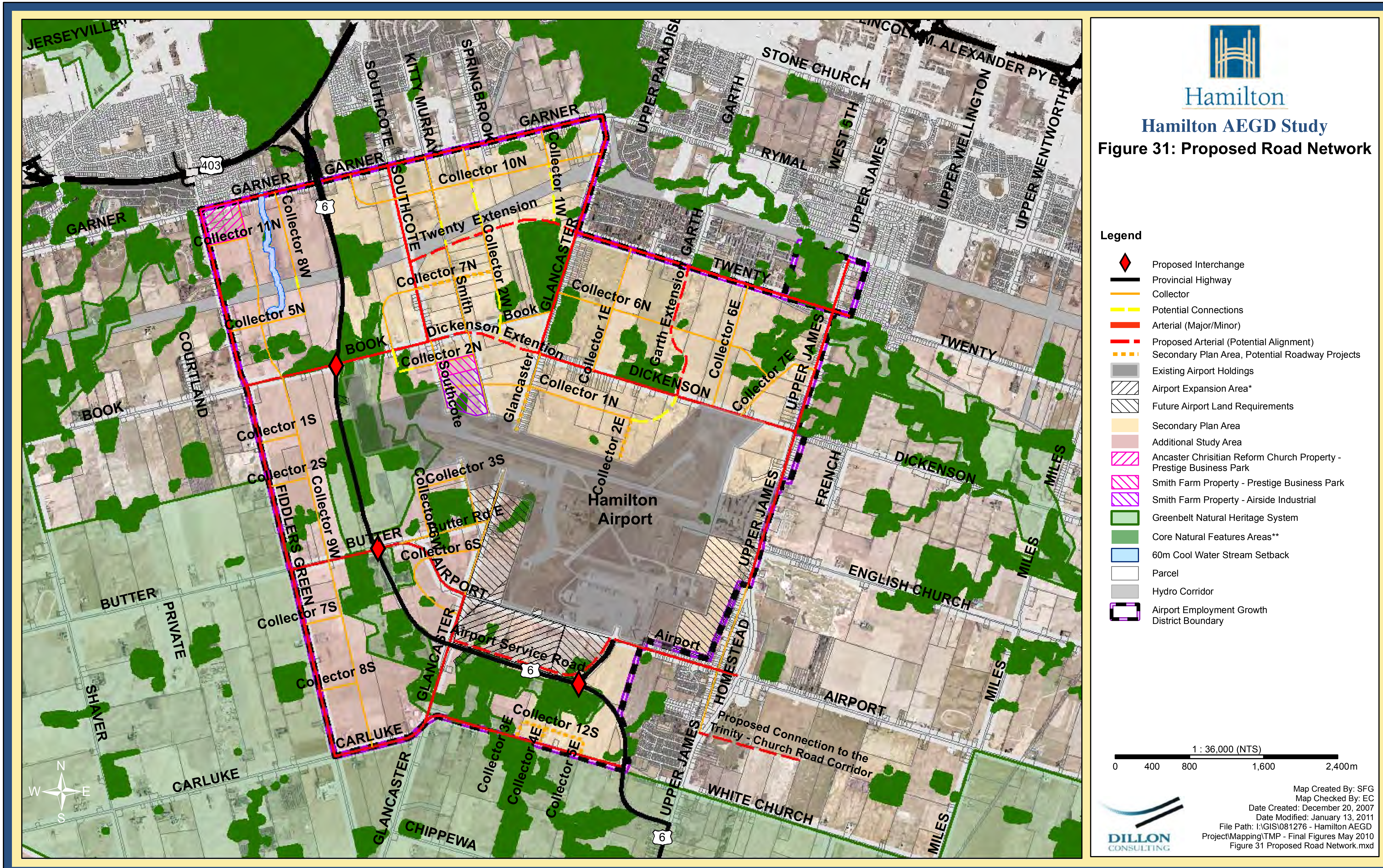
The primary functions of, and general policies relating to, the arterial and collector roadways within the AEGD were based on the City's Roadway Classification policies. The roadway ROWs within the AEGD will be unique and are specified in the Roadway Cross-Sections (**Section 9.3.1**) below.

The following generally describes roadways classifications within the AEGD:

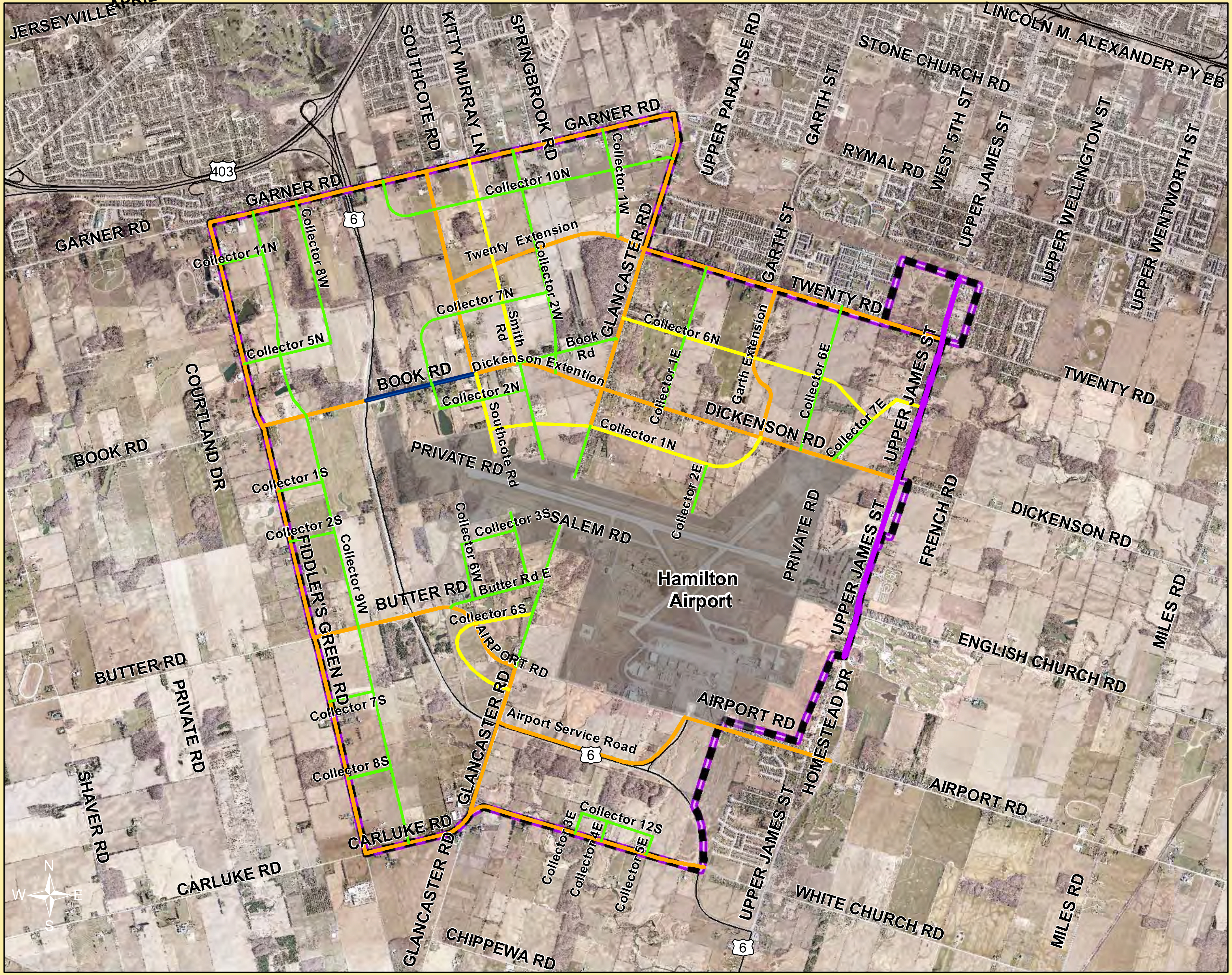
Provincial Highways are provincially-owned roadway facilities. Improvements to provincial highways, including road widenings and accesses, are under the jurisdiction of the Ministry of Transportation, Ontario.

Arterial Roadways will carry moderate to high traffic volumes. They will include pedestrian facilities (preferably in the form of sidewalks) along both sides of the roadway as well as on-street cycling facilities. Multi-use trails may be used to substitute on-street cycling facilities and sidewalks in certain cases selected by the City.

Collector Roadways will serve the function of moving moderate amounts of traffic as well as providing access to development parcels. Collectors will incorporate sidewalks along both sides of the roadway as well as on-street cycling facilities.



Hamilton
Hamilton AEGD Study
Figure 31: Proposed Road Network
Legend
Proposed Interchange
Provincial Highway
Collector
Potential Connections
Arterial (Major/Minor)
Proposed Arterial (Potential Alignment)
Secondary Plan Area, Potential Roadway Projects
Existing Airport Holdings
Airport Expansion Area*
Future Airport Land Requirements
Secondary Plan Area
Additional Study Area
Ancaster Chrisitian Reform Church Property - Prestige Business Park
Smith Farm Property - Prestige Business Park
Smith Farm Property - Airside Industrial
Greenbelt Natural Heritage System
Core Natural Features Areas**
60m Cool Water Stream Setback
Parcel
Hydro Corridor
Airport Employment Growth District Boundary
1 : 36,000 (NTS)
0 400 800 1,600 2,400m
Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: January 13, 2011
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP - Final Figures May 2010
Figure 31 Proposed Road Network.mxd
DILLON CONSULTING
Hamilton Airport
JERSEYVILLE
GARNER
403
6
SOUTHCOTE
KITTY MURRAY
SPRINGBROOK
UPPER PARADISE
GARTH
STONE CHURCH
LINCOLN M. ALEXANDER PY E
RYMAL
WEST 5TH
UPPER JAMES
UPPER WELLINGTON
UPPER WENTWORTH
Collector 10N
Collector 11N
Collector 8W
Collector 1W
Twenty Extension
Collector 7N
Collector 2W
Smith
Book
GLANCASTER
Collector 6N
Garth Extension
Collector 6E
Collector 1E
Collector 7E
TWENTY
Collector 5N
COURTLAND
BOOK
Dickenson Extension
Collector 2N
Southcote
Glancaster
Collector 1N
DICKENSON
Collector 2E
Collector 1S
Collector 2S
Collector 9W
FIDDLERS GREEN
Collector 3S
Collector 5W
Butter Rd E
Collector 6S
BUTTER
AIRPORT
FRENCH
ENGLISH CHURCH
MILES
Collector 7S
PRIVATE
Collector 8S
Airport Service Road
Airport
HOMESTEAD
SHAVER
CARLUKE
Collector 12S
Collector 3E
Collector 4E
Collector 5E
Proposed Connection to the Trinity - Church Road Corridor
WHITE CHURCH
CHIPPEWA
N
E
S
W



Hamilton

Hamilton AEGD Study

Figure 32 - Transportation Master Plan Recommended Right-of-Ways

Legend

- Provincial Highway
- Existing Airport Holdings
- Airport Employment Growth District Boundary
- 26m 2 Lane Collector
- 33m 4 Lane Collector
- 37m 4 Lane Collector
- 44m 6 Lane Arterial
- 44.5m 6 Lane Arterial

N
W E
S

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

DILLON CONSULTING

Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: November 5, 2009
File Path: G:\GIS\081276\GIS_Data\Figure31-Recommended ROW.mxd

9.1.3 AEGD Roadway Cross-Sections

Conceptual cross-sections were developed, specific to roadways in the AEGD area. Although the roadways within the AEGD will be urban roadways, they will not be designed as standard urban cross-section. The AEGD cross-sections incorporate vehicular, pedestrian, transit and cycling needs, recognizing conditions within the AEGD and unique objectives for this area (e.g. Low Impact Design for stormwater management, additional emphasis on alternative modes).

It should be noted that a separate stormwater master plan was prepared for the AEGD to specifically address stormwater recommendations. The stormwater facilities shown within the roadway cross-sections are conceptual.

Typical cross-sections were developed for 4-lane arterial roadways (ROW of 37 metres) and 6-lane arterial roadways (ROW of 44 metres). Arterial roadway cross-sections include a 4.0 metre provision for centre turn lanes and/or a median with turn lanes at intersections. The 4-lane and 6-lane arterial cross-sections are shown in ***Figures 33*** and ***34*** respectively.

Typical cross-sections were also developed for 2-lane (ROW of 26 metres) and 4-lane (ROW of 33 metres) collector roadways. These are shown in ***Figures 35*** and ***36*** respectively.

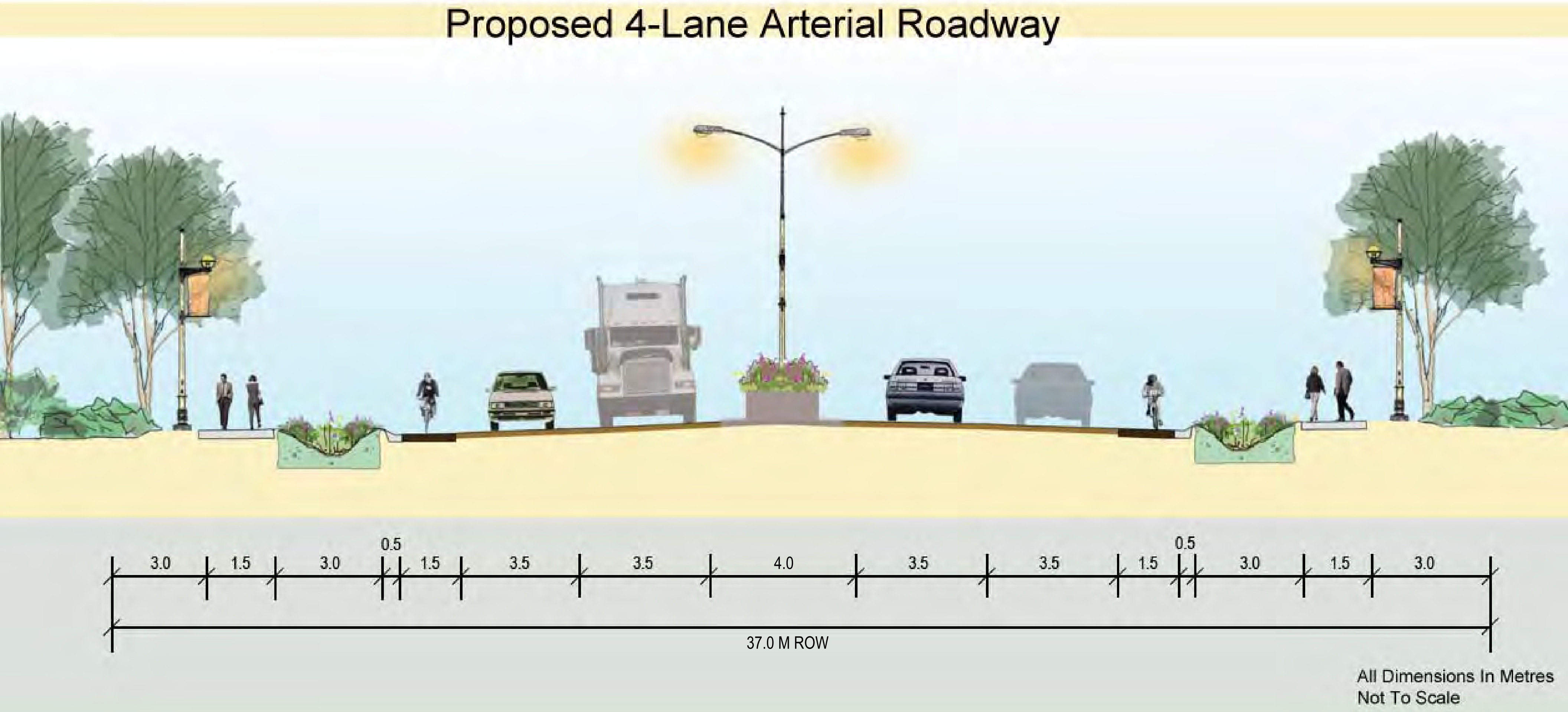
A summary of the ROWs proposed for all roadways within the AEGD for the Secondary Plan Area is presented below in ***Table 13***. Transportation infrastructure required in the Council Directed Additional Lands and the Additional Study Area (beyond 2031) was included in ***Appendix D***.

Table 13: Secondary Plan Area Future Road Widenings

HAMILTON AEGD TMP - SECONDARY PLAN AREA FUTURE ROAD WIDENINGS			
Road	**From**	**To**	**AEGD ROW (m)**
Airport Road	Terminal Access Rd	East Cargo Road	37.0
Airport Service Road	Glancaster Road	Airport Road	37.0
Book Road	Highway 6	Southcote Road	44.0*
Book Road East	Collector 2W	Glancaster Road	26.0
Collector 1E	Twenty Road	Dickenson Road	26.0
Collector 2E	Collector 1N	Airport (HI)	26.0
Collector 4E	Collector 12S	White Church	26.0
Collector 5E	Collector 12S	White Church	26.0
Collector 6E	Twenty Road	Dickenson Road	26.0
Collector 7E	Dickenson Road	Collector 6N	26.0
	Collector 6N	Upper James Street	33.0
Collector 1N	Smith Road	Collector 2E	33.0
Collector 6N	Glancaster Road	Collector 6E	33.0
	Collector 6E	Collector 7E	33.0
Collector 7N	Southcote Road	Collector 2W	26.0
Collector 10N	Collector 5W	Smith Road	26.0
	Smith Road	Glancaster Road	26.0
Collector 12S	Collector 4E	Collector 5E	26.0
Collector 1W	Garner Road	Collector 10N	26.0
	Collector 10N	Twenty Road Extension	26.0
Collector 2W	Garner Road	Dickenson Road Extension	26.0
	Garner Road	Dickenson Road Extension	26.0
Dickenson Road	Glancaster Road	Upper James Street	37.0
Dickenson Road Extension	Smith Road	Glancaster Road	37.0
	Southcote Road	Smith Road	37.0
	Southcote Road	Smith Road	44.0*
Garner Road East	Fiddlers Green Road	Glancaster Road	37.0
Garth Street Extension	Dickenson Road	Collector 2E	37.0
	Twenty Road	Dickenson Road	37.0
Glancaster Road	Dickenson Road Extension	Collector 1N	33.0
	Garner Road	Dickenson Road	37.0
Smith Road	Garner Road	Dickenson Road Extension	26.0
Southcote Road	Garner Road	Twenty Road Extension	37.0
	Twenty Road Extension	Book Road	37.0
Twenty Road	Glancaster Road	Aldercrest (Upper James)	37.0
Twenty Road Extension	Southcote Road	Glancaster Road	37.0
Upper James Street	Alderlea Avenue	Homestead Drive	44.0

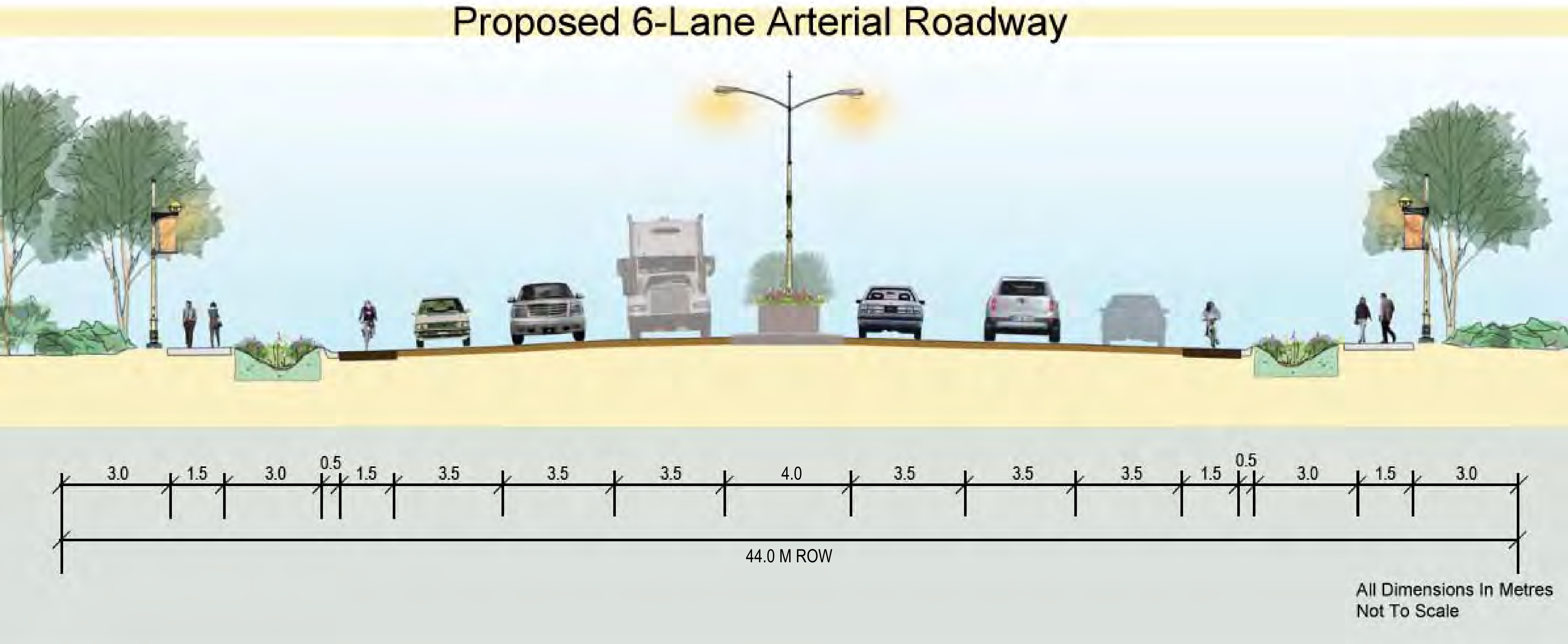
** Book Road (Highway 6 to Southcote Road) / Dickenson Road Extension (Southcote Road to Smith Road) should be protected for a 6-lane cross-section that will be required beyond 2031.*

Figure 33 – 4-Lane Arterial Cross-Section



NOTE: ROW conveyance portion may include such LID features as grass swales, dry-swales or bio-swales, subsurface Exfiltration pipes or combinations thereof. Additional storage can be included through subsurface gravel or pre-manufactured storage areas, infiltration through amended or engineered soils or other such techniques as outlined in the SWMP.

Figure 34 – 6-Lane Arterial Cross-Section



NOTE: ROW conveyance portion may include such LID features as grass swales, dry-swales or bio-swales, subsurface Exfiltration pipes or combinations thereof. Additional storage can be included through subsurface gravel or pre-manufactured storage areas, infiltration through amended or engineered soils or other such techniques as outlined in the SWMP.

Figure 35 – 2-Lane Collector Cross-Section

NOTE: ROW conveyance portion may include such LID features as grass swales, dry-swales or bio-swales, subsurface Exfiltration pipes or combinations thereof. Additional storage can be included through subsurface gravel or pre-manufactured storage areas, infiltration through amended or engineered soils or other such techniques as outlined in the SWMP.

Figure 36 – 4-Lane Collector Cross-Section

NOTE: ROW conveyance portion may include such LID features as grass swales, dry-swales or bio-swales, subsurface Exfiltration pipes or combinations thereof. Additional storage can be included through subsurface gravel or pre-manufactured storage areas, infiltration through amended or engineered soils or other such techniques as outlined in the SWMP.

9.1.4 Greenway Provisions

In keeping with the eco-industrial and sustainability focus for the AEGD an allowance should be provided within the road right-of-way for a gray water reuse system or other "green pipe" infrastructure. It is estimated that reserving a width of "green" space of approximately 5 metres in the ROW would be sufficient for future use. This area should be clear of underground infrastructure and/or utilities. It is not accounted for within the road right-of-way but should be once a suitable location and/or corridor is established.

In addition, a width of approximately 3 metres should be reserved on each side of the right-of-way for stormwater management. The area has been accounted for in the road right-of-way and should be clear of underground infrastructure and/or utilities.

No allocation was made for dedicated future transit lanes within the ROW.

9.1.5 Proposed Roadway Improvements

In order to improve the existing roadway to meet the requirements of the preferred roadway network, a number of road widenings and new roadway construction projects were identified. Timing for the implementation of these projects is discussed in **Section 12.0**.

The proposed roadway improvement projects are summarized in ***Table 14***. An ID prefaced with the letter "R" indicates a "required" project. An ID prefaced with the letter "P" indicates a "planned" project that may not be required if development parcels are very large, negating the need for a collector roadway.

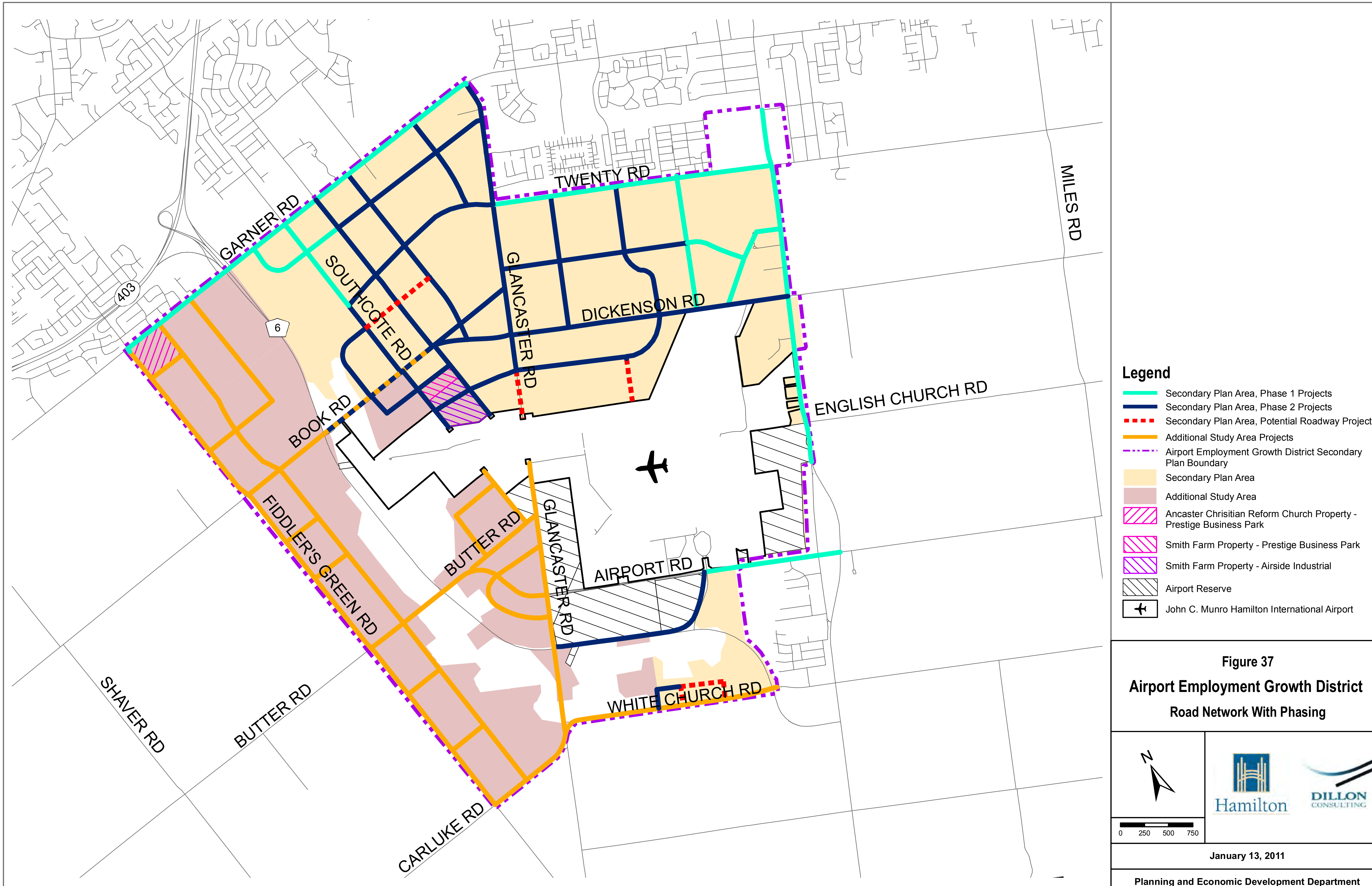
The phasing for the proposed road network is identified in ***Figure 37****.*

Table 14: Summary of Recommended Roadway Improvements

Id	Road	From	To	Description
Secondary Plan Area Required Roadway Projects (2009 – 2031)				
North-South Arterial Roadways				
R1	Southcote Road	Garner Road	Twenty Road Extension	2 lane reconstruction
R2	Southcote Road	Twenty Road Extension	Book Road	2 lane reconstruction
R3	Glancaster Road	Garner Road	Dickenson Road	Widening 2 to 4 lanes
R4	Upper James Street	Alderlea Avenue	Homestead Drive	Widening 4 to 6 lanes
R5	Garth Street Extension	Twenty Road	Dickenson Road	New 4 lane construction
R6	Garth Street Extension	Dickenson Road	Collector 2E	New 4 lane construction
East-West Arterial Roadways				
R7	Book Road	Highway 6	Southcote Road	Widening 2 to 4 lanes
R8	Garner Road E	Fiddlers Green Road	Glancaster Road	Widening 2 to 4 lanes
R9	Dickenson Road	Glancaster Road	Upper James Street	Widening 2 to 4 lanes

Id	Road	From	To	Description
R10	Dickenson Road Extension	Southcote Road	Smith Road	Widening 2 to 4 lanes
R11	Dickenson Road Extension	Smith Road	Glancaster Road	New 4 lane construction
R12	Twenty Road	Glancaster Road	Aldercrest Avenue (Upper James Street)	Widening 2 to 4 lanes
R13	Twenty Road Extension	Southcote Road	Glancaster Road	New 2 lane construction
R14	Airport Road	Terminal Access Road	East Cargo Road	Widening 2 to 4 lanes
R15	Airport Service Road	Glancaster Road	Airport Road	New 4 lane construction
East-West Collector Roadways				
R16	Collector 1N	Smith Road	Collector 2E	New 2 lane construction
R17	Book Road E	Collector 2W	Glancaster Road	2 lane reconstruction
R18	Collector 6N	Glancaster Road	Collector 6E	New 4 lane construction
R19	Collector 6N	Collector 6E	Collector 7E	New 4 lane construction
R20	Collector 10N	Collector 5W	Smith Road	New 2 lane construction
R21	Collector 10N	Smith Road	Glancaster Road	New 2 lane construction
North-South Collector Roadways				
R22	Smith Road	Garner Road	Dickenson Road Extension	New 2 lane construction
R23	Smith Road Extension	Hydro Corridor N		New 2 lane construction
R24	Glancaster Road	Dickenson Road Extension	Collector 1N	Widening 2 to 4 lanes
R25	Collector 1E	Twenty Road	Dickenson Road	New 2 lane construction
R26	Collector 6E	Twenty Road	Dickenson Road	New 2 lane construction
R27	Collector 7E	Dickenson Road	Collector 6N	New 2 lane construction
R28	Collector 7E	Collector 6N	Upper James Street	New 4 lane construction
R29	Collector 1W	Garner Road	Collector 10N	New 2 lane construction
R30	Collector 1W	Collector 10N	Twenty Road Extension	New 2 lane construction
R31	Collector 2W	Garner Road	Dickenson Road Extension	New 2 lane construction
R32	Collector 2W	Garner Road	Dickenson Road Extension	New 2 lane construction
R33	Collector 7N	Collector 5W	Southcote Road	New 2 lane construction
Secondary Plan Area Potential Roadway Projects (2009-2031) **(May be omitted depending on Site Development Plans)**				
East-West Collector Roadways				
P40	Collector 7N	Southcote	Collector 2W	New 2 lane construction
P41	Collector 12S	Collector 4E	Collector 5E	New 2 lane construction
North-South Collector Roadways				
P42	Glancaster Road	Collector 1N	Airport	2 lane reconstruction
P43	Collector 2E	Collector 1N	Airport	New 2 lane construction
P44	Collector 4E	Collector 12S	White Church	New 2 lane construction
P45	Collector 5E	Collector 12S	White Church	New 2 lane construction
Council Directed Additional Lands and Additional Study Area Recommended Roadway Projects (Beyond 2031)				
North-South Arterial Roadways				
R46	Fiddlers Green Road	Garner Road	Carluke Road	Widening 2 to 4 lanes
R47	Southcote Road	Garner Road	Twenty Road Extension	Widening 2 to 4 lanes

Id	Road	From	To	Description
R48	Southcote Road	Twenty Road Extension	Book Road	Widening 2 to 4 lanes
R49	Glancaster Road	Airport Road	White Church Road	Widening 2 to 4 lanes
East-West Arterial Roadways				
R50	Book Road	Fiddlers Green Road	Highway 6	Widening 2 to 4 lanes
R51	Book Road	Highway 6	Southcote Road	Widening 4 to 6 lanes
R52	Butter Road	Fiddlers Green Road	Airport Road	Widening 2 to 4 lanes
R53	Airport Road	Butter Road	Glancaster Road	Widening 2 to 4 lanes
R54	Dickenson Road Extension	Southcote Road	Smith Road	Widening 4 to 6 lanes
R55	Twenty Road Extension	Southcote Road	Glancaster Road	Widening 2 to 4 lanes
R56	Carluke Road E	Fiddlers Green Road	Glancaster Road	Widening 2 to 4 lanes
R57	White Church Road	Glancaster Road	Highway 6	Widening 2 to 4 lanes
East-West Collector Roadways				
R58	Collector 1N	Southcote Road	Smith Road	Widening 2 to 4 lanes
R59	Collector 5N	Fiddlers Green Road	Collector 8W	New 2 lane construction
R60	Collector 2S	Fiddlers Green Road	Collector 9W	New 2 lane construction
R61	Butter Road E	Airport Road	Glancaster	2 lane reconstruction
R62	Collector 8S	Fiddlers Green Road	Collector 9W	New 2 lane construction
North-South Collector Roadways				
R63	Southcote Road (south)	Book Road	Collector 1N	Widening 2 to 4 lanes
R64	Smith Road	Dickenson Road Extension	Collector 1N	2 lane reconstruction
R65	Smith Road	Garner Road	Dickenson Road Extension	Widening 2 to 4 lanes
R66	Smith Road Extension	Hydro Corridor North Crossing		Widening 2 to 4 lanes
R67	Collector 8W	Garner Road	Collector 5N	New 2 lane construction
R68	Collector 9W	Garner Road	Carluke Road	New 2 lane construction
Council Directed Additional Lands and Additional Study Area Potential Roadway Projects (Beyond 2031) **(May be omitted depending on Site Development Plans)**				
East-West Collector Roadways				
P69	Collector 2N	Collector 7N	Smith Road	New 2 lane construction
P70	Collector 11N	Fiddlers Green Road	Collector 9W	New 2 lane construction
P71	Collector 1S	Fiddlers Green Road	Collector 9W	New 2 lane construction
P72	Collector 3S	Collector 6W	Southcote Road	New 2 lane construction
P73	Collector 6S	Glancaster Road (north)	Airport Road	New 2 lane construction
P74	Collector 6S	Airport Road	Glancaster Road (south)	New 2 lane construction
P75	Collector 7S	Fiddlers Green Road	Collector 9W	New 2 lane construction
P76	Collector 12S	Collector 3E	Collector 4E	New 2 lane construction
North-South Collector Roadways				
P77	Southcote Road (south)	Collector 1N	Butter Road	2 lane reconstruction
P78	Smith Road	Collector 1N	Airport Lands	2 lane reconstruction
P79	Collector 3E	Collector 12S	White Church Road	New 2 lane construction
P80	Collector 6W	Collector 3S	Butter Road	New 2 lane construction


GARNER RD
TWENTY RD
MILES RD
SOUTHCOTE RD
GLANCASTER RD
DICKENSON RD
ENGLISH CHURCH RD
403
6
BOOK RD
FIDDLER'S GREEN RD
BUTTER RD
AIRPORT RD
WHITE CHURCH RD
SHAVER RD
CARLUKE RD
Legend
Secondary Plan Area, Phase 1 Projects
Secondary Plan Area, Phase 2 Projects
Secondary Plan Area, Potential Roadway Projects
Additional Study Area Projects
Airport Employment Growth District Secondary Plan Boundary
Secondary Plan Area
Additional Study Area
Ancaster Christian Reform Church Property - Prestige Business Park
Smith Farm Property - Prestige Business Park
Smith Farm Property - Airside Industrial
Airport Reserve
John C. Munro Hamilton International Airport
Figure 37
Airport Employment Growth District
Road Network With Phasing
N
0 250 500 750
Hamilton
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Planning and Economic Development Department

9.2 Transit

9.2.1 2007 Hamilton TMP Recommended Transit Network

The 2007 City-wide comprehensive Hamilton Transportation Master Plan (HTMP) recommends a strategic, higher-order transit network using Rapid Transit (RT). The purpose of the network is to provide high quality transit service throughout the city in an effort to reach the 12 percent transit mode split target by 2021.

The City of Hamilton conducted a Rapid Transit Feasibility Study in November 2007 to assess rapid transit and the feasibility for implementing rapid transit routes in the City. In 2008, Metrolinx released its final transportation strategy which identified the potential for BRT or LRT along two major corridors in Hamilton: the corridor running along Upper James Street from downtown to the airport (A-Line); and a corridor connecting McMaster University with Centennial Parkway (B-Line). The A-Line and B-Line were included in the first 15 years of the plan.

Beyond the 15-year horizon, the Metrolinx draft Regional Transportation Plan also identified three additional rapid transit corridors in Hamilton (the T-Line, a Mohawk Road route from Ancaster to Main Street; the S-Line, a Centennial Parkway/Rymal Route; and a proposed L-Line, connecting downtown with Waterdown and the proposed BRT corridor along Dundas Street). These five rapid transit plans would form the Hamilton "B-L-A-S-T" rapid transit system.

In September 2009, an A-Line Express BRT-lite route was introduced as part of Metrolinx's Quick-Wins projects for MoveOntario 2020. The route provides service between the airport and downtown Hamilton.

<u>GO Transit</u>

Integration between local and inter-regional transit service providers was an important consideration for implementing an effective transit system as outlined in the Niagara-to-GTA Study. To maintain consistency with this goal and in order to provide reliable and cost-effective transit services between the AEGD and other major employment centres, it will be necessary to consider coordinating with service providers such as GO Transit.

GO Transit is considering service from Hamilton's GO Station to Brantford, in order to serve Mohawk students and Ancaster. No routes are set as of yet as plans are still preliminary. It is possible that this route will be active within 5 years, if approved.

The *GO 2020* Strategic Plan references a number of possible new service extensions, including a proposed link between the Brantford Urban Growth Center and the

Downtown Hamilton Urban Growth Centres. Planning for a future Brantford-Hamilton GO Transit service extension is in the very preliminary stages and there has been no formal announcement regarding timelines for any new service.

GO Transit is moving to increase travel speeds and make bus travel more competitive with private vehicles by running limited stop bus services along 400-series highways. The GO Transit service model does not generally serve the internal street network of business parks. However, GO Transit may consider serving an AEGD enhanced transit stop if it was conveniently located near a Highway 403 interchange.

The interchange configuration at Garner Road / Highway 6 / Highway 403 makes it difficult to locate an enhanced transit stop site close to Highway 403. From Highway 403, vehicles can gain access to southbound Highway 6 from either the eastbound or westbound directions. As well, northbound traffic on Highway 6 can access both the eastbound and westbound Highway 403. However, Garner Road is only accessible to traffic coming from or going to Hamilton. This makes serving the area with a Brantford-Hamilton route difficult.

GO Transit generally does not serve internal streets of business parks, but would possibly consider serving enhanced transit stops if the market / demand supported it. Generally GO routes are along 400-series Highways.

Access issues at Highway 6 and Highway 403 and at Highway 403 and Garner would make it difficult to serve with GO Transit, and would make less viable options as enhanced transit stops. From Highway 403, vehicles can gain access to southbound Highway 6 from either the eastbound or westbound directions. As well, northbound traffic on Highway 6 can access both the eastbound and westbound Highway 403. However, from Highway 403, Garner Road can only be accessed by westbound traffic. Vehicles travelling along Garner Road are only able to gain access to Highway 403 in the eastbound direction. There is no interchange at Highway 6 and Garner Road.

Currently, vehicles are only able to exit at Highway 6 and Highway 403 when travelling in the southbound direction. There is no exit for vehicles travelling northbound; and vehicles entering the Highway at that location are only able to travel on Highway 403 in a westbound direction.

Opportunities/Constraints

Transit service in the AEGD is limited, which has resulted in a transit modal split far below the 12 percent target. Currently, the population in the study area is also limited, which leads to a low level of transit service and contributes to residents not choosing transit as their preferred transportation choice. As development occurs, and new employees enter the area an increase in ridership is likely. This will require a base level of transit service to be introduced as the area begins to grow. New service should be introduced early; before commuters make alternate transportation decisions (e.g. single occupant vehicle use).

Transit service is a critical part of the transportation solution for the AEGD. More traditional industrial parks within Hamilton have low transit modal share, however the transportation network and travel demand assumptions for the AEGD were premised on achieving a high degree of transit use. This is consistent with Rapid Transit plans for Upper James Street which includes a transit terminal. It is in line with significant passenger service growth expected at Hamilton International Airport. It is also consistent with ideas generated in the Niagara-to-GTA Corridor Planning and Environmental Assessment Study to optimize the existing transportation network.

In order for the AEGD to achieve high transit ridership a distance of 400 metres to a transit stop or 800 metres to a Rapid Transit station were selected as targets. These distances have been shown to provide good access for employees and residents and, as identified in the OP, are “reasonable walking distances” for transit riders.

Research has shown that individuals are willing to walk further to use public transit when the service is more reliable, frequent, and faster (i.e. Rapid Transit). The collector and arterial road network for the AEGD was designed with this in mind. The establishment of good pedestrian connectivity will also promote access to transit by reducing walk times and increasing direct travel paths to transit facilities.

9.2.2 Proposed Employment Supportive Centres

To further promote good transit access for the AEGD and to provide amenities to AEGD’s employees, a number of Employment Supportive Centres were planned as part of the Hamilton AEGD Secondary Plan. These centres are intended to serve as small scale focal points serving a limited range of amenity uses for Airport Employment Growth District’s employees. Where practical, development within the Employment Supportive Centre should be integrated with a transit facility. Proposed locations for Employment Supportive Centres are illustrated in ***Figure 38***.

Not all of the above listed Employment Supportive Centre locations will include enhanced transit stops. However, where possible Employment Supportive Centres should be integrated with enhanced transit stops to provide convenient commuter access and help achieve a 12% modal split.

Potentially the most important location for integration between an Employment Supportive Centre and an enhanced transit stop is near Redeemer College, ideally at Kitty Murray Lane and Garner Road. However, assuming this location is not feasible; locating an enhanced transit stop at Garner Road and Southcote Road would still provide convenient and accessible access for Redeemer College students. This could serve as a major transit stop in the northern portion of the study area and allow commuters and students direct access to the rest of the Airport lands. Redeemer College currently has approximately 800 students but enrollment is growing by over 50 students per year. Redeemer College is transit-supportive and currently has a transit pass agreement in place.

9.2.3 Enhanced Transit Stops

Enhanced transit stops are consistent with, and where possible should be located within Employment Supportive Centres, as described above. They can include land uses such as convenient stores, recreational facilities, restaurants, among other uses. They are oriented around transit to provide convenient access for employees and residents to and from these locations. They may include amenities such as signage, transit shelters, drinking fountains, benches, trash receptacles, bike racks, lighting, decorative paving; and trees, shrubs and groundcovers. Two “major enhanced transit stops” were identified for inclusion in the AEGD. These would be located at the following locations:

- The intersection of Kitty Murray Lane and Garner Road, or Southcote Road and Garner Road; and
- South of the Airport and east of Highway 6, on Airport Road.

In addition, two "minor enhanced transit stops" were identified. These more modest transit stops are slightly smaller and would include fewer of the above amenities (trees, shrubs, paving, etc.). Two minor enhanced transit stops were identified for inclusion in the AEGD. These would be located at the following locations:

- Slightly north of Dickenson Road on Upper James Street; and
- At the intersection of Dickenson Road and Glancaster Road.

Enhanced transit stops are different from typical transit stops in that transit stops are individual stops along typical roadway corridors. They include a shelter for waiting passengers and a concrete pad with benches, some decorative paving, and pedestrian lighting. As noted above, transit stops should be located 400 metres apart to encourage high transit ridership.

Including enhanced transit stops within the AEGD is consistent with the Niagara-to-GTA Study's strategy to improve access to transit stations for pedestrians. The locations for proposed enhanced transit stops are shown in ***Figure 39*** below.

9.2.4 Transit Service Design

The transit strategy was designed to accommodate a 12 percent municipal transit modal split. It should be noted that this route concept and high anticipated ridership does not guarantee that this modal split target will be achieved. Much of this will depend on transit supportive land use patterns and parking policies being established, the implementation of transit priority infrastructure, and system improvements elsewhere in the City being completed to ensure an attractive level of transit service for the entire trip.

Figure 39 illustrates the proposed municipal transit service for the AEGD area. As shown, there are 8 proposed transit routes, two of which would operate as extensions to existing HSR routes, as well as one proposed "community shuttle" route. Local transit routes would operate in east-west and north-south directions, as well as operate as radial routes. Other options not shown include extending Route 20 and/or Route 27. The latter should be considered in more detail as transit plans are developed for the AEGD. All routes would terminate at one of the proposed Employment Supportive Centres.

9.3 Transportation Demand Management (TDM)

9.3.1 2007 Hamilton TMP Recommendations

As previously mentioned, the 2007 Hamilton TMP identifies two types of objectives for TDM; System objectives and Program objectives.

Based on these two broad objectives, the TMP identifies a number of policies that should be implemented to meet its mode split targets. The targets that apply to the AEGD area are identified below.

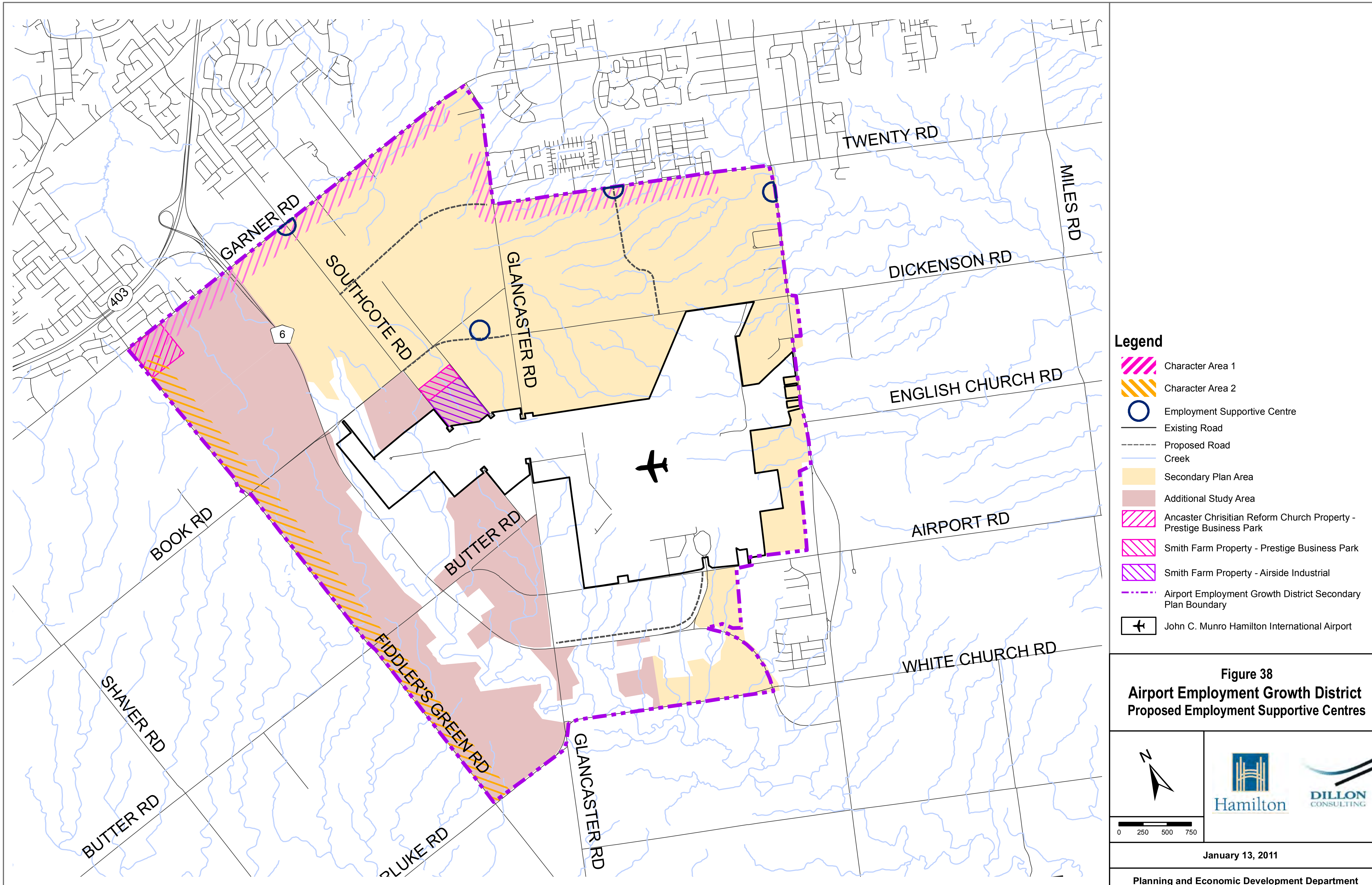

Figure 38
Airport Employment Growth District
Proposed Employment Supportive Centres

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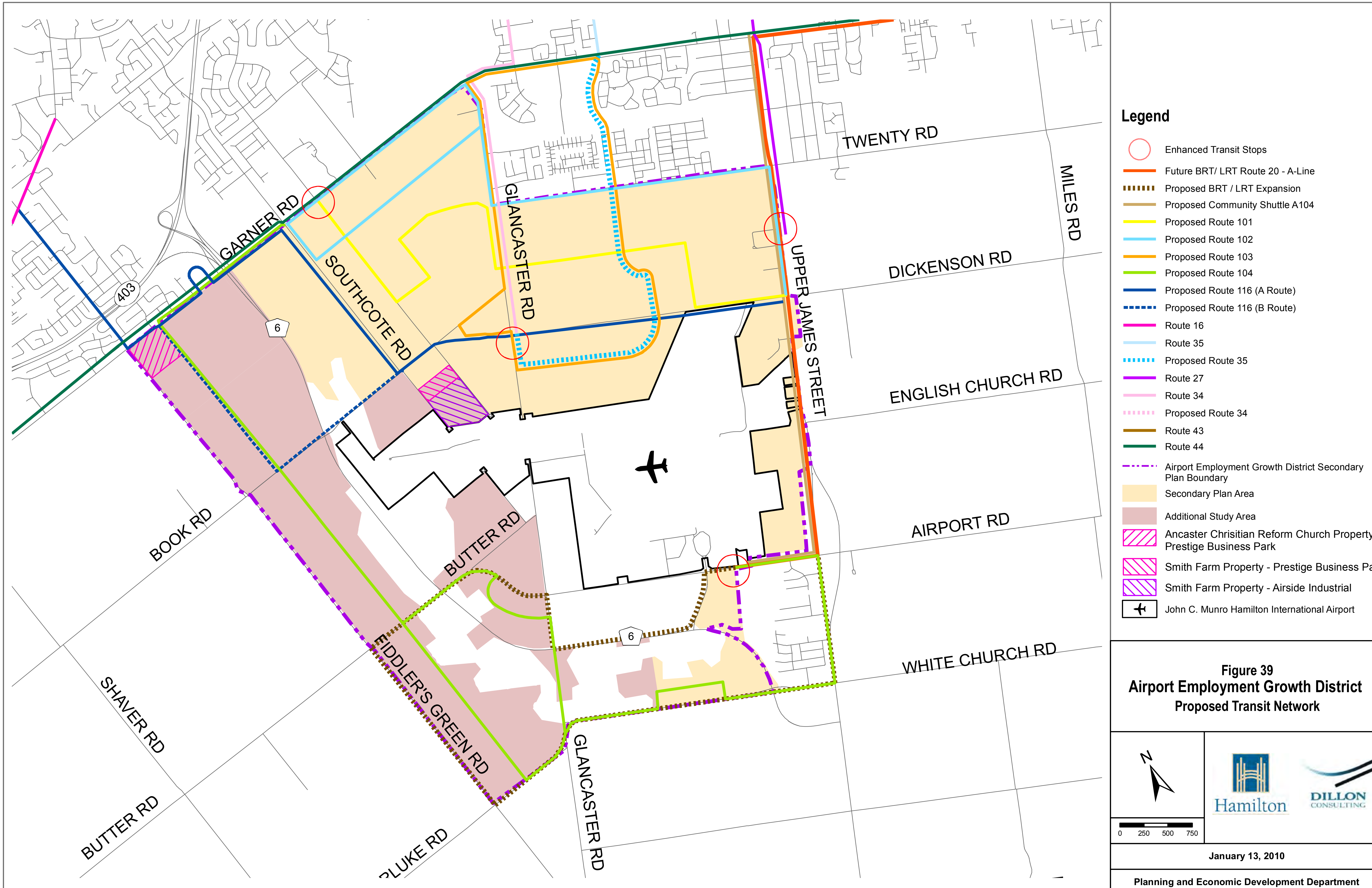

Figure 39
Airport Employment Growth District
Proposed Transit Network

9.3.2 Recommended Strategies for AEGD

Given the characteristics of Hamilton's AEGD, the following points outline the proposed TDM plan for the AEGD.

Trip Elimination

- Support teleworking and alternative work arrangements for employees, when possible.
- Optimize electronic payment opportunities and web-based information dissemination using Intelligent Transportation Systems technology. This could consist of parking space information, public transit schedules, general information updates, etc.

Trip Scheduling

- Investigate opportunities to schedule shift start and end times outside of peak periods.
- Permit flex hours within administrative/office staff core to spread peak arrival and departure times as much as possible.

Trip Linking

- Develop enhanced convenience retail on, or within walking distance of site (e.g. restaurant, bank, convenience store, etc.).
- Provide recreational/fitness facilities and/or child care facilities.

Modal Choice

- Investigate feasibility of providing corporate bus passes for casual use by staff.
- Introduce a subsidized public transit pass scheme for employees. One potential method for implementing such a scheme could be via the *Smart Commute Hamilton Transportation Management Association* – whereby employees of member-companies could save up to 40% off the cost of their monthly ticket, subsidized in part by the employer and in part by the transit operator.
- Work with transit providers to ensure access and service to site is optimum and that ancillary facilities (e.g. shelters, benches, etc.) are provided, where appropriate.
- Investigate feasibility of collector bus service to enhanced transit stops and Hamilton's A-Line RT service.
- Investigate feasibility of implementing parking charges at appropriate locations to improve attractiveness of alternative modes.
- Investigate feasibility of implementing carpool/vanpool programs to reduce SOVs.

- Promote cycling and provide links to existing local cycling trails; provide secure bicycle storage facilities.
- Provide on-site shower facilities to promote cycling/walking to work.

Trip Sharing

- Establish a preferential parking strategy for carpools/vanpools, using location and cost as incentives.
- Investigate feasibility of implementing a ride-matching service.

Land Use

- Areas designated as Prestige Business Park should be treated as "high TDM zones" with an added emphasis on promotion of TDM policies and programs.
- Areas designated Light Industrial should be treated as high potential for employee shuttle buses or other similar programs.

TDM can be a significant contributing factor to the reduction of peak period roadway congestion. It also serves as the primary mechanism for promoting alternative travel modes and educating the public about numerous issues associated with transportation. Given this, ***Table 15*** below defines broad goals and potential benefits that have been established for TDM in the AEGD.

Table 15: TDM Goals and Benefits

TDM Goals	Potential Benefits
• Reduce auto demands in the commuter peak periods as a contributing strategy for reducing congestion	• Delayed or possibly eliminated need for some roadway modification projects • Reduced congestion-related air quality impacts • Improved safety of all transportation system users during commuter peak periods
• Promote walking and cycling as alternatives to travel by auto	• Improved equity of transportation service • Reduced environmental impacts in the AEGD and Hamilton region • Improved health benefits to all residents
• Promote public transit as an alternative to travel by auto	• Improved equity of transportation service • Reduced environmental impacts of travel in the AEGD and Hamilton region • Improved economic self-sustainability of public transit
• Encourage development to provide TDM measures in site design	• Improved accessibility to transit stops through strategic location of building entrances • Improved transit customer safety/comfort through high-quality covered, yet visible, transit shelters and waiting areas • Improved connectivity and utilization of primary-mode trails • Improved primary mode safety through well-lit approaches to sidewalk and trail designs to ensure public safety • Improved commuter security through provided biking storage and parking in close proximity to buildings

Park and Rides / Carpool Lots

A Park and Ride / Carpool Lot has been included at the corner of Garner Road and Smith Road to take advantage of the frequent transit service planned for the Garner Road corridor.

Opportunities for carpooling exist at Garner Road and Smith Road given its proximity to Highway 403. However, the proposed carpool lot at this location is only convenient for GO Transit to/from Hamilton. This lot location is not readily accessible from Highway 403 for travel to/from Brantford. As well, it would not provide convenient access for commuters trying to access Highway 6 and travel south. The only access to Highway 403 is via the north-only interchange on Garner Road as there is no southern access at this location. In addition, commuters are only able to travel east on Highway 403 when using this interchange. The Highway 6 / Highway 403 interchange is shown in **Figure 40** below.

Figure 40: Highway 6/Highway 403 Interchange

In addition to the planned Park and Ride / Carpool Lot at Garner Road and Smith Road, two additional locations are recommended for additional Park and Ride / Carpool Lot facilities. This is consistent with the general findings of the Niagara-to-GTA Corridor Planning and Environmental Assessment Study which identifies additional Park and Ride facilities as a complementary strategy for improving non-road infrastructure.

One proposed location for a Park and Ride / Carpool Lot is on Upper James Street, slightly north of Dickenson Road. This location is close to a proposed Employment Supportive Centre and would provide commuters with convenient connections to major roads in all directions (see ***Figure 38*** for the location of Employment Supportive Centres). It is not however located close to Highway 6 or Highway 403 and would not be conveniently accessed by GO Transit. It is understood that property is available at the HSR Mountain Transit Centre slightly north of the proposed location, which could be used to develop a Park and Ride / Carpool Lot. Although this location would eliminate the need for land acquisition and, likely, reduce costs, a location north of Dickenson Road on Upper James Street would provide a more advantageous location due to the confluence of major existing arterial roads and proposed roads. This location is also identified in the City of Hamilton Urban Official Plan Amendment.

One additional Park and Ride / Carpool Lot, for consideration beyond the 2031 horizon, is in the vicinity of Book Road and Southcote Road. This recommendation assumes an interchange at Book Road and Highway 6 is built, as proposed in the MTO Highway 6 Preliminary Design study. If that interchange was constructed, this location would enable commuters to connect to both the east and west Highway 403 connectors and access the Park and Ride / Carpool Lot when exiting either in the northbound or southbound direction off Highway 6. This location would also be more accessible for commuters (see **Figure 42**).

9.4 Cycling/Pedestrians/Trails

9.4.1 2007 Hamilton TMP Recommended Cycling Network

The 2007 Hamilton TMP builds on the existing bicycle network in the City of Hamilton by recommending a number of facility expansions and improvements. The criteria used for the evaluation of proposed infrastructure improvements include:

- Connectivity and Continuity;
- Directness of Route; and
- Safety and Comfort.

9.4.2 Recommended Cycling/Pedestrian/Trails Network

Based on the 2007 Hamilton TMP criteria identified above, and using the City of Hamilton's Cycling Network Strategy and Cycling Master Plan as frameworks, a number of recommendations were developed to improve cycling connectivity within the study area and between the study area and surrounding lands. These include:

- A proposed cycling lane running north-south along Southcote Road, connecting Garner Road with Book Road
- A Proposed cycling lane running north-south along Fiddler's Green, connecting Garner Road with Carluke Road
- A proposed cycling lane running east-west along Butter Road, connecting Fiddler's Green to Glancaster and then running north-south connecting Butter Road to Carluke Road.

- A proposed cycling lane running east-west along Book Road, Dickenson Extension and Dickenson Road, connecting Fiddler's Green with Upper James Street.
- A proposed cycling lane running north-south along Garth Street Extension, connecting Twenty Road with Dickenson Road.
- A proposed cycling lane running east-west along Twenty Extension, connecting Southcote Road with Glancaster Road.
- A signed on-street cycling route running north-south along Smith Road, connecting Garner Road to Dickenson Extension.
- A signed on-street bike cycling running north-south along Collector 9W, connecting Garner Road and Carluke Road.
- A signed on-street cycling route running along Collector 6N and Collector 7E, connecting Glancaster Road to Upper James Street in an east-west direction.
- A multi-use trail along Upper James Street (as opposed to an on-road bicycle facility because of the nature of the roadway as a high volume arterial road from a network connectivity viewpoint). Cycling facilities are needed along Upper James Street, as it is one of the few continuous north-south roadways, connecting Mount Hope, the Airport Lands and the Downtown.

These cycling and trails facilities are shown in ***Figure 41*** and should be provided in accordance with City standards.

Pedestrians

The City of Hamilton Urban Official Plan emphasizes the importance of creating "pedestrian-oriented and transit-supportive communities within which all people can attain a high quality of life". It also encourages direct connections to transit facilities.

Within the AEGD it is important that a positive environment for pedestrians is created. Pedestrians should feel safe, have convenient access to and from places of interest and be able to navigate easily to their destination.

Pedestrian environments supported by transit should be encouraged and access to transit facilities should be provided via sidewalks, walkways and direct links to other neighbouring areas. To encourage employees and residents to engage in active transportation it is also important that enhanced transit stops are well-lit and have appropriate signage.

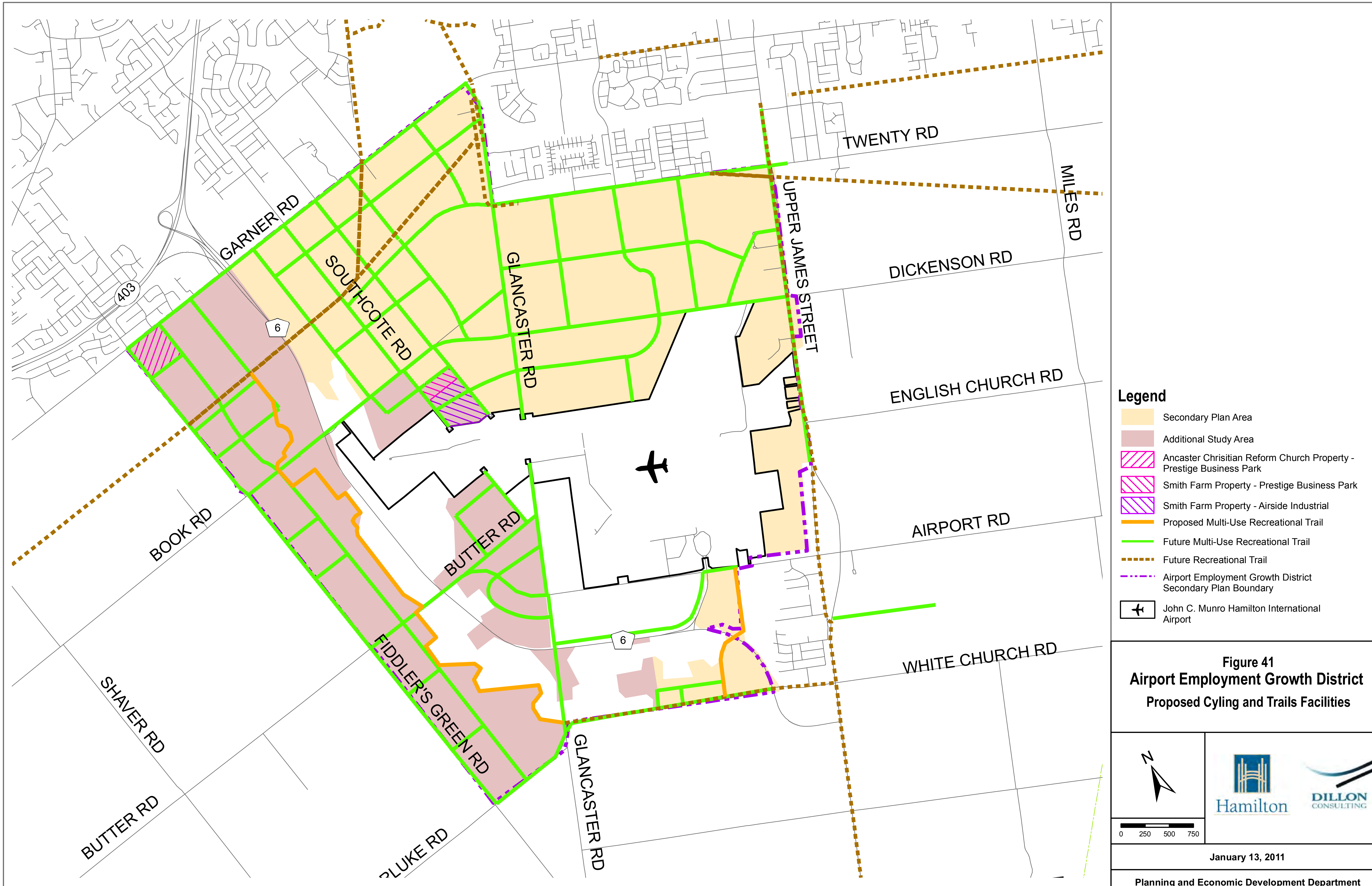

Figure 41
Airport Employment Growth District
Proposed Cyling and Trails Facilities

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Without safe and easy access to transit stations, cyclists and pedestrians are far less likely to use the transit system. The Hamilton Urban Official Plan identifies access to transit through site layout and location, traffic management and bicycle parking as measures necessary to consider when designing transit facilities such as stations, hubs or stops.

Trails

The City of Hamilton Recreational Trails Master Plan focuses on providing a “multi-purpose off-road recreational trail system” that connects all major areas (natural, cultural, major land use) within the City of Hamilton. Initiatives identified in the Trails Master Plan, whether completed or proposed, were considered when developing recommendations for this study.

This TMP assumes that a recreational trail can be accommodated on the western edge of the Greenbelt as well as a link from the existing multi-use trail into the Hydro easement. Further investigation is required into the feasibility of expanding the trails network through Core Natural Features and/or Greenbelt areas surrounding the Airport lands.

Based on these recommendations a proposed pedestrian and trails network was developed and is shown below in ***Figure 42*.**

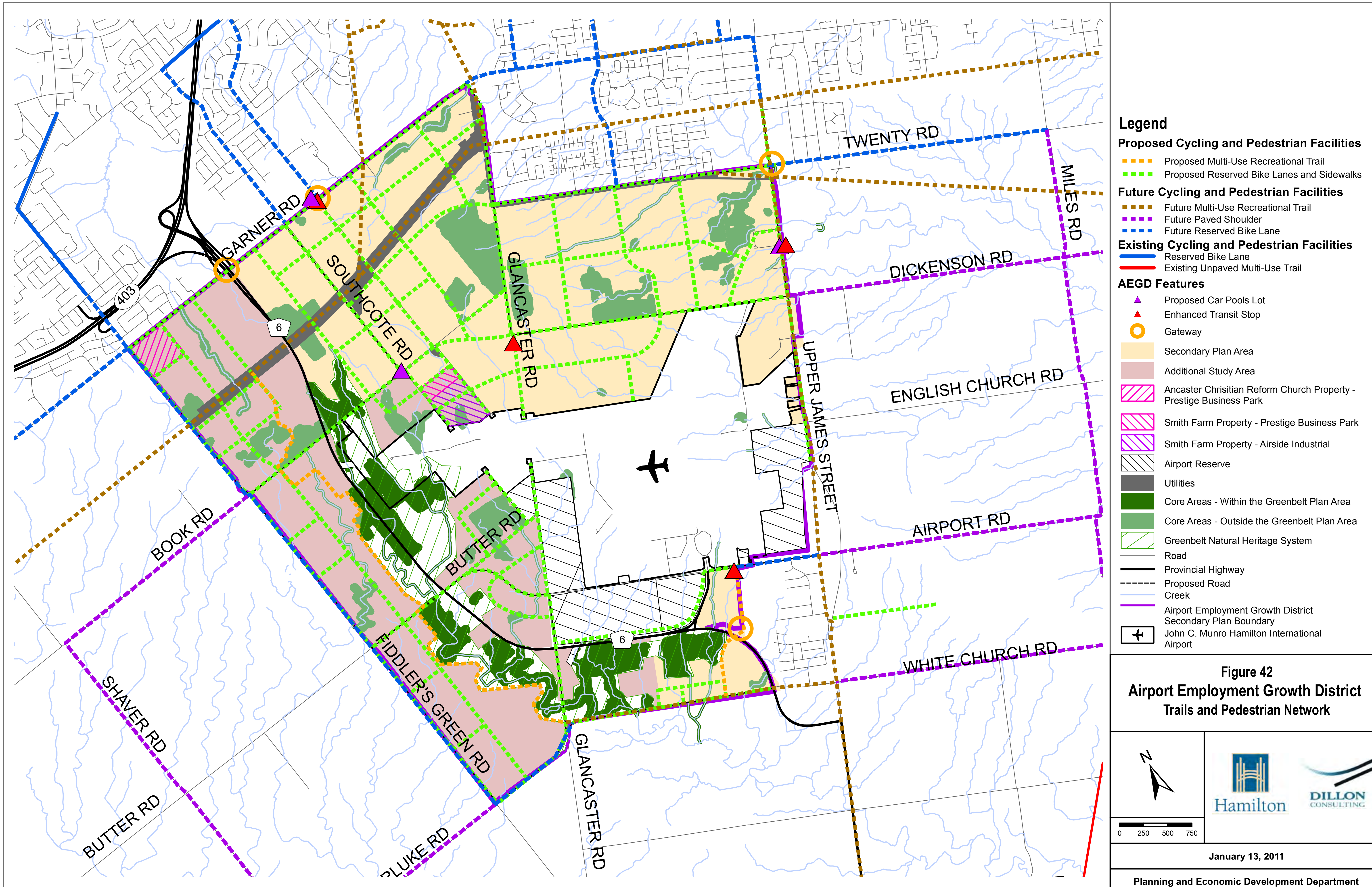


Figure 42
Airport Employment Growth District
Trails and Pedestrian Network

9.5 Goods Movement

The City of Hamilton is strategically located at the crossroads of major trade flows from eastern and western Canada, and the United States. Coupled with the modal connections Hamilton can offer, the city is well positioned for participation in large trade volumes.

In order to ensure increasing involvement in national and international trade, development surrounding the Hamilton airport must be considered an "emerging cluster" where transportation links are essential in order to increase competitive advantage of employment lands.

9.5.1 Proposed Truck Routes

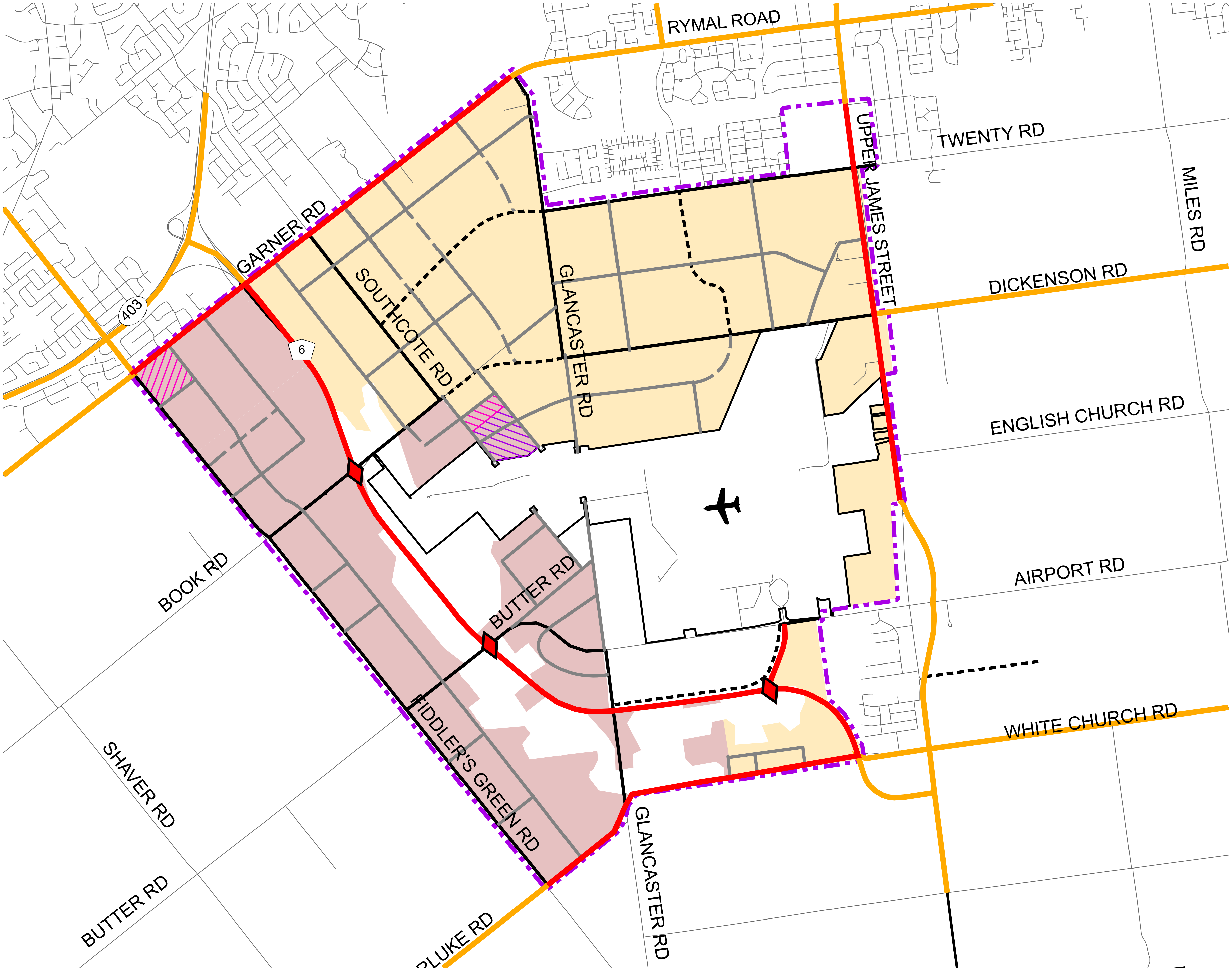
A number of potential truck routes were identified in this study. New truck routes were determined based on the need for goods movement between the study area and major goods movement destinations such as the Hamilton Port. An attempt was made to connect new truck routes to existing routes in order to reduce the need for additional infrastructure.

New truck routes were identified after consideration was given to the location of potential future transit routes. This sequence was selected to avoid identifying truck routes on major transit routes within the study area. To a large extent this goal was achieved, however in certain instances some overlap did occur on a number of major arterials roads within the AEGD.

Proposed full time truck routes include the following:

- Highway 6
- Upper James Street
- Garner Road & Rymal Road
- Carluke Road & White Church Road
- Dickenson Road (east of Upper James Street)
- Garth Street (from Rymal Road to Mohawk Road)

Figure 43 below shows the location of these proposed truck routes.



Legend

- Proposed Interchange
- Provincial Highway
- Full Time Truck Routes Beyond the Hamilton AEGD
- Hamilton AEGD Proposed Full Time Truck Routes
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area
- Additional Study Area
- Ancaster Christian Reform Church Property - Prestige Business Park
- Smith Farm Property - Prestige Business Park
- Smith Farm Property - Airside Industrial
- Airport Employment Growth District Secondary Plan Boundary
- John C. Munro Hamilton International Airport

Figure 43
Airport Employment Growth District
Proposed Truck Routes

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Hamilton

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9.5.2 Rail Opportunities

Preliminary discussions with the Rail Association of Canada identified potential to promote better use of rail infrastructure in proximity to the AEGD. However, further investigation determined that rail was not the most viable option for the AEGD. This conclusion is consistent with findings from the Niagara-to-GTA Corridor Planning and Environmental Assessment Study which indicated that CN and CP freight rail services are unlikely within the study area. In addition, the steep grade required to traverse the escarpment limits the feasibility of extending rail service into the AEGD. Overcoming the steep grade through facility design for heavy rail would incur high costs.

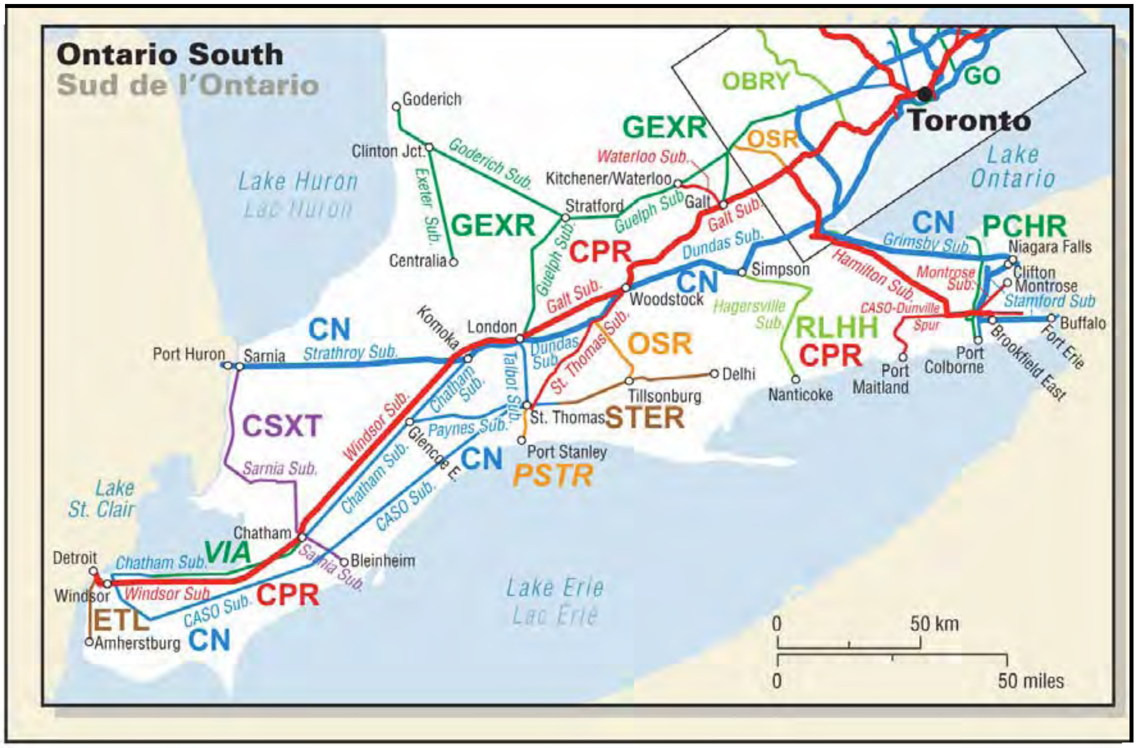
Rail transportation is best suited for bulk goods that fit into large shipping containers. These are typically heavy goods of lower value whose delivery has lower time sensitivity (e.g. steel, concrete). Manufacturing or production of such goods typically produce high emissions and is not consistent with the vision for the AEGD as an eco-industrial park of attracting “progressive and clean industries” with “minimum emissions/noise/dust/and other nuisances”. It is more appropriate that the goods shipped to and from the AEGD are moved by truck or air. Goods conducive to these modes are typically time-sensitive, high value products that are produced in a manner more consistent with the vision for the AEGD (e.g. electronics, medical supplies/equipment). This conclusion is supported by the findings of the Niagara-to-GTA Corridor Planning and Environmental Assessment Study.

Hamilton International Airport will experience growth as Toronto’s Pearson Airport approaches its capacity. Air passengers currently residing to the west of Pearson International Airport could benefit from a rail line link to the City of Hamilton to facilitate use of HIA. As identified in the Niagara-to-GTA Study this could be done by utilizing existing corridors through increasing short-line railway services.

A potential synergy might be for heavy rail to make use of a passenger rail connection with GO trains that already use CN/CP mainlines between downtown Hamilton and the GTA. For example, there could be a passenger connection between the airport and downtown Hamilton and along Upper James Street using LRT technology. This would potentially connect with GTA GO trains travelling to Union Station or to Greyhound and Canada Coach services connecting to the Niagara region via the QEW. Further discussions with GO Transit and/or Greyhound would be necessary to determine feasibility.

Current CN and CP rail lines are shown in ***Figure 44.*** .

Figure 44: CN and CP Rail Lines in the GTA



9.5.3 Hamilton Port to Airport Connections

Currently, the most direct truck route between the Hamilton Port and the HIA is via Highway 403 and Highway 6. There is also the alternative of travelling along the Red Hill Valley Parkway and connecting with Upper James Street via the Lincoln Alexander Parkway. The fastest local route that utilizes full time truck routes, as specified in the City of Hamilton Truck Route Master Plan Study, is along Upper James Street connecting to Wellington Street or Victoria Avenue. It should be noted that any route that employs Upper James Street is subject to existing congestion.

A report was released by the Southern Ontario Gateway Council in 2008 (*Southern Ontario Transportation and Logistics Issues Report).* The report estimated an increase in truck traffic growth from 2.2 to 2.8% per annum between 2003 and 2020 and identified a need in the Greater Toronto and Hamilton Area to provide uncongested routes for trucks travelling between Hamilton Airport Lands and the Hamilton Port, Niagara Region and other areas of the GTA.

The preferred alternative in the Hamilton Truck Route Study would see White Church Road connecting to Highway 56 which could be used for connections to the Red Hill

Valley Parkway (RHVP) and onward to the GTA or Niagara region. This would be an alternative to using Upper James Street in an effort to avoid the high levels of congestion along that corridor.

One possibility for improving freight movements between the AEGD and the Hamilton Port and/or RHVP would be to consider truck-only lanes connecting the Hamilton Port/ RHVP with an intermodal logistics/warehouse facility located within the airport lands. The Niagara-to-GTA Corridor Study identified the Hamilton International Airport as a good location for an intermodal facility, given its strategic location and expected growth in cargo shipments. If an intermodal facility was built within the AEGD study area, truck-only lanes should be considered.

Truck-only lanes would be reserved for freight vehicles and could include specialized signal timing for trucks entering and leaving the AEGD to minimize delays for all vehicles in the area. Proposals for truck-only lanes have appeared in numerous areas of the United States, including California, Virginia, Texas and Florida. Although further investigation would be necessary to determine the feasibility of such an option within the AEGD and surrounding area, preliminary research into truck-only facilities has identified numerous benefits.

Truck-only facilities relieve congestion by adding road capacity. They can generate revenue if tolling is included and can reduce long-term infrastructure costs. There are also disadvantages including high costs associated with new infrastructure. Further research into truck-only facilities should examine cost-effectiveness based primarily on the fraction of truck traffic expected to use connections between the airport and other major destinations. In addition, it is important to consider any potential for increased congestion on alternate routes caused by truck-only toll roads[14].

9.5.4 Hamilton AEGD to Red Hill Valley Parkway Link

An EMME/2 model was used for traffic analysis for the 2031 horizon (Secondary Plan Area + Council Directed Additional Lands + Additional Study Area). A route was considered in the model connecting the RHVP with Upper James Street, via Trinity Church Road. The EMME/2 model was used to determine the number of vehicles that would potentially use an upgraded connection along Trinity Church Road to access the RHVP and LINC.

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[14] http://www.rff.org/Publications/WPC/Pages/03_16_09_Has_the_Time_Come_for_Truck-Only_Toll_Lanes.aspx FROM *Resources Magazine*

EMME/2 results suggested that considering the overall network and the convenience for commuters and other drivers to access the RHVP via Upper James Street, only a modest number of vehicles would use a Trinity Church Road connection to access the RHVP. Upper James Street is the most direct route to RHVP for most road users. As such, additional connections to the RHVP via Trinity Church Road should only be considered as a supporting corridor, not a primary route.

10.0 PUBLIC CONSULTATION

The AEGD Study included an important consultation component which informed and gathered input from different stakeholders with interests in the project. Public consultation elements included the creation of a Community Liaison Committee (CLC), workshops, public information centres, public meetings and information about the project on the City of Hamilton's website. The public consultation activities carried out as part of this study fulfilled the requirements of Phases 1 and 2 of the Municipal Class EA process. A summary of the public consultation program for the entire AEGD study is contained within the AEGD Consultation Report.

Community Liaison Committee (CLC)

A CLC was created in order to give local residents, businesses, and community leaders the opportunity to provide comments and advice on the AEGD Study. CLC meetings were held on the following dates:

- Phase 1 meetings: #1. November 07, 2007
  #2. December 05, 2007
  #3. January 16, 2008 (Workshop #1 – see below)
  #4. February 20, 2008
  #5. March 19, 2008
  #6. April 16, 2008
  #7. May 21, 2008 (Joint PIC#1 – see below)
  #8. June 18, 2008

- Phase 2 meetings: #1. August 20, 2008
  #2. December 09, 2008
  #3. January 20, 2009 (Workshop #2 – see below)
  #4. February 10, 2009 (Workshop #3 – see below)
  #5. April 28, 2009
  #6. August 19, 2009
  #7. September 15, 2009
  #8. October 05, 2009 (Joint PIC#3 – see below)
  #9. January 26, 2010

Workshop #2 & #3: During Phase 2 the consultant team organized workshops with the CLC to develop the Vision for the AEGD and to create the development options. These workshops were held on January 20, 2009 and February 10, 2009, respectively.

Public Information Centres (PICs)

The City of Hamilton held public information centres and public meetings in order to provide information on the project and to gather input from the community, agencies, businesses and other stakeholders. PICs were held on May 21& 27, 2008 (AEGD Study

Phase 1 PIC) and May 25 & 26, as well as on October 5 & 6, 2009 (AEGD Study Phase 2 PICs). A second round of Phase 2 PICs were held in the summer of 2010, on July 15, August 3 & 10, and September 8.

Agency Consultation

Throughout the course of the study, meetings were held to gain technical input and feedback from city staff in various departments. In addition, meetings were held to discuss opportunities and planned improvements under the responsibility of agencies such as Metrolinx (GO Transit).

Web Site

The City provided information regarding the study on the project website: www.hamilton.ca/aegd. In the website, interested stakeholders can find the CLC meeting minutes; presentations; project news and media releases; related studies and plans; and, contact information.

A more detailed account of the study's public consultation activities is provided in the *Hamilton Airport Employment Growth District Public and Agency Consultation Report,* under a separate cover. The report summarizes the public consultation process and information provided for all components of the AEGD Study, including the Secondary Plan, Zoning by-Law, Financing/Phasing Plan, Transportation Master Plan, Water/Wastewater Master Plan and Subwatershed Study and Stormwater Master Plan.

11.0 SUMMARY OF A RECOMMENDED TRANSPORTATION SYSTEM

The following section summarizes the recommendations for the Transportation Master Plan for the AEGD area.

11.1 Road Network Improvements

- Improve the existing road network through road widenings and new roadway construction projects as identified in ***Table 14*** *(***Section 9.1.5**);
- Carry out a more detailed assessment of Highway 6 access in order to plan for, and construct interchanges along Highway 6 at Book Road, Butter Road (north access only), and Airport Access as proposed in the MTO Pre-Design Report (1997) when development levels warrant. The following are required based on transportation modelling analysis:
  - Full interchange at Book Road
  - Partial interchange Butter Road
  - Full interchange at Airport Access; and
- Design AEGD road network to accommodate and promote alternative modes and transit accessibility within development lands.

11.2 Transit

- Ensure good transit accessibility by locating bus-based transit stops within a 400 metres walking distance of development or Rapid Transit stations within 800 metres walking distance of development;
- Integrate enhanced transit stops and/or stations within Employment Supportive Centres, where applicable; and
- Preserve transit ROWs along Upper James Street and Garner Road, within the AEGD, for the future use of Rapid Transit (BRT and/or LRT) opportunities.

11.2.1 Transit Service Design

- Extend existing Hamilton HSR transit routes as appropriate. The following are recommended extensions:
  - **Route 35** – Extend the route south to provide a north-south connection to the Employment Supportive Centre located at the northwest corner of the future realigned Book Road East and Glancaster Road; and
  - **Route 34** – Extend the route south along Glancaster Road to provide a north-south connection to the Employment Supportive Centre located at the

northwest corner of the future realigned Book Road East and Glancaster Road

- Other options could be considered throughout the development process (e.g. extending existing HSR Routes 20 and 27)

- Develop the following six routes to service the AEGD area:
  - **Proposed Route 101** – The route provides two-way transit service along roads to be developed in the Secondary Plan Area, connecting the Employment Supportive Centre at Kitty Murray and Garner Road with the Employment Supportive Centre on the west side of Upper James Street.
  - **Proposed Route 102** – The route provides service along Garner Road, Twenty Road and terminates at the Employment Supportive Centre on Upper James Street. This route would provide service to Redeemer College.
  - **Proposed Route 103** – The route provides transit service along a radial route between Rymal Road and south of Dickenson Road.
  - **Proposed Route 104** – The route provides transit service for riders on the west side of Highway 6 to the employment lands south of the Airport. Service would connect the Employment Supportive Centres located at Kitty Murray and Southcote Road; and south of the Airport. However, it is anticipated that demand would not require this route to be implemented until beyond 2031 (i.e. Additional Study Area).
  - **Community Shuttle A104** – This route would act as an interim shuttle service to connect riders from downtown Hamilton and other key areas to the enhanced transit stop and Employment Supportive Centre along Airport Road, within the Secondary Plan Area. Beyond 2031 (i.e. when Additional Study Area lands are considered) an enhanced transit stop should be served by Proposed Route 104 (see above).
  - **Proposed Route 116 (A Route)** – The route provides service along Garner Road, Southcote Road and Dickenson Road and connects the proposed Employment Supportive Centres located at Kitty Murray and Southcote Road and Upper James Street.
  - **Proposed Route 116 (B Route)** – The service heads southbound along the proposed collector on the east side of Fiddler's Green Road and then heads eastbound along Book Road. At the intersection of Book Road and Southcote Road it provides the same service as the A Route, travelling along Dickenson Road and terminating at the Upper James Street Employment Supportive Centre. Depending on demand, this route may not be required until beyond 2031 (i.e. when Additional Study Area lands are considered)

11.3 Pedestrians and Cycling

11.3.1 Pedestrians and Trails

- Create a comprehensive trails and pedestrian network that includes the following:
  - A multi-use trail that utilizes the Hydro corridor to connect the northeastern portion of the study area at Garner Road / Rymal Road with Fiddler’s Green Road.
  - A multi-use trail that follows the Greenbelt in a north-south direction west of Highway 6. This would provide a connection between the Hydro corridor north of Book Road with the Employment Supportive Centre at the south of the Airport.
  - A multi-use trail that runs in a north-south direction along Upper James Street.
  - A sidewalk system throughout the study area predominantly focused in the Secondary Plan Area to the north of the Airport.

11.3.2 Cycling

- Create a comprehensive and interconnected network of cycling routes. This should include the proposed cycling network in the 2007 Hamilton TMP along with the following links:
  - A proposed cycling lane running north-south along Southcote Road, connecting Garner Road with Book Road
  - A Proposed cycling lane running north-south along Fiddler’s Green Road, connecting Garner Road with Carluke Road
  - A proposed cycling lane running east-west along Butter Road, connecting Fiddler’s Green Road to Glancaster and then running north-south connecting Butter Road to Carluke Road.
  - A proposed cycling lane running east-west along Book Road, Dickenson Extension and Dickenson Road, connecting Fiddler’s Green with Upper James Street.
  - A proposed cycling lane running north-south along Garth Street Extension, connecting Twenty Road with Dickenson Road.
  - A proposed cycling lane running east-west along Twenty Extension, connecting Southcote Road with Glancaster Road.
  - A signed on-street cycling route running north-south along Smith Road, connecting Garner Road to Dickenson Extension.
  - A signed on-street cycling route running north-south along Collector 9W, connecting Garner Road and Carluke Road.

   - A signed on-street cycling route running along Collector 6N and Collector 7E, connecting Glancaster Road to Upper James Street in an east-west direction.

11.4 Transportation Demand Management (TDM)

- A Transportation Demand Management Strategy should be developed for the AEGD area. The following should be considered for inclusion in the strategy:
   - Require employers within the AEGD to join the Smart Commute Hamilton Transportation Management Association.
   - Suggest that employers within the AEGD create, implement, and monitor a unique, company-specific TDM Plan – which could potentially be organized by a 'Commuter Manager' for that company.
   - Provide tools and assistance for employers within the AEGD to develop TDM programs.
   - Suggest that AEGD developers and/or employers:
      - Provide on-site bicycle parking facilities in a safe, well-lit, and sheltered location.
      - Ensure showers, change-rooms, and lockers are part of every building to encourage cycling.
      - Erect information boards in strategic locations providing useful information to commuters such as up-to-date public transit maps and timetables, bike-routes, walking trip times, relevant news items, car-pool information and other useful features (and/or launch a website).
      - Promote carpooling to the AEGD using the *Smart Commute Carpool Zone* website (located at www.carpoolzone.ca) and use 'preferential parking spaces' for carpools/ vanpools
      - Explore opportunities for a bike-share scheme.
      - Explore opportunities for communal 'fleet vehicles' for business travel.
      - Support teleworking and alternative work arrangements for employees (if possible),
      - Investigate opportunities to schedule shift start and end times outside of peak periods and
      - Investigate feasibility of providing corporate bus passes for staff.
   - Work with transit providers to ensure access and service to site is optimum and that ancillary facilities (e.g. shelters, benches, etc.) are provided, where appropriate.
   - Investigate the feasibility of implementing a ride-matching service.

- Develop enhanced convenience retail on, or within walking distance of site (e.g. restaurant, bank, convenience store, etc.)
- Investigate feasibility of implementing parking charges at appropriate locations to improve attractiveness of alternative modes.

11.5 Parking

- Provide two new Park and Ride / Carpool Lots during the Secondary Plan Area within or adjacent to the AEGD. These are suggested to be located at Garner Road and Smith Road and north of Dickenson Road on Upper James Street.
- Follow the recommendations made in the city-wide TMP Parking Policy Paper, such as: off-street parking facilities, parking rates regulated by zoning, shared parking options, parking incentives for rideshare / TDM measures;
- Promote reduced parking at commercial and employment developments to promote alternative modes of travel;
- Provide designated ‘preferential spaces’ for carpools/vanpools;
- Provide designated ‘car-share’ parking spaces for use by company ‘fleet vehicles’ or for employees who belong to a car club (e.g. ZipCar); and
- Consider reducing the requirement for on-site parking spaces in order to facilitate the use of alternatives.

11.6 Goods Movement

- Consider introducing full-time truck routes in the following locations:
  - Book Road & Dickenson Road;
  - Upper James Street;
  - Garner Road & Rymal Road;
  - Carluke Road & White Church Road; and
  - Highway 6.
- Commercial rail is not considered to be a viable option for the AEGD at this time, due to the steep grade at the Niagara Escarpment, high costs, and lack of consistency with the vision for the AEGD as an eco-industrial park. Monitor and assess type of development attracted to the AEGD to determine whether this recommendation should be revisited.
- Explore the possibility of employing a passenger rail connection with GO trains that already use CN/CP mainlines through discussions with GO Transit, Greyhound, CN and CP.

11.7 Airport Growth Recommendations

- Provide enhanced transit accessibility to the Hamilton International Airport for the Rapid Transit A-Line and the surrounding road network to accommodate the significant increase in passenger and cargo traffic at Hamilton International Airport anticipated by 2030; and
- Carry out a more detailed assessment of transportation infrastructure related to HIA growth (e.g. timing of Airport Road realignment and upgraded access between Highway 6 and HIA, potential pedestrian connection to employment lands south of Highway 6, etc.) to accommodate significant increase in passenger and cargo traffic at Hamilton International Airport. The study should include triggers for planning and design stages.

12.0 IMPLEMENTATION PLAN

The following implementation plan takes into account existing water / wastewater servicing capacity within the AEGD as well as the recommended phasing for areas requiring new servicing infrastructure and lands.

Build-out of the Secondary Plan Area and Council Directed Additional Lands is anticipated to be completed in conjunction with water / wastewater servicing phasing, according to the following schedule:

- Phase 1 completed by 2021; and
- Phase 2 completed by 2031.

The Council Directed Additional Lands (i.e. Ancaster Christian Reform Church and Smith Farm) are proposed for development within the same time horizon as the Secondary Plan Area (i.e. development by 2031). The roadway volume increases predicted to result from the development of these particular lands are relatively low. As a result the roads adjacent to the Council Directed Additional Lands do not require widening or improvements until full build-out of the study area, beyond 2031. In the interim, the Ancaster Christian Reform Church can be accessed via the existing Fiddlers Green Road. The Smith Farm property can be accessed via Southcote Road and Smith Road, the existing rural roads located directly adjacent to the lands. It is expected that the existing roadway infrastructure would be sufficient to support development of these lands until other roadway projects are implemented (e.g. Southcote Road, Smith Road and Collectors 2N, 9W and 11N).

Table 16, 17 and 18 include summaries of the AEGD Implementation Plan for the Secondary Plan Area and the Council Directed Additional Lands. A summary of the AEGD Implementation Plan for the Additional Study Area was included in **Appendix E**. Capital costs and timing are listed in addition to the applicable Municipal Class EA project schedule. An ID prefaced with the letter “R” indicates a “required” project. An ID prefaced with the letter “P” indicates a “planned” project that may not be required if development parcels are very large, negating the need for a collector roadway.

Table 16: Implementation Plan Summary

Id	Road	From	To	Description	Total Road Cost* ($M)	Anticipated Timing**	EA Schedule
ROADWAY PROJECTS AND COST ESTIMATES							
Secondary Plan Area Required Roadway Projects (2009 – 2031)							
North-South Arterial Roadways							
R1	Southcote Road	Garner Road	Twenty Road Extension	2 lane reconstruction	**2.71**	**2009-2021**	**B**
R2	Southcote Road	Twenty Road Extension	Book Road	2 lane reconstruction	**2.71**	**2022-2031**	**B**
R3	Glancaster Road	Garner Road	Dickenson Road	Widening 2 to 4 lanes	**13.32**	**2022-2031**	**C**
R4	Upper James Street	Alderlea Avenue	Homestead Drive	Widening 4 to 6 lanes	**30.23**	**2009-2021**	**C**
R5	Garth Street Extension	Twenty Road	Dickenson Road	New 4 lane construction	**10.07**	**2022-2031**	**C**
R6	Garth Street Extension	Dickenson Road	Collector 2E	New 4 lane construction	**3.19**	**2022-2031**	**C**
East-West Arterial Roadways							
R7	Book Road	Highway 6	Southcote Road	Widening 2 to 4 lanes	**4.67**	**2022-2031**	**C**
R8	Garner Road E	Fiddlers Green Road	Glancaster Road	Widening 2 to 4 lanes	**19.52**	**2009-2021**	**C**
R9	Dickenson Road	Glancaster Road	Upper James Street	Widening 2 to 4 lanes	**11.93**	**2022-2031**	**C**
R10	Dickenson Road Extension	Southcote Road	Smith Road	Widening 2 to 4 lanes	**2.08**	**2022-2031**	**B**
R11	Dickenson Road Extension	Smith Road	Glancaster Road	New 4 lane construction	**4.11**	**2022-2031**	**C**
R12	Twenty Road	Glancaster Road	Aldercrest Avenue (Upper James Street)	Widening 2 to 4 lanes	**14.17**	**2009-2021**	**C**
R13	Twenty Road Extension	Southcote Road	Glancaster Road	New 2 lane construction	**4.78**	**2022-2031**	**C**
R14	Airport Road	Terminal Access Road	East Cargo Road	Widening 2 to 4 lanes	**2.10**	**2009-2021**	**B**
R15	Airport Service Road	Glancaster Road	Airport Road	New 4 lane construction	**12.27**	**2022-2031**	**C**
East-West Collector Roadways							
R16	Collector 1N	Smith Road	Collector 2E	New 2 lane construction	**3.68**	**2022-2031**	**C**
R17	Book Road E	Collector 2W	Glancaster Road	2 lane reconstruction	**1.76**	**2022-2031**	**B**
R18	Collector 6N	Glancaster Road	Collector 6E	New 4 lane construction	**8.09**	**2022-2031**	**C**
R19	Collector 6N	Collector 6E	Collector 7E	New 4 lane construction	**3.47**	**2009-2021**	**C**
R20	Collector 10N	Collector 5W	Smith Road	New 2 lane construction	**2.95**	**2009-2021**	**C**
R21	Collector 10N	Smith Road	Glancaster Road	New 2 lane construction	**7.59**	**2022-2031**	**C**
North-South Collector Roadways							

Id	Road	From	To	Description	Total Road Cost* ($M)	Anticipated Timing**	EA Schedule
R22	Smith Road	Garner Road	Dickenson Road Extension	New 2 lane construction	**4.74**	**2022-2031**	**C**
R23	Smith Road Extension	Hydro Corridor N		New 2 lane construction	**0.54**	**2022-2031**	**B**
R24	Glancaster Road	Dickenson Road Extension	Collector 1N	Widening 2 to 4 lanes	**1.88**	**2022-2031**	**B**
R25	Collector 1E	Twenty Road	Dickenson Road	New 2 lane construction	**6.91**	**2022-2031**	**C**
R26	Collector 6E	Twenty Road	Dickenson Road	New 2 lane construction	**6.79**	**2009-2021**	**C**
R27	Collector 7E	Dickenson Road	Collector 6N	New 2 lane construction	**2.73**	**2009-2021**	**C**
R28	Collector 7E	Collector 6N	Upper James Street	New 4 lane construction	**2.60**	**2009-2021**	**B**
R29	Collector 1W	Garner Road	Collector 10N	New 2 lane construction	**2.46**	**2022-2031**	**B**
R30	Collector 1W	Collector 10N	Twenty Road Extension	New 2 lane construction	**3.17**	**2022-2031**	**C**
R31	Collector 2W	Garner Road	Dickenson Road Extension	New 2 lane construction	**5.82**	**2022-2031**	**C**
R32	Collector 2W	Garner Road	Dickenson Road Extension	New 2 lane construction	**3.09**	**2022-2031**	**C**
R33	Collector 7N	Collector 5W	Southcote Road	New 2 lane construction	**3.87**	**2022-2031**	**C**
Secondary Plan Area Required Roadway Projects TOTAL					**209.98**		
Secondary Plan Area Potential Roadway Projects (2009-2031) (May be omitted depending on Site Development Plans)							
East-West Collector Roadways							
P40	Collector 7N	Southcote	Collector 2W	New 2 lane construction	**4.33**	**2022-2031**	**C**
P41	Collector 12S	Collector 4E	Collector 5E	New 2 lane construction	**1.13**	**2022-2031**	**B**
North-South Collector Roadways							
P42	Glancaster Road	Collector 1N	Airport	2 lane reconstruction	**5.73**	**2022-2031**	**C**
P43	Collector 2E	Collector 1N	Airport	New 2 lane construction	**2.96**	**2022-2031**	**C**
P44	Collector 4E	Collector 12S	White Church	New 2 lane construction	**1.21**	**2022-2031**	**B**
P45	Collector 5E	Collector 12S	White Church	New 2 lane construction	**1.21**	**2022-2031**	**B**
Secondary Plan Area Potential Roadway Projects TOTAL					**16.58**		
SUB-TOTAL					**226.57**		

** Road costs include property and exclude transit-related landscaping costs*
***Timing to be coordinated with Water-Wastewater Servicing*

Table 17: Implementation Plan Summary: Transit Projects and Cost Estimates

TRANSIT PROJECTS AND COST ESTIMATES					
TRANSIT STOP & LANDSCAPING COST TOTALS – Secondary Plan Area (2009-2031)					
Id	**Project**	**Intersection**		**Description**	**Cost ($M)**
34T	Enhanced transit stop	Southcote Road &	Garner Road	Major Enhanced transit stop	**0.34**
35T	Enhanced transit stop	Dickenson Road &	Upper James Road	Minor Enhanced transit stop	**0.22**
36T	Enhanced transit stop	Dickenson Road &	Glancaster Road	Minor Enhanced transit stop	**0.22**
37T	Enhanced transit stop	Glancaster Road &	Airport Road	Major Enhanced transit stop	**0.34**
38T		Transit Other (i.e. such as shelters, landscaping, etc.)			**0.36**
TOTAL REQUIRED TRANSIT PROJECTS					**1.48**
TRANSIT VEHICLE COSTS – Secondary Plan Area (2009-2031)					
a39T	Transit Vehicles Capital Cost				**6.08**
TOTAL BUS COSTS					**6.08**
TOTAL CAPITAL TRANSIT COSTS					**7.56**
TRANSIT OPERATIONAL COSTS					
TOTAL ANNUAL TRANSIT OPERATIONAL COSTS					**4.14**

12.1 Financial Strategy

A Capital Expenditure Plan for the AEGD network to 2031 was developed as part of this study. The plan covers:

- Roadway Widening / New Alignments;
- New Intersections / Traffic Management; and
- Transit Costs (Capital and Operating).

12.1.1 Capital Costs – Roadway Widening / New Alignments

The transportation network for the AEGD Secondary Plan Area and Council Directed Additional Lands (i.e. up to 2031) contains widenings, new alignments, and reconstruction costs to bring existing rural roads up to urban standards for the AEGD. The total costs and anticipated timing of these projects will need to be refined as development proceeds.

The cost assessment compared the capital costs associated with transportation network improvements for each alternative. Road improvement costing was based on benchmark costs and typical roadway cross-sections. Unit prices were selected according to typical market values for the study area. The benchmark costs contain typical engineering and construction contingency allowances. Estimates took into consideration the costs typically associated with earthworks, underground servicing, utility servicing, street and traffic lighting, structures, roadworks and amenities, and drainage. Transit-related landscaping costs were excluded from the total road costs.

12.1.2 Capital and Operating Costs - Transit

Based on the service plan presented in this study, the annual operating costs and capital costs were estimated to provide local transit service into the AEGD. Several assumptions were used in this cost estimate:

- Bus purchase cost of $450,000;
- Hourly operating cost of $60.00 for peak and off peak service;
- 17.5 hours of service per weekday (06:00 – 23:30) and no weekend service;
- Inclusion of capital costs for enhanced transit stops (e.g. landscaping and amenities such as benches, trash receptacles, signage, etc.) within total transit project cost estimate;
- Purchase of sufficient new transit vehicles for provision of high level of transit service by full build-out of AEGD (e.g. 15-30 min service during peaks)

- Allocation of sufficient annual transit operating funds to provide a high level of transit service (estimated at $4.14 Million per year)

It is important to note that suggested transit routes would need to continue into the City of Hamilton and terminate at logical nodes within the city. The transit strategy for the AEGD should therefore be reviewed by the HSR and integrated into its existing and planned system. This will require a recalculation of both service and capital costs for the city's overall transit network.

Capital and operating cost allocations for transit were identified above. Transit service must be in place in the AEGD at the same time as the first developments are completed. Funding for increased transit service must be approved for each phase of AEGD development. Capital costs for transit vehicles must also be set aside to ensure that a sufficient number of buses are available with which to deliver the service.

12.1.3 Capital Cost – Parks and Recreation Facilities

The capital costs for on-street cycling lanes, multi-use trails and sidewalks were incorporated in capital roadway cost estimates. The cost assessment compared the capital costs associated with transportation network improvements for each alternative. The benchmark costs contain typical engineering and construction contingency allowances. It is anticipated that pedestrian and trails infrastructure will be planned and developed in conjunction with roadway improvements.

13.0 SUMMARY OF RECOMMENDATIONS

A number of recommendations were made as part of the AEGD study. These recommendations are summarized below.

Road Network Improvements

- Carry out road network improvements (new roads, widenings and reconstruction projects) according to timing identified in **Table 16**.
- As development progresses, conduct more detailed transportation studies within the AEGD to confirm need for operational improvements and refine timing for transportation decisions (e.g. signalization, use of roundabouts, infrastructure).
- Carry out a detailed assessment of Highway 6 access to the AEGD area to determine appropriate design of, and timing for, interchanges.

Transit Improvements

- Ensure that transit service is planned within the AEGD as the first developments are approved and constructed.
- Extend and develop Hamilton HSR transit routes to meet transit mode share targets for the AEGD.
- Ensure that employment development meets transit accessibility targets for the AEGD (e.g. distance from development to transit facilities such as stops or stations).
- Integrate enhanced transit stops and/or stations within Employment Supportive Centres, as specified with the TMP.
- Protect ROW for future Rapid Transit (BRT/LRT) use.

Pedestrian and Cycling Network Improvements

- Create a comprehensive and interconnected network of cycling routes as outlined within the TMP.
- Create a comprehensive trails and pedestrian network as outlined within the TMP.

Goods Movement Improvements

- Implement truck routes for the AEGD consistent with the outcome of Hamilton's Truck Route Master Plan Study.
- Monitor development types attracted to AEGD and re-assess feasibility of goods movement by rail.
- Carry out detailed assessments of transportation infrastructure related to Hamilton International Airport (HIA) growth.
- Explore the possibility of employing a passenger rail connection with GO Trains that currently use CN/CP mainlines.

TDM Improvements

- Develop a Transportation Demand Strategy for the AEGD as identified in this Transportation Master Plan.

Parking Improvements

- Apply parking policies for the AEGD as identified within the TMP.

Airport Growth Recommendations

- Provide enhanced transit accessibility to the HIA for the Rapid Transit A-Line.
- Carry out a detailed assessment of transportation infrastructure related to HIA growth.

GLOSSARY OF TERMS

Acronyms & Definitions

AADT / Average Annual Daily Traffic – The number of vehicles measured passing a certain location, commonly presented either by origin, destination, turning movement, or direction of travel.

AEGD / [Hamilton] Airport Employment Growth District – An area approximately 1,200 hectares in size surrounding Hamilton Airport which is expected to employee approximately 28,000 people by 2031 in a variety of ancillary job-types.

Airside Industrial – AEGD land-use designation which primarily permits the development of warehousing, transportation terminals, research and development, office, communication establishment, fuel storage, and airport catering services. Airport-related industrial uses will also be permitted, such as airport transportation and cargo services, airport waste processing facilities, and airport waste transfer facilities, and utility activities benefiting from proximity to airport services.

Airport-Related Business – AEGD land-use designation which primarily permits the development of hotel/motels, convention centres, restaurants and catering services, commercial storage facilities, automobile rental, leasing and servicing, gas stations, taxi terminals, places of entertainment and recreation and financial institutions.

AM Peak Hour – The busiest one-hour time period during the 'morning rush hour', typically occurring sometime between approximately 7:00 A.M. and 9:00 A.M., when most commuters travel from home to their place of employment or education.

Arterial Road – A roadway type carrying moderate to high volumes of inter-regional and intra-municipal traffic throughout an area and/or city.

Bike Lane – Typically a paved curb-side lane on a roadway which is dedicated to bicycles through signage, pavement marking and/or physical barriers.

BRT / Bus Rapid Transit – A bus corridor which provides a higher quality of service by means including increased frequency, traffic signal priority, designated bus lanes, rear-door entry for pass holders, etc. with an aim to improve trip time, convenience, and reliability.

Collector Road – A roadway which provides direct land access to businesses and accommodates the movement of moderate traffic volumes through industrial / commercial areas.

EA / Environmental Assessment – A study which analyses the potential positive and negative impacts which a proposed development/project might have on the natural, social, economic or physical environment.

EMME/2 – A software program (created by *INRO*) used to create a model of a transportation network and forecast resultant traffic volumes, analyse intersection performance, etc.

Existing Network – The current 'as-is' transportation system including all hierarchies of roads, public transit facilities/infrastructure, provisions for pedestrians/cyclists, etc.

FHWA / [United States] Federal Highway Administration – Part of the United States Department of Transportation, which produces many standards and methodologies used across North America.

GGH / Greater Golden Horseshoe – A general phrase used to describe the densely-populated, 'horseshoe-shaped' urban conglomeration around the western edge of Lake Ontario, consisting of cities such as Niagara Falls, Hamilton, Kitchener-Waterloo, Oshawa and the Greater Toronto Area.

GRIDS / Growth Related Integrated Development Strategy – City of Hamilton strategy to identify the most ideal places for growth and the type of growth based on environmental priorities, social issues, economic opportunities and population studies as well as to identify strategies to fund the servicing of these areas.

GTA / Greater Toronto Area – The area populated by approximately 6 million residents consisting of the City of Toronto and the surrounding regional municipalities of Durham, Halton, York and Peel.

HIA – [John C. Munro] Hamilton International Airport

Horizon Year – A selected future year (e.g. 2021) for which certain assumptions have been made related to criteria such as population and employment growth, transportation infrastructure, modal split, etc.

HSR / Hamilton Street Railway Company – The City of Hamilton's department with jurisdiction over bus routes in the area.

ITE / Institute of Transportation Engineers – An international educational and scientific association of transportation professionals who are responsible for meeting mobility and safety needs.

Light Industrial – AEGD land-use designation which primarily permits the development of manufacturing, high technology, and warehousing and communication activities. Additionally, uses that support industry are permitted, such as conference and convention centres, trade schools, and commercial rental establishments.

LINC / Lincoln M. Alexander Parkway – A major 'east-west' expressway in the Hamilton area connecting Ancaster and Highway 403 in the west to the Red Hill Valley Parkway and the shores of Lake Ontario in the east.

Local Road – A roadway which primarily provides direct land accesses to businesses; the accommodation of low traffic volumes is considered a secondary function.

LOS / Level of Service – A measurement typically used to communicate the effectiveness of an intersection, ranging from 'A' (best) to 'F' (worst). For a more thorough explanation on *LOS*, please refer to **Appendix B**.

LRT / Light Rail/Rapid Transit – A form of public transit typically consisting of 'light' trains providing a high frequency and high capacity rail service in an urban setting, typically calling at stations located in short, regular intervals. *LRT* is often perceived to be the 'middle-ground' between a tram and a heavy rail commuter service.

MEA / [Ontario] Municipal Engineers Association – An association of public sector Professional Engineers in the full time employment of municipalities performing the various functions that comprise the field of municipal engineering.

Modal/Mode Choice – The form of travel used to travel to/from a destination, such as single occupant vehicle, car-pool, bus, train, tram, ferry, bicycle, walk – and in some instances, 'telecommuting'.

MTO – Ministry of Transportation, Ontario

Multi-Use Path – Typically a paved or unpaved off-street pathway designated to be shared for both cyclists and pedestrians.

Net Developable Area – A term typically referring to the total area of a site which can be built upon, excluding land allocated for roadways, floodways, and other right of ways.

OMB – Ontario Municipal Board

OP / [City of Hamilton] Official Plan – One of seven Official Plans in the Greater Hamilton Area which “provides guidance to ensure that development progresses in a rational, efficient and orderly manner, while minimizing impacts on adjacent land uses and existing infrastructure systems”.

Park and Ride – Typically a suburban car park which invites car drivers to park their private vehicles then transfer onto a bus, train, or car-pool for the rest of their journey – usually in the city centre. The vehicle is collected at the end of the day when the commuter returns.

PM Peak Hour – The busiest one-hour time period during the ‘evening rush hour’, typically occurring sometime between approximately 4:00 P.M. and 6:00 P.M., when most commuters travel from their place of employment or education back to their homes.

Prestige Business Park – AEGD land-use designation which primarily permits the development of corporate / office uses.

QEW / Queen Elizabeth Way – A major ‘east-west’ highway in the Hamilton area running parallel to the shore of Lake Ontario.

ROW / Right of Way – A parcel of land designated for existing or future infrastructure such as roads, railways, hydro towers, etc.

Screenline – An imaginary line across roadways (e.g. highways, expressways, arterials, collectors, etc.) used in transportation modeling and analysis to examine traffic volumes and roadway capacity entering or exiting a particular area.

SOV / Single Occupancy Vehicle – The term assigned to a vehicle consisting of a single driver who carries no passengers. Such vehicles typically make up the majority of all vehicles on urban roads in Canada.

Synchro – Traffic analysis software (created by *Trafficware*).

TAC / Transportation Association of Canada – A national organisation which aims “to promote safe, secure, efficient, effective and environmentally and financially sustainable transportation services in support of Canada’s social and economic goals.”

TDM / Transportation Demand Management – A strategy which aims to 1) reduce the number of unnecessary single occupant vehicle trips; 2) encourage the use of more sustainable alternatives such as public transit, car-pooling, tele-commuting, walking and cycling; and 3) make more efficient use of existing infrastructure and resources.

TMA / Transportation Management Association – An organisation typically comprised of businesses, institutions, individuals, or other organisations which have similar transportation, parking, safety or traffic-related needs/concerns within a certain local area such as a business park, mall or neighbourhood.

TMP / Transportation Master Plan – A strategy which aims to accommodate predicted transportation-related requirements created by future population and employment growth forecasts.

Transit Hub – A central, transit-oriented area which, in addition to bus stops or rapid transit stations (if applicable), may include amenities such as signage, shelters, drinking fountains, benches, trash receptacles, bicycle racks, lighting, decorative paving; and trees, shrubs and groundcovers.

Trip Elimination – A term referring to the ‘elimination’ of an otherwise would-be vehicle trip by means of various Transportation Demand Management measures.

Trip Chaining – A term referring to multi-stop, multi-purpose trips en-route to/from a destination (e.g. after work, between one’s workplace and one’s home, the trip involves a stop at the post office, the gym, and the grocery store).

Trip Scheduling – A term referring to influencing the *timing* of person-trips with an aim to shifting journeys to off-peak periods in order to reduce pressure on the existing roads or public transit system. Such can be done using initiatives such as flexible work-hours, shifting class start times, permitting ‘compressed’ work-weeks, etc.

Trip Sharing – A term referring to sharing a journey by means of car-pooling or van-pooling.

Truck Route Master Plan Review Study – A study assessing the efficient movement of goods in and around the Hamilton area with an aim to cater for the business community while minimizing impacts to residents, traffic, and the environment.

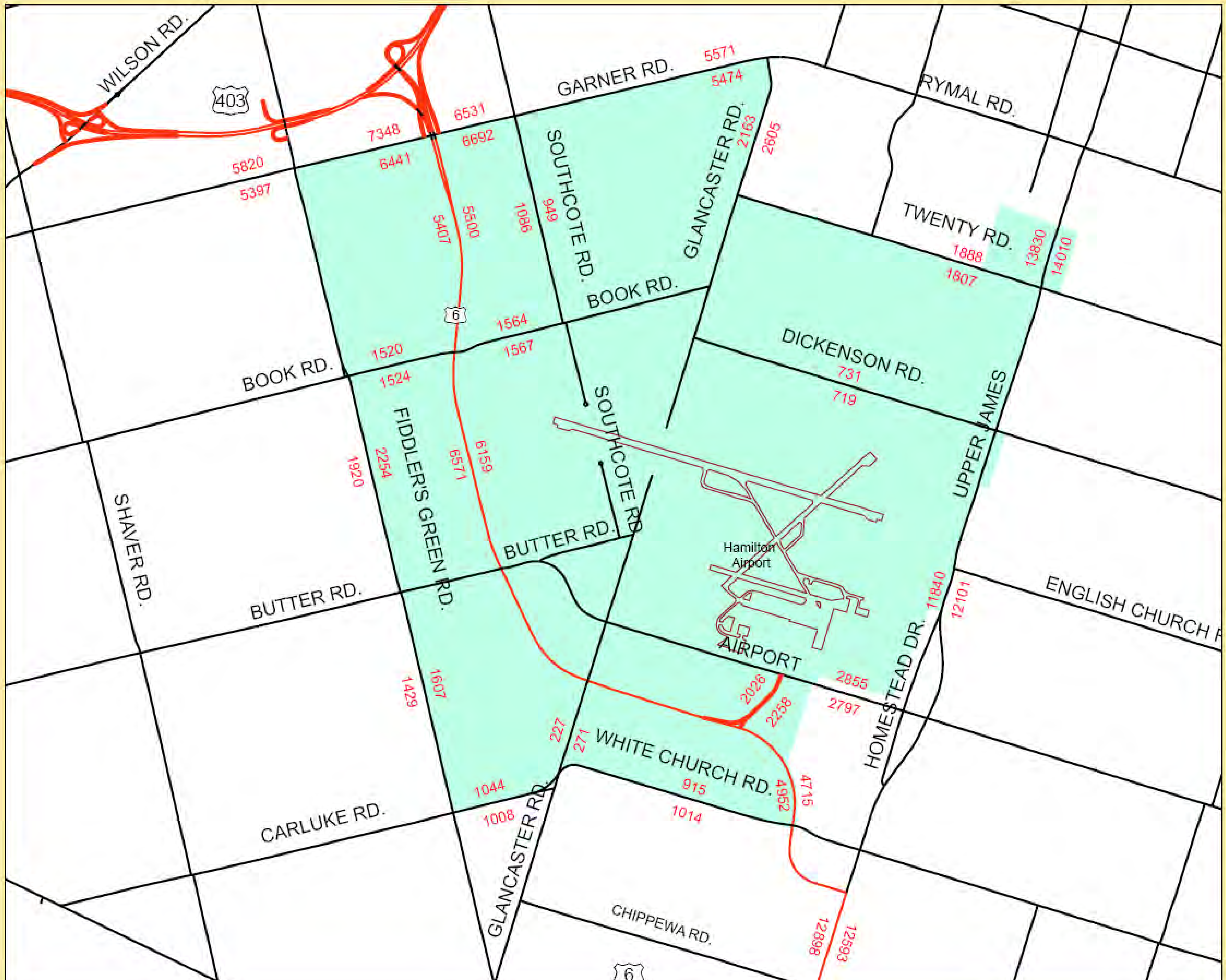
Ultimate Build-Out – The predicted scale of a development based on assumptions/knowledge related to criteria such as population and employment growth, land use type, transportation infrastructure, modal split, etc. upon full development of the Secondary Plan Area + Additional Study Area.

V/C / Volume-to-Capacity Ratio – A term used to express the number of vehicle trips per hour relative to the intended design capacity of that road, usually expressed as a decimal. Conventional traffic engineering practice states that a V/C ratio greater than 0.85 indicates a roadway is approaching capacity, while a V/C ratio above 1.00 indicates a roadway is over capacity.

APPENDIX A

ROADWAY VOLUMES – EXISTING AND FORECASTED

APPENDIX A: ADDITIONAL FIGURES



Hamilton

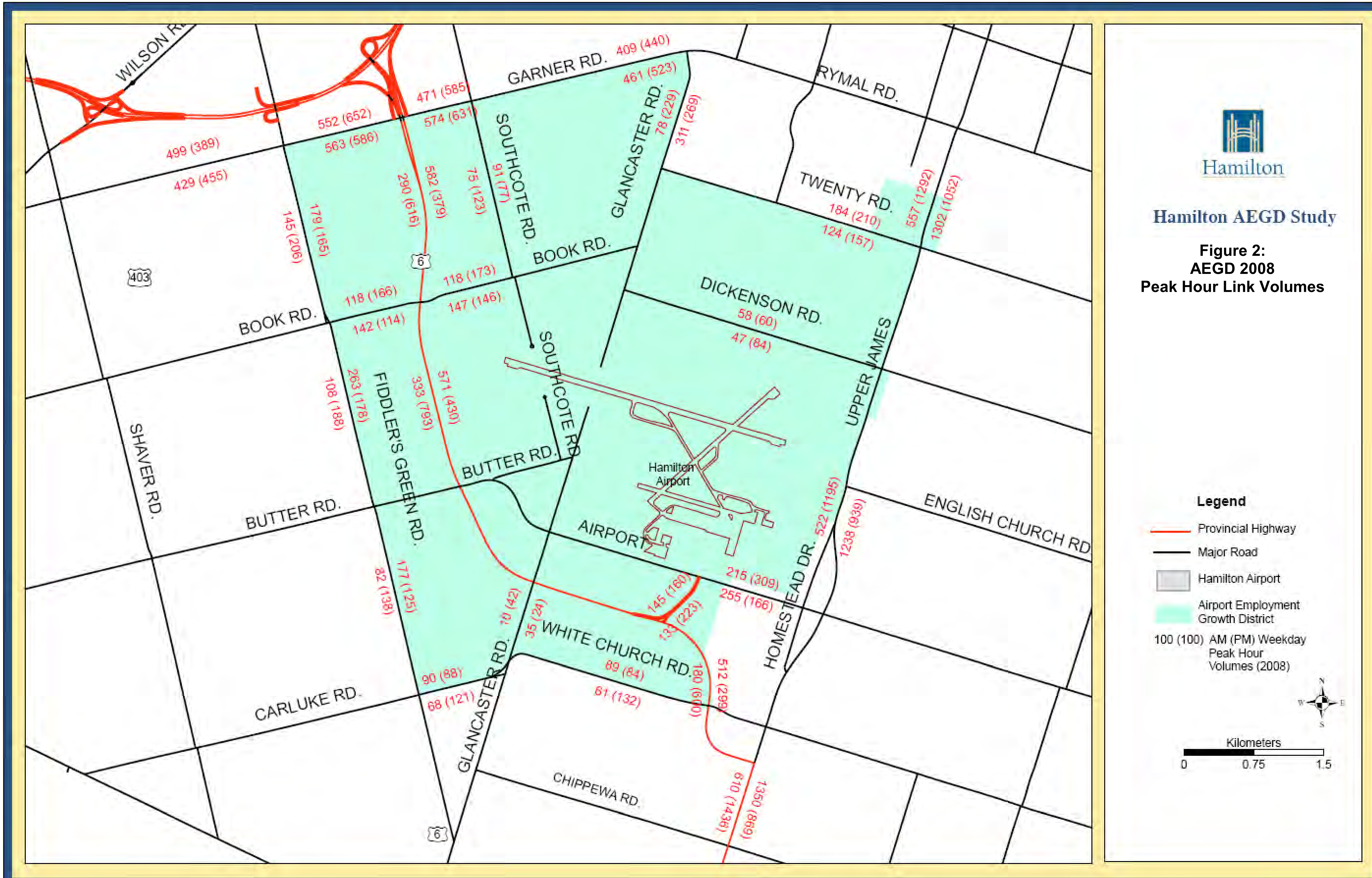
Hamilton AEGD Study

Figure 1:
AEGD 2008
Average Annual Daily Traffic
(AADT)

Legend

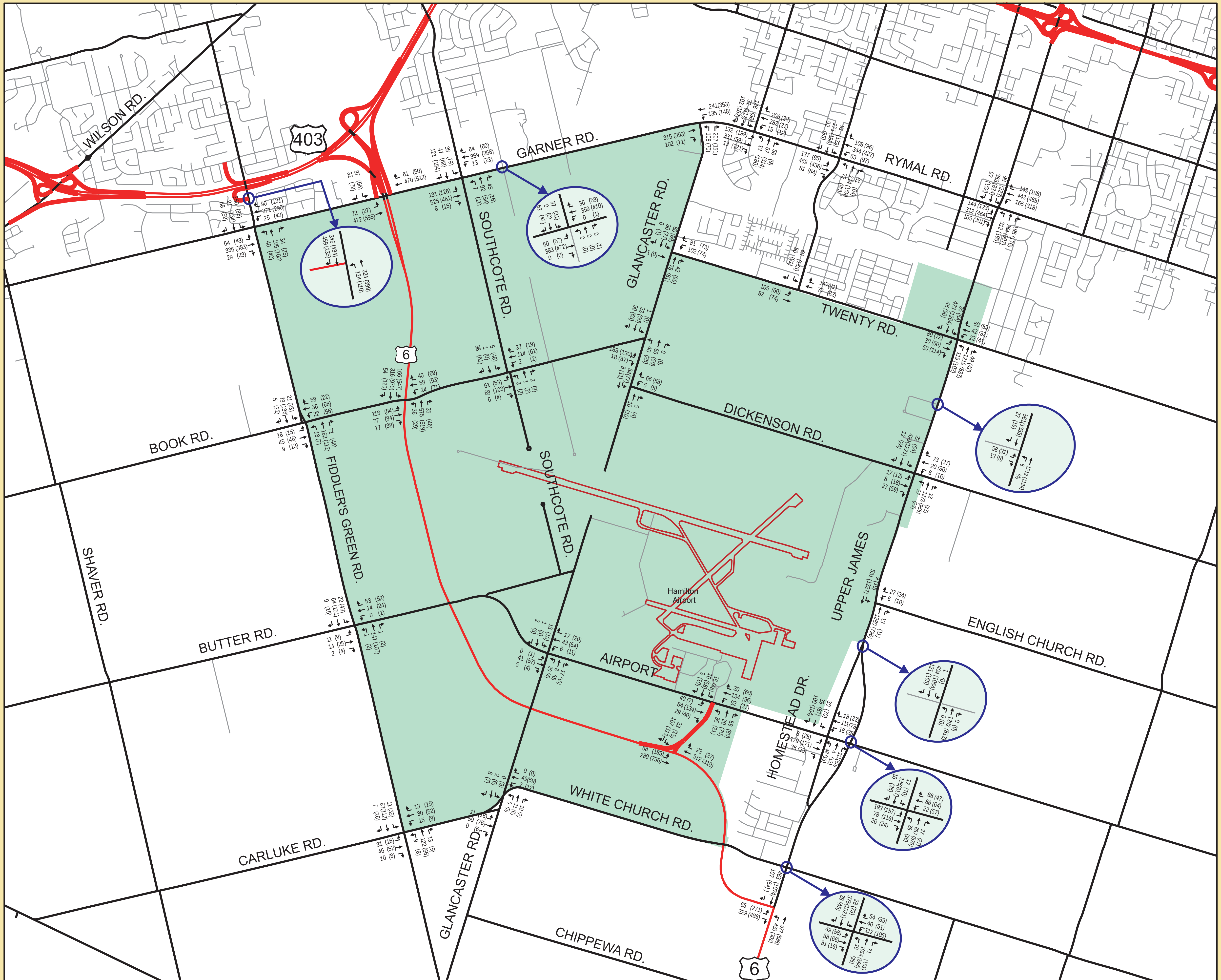
- Provincial Highway
- Major Road
- Hamilton Airport
- Airport Employment Growth District
- 1000 Daily Weekday Volumes (2008)

Kilometers
0 0.75 1.5



GARNER RD.
RYMAL RD.
TWENTY RD.
BOOK RD.
DICKENSON RD.
BUTTER RD.
AIRPORT
WHITE CHURCH RD.
CARLUKE RD.
CHIPPEWA RD.
ENGLISH CHURCH RD
SHAVER RD.
FIDDLER'S GREEN RD.
GLANCASTER RD.
SOUTHCOTE RD.
UPPER JAMES
HOMESTEAD DR.
WILSON
403
6
Hamilton Airport
409 (440)
461 (523)
471 (585)
574 (631)
552 (652)
563 (586)
499 (389)
429 (455)
78 (229)
311 (269)
184 (210)
124 (157)
557 (1292)
1302 (1052)
145 (206)
179 (165)
290 (616)
582 (379)
75 (123)
91 (77)
118 (166)
118 (173)
142 (114)
147 (146)
58 (60)
47 (84)
108 (188)
263 (178)
333 (793)
571 (430)
522 (1195)
1238 (939)
215 (309)
255 (166)
145 (160)
(223)
82 (138)
177 (125)
18 (42)
35 (24)
90 (88)
68 (121)
89 (84)
61 (132)
180 (600)
512 (299)
610 (1436)
1350 (869)

Hamilton
Hamilton AEGD Study
Figure 2:
AEGD 2008
Peak Hour Link Volumes
Legend
Provincial Highway
Major Road
Hamilton Airport
Airport Employment Growth District
100 (100) AM (PM) Weekday Peak Hour Volumes (2008)
Kilometers
0
0.75
1.5



Hamilton

Hamilton AEGD Study

Existing Intersection Turning Movement Volumes (Weekday Peak Hour)

Legend

Major Road

Minor Road

Highway

Airport Study Area

100 (100)
100 (100)
100 (100)

Weekday AM (PM) Peak Hour Traffic Volumes

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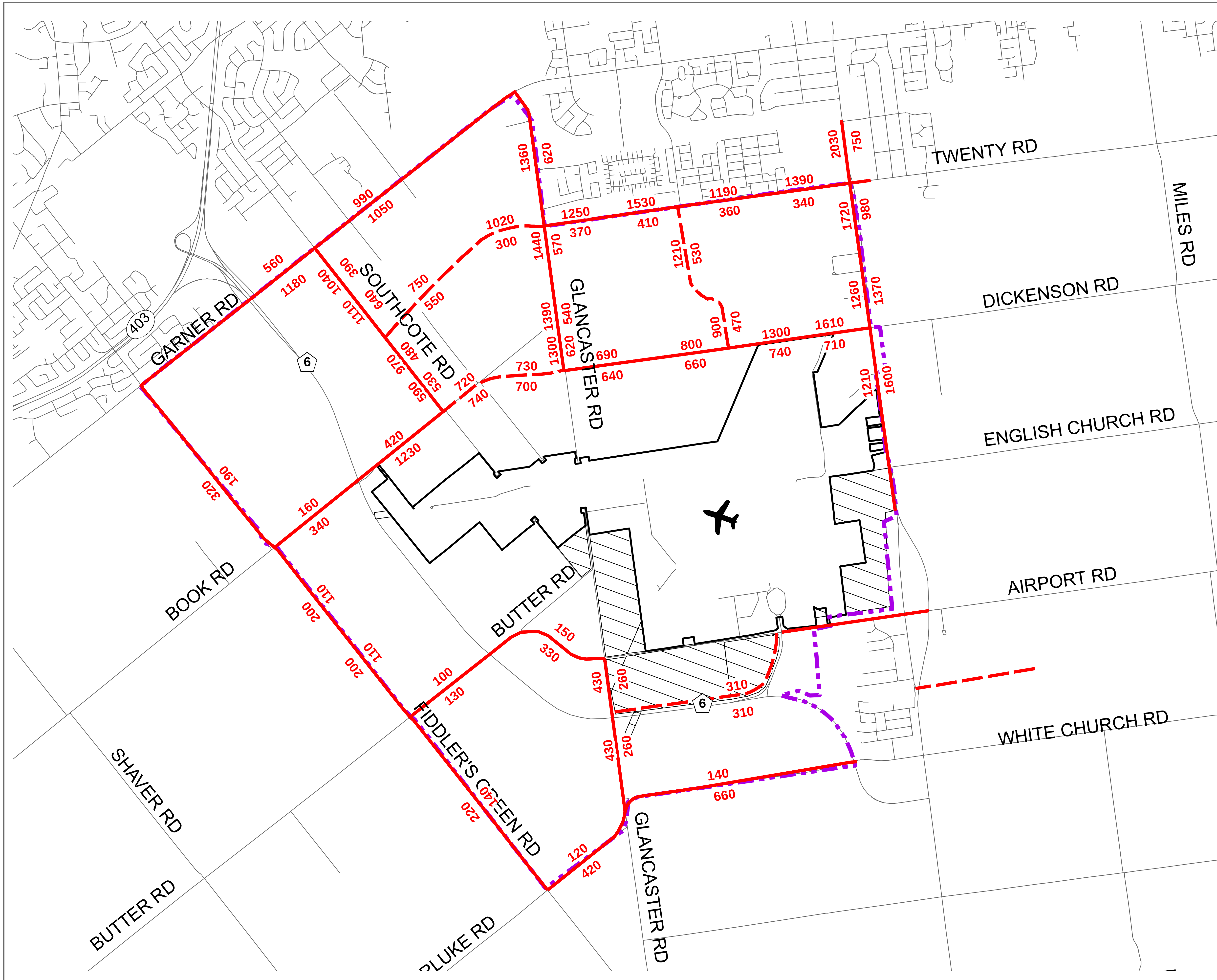
N.T.S.

Figure 4



Legend

- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Airport Employment Growth District Secondary Plan Boundary
- Secondary Plan Area
- Additional Study Area
- Airport Reserve
- John C. Munro Hamilton International Airport

Airport Employment Growth District
Secondary Plan Area, Phase 2 (2031 Horizon)
Alternative #2 - AM Peak Hour Link Volumes

N

0 250 500 750

Hamilton

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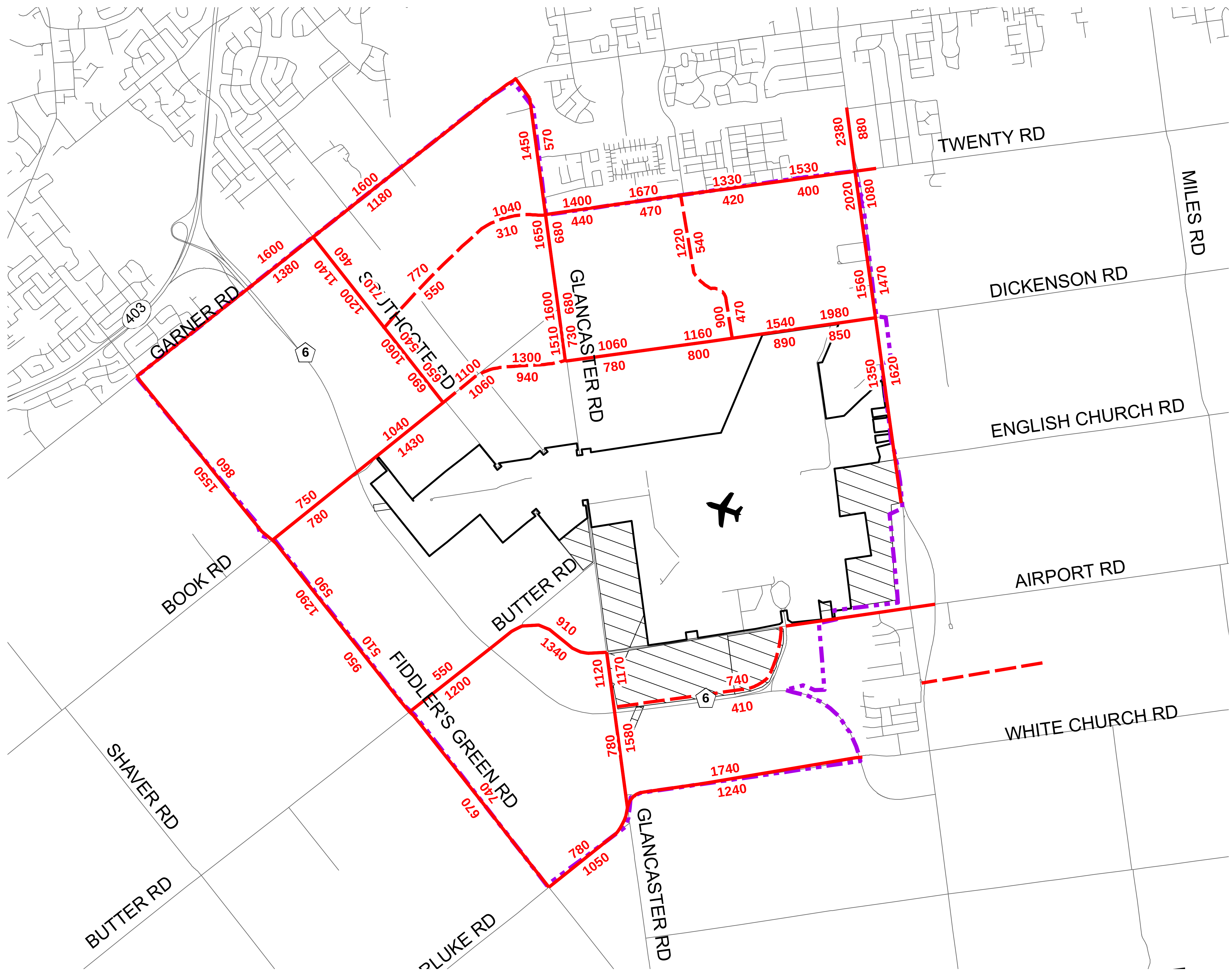
February 2011

Planning and Economic Development Department

Figure 5



Legend

- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Airport Employment Growth District Secondary Plan Boundary
- Secondary Plan Area
- Additional Study Area
- Airport Reserve
- John C. Munro Hamilton International Airport

Airport Employment Growth District

Secondary Plan Area and Additional (Beyond 2031)
Alternative #2 - AM Peak Hour Link Volumes

N

0 250 500 750

Hamilton

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February 2011

Planning and Economic Development Department

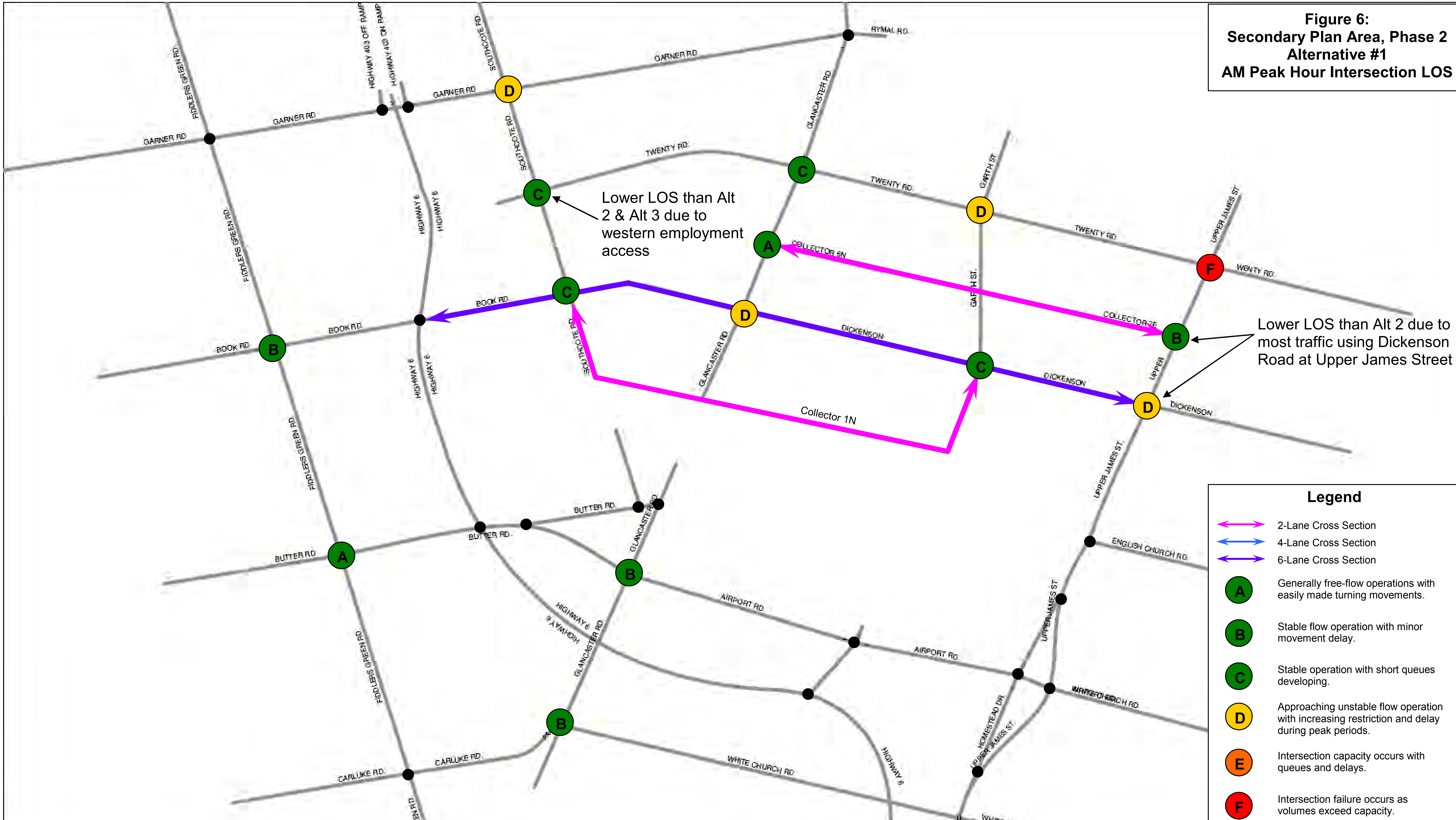
Figure 6:
Secondary Plan Area, Phase 2
Alternative #1
AM Peak Hour Intersection LOS
Lower LOS than Alt 2 & Alt 3 due to western employment access
Lower LOS than Alt 2 due to most traffic using Dickenson Road at Upper James Street
Collector 1N
Legend
2-Lane Cross Section
4-Lane Cross Section
6-Lane Cross Section
A Generally free-flow operations with easily made turning movements.
B Stable flow operation with minor movement delay.
C Stable operation with short queues developing.
D Approaching unstable flow operation with increasing restriction and delay during peak periods.
E Intersection capacity occurs with queues and delays.
F Intersection failure occurs as volumes exceed capacity.
GARNER RD
RYMAL RD
TWENTY RD
BOOK RD
BUTTER RD
AIRPORT RD
CARLUKE RD
WHITE CHURCH RD
ENGLISH CHURCH RD
DICKENSON
COLLECTOR 6N
COLLECTOR 7E
FIDDLERS GREEN RD
HIGHWAY 403 OFF RAMP
HIGHWAY 403 ON RAMP
HIGHWAY 6
SOUTHCOTE RD
GLANCASTER RD
GARTH ST
UPPER JAMES ST
HOMESTEAD DR

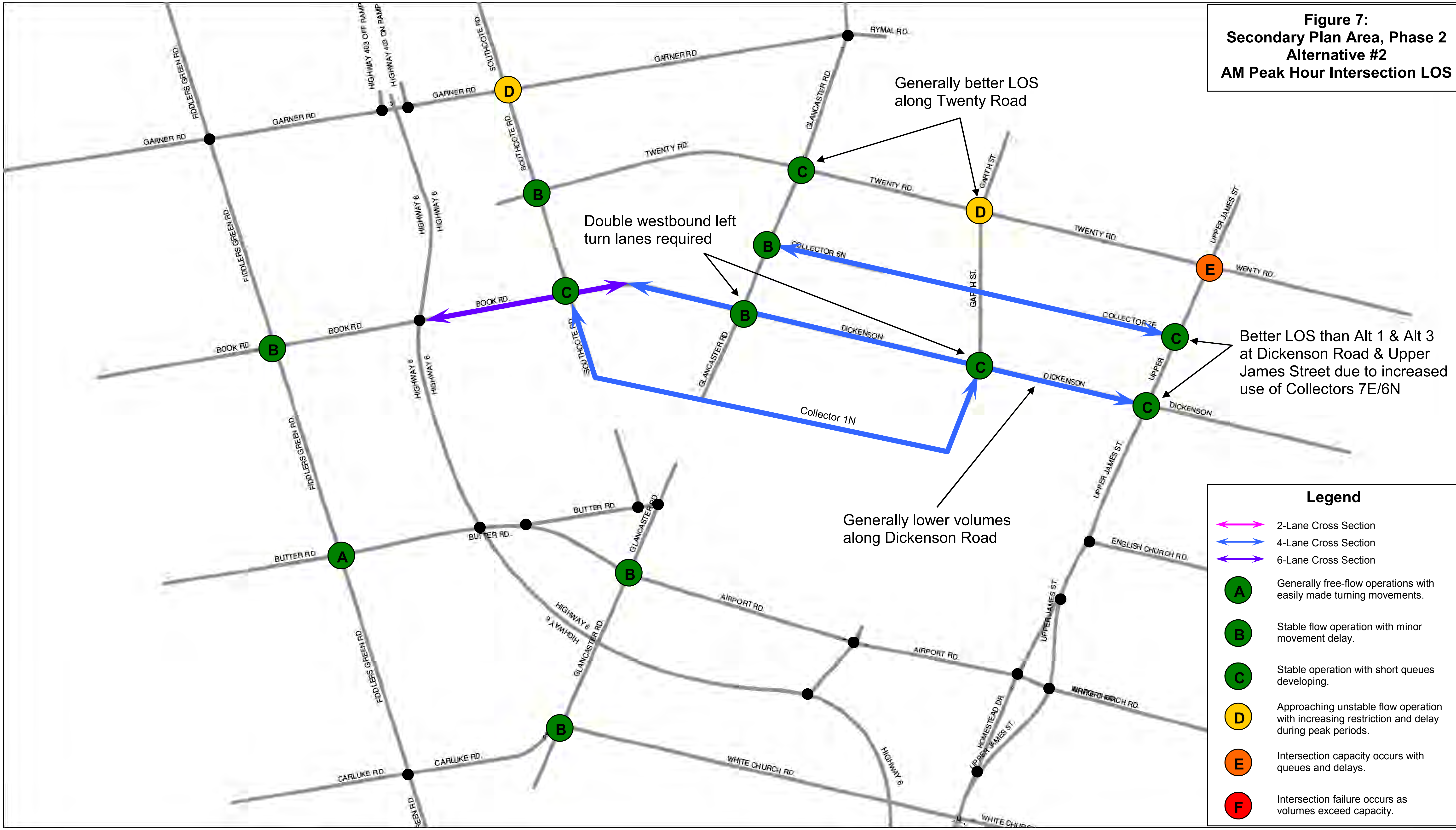
Figure 7:
Secondary Plan Area, Phase 2
Alternative #2
AM Peak Hour Intersection LOS
Generally better LOS along Twenty Road
Double westbound left turn lanes required
Better LOS than Alt 1 & Alt 3 at Dickenson Road & Upper James Street due to increased use of Collectors 7E/6N
Generally lower volumes along Dickenson Road
Collector 1N
Legend
2-Lane Cross Section
4-Lane Cross Section
6-Lane Cross Section
A Generally free-flow operations with easily made turning movements.
B Stable flow operation with minor movement delay.
C Stable operation with short queues developing.
D Approaching unstable flow operation with increasing restriction and delay during peak periods.
E Intersection capacity occurs with queues and delays.
F Intersection failure occurs as volumes exceed capacity.

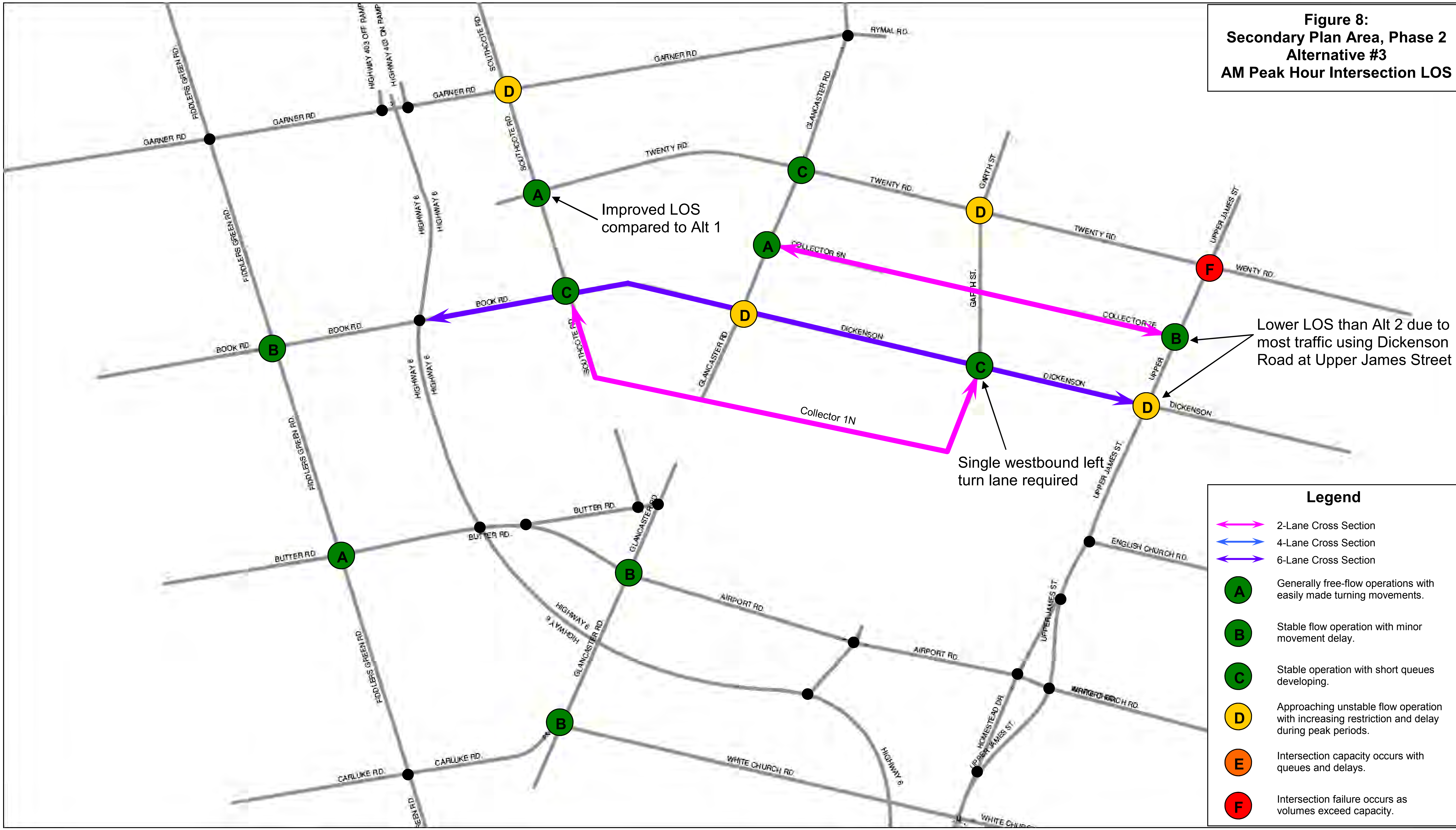
Figure 8:
Secondary Plan Area, Phase 2
Alternative #3
AM Peak Hour Intersection LOS
Improved LOS compared to Alt 1
Lower LOS than Alt 2 due to most traffic using Dickenson Road at Upper James Street
Single westbound left turn lane required
Collector 1N
Legend
2-Lane Cross Section
4-Lane Cross Section
6-Lane Cross Section
A Generally free-flow operations with easily made turning movements.
B Stable flow operation with minor movement delay.
C Stable operation with short queues developing.
D Approaching unstable flow operation with increasing restriction and delay during peak periods.
E Intersection capacity occurs with queues and delays.
F Intersection failure occurs as volumes exceed capacity.

APPENDIX B

SYNCHRO ANALYSIS OUTPUTS

APPENDIX B: SYNCHRO ANALYSIS OUTPUTS

Section 1	Level of Service (LOS) Definitions
Section 2	Secondary Plan Area, Phase 2 (2031 Horizon) Alternative #1 AM
Section 3	Secondary Plan Area, Phase 2 (2031 Horizon) Alternative #2 AM
Section 4	Secondary Plan Area, Phase 2 (2031 Horizon) Alternative #3 AM
Section 5	Secondary + Additional Plan Area (Beyond 2031) Alternative #1 AM
Section 6	Secondary + Additional Plan Area (Beyond 2031) Alternative #2 AM
Section 7	Secondary + Additional Plan Area (Beyond 2031) Alternative #3 AM
Section 8	Secondary + Additional Plan Area (Beyond 2031) Alternative #2 PM (Original Run)

<u>Note:</u>

Original Run – September 2009
Final Run – April 2010
Final Run with Council Directed Lands – February 2011

Section 1:
Level of Service (LOS) Definitions

LEVEL OF SERVICE[1]

Level of Service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. This concept was introduced in the 1965 *Highway Capacity Manual* as a criteria for interrupted flow conditions. The 2000 *Highway Capacity Manual* changed the basis for measuring Level of Service at intersections to control delay[2].

Six Levels of Service are defined with LOS A representing the best operating conditions, and LOS F the worst (briefly described below). It should be noted that there is often significant variability in the amount of delay experienced by individual drivers.

LOS A: This Level of Service describes the highest quality of traffic flow and is referred to as free flow. The approach appears open, turning movements are easily made and drivers have freedom of operation. Control delay is less than 10 seconds/vehicle.

LOS B: This Level of Service is referred to as a stable flow. Drivers feel somewhat restricted and occasionally may have to wait to complete the minor movement. Control delay is 10-15 seconds/vehicle for unsignalized intersections and 10-20 seconds/vehicle for signalized intersections.

LOS C: At this level, the operation is stable. Drivers feel more restricted and may have to wait, with queues developing for short periods. Control delay is 15-25 seconds/vehicle at unsignalized intersections and 20-35 seconds/vehicle at signalized intersections.

LOS D: At this level, traffic is approaching unstable flow. The motorist experiences increasing restriction and instability of flow. There are substantial delays to approaching vehicles during short peaks within the peak period, but there are enough gaps to lower demand to permit occasional clearance of developing queues and prevent excessive back-ups. Control delay is 25-35 seconds/vehicle at unsignalized intersections and 35-55 seconds/vehicle at signalized intersections.

LOS E: At this level capacity occurs. Long queues of vehicles exist and delays to vehicles may extend. Control delay is 35-50 seconds/vehicle at unsignalized intersections and 55-80 seconds/vehicle at signalized intersections.

LOS F: At this Level of Service, the intersection has failed. Capacity of the intersection has been exceeded. Control delay exceeds 50 seconds/vehicle at unsignalized intersections and exceeds 80 seconds/vehicle at signalized intersections.

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[1] *Transportation Research Board: Highway Capacity Manual 1965, 2000*

[2] *Control delay is defined as the component of delay that results when a control signal causes a lane group to reduce speed or to stop; it is measured by comparison with the uncontrolled condition.*

Section 2:
Secondary Plan Area (2031 Horizon), Phase 2
Alternative #1 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	1127	3005	1008	1127	2775		1127	3005	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1127	3005	1008	1127	3005	1008	1127	2775		1127	3005	
Volume (vph)	7	618	326	256	497	152	146	108	113	254	360	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	7	651	343	269	523	160	154	114	119	267	379	0
RTOR Reduction (vph)	0	0	261	0	0	91	0	100	0	0	0	0
Lane Group Flow (vph)	7	651	82	269	523	69	154	133	0	267	379	0
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	0.8	20.2	20.2	19.0	38.4	38.4	16.0	13.0		21.0	18.0	
Effective Green, g (s)	0.8	22.2	22.2	19.0	40.4	40.4	16.0	15.0		21.0	20.0	
Actuated g/C Ratio	0.01	0.24	0.24	0.20	0.43	0.43	0.17	0.16		0.23	0.21	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	10	716	240	230	1303	437	193	447		254	645	
v/s Ratio Prot	0.01	c0.22		c0.24	0.17		c0.14	0.05		c0.24	0.13	
v/s Ratio Perm			0.08			0.07						
v/c Ratio	0.70	0.91	0.34	1.17	0.40	0.16	0.80	0.30		1.05	0.59	
Uniform Delay, d1	46.1	34.5	29.4	37.1	18.1	16.1	37.0	34.5		36.1	32.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	117.6	15.4	0.8	112.8	0.2	0.2	20.1	1.7		70.5	3.9	
Delay (s)	163.7	49.9	30.3	149.9	18.3	16.2	57.1	36.2		106.6	36.8	
Level of Service	F	D	C	F	B	B	E	D		F	D	
Approach Delay (s)		44.0			55.1			44.5			65.7	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM Average Control Delay	52.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	0.93		1.00	0.96		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1572	1569		1572	1543		1572	3007		1572	3026	
Flt Permitted	0.56	1.00		0.59	1.00		0.39	1.00		0.34	1.00	
Satd. Flow (perm)	934	1569		975	1543		648	3007		559	3026	
Volume (vph)	20	20	10	186	170	138	81	253	103	334	487	162
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	21	11	196	179	145	85	266	108	352	513	171
RTOR Reduction (vph)	0	9	0	0	39	0	0	58	0	0	43	0
Lane Group Flow (vph)	21	23	0	196	285	0	85	316	0	352	641	0
Turn Type	Perm			pm+pt			Perm			pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.0	16.0		36.0	36.0		16.0	16.0		31.0	31.0	
Effective Green, g (s)	16.0	16.0		36.0	36.0		16.0	16.0		31.0	31.0	
Actuated g/C Ratio	0.21	0.21		0.48	0.48		0.21	0.21		0.41	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	199	335		595	741		138	641		380	1251	
v/s Ratio Prot		0.01		0.07	c0.18			0.11		c0.14	0.21	
v/s Ratio Perm	0.02			0.09			0.13			c0.25		
v/c Ratio	0.11	0.07		0.33	0.38		0.62	0.49		0.93	0.51	
Uniform Delay, d1	23.7	23.6		11.7	12.4		26.7	25.9		18.3	16.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	0.4		1.5	1.5		18.9	2.7		30.8	1.5	
Delay (s)	24.8	24.0		13.2	13.9		45.6	28.6		49.1	17.9	
Level of Service	C	C		B	B		D	C		D	B	
Approach Delay (s)		24.3			13.7			31.8			28.5	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	25.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98		1.00	0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1572	3095		2186	3121		1572	2913		1127	3005	1406
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1572	3095		2186	3121		1572	2913		1127	3005	1406
Volume (vph)	35	231	27	395	776	39	24	415	107	25	908	184
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	243	28	416	817	41	25	437	113	26	956	194
RTOR Reduction (vph)	0	11	0	0	4	0	0	27	0	0	0	126
Lane Group Flow (vph)	37	260	0	416	854	0	25	523	0	26	956	68
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	2.2	13.4		16.0	27.2		1.4	24.2		2.7	25.5	25.5
Effective Green, g (s)	2.2	13.4		16.0	27.2		1.4	24.2		2.7	25.5	25.5
Actuated g/C Ratio	0.03	0.19		0.22	0.38		0.02	0.33		0.04	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	48	574		484	1174		30	975		42	1060	496
v/s Ratio Prot	0.02	0.08		c0.19	c0.27		0.02	0.18		c0.02	c0.32	
v/s Ratio Perm												0.05
v/c Ratio	0.77	0.45		0.86	0.73		0.83	0.54		0.62	0.90	0.14
Uniform Delay, d1	34.8	26.2		27.1	19.4		35.3	19.5		34.3	22.2	15.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	53.1	0.6		14.1	2.3		95.9	0.6		24.2	10.6	0.1
Delay (s)	87.9	26.8		41.2	21.6		131.2	20.1		58.5	32.8	16.0
Level of Service	F	C		D	C		F	C		E	C	B
Approach Delay (s)		34.1			28.0			24.9			30.6	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	29.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	72.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3002		1572	3144	1406	1127	3144	1008
Flt Permitted	0.95	1.00	1.00	0.58	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1406	968	3002		1572	3144	1406	1127	3144	1008
Volume (vph)	99	257	42	134	1022	8	60	415	56	36	1034	399
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	271	44	141	1076	8	63	437	59	38	1088	420
RTOR Reduction (vph)	0	0	27	0	1	0	0	0	39	0	0	99
Lane Group Flow (vph)	104	271	17	141	1083	0	63	437	20	38	1088	321
Confl. Peds. (#/hr)										1		
Turn Type	Prot		Perm	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2	6					8			4
Actuated Green, G (s)	10.0	41.6	41.6	43.6	37.6		5.0	37.4	37.4	6.9	39.3	39.3
Effective Green, g (s)	10.0	44.0	44.0	46.0	40.0		5.0	37.4	37.4	9.2	41.6	41.6
Actuated g/C Ratio	0.09	0.39	0.39	0.41	0.36		0.04	0.33	0.33	0.08	0.37	0.37
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	100	1174	549	428	1066		70	1044	467	92	1162	372
v/s Ratio Prot	c0.09	c0.09		0.02	c0.36		c0.04	0.14		0.03	c0.35	
v/s Ratio Perm			0.01	0.12					0.01			0.32
v/c Ratio	1.04	0.23	0.03	0.33	1.02		0.90	0.42	0.04	0.41	0.94	0.86
Uniform Delay, d1	51.3	23.0	21.2	21.6	36.3		53.6	29.2	25.5	49.1	34.2	32.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	101.2	0.5	0.1	0.5	31.7		73.7	0.3	0.0	3.0	13.7	18.2
Delay (s)	152.5	23.4	21.3	22.1	68.0		127.3	29.4	25.5	52.1	47.9	51.1
Level of Service	F	C	C	C	E		F	C	C	D	D	D
Approach Delay (s)		55.2			62.7			40.0			48.9	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	112.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	1.00	0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005		1127	3005	1008		3005	1008	2186	3003	
Flt Permitted	0.71	1.00		0.48	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)	840	3005		564	3005	1008		3005	1008	2186	3003	
Volume (vph)	10	190	0	2	67	89	0	85	17	117	195	1
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	200	0	2	71	94	0	89	18	123	205	1
RTOR Reduction (vph)	0	0	0	0	0	63	0	0	12	0	0	0
Lane Group Flow (vph)	11	200	0	2	71	31	0	89	6	123	206	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	11.3	11.3		16.0	16.0	16.0		17.4	17.4	4.5	25.9	
Effective Green, g (s)	12.6	12.6		17.3	17.3	17.3		19.0	19.0	4.5	27.5	
Actuated g/C Ratio	0.24	0.24		0.33	0.33	0.33		0.36	0.36	0.09	0.52	
Clearance Time (s)	5.3	5.3		4.0	5.3	5.3		5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	200	717		192	985	330		1081	363	186	1564	
v/s Ratio Prot		c0.07		0.00	0.02			0.03		c0.06	c0.07	
v/s Ratio Perm	0.01			0.00		c0.03			0.01			
v/c Ratio	0.06	0.28		0.01	0.07	0.09		0.08	0.02	0.66	0.13	
Uniform Delay, d1	15.5	16.4		12.1	12.2	12.3		11.1	10.9	23.4	6.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.2		0.0	0.0	0.1		0.1	0.1	8.5	0.2	
Delay (s)	15.6	16.6		12.1	12.3	12.4		11.3	11.0	31.9	6.7	
Level of Service	B	B		B	B	B		B	B	C	A	
Approach Delay (s)		16.6			12.4			11.2			16.1	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	52.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1127	4517	1008	1572	4517	1406	1127	2945		1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.37	1.00		0.65	1.00	1.00
Satd. Flow (perm)	1127	4517	1008	1572	4517	1406	438	2945		1081	3005	1008
Volume (vph)	345	670	82	46	348	96	36	128	20	61	292	133
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	363	705	86	48	366	101	38	135	21	64	307	140
RTOR Reduction (vph)	0	0	42	0	0	81	0	15	0	0	0	115
Lane Group Flow (vph)	363	705	44	48	366	20	38	141	0	64	307	25
Turn Type	Prot		Perm	Prot		Perm	pm+pt			Perm		Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2			6		6
Actuated Green, G (s)	24.4	34.4	34.4	3.0	13.0	13.0	17.8	17.8		11.8	11.8	11.8
Effective Green, g (s)	24.4	34.4	34.4	3.0	13.0	13.0	17.8	17.8		11.8	11.8	11.8
Actuated g/C Ratio	0.36	0.51	0.51	0.04	0.19	0.19	0.26	0.26		0.18	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	409	2312	516	70	874	272	137	780		190	528	177
v/s Ratio Prot	c0.32	0.16		0.03	c0.08		c0.01	0.05			c0.10	
v/s Ratio Perm			0.04			0.01	0.07			0.06		0.02
v/c Ratio	0.89	0.30	0.09	0.69	0.42	0.07	0.28	0.18		0.34	0.58	0.14
Uniform Delay, d1	20.1	9.5	8.4	31.6	23.8	22.2	19.0	19.1		24.3	25.4	23.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	20.1	0.1	0.1	24.3	0.3	0.1	1.1	0.1		1.1	1.6	0.4
Delay (s)	40.2	9.6	8.4	56.0	24.1	22.3	20.1	19.2		25.3	27.1	23.8
Level of Service	D	A	A	E	C	C	C	B		C	C	C
Approach Delay (s)		19.1			26.7			19.4			25.9	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	67.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	47	435	173	428	522	91	80	409	207	36	865	82
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	49	458	182	451	549	96	84	431	218	38	911	86
RTOR Reduction (vph)	0	0	156	0	0	65	0	0	122	0	0	50
Lane Group Flow (vph)	49	458	26	451	549	31	84	431	96	38	911	36
Confl. Peds. (#/hr)				1								
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.9	17.0	17.0	28.1	38.2	38.2	8.7	53.0	53.0	5.9	50.2	50.2
Effective Green, g (s)	6.9	17.0	17.0	28.1	38.2	38.2	8.7	53.0	53.0	5.9	50.2	50.2
Actuated g/C Ratio	0.06	0.14	0.14	0.23	0.32	0.32	0.07	0.44	0.44	0.05	0.42	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	90	640	199	512	1438	321	114	1327	445	55	1257	588
v/s Ratio Prot	0.03	c0.10		c0.21	0.12		c0.05	c0.14		0.03	c0.30	
v/s Ratio Perm			0.02			0.03			0.10			0.03
v/c Ratio	0.54	0.72	0.13	0.88	0.38	0.10	0.74	0.32	0.22	0.69	0.72	0.06
Uniform Delay, d1	55.0	49.2	45.0	44.3	31.7	28.8	54.5	21.8	20.7	56.2	29.1	20.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.95	1.03
Incremental Delay, d2	6.6	3.8	0.3	16.1	0.2	0.1	21.7	0.7	1.1	29.3	3.4	0.2
Delay (s)	61.6	53.0	45.3	60.5	31.9	28.9	76.3	22.5	21.8	82.9	31.0	21.6
Level of Service	E	D	D	E	C	C	E	C	C	F	C	C
Approach Delay (s)		51.6			43.4			28.4			32.1	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	38.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	57	556	84	225	1218	250	41	361	110	124	737	37
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	585	88	237	1282	263	43	380	116	131	776	39
RTOR Reduction (vph)	0	0	68	0	0	173	0	0	88	0	0	27
Lane Group Flow (vph)	60	585	20	237	1282	90	43	380	28	131	776	12
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	16.0	16.0	13.0	24.0	24.0	4.0	17.0	17.0	8.0	21.0	21.0
Effective Green, g (s)	5.0	16.0	16.0	13.0	24.0	24.0	4.0	17.0	17.0	8.0	21.0	21.0
Actuated g/C Ratio	0.07	0.23	0.23	0.19	0.34	0.34	0.06	0.24	0.24	0.11	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	112	1032	321	292	1549	482	90	764	341	180	943	422
v/s Ratio Prot	0.04	0.13		c0.15	c0.28		0.03	0.12		c0.08	c0.25	
v/s Ratio Perm			0.01			0.06			0.02			0.01
v/c Ratio	0.54	0.57	0.06	0.81	0.83	0.19	0.48	0.50	0.08	0.73	0.82	0.03
Uniform Delay, d1	31.4	23.9	21.1	27.3	21.1	16.2	32.0	22.8	20.5	29.9	22.8	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.1	2.3	0.4	21.2	5.2	0.9	17.1	2.3	0.5	22.6	8.1	0.1
Delay (s)	48.5	26.2	21.5	48.6	26.3	17.0	49.0	25.1	20.9	52.5	30.8	17.4
Level of Service	D	C	C	D	C	B	D	C	C	D	C	B
Approach Delay (s)		27.5			27.9			26.1			33.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.91		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2748		1127	3005	1008	1127	3005	1008	2186	3005	
Flt Permitted		1.00		0.70	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2748		833	3005	1008	1127	3005	1008	2186	3005	
Volume (vph)	0	26	34	23	30	39	6	63	62	34	163	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	27	36	24	32	41	6	66	65	36	172	0
RTOR Reduction (vph)	0	35	0	0	0	36	0	0	23	0	0	0
Lane Group Flow (vph)	0	28	0	24	32	5	6	66	42	36	172	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		1.7		6.9	6.9	6.9	1.2	36.0	36.0	1.2	36.0	
Effective Green, g (s)		1.7		6.9	6.9	6.9	1.2	36.0	36.0	1.2	36.0	
Actuated g/C Ratio		0.03		0.12	0.12	0.12	0.02	0.64	0.64	0.02	0.64	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		83		109	370	124	24	1928	647	47	1928	
v/s Ratio Prot		0.01		c0.00	0.01		0.01	0.02		c0.02	c0.06	
v/s Ratio Perm				c0.02		0.01			0.04			
v/c Ratio		0.34		0.22	0.09	0.04	0.25	0.03	0.06	0.77	0.09	
Uniform Delay, d1		26.6		22.2	21.8	21.7	27.0	3.7	3.8	27.3	3.8	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.4		1.0	0.1	0.1	5.4	0.0	0.0	52.3	0.0	
Delay (s)		29.1		23.2	21.9	21.8	32.4	3.7	3.8	79.6	3.8	
Level of Service		C		C	C	C	C	A	A	E	A	
Approach Delay (s)		29.1			22.2			5.0			16.9	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	56.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0			
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00		1.00			
Frpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00			
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00			
Frt		1.00	0.85	1.00	1.00		1.00		0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00			
Satd. Flow (prot)		3005	1008	1127	3005		1127		1008			
Flt Permitted		1.00	1.00	0.95	1.00		0.54		1.00			
Satd. Flow (perm)		3005	1008	1127	3005		638		1008			
Volume (vph)	0	95	232	200	107	0	44	0	212	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	100	244	211	113	0	46	0	223	0	0	0
RTOR Reduction (vph)	0	0	206	0	0	0	0	0	152	0	0	0
Lane Group Flow (vph)	0	100	38	211	113	0	46	0	71	0	0	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	Perm		
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)		7.5	7.5	13.0	24.5		15.2		15.2			
Effective Green, g (s)		7.5	7.5	13.0	24.5		15.2		15.2			
Actuated g/C Ratio		0.16	0.16	0.27	0.51		0.32		0.32			
Clearance Time (s)		4.0	4.0	4.0	4.0		4.0		4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0			
Lane Grp Cap (vph)		472	158	307	1543		218		321			
v/s Ratio Prot		0.03		c0.19	0.04		0.01					
v/s Ratio Perm			c0.04				0.06		c0.07			
v/c Ratio		0.21	0.24	0.69	0.07		0.21		0.22			
Uniform Delay, d1		17.5	17.6	15.5	5.9		11.7		11.9			
Progression Factor		1.00	1.00	1.00	1.00		1.00		1.00			
Incremental Delay, d2		0.2	0.8	6.3	0.0		0.5		0.4			
Delay (s)		17.7	18.4	21.8	5.9		12.2		12.3			
Level of Service		B	B	C	A		B		B			
Approach Delay (s)		18.2			16.2			12.3			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	47.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88		0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1127	3005		1127	3005	1775		2950		2186	2866	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00		0.48	1.00	
Satd. Flow (perm)	1127	3005		1127	3005	1775		2950		1096	2866	
Volume (vph)	74	343	0	3	76	54	0	128	18	290	98	44
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	361	0	3	80	57	0	135	19	305	103	46
RTOR Reduction (vph)	0	0	0	0	0	43	0	14	0	0	26	0
Lane Group Flow (vph)	78	361	0	3	80	14	0	140	0	305	123	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	3.4	10.0		0.6	7.2	10.1		10.7		17.6	17.6	
Effective Green, g (s)	3.4	10.0		0.6	7.2	10.1		10.7		17.6	17.6	
Actuated g/C Ratio	0.08	0.25		0.01	0.18	0.25		0.27		0.44	0.44	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	95	748		17	538	623		785		558	1255	
v/s Ratio Prot	c0.07	c0.12		0.00	0.03	0.00		0.05		c0.04	0.04	
v/s Ratio Perm						0.01				c0.20		
v/c Ratio	0.82	0.48		0.18	0.15	0.02		0.18		0.55	0.10	
Uniform Delay, d1	18.1	12.9		19.6	13.9	11.3		11.4		8.2	6.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	41.0	0.5		4.9	0.1	0.0		0.1		1.1	0.0	
Delay (s)	59.1	13.4		24.5	14.0	11.3		11.5		9.3	6.7	
Level of Service	E	B		C	B	B		B		A	A	
Approach Delay (s)		21.5			13.2			11.5			8.5	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	40.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.89		1.00	0.85	1.00	1.00
Flt Protected	0.99		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1045		3005	1008	1127	3005
Flt Permitted	0.99		1.00	1.00	0.44	1.00
Satd. Flow (perm)	1045		3005	1008	520	3005
Volume (vph)	13	62	482	55	257	1050
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	65	507	58	271	1105
RTOR Reduction (vph)	61	0	0	15	0	0
Lane Group Flow (vph)	18	0	507	43	271	1105
Turn Type				Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases				2	6	
Actuated Green, G (s)	7.3		89.1	89.1	104.7	104.7
Effective Green, g (s)	7.3		89.1	89.1	104.7	104.7
Actuated g/C Ratio	0.06		0.74	0.74	0.87	0.87
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	64		2231	748	512	2622
v/s Ratio Prot	c0.02		0.17		c0.05	0.37
v/s Ratio Perm				0.04	c0.41	
v/c Ratio	0.28		0.23	0.06	0.53	0.42
Uniform Delay, d1	53.8		4.8	4.2	1.5	1.5
Progression Factor	1.00		0.22	0.01	1.00	1.00
Incremental Delay, d2	2.4		0.2	0.1	1.0	0.5
Delay (s)	56.2		1.3	0.2	2.5	2.0
Level of Service	E		A	A	A	A
Approach Delay (s)	56.2		1.2			2.1
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	2186	4235		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	2186	4235		2186	4318	1008	1127	4318	1775
Volume (vph)	211	242	295	96	705	104	701	832	58	21	815	645
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	222	255	311	101	742	109	738	876	61	22	858	679
RTOR Reduction (vph)	0	0	243	0	16	0	0	0	28	0	0	44
Lane Group Flow (vph)	222	255	68	101	835	0	738	876	33	22	858	635
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	12.0	26.1	26.1	7.9	22.0		40.0	65.2	65.2	4.8	30.0	42.0
Effective Green, g (s)	12.0	26.1	26.1	7.9	22.0		40.0	65.2	65.2	4.8	30.0	42.0
Actuated g/C Ratio	0.10	0.22	0.22	0.07	0.18		0.33	0.54	0.54	0.04	0.25	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	219	654	219	144	776		729	2346	548	45	1080	621
v/s Ratio Prot	0.10	0.08		0.05	c0.20		c0.34	0.20		0.02	0.20	c0.36
v/s Ratio Perm			0.07						0.03			
v/c Ratio	1.01	0.39	0.31	0.70	1.08		1.01	0.37	0.06	0.49	0.79	1.02
Uniform Delay, d1	54.0	40.1	39.4	54.9	49.0		40.0	15.7	12.9	56.4	42.1	39.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.21	0.34	0.76
Incremental Delay, d2	64.4	0.4	0.8	14.3	54.6		36.4	0.5	0.2	5.9	4.4	36.5
Delay (s)	118.4	40.5	40.2	69.2	103.6		76.4	16.2	13.1	74.2	18.9	66.1
Level of Service	F	D	D	E	F		E	B	B	E	B	E
Approach Delay (s)		62.3			99.9			42.6			40.3	
Approach LOS		E			F			D			D	

Intersection Summary			
HCM Average Control Delay	56.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1140	1020	1140	4368	4368	1002
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1140	1020	1140	4368	4368	1002
Volume (vph)	50	39	218	928	1443	270
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	41	229	977	1519	284
RTOR Reduction (vph)	0	34	0	0	0	94
Lane Group Flow (vph)	53	7	229	977	1519	190
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	18.4	18.4	27.8	89.6	57.8	76.2
Effective Green, g (s)	20.0	20.0	27.8	92.0	60.2	80.2
Actuated g/C Ratio	0.17	0.17	0.23	0.77	0.50	0.67
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	190	170	264	3349	2191	703
v/s Ratio Prot	0.05		c0.20	0.22	c0.35	c0.04
v/s Ratio Perm		0.01				0.14
v/c Ratio	0.28	0.04	0.87	0.29	0.69	0.27
Uniform Delay, d1	43.7	41.9	44.3	4.2	22.8	8.1
Progression Factor	1.00	1.00	1.16	0.67	0.19	0.60
Incremental Delay, d2	3.6	0.4	21.5	0.2	0.2	0.1
Delay (s)	47.3	42.4	73.1	3.0	4.5	4.9
Level of Service	D	D	E	A	A	A
Approach Delay (s)	45.2			16.3	4.6	
Approach LOS	D			B	A	

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1127	2830		1127	3005		1127	4263			4318	998
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)	1127	2830		1127	3005		1127	4263			4318	998
Volume (vph)	110	144	81	172	505	0	291	633	54	0	1460	567
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	116	152	85	181	532	0	306	666	57	0	1537	597
RTOR Reduction (vph)	0	66	0	0	0	0	0	7	0	0	0	58
Lane Group Flow (vph)	116	171	0	181	532	0	306	716	0	0	1537	539
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases												6
Actuated Green, G (s)	13.0	24.2		14.0	25.2		26.8	64.9			34.1	47.1
Effective Green, g (s)	13.0	27.0		14.0	28.0		26.8	67.0			36.2	49.2
Actuated g/C Ratio	0.11	0.22		0.12	0.23		0.22	0.56			0.30	0.41
Clearance Time (s)	4.0	6.8		4.0	6.8		4.0	6.1			6.1	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	122	637		131	701		252	2380			1303	442
v/s Ratio Prot	0.10	0.06		c0.16	c0.18		c0.27	0.17			0.36	c0.13
v/s Ratio Perm												0.41
v/c Ratio	0.95	0.27		1.38	0.76		1.21	0.30			1.18	1.22
Uniform Delay, d1	53.2	38.4		53.0	42.9		46.6	14.1			41.9	35.4
Progression Factor	1.00	1.00		1.00	1.00		0.84	0.87			1.00	1.00
Incremental Delay, d2	65.9	0.2		212.0	4.7		126.4	0.3			89.0	117.9
Delay (s)	119.1	38.6		265.0	47.6		165.5	12.5			130.9	153.3
Level of Service	F	D		F	D		F	B			F	F
Approach Delay (s)		65.1			102.8			58.0			137.2	
Approach LOS		E			F			E			F	

Intersection Summary			
HCM Average Control Delay	106.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Section 3:
Secondary Plan Area (2031 Horizon), Phase 2
Alternative #2 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	2186	3005	1008	1127	3005	1008	1127	3005	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1127	3005	1008	2186	3005	1008	1127	3005	1008	1127	3005	
Volume (vph)	7	644	339	327	502	157	149	110	126	279	372	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	7	678	357	344	528	165	157	116	133	294	392	0
RTOR Reduction (vph)	0	0	264	0	0	97	0	0	113	0	0	0
Lane Group Flow (vph)	7	678	93	344	528	68	157	116	20	294	392	0
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	0.8	22.2	22.2	15.0	36.4	36.4	17.0	12.0	12.0	24.0	19.0	
Effective Green, g (s)	0.8	24.2	24.2	15.0	38.4	38.4	17.0	14.0	14.0	24.0	21.0	
Actuated g/C Ratio	0.01	0.26	0.26	0.16	0.41	0.41	0.18	0.15	0.15	0.26	0.23	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	10	780	262	352	1238	415	206	451	151	290	677	
v/s Ratio Prot	0.01	c0.23		c0.16	0.18		c0.14	0.04		c0.26	0.13	
v/s Ratio Perm			0.09			0.07			0.02			
v/c Ratio	0.70	0.87	0.35	0.98	0.43	0.16	0.76	0.26	0.13	1.01	0.58	
Uniform Delay, d1	46.1	33.0	28.1	38.9	19.5	17.3	36.2	35.0	34.3	34.6	32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	117.6	10.2	0.8	41.4	0.2	0.2	15.3	1.4	1.8	56.4	3.6	
Delay (s)	163.7	43.1	29.0	80.4	19.8	17.5	51.5	36.4	36.1	91.0	35.8	
Level of Service	F	D	C	F	B	B	D	D	D	F	D	
Approach Delay (s)		39.1			39.5			42.1			59.4	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM Average Control Delay	44.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor				1.00		1.00		0.95	1.00	1.00	0.95	
Frt				1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected				0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1572		1406		3144	1406	1572	3144	
Flt Permitted				0.95		1.00		1.00	1.00	0.52	1.00	
Satd. Flow (perm)				1572		1406		3144	1406	868	3144	
Volume (vph)	0	0	0	223	0	266	0	365	112	344	742	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	235	0	280	0	384	118	362	781	0
RTOR Reduction (vph)	0	0	0	0	0	205	0	0	47	0	0	0
Lane Group Flow (vph)	0	0	0	235	0	75	0	384	71	362	781	0
Turn Type				Prot		custom			Perm	Perm		
Protected Phases				8				2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)				16.0		16.0		36.0	36.0	36.0	36.0	
Effective Green, g (s)				16.0		16.0		36.0	36.0	36.0	36.0	
Actuated g/C Ratio				0.27		0.27		0.60	0.60	0.60	0.60	
Clearance Time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)				419		375		1886	844	521	1886	
v/s Ratio Prot				c0.15				0.12			0.25	
v/s Ratio Perm						0.05			0.05	c0.42		
v/c Ratio				0.56		0.20		0.20	0.08	0.69	0.41	
Uniform Delay, d1				19.0		17.0		5.5	5.1	8.2	6.4	
Progression Factor				1.00		1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2				5.3		1.2		0.2	0.2	7.5	0.7	
Delay (s)				24.3		18.2		5.7	5.2	15.7	7.1	
Level of Service				C		B		A	A	B	A	
Approach Delay (s)		0.0			21.0			5.6			9.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	2186	3144	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	3144	1406	2186	3144	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	35	238	27	403	810	39	24	433	109	25	1003	184
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	251	28	424	853	41	25	456	115	26	1056	194
RTOR Reduction (vph)	0	0	22	0	0	26	0	0	76	0	0	125
Lane Group Flow (vph)	37	251	6	424	853	15	25	456	39	26	1056	69
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	2.4	14.6	14.6	13.0	25.2	25.2	1.6	23.6	23.6	2.8	24.8	24.8
Effective Green, g (s)	2.4	14.6	14.6	13.0	25.2	25.2	1.6	23.6	23.6	2.8	24.8	24.8
Actuated g/C Ratio	0.03	0.21	0.21	0.19	0.36	0.36	0.02	0.34	0.34	0.04	0.35	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	54	656	293	406	1132	363	36	1013	340	45	1065	498
v/s Ratio Prot	0.02	0.08		c0.19	c0.27		0.02	0.15		c0.02	c0.35	
v/s Ratio Perm			0.00			0.01			0.04			0.05
v/c Ratio	0.69	0.38	0.02	1.04	0.75	0.04	0.69	0.45	0.11	0.58	0.99	0.14
Uniform Delay, d1	33.4	23.8	22.0	28.5	19.7	14.5	34.0	18.1	16.0	33.0	22.5	15.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.54	0.15	0.01	1.00	1.00	1.00
Incremental Delay, d2	30.4	0.4	0.0	56.7	2.9	0.0	41.7	1.3	0.6	16.7	25.6	0.6
Delay (s)	63.8	24.2	22.0	85.2	22.6	14.6	94.1	4.1	0.7	49.7	48.1	15.9
Level of Service	E	C	C	F	C	B	F	A	A	D	D	B
Approach Delay (s)		28.6			42.5			7.2			43.3	
Approach LOS		C			D			A			D	

Intersection Summary			
HCM Average Control Delay	35.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3005	1008	1572	3144	1406	1127	3144	1008
Flt Permitted	0.13	1.00	1.00	0.50	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	157	3005	1406	835	3005	1008	1572	3144	1406	1127	3144	1008
Volume (vph)	102	261	42	134	1044	8	60	415	56	36	1034	419
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	107	275	44	141	1099	8	63	437	59	38	1088	441
RTOR Reduction (vph)	0	0	30	0	0	5	0	0	40	0	0	90
Lane Group Flow (vph)	107	275	14	141	1099	3	63	437	19	38	1088	351
Confl. Peds. (#/hr)										1		
Turn Type	pm+pt		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	31.8	27.8	27.8	37.8	30.8	30.8	4.0	30.6	30.6	6.5	33.1	33.1
Effective Green, g (s)	34.2	30.2	30.2	40.2	33.2	33.2	4.0	30.6	30.6	8.8	35.4	35.4
Actuated g/C Ratio	0.37	0.33	0.33	0.43	0.36	0.36	0.04	0.33	0.33	0.10	0.38	0.38
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4	6.4	4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	100	980	459	418	1077	361	68	1039	465	107	1202	385
v/s Ratio Prot	c0.05	0.09		c0.03	c0.37		c0.04	0.14		0.03	0.35	
v/s Ratio Perm	0.35		0.01	0.12		0.00			0.01			c0.35
v/c Ratio	1.07	0.28	0.03	0.34	1.02	0.01	0.93	0.42	0.04	0.36	0.91	0.91
Uniform Delay, d1	28.3	23.1	21.2	16.4	29.7	19.1	44.2	24.1	21.0	39.2	27.0	27.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	110.2	0.7	0.1	0.5	32.7	0.0	82.9	0.3	0.0	2.0	9.8	25.2
Delay (s)	138.5	23.9	21.4	16.9	62.4	19.1	127.1	24.4	21.1	41.3	36.8	52.3
Level of Service	F	C	C	B	E	B	F	C	C	D	D	D
Approach Delay (s)		52.4			57.0			35.6			41.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	46.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	92.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	1.00	0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005		1127	3005	1008		3005	1008	2186	3003	
Flt Permitted	0.71	1.00		0.47	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)	839	3005		555	3005	1008		3005	1008	2186	3003	
Volume (vph)	10	203	0	2	69	90	0	85	17	120	195	1
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	214	0	2	73	95	0	89	18	126	205	1
RTOR Reduction (vph)	0	0	0	0	0	64	0	0	12	0	0	0
Lane Group Flow (vph)	11	214	0	2	73	31	0	89	6	126	206	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	11.2	11.2		15.9	15.9	15.9		15.2	15.2	6.0	25.2	
Effective Green, g (s)	12.5	12.5		17.2	17.2	17.2		16.8	16.8	6.0	26.8	
Actuated g/C Ratio	0.24	0.24		0.33	0.33	0.33		0.32	0.32	0.12	0.52	
Clearance Time (s)	5.3	5.3		4.0	5.3	5.3		5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	202	722		191	994	333		971	326	252	1548	
v/s Ratio Prot		c0.07		0.00	0.02			0.03		c0.06	c0.07	
v/s Ratio Perm	0.01			0.00		c0.03			0.01			
v/c Ratio	0.05	0.30		0.01	0.07	0.09		0.09	0.02	0.50	0.13	
Uniform Delay, d1	15.2	16.2		11.8	11.9	12.0		12.3	12.0	21.6	6.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.2		0.0	0.0	0.1		0.2	0.1	1.6	0.2	
Delay (s)	15.3	16.4		11.8	12.0	12.1		12.5	12.1	23.2	6.7	
Level of Service	B	B		B	B	B		B	B	C	A	
Approach Delay (s)		16.3			12.1			12.4			13.0	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	52.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3144	1008	1572	3144	1406	2186	3005	1406	1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3144	1008	1572	3144	1406	2186	3005	1406	1572	3005	1008
Volume (vph)	345	726	111	63	359	96	41	148	23	61	395	133
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	363	764	117	66	378	101	43	156	24	64	416	140
RTOR Reduction (vph)	0	0	60	0	0	81	0	0	19	0	0	112
Lane Group Flow (vph)	363	764	57	66	378	20	43	156	5	64	416	28
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	25.5	35.3	35.3	4.4	14.2	14.2	2.1	13.7	13.7	3.0	14.6	14.6
Effective Green, g (s)	25.5	35.3	35.3	4.4	14.2	14.2	2.1	13.7	13.7	3.0	14.6	14.6
Actuated g/C Ratio	0.35	0.49	0.49	0.06	0.20	0.20	0.03	0.19	0.19	0.04	0.20	0.20
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	397	1533	491	96	617	276	63	569	266	65	606	203
v/s Ratio Prot	c0.32	0.24		0.04	c0.12		0.02	0.05		c0.04	c0.14	
v/s Ratio Perm			0.06			0.01			0.00			0.03
v/c Ratio	0.91	0.50	0.12	0.69	0.61	0.07	0.68	0.27	0.02	0.98	0.69	0.14
Uniform Delay, d1	22.4	12.6	10.1	33.3	26.6	23.7	34.8	25.1	23.9	34.7	26.8	23.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.1	0.3	0.1	18.5	1.8	0.1	26.3	0.3	0.0	105.6	3.2	0.3
Delay (s)	47.5	12.8	10.2	51.8	28.4	23.8	61.2	25.4	23.9	140.3	30.0	24.1
Level of Service	D	B	B	D	C	C	E	C	C	F	C	C
Approach Delay (s)		22.7			30.4			32.1			40.0	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	72.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	1127	3144	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.26	1.00	1.00	0.34	1.00	1.00	0.12	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)	424	3144	1406	408	3144	1008	192	3005	1008	554	3005	1406
Volume (vph)	47	441	203	44	554	91	86	478	160	36	1182	82
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	49	464	214	46	583	96	91	503	168	38	1244	86
RTOR Reduction (vph)	0	0	161	0	0	75	0	0	85	0	0	46
Lane Group Flow (vph)	49	464	53	46	583	21	91	503	83	38	1244	40
Confl. Peds. (#/hr)				1								
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	18.0	15.6	15.6	18.0	15.6	15.6	38.1	34.4	34.4	33.9	32.3	32.3
Effective Green, g (s)	18.0	15.6	15.6	18.0	15.6	15.6	38.1	34.4	34.4	33.9	32.3	32.3
Actuated g/C Ratio	0.26	0.22	0.22	0.26	0.22	0.22	0.54	0.49	0.49	0.48	0.46	0.46
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	148	701	313	130	701	225	177	1477	495	281	1387	649
v/s Ratio Prot	0.01	0.15		c0.01	c0.19		c0.03	0.17		0.00	c0.41	
v/s Ratio Perm	0.07		0.04	0.08		0.02	0.25		0.08	0.06		0.03
v/c Ratio	0.33	0.66	0.17	0.35	0.83	0.10	0.51	0.34	0.17	0.14	0.90	0.06
Uniform Delay, d1	20.3	24.8	22.0	20.3	25.9	21.6	11.2	10.9	9.9	9.6	17.3	10.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.48	0.64	0.22
Incremental Delay, d2	1.3	2.4	0.3	1.7	8.3	0.2	2.5	0.6	0.7	0.2	7.1	0.1
Delay (s)	21.6	27.2	22.2	22.0	34.3	21.8	13.7	11.5	10.6	4.8	18.3	2.4
Level of Service	C	C	C	C	C	C	B	B	B	A	B	A
Approach Delay (s)		25.3			31.8			11.6			16.9	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	3049	3144	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	3144	1406	3049	3144	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	57	515	84	410	717	50	41	361	110	124	737	37
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	542	88	432	755	53	43	380	116	131	776	39
RTOR Reduction (vph)	0	0	66	0	0	35	0	0	86	0	0	28
Lane Group Flow (vph)	60	542	22	432	755	18	43	380	30	131	776	11
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	16.0	16.0	10.0	22.0	22.0	4.0	17.0	17.0	6.0	19.0	19.0
Effective Green, g (s)	4.0	16.0	16.0	10.0	22.0	22.0	4.0	17.0	17.0	6.0	19.0	19.0
Actuated g/C Ratio	0.06	0.25	0.25	0.15	0.34	0.34	0.06	0.26	0.26	0.09	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	97	774	346	469	1064	476	97	822	368	145	919	411
v/s Ratio Prot	0.04	0.17		c0.14	c0.24		0.03	0.12		c0.08	c0.25	
v/s Ratio Perm			0.02			0.01			0.02			0.01
v/c Ratio	0.62	0.70	0.06	0.92	0.71	0.04	0.44	0.46	0.08	0.90	0.84	0.03
Uniform Delay, d1	29.8	22.3	18.8	27.1	18.7	14.4	29.4	20.2	18.1	29.2	21.6	16.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	26.1	5.2	0.3	25.9	4.0	0.1	14.0	1.9	0.4	52.6	9.4	0.1
Delay (s)	55.9	27.5	19.1	53.0	22.7	14.6	43.4	22.0	18.6	81.8	31.0	16.5
Level of Service	E	C	B	D	C	B	D	C	B	F	C	B
Approach Delay (s)		28.9			32.9			23.0			37.4	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.91		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2748		1127	3005	1008	1127	3005	1008	2186	3005	
Flt Permitted		1.00		0.70	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2748		833	3005	1008	1127	3005	1008	2186	3005	
Volume (vph)	0	26	34	23	30	39	6	63	62	34	163	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	27	36	24	32	41	6	66	65	36	172	0
RTOR Reduction (vph)	0	35	0	0	0	36	0	0	23	0	0	0
Lane Group Flow (vph)	0	28	0	24	32	5	6	66	42	36	172	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		1.7		6.9	6.9	6.9	1.2	36.0	36.0	1.2	36.0	
Effective Green, g (s)		1.7		6.9	6.9	6.9	1.2	36.0	36.0	1.2	36.0	
Actuated g/C Ratio		0.03		0.12	0.12	0.12	0.02	0.64	0.64	0.02	0.64	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		83		109	370	124	24	1928	647	47	1928	
v/s Ratio Prot		0.01		c0.00	0.01		0.01	0.02		c0.02	c0.06	
v/s Ratio Perm				c0.02		0.01			0.04			
v/c Ratio		0.34		0.22	0.09	0.04	0.25	0.03	0.06	0.77	0.09	
Uniform Delay, d1		26.6		22.2	21.8	21.7	27.0	3.7	3.8	27.3	3.8	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.4		1.0	0.1	0.1	5.4	0.0	0.0	52.3	0.0	
Delay (s)		29.1		23.2	21.9	21.8	32.4	3.7	3.8	79.6	3.8	
Level of Service		C		C	C	C	C	A	A	E	A	
Approach Delay (s)		29.1			22.2			5.0			16.9	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	56.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0			
Lane Util. Factor		0.95	1.00	1.00	0.95		0.97		1.00			
Frpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00			
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00			
Frt		1.00	0.85	1.00	1.00		1.00		0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00			
Satd. Flow (prot)		3005	1008	1127	3005		2186		1008			
Flt Permitted		1.00	1.00	0.95	1.00		0.54		1.00			
Satd. Flow (perm)		3005	1008	1127	3005		1238		1008			
Volume (vph)	0	95	232	200	107	0	44	0	212	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	100	244	211	113	0	46	0	223	0	0	0
RTOR Reduction (vph)	0	0	206	0	0	0	0	0	152	0	0	0
Lane Group Flow (vph)	0	100	38	211	113	0	46	0	71	0	0	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	Perm		
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)		7.5	7.5	13.0	24.5		15.2		15.2			
Effective Green, g (s)		7.5	7.5	13.0	24.5		15.2		15.2			
Actuated g/C Ratio		0.16	0.16	0.27	0.51		0.32		0.32			
Clearance Time (s)		4.0	4.0	4.0	4.0		4.0		4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0			
Lane Grp Cap (vph)		472	158	307	1543		422		321			
v/s Ratio Prot		0.03		c0.19	0.04		0.00					
v/s Ratio Perm			c0.04				0.03		c0.07			
v/c Ratio		0.21	0.24	0.69	0.07		0.11		0.22			
Uniform Delay, d1		17.5	17.6	15.5	5.9		11.5		11.9			
Progression Factor		1.00	1.00	1.00	1.00		1.00		1.00			
Incremental Delay, d2		0.2	0.8	6.3	0.0		0.1		0.4			
Delay (s)		17.7	18.4	21.8	5.9		11.6		12.3			
Level of Service		B	B	C	A		B		B			
Approach Delay (s)		18.2			16.2			12.1			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	47.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88		0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1127	3005		1127	3005	1775		2950		2186	2866	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00		0.48	1.00	
Satd. Flow (perm)	1127	3005		1127	3005	1775		2950		1096	2866	
Volume (vph)	74	343	0	3	76	54	0	128	18	290	98	44
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	361	0	3	80	57	0	135	19	305	103	46
RTOR Reduction (vph)	0	0	0	0	0	43	0	14	0	0	26	0
Lane Group Flow (vph)	78	361	0	3	80	14	0	140	0	305	123	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	3.4	10.0		0.6	7.2	10.1		10.7		17.6	17.6	
Effective Green, g (s)	3.4	10.0		0.6	7.2	10.1		10.7		17.6	17.6	
Actuated g/C Ratio	0.08	0.25		0.01	0.18	0.25		0.27		0.44	0.44	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	95	748		17	538	623		785		558	1255	
v/s Ratio Prot	c0.07	c0.12		0.00	0.03	0.00		0.05		c0.04	0.04	
v/s Ratio Perm						0.01				c0.20		
v/c Ratio	0.82	0.48		0.18	0.15	0.02		0.18		0.55	0.10	
Uniform Delay, d1	18.1	12.9		19.6	13.9	11.3		11.4		8.2	6.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	41.0	0.5		4.9	0.1	0.0		0.1		1.1	0.0	
Delay (s)	59.1	13.4		24.5	14.0	11.3		11.5		9.3	6.7	
Level of Service	E	B		C	B	B		B		A	A	
Approach Delay (s)		21.5			13.2			11.5			8.5	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	40.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1127	1008	3005	1008	1127	3005
Flt Permitted	0.95	1.00	1.00	1.00	0.33	1.00
Satd. Flow (perm)	1127	1008	3005	1008	395	3005
Volume (vph)	228	62	501	105	257	1153
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	240	65	527	111	271	1214
RTOR Reduction (vph)	0	48	0	70	0	0
Lane Group Flow (vph)	240	17	527	41	271	1214
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	18.3	18.3	25.8	25.8	43.7	43.7
Effective Green, g (s)	18.3	18.3	25.8	25.8	43.7	43.7
Actuated g/C Ratio	0.26	0.26	0.37	0.37	0.62	0.62
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	295	264	1108	372	392	1876
v/s Ratio Prot	c0.21		0.18		c0.14	0.40
v/s Ratio Perm		0.02		0.04	c0.29	
v/c Ratio	0.81	0.06	0.48	0.11	0.69	0.65
Uniform Delay, d1	24.2	19.4	16.9	14.5	7.4	8.3
Progression Factor	1.00	1.00	0.94	1.69	2.18	0.80
Incremental Delay, d2	15.6	0.1	1.4	0.6	2.3	0.7
Delay (s)	39.9	19.5	17.3	25.2	18.4	7.4
Level of Service	D	B	B	C	B	A
Approach Delay (s)	35.5		18.7			9.4
Approach LOS	D		B			A

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	1127	4240		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	1127	4240		2186	4318	1008	1127	4318	1775
Volume (vph)	161	251	295	96	754	104	436	1097	58	21	815	420
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	169	264	311	101	794	109	459	1155	61	22	858	442
RTOR Reduction (vph)	0	0	240	0	25	0	0	0	35	0	0	42
Lane Group Flow (vph)	169	264	71	101	878	0	459	1155	26	22	858	400
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	6.4	16.0	16.0	7.0	16.6		15.0	29.4	29.4	1.6	16.0	22.4
Effective Green, g (s)	6.4	16.0	16.0	7.0	16.6		15.0	29.4	29.4	1.6	16.0	22.4
Actuated g/C Ratio	0.09	0.23	0.23	0.10	0.24		0.21	0.42	0.42	0.02	0.23	0.32
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	200	687	230	113	1005		468	1814	423	26	987	568
v/s Ratio Prot	c0.08	0.09		0.09	c0.21		c0.21	0.27		0.02	c0.20	0.23
v/s Ratio Perm			0.07						0.03			
v/c Ratio	0.84	0.38	0.31	0.89	0.87		0.98	0.64	0.06	0.85	0.87	0.70
Uniform Delay, d1	31.3	22.8	22.4	31.1	25.7		27.4	16.1	12.1	34.1	26.0	20.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.47	0.16	0.68
Incremental Delay, d2	26.5	0.4	0.8	52.6	8.5		36.4	1.7	0.3	63.2	4.8	1.7
Delay (s)	57.8	23.2	23.2	83.7	34.2		63.8	17.8	12.4	113.2	9.0	15.8
Level of Service	E	C	C	F	C		E	B	B	F	A	B
Approach Delay (s)		31.0			39.2			30.2			13.0	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	2212	1020	2212	4368	4368	1013
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	2212	1020	2212	4368	4368	1013
Volume (vph)	100	39	483	878	1218	495
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	41	508	924	1282	521
RTOR Reduction (vph)	0	30	0	0	0	22
Lane Group Flow (vph)	105	11	508	924	1282	499
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	18.0	18.0	16.0	40.0	20.0	38.0
Effective Green, g (s)	19.6	19.6	16.0	42.4	22.4	42.0
Actuated g/C Ratio	0.28	0.28	0.23	0.61	0.32	0.60
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	619	286	506	2646	1398	666
v/s Ratio Prot	0.05		c0.23	0.21	c0.29	c0.21
v/s Ratio Perm		0.01				0.28
v/c Ratio	0.17	0.04	1.00	0.35	0.92	0.75
Uniform Delay, d1	19.0	18.4	27.0	6.9	22.9	10.2
Progression Factor	1.00	1.00	0.64	0.79	1.00	1.00
Incremental Delay, d2	0.6	0.3	35.9	0.3	11.0	7.5
Delay (s)	19.6	18.6	53.3	5.7	33.9	17.7
Level of Service	B	B	D	A	C	B
Approach Delay (s)	19.4			22.6	29.2	
Approach LOS	B			C	C	

Intersection Summary			
HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	2186	2833		1127	3005		1127	4263			4318	994
Flt Permitted	0.95	1.00		0.60	1.00		0.08	1.00			1.00	1.00
Satd. Flow (perm)	2186	2833		714	3005		96	4263			4318	994
Volume (vph)	110	148	81	172	527	0	291	633	54	0	1460	567
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	116	156	85	181	555	0	306	666	57	0	1537	597
RTOR Reduction (vph)	0	55	0	0	0	0	0	7	0	0	0	138
Lane Group Flow (vph)	116	186	0	181	555	0	306	716	0	0	1537	459
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Perm			pm+pt			pm+pt		Perm
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases				8			2			6		6
Actuated Green, G (s)	7.0	39.0		28.0	28.0		68.1	68.1			43.1	43.1
Effective Green, g (s)	7.0	41.8		30.8	30.8		70.2	70.2			45.2	45.2
Actuated g/C Ratio	0.06	0.35		0.26	0.26		0.59	0.59			0.38	0.38
Clearance Time (s)	4.0	6.8		6.8	6.8		4.0	6.1			6.1	6.1
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	128	987		183	771		237	2494			1626	374
v/s Ratio Prot	c0.05	0.07			0.18		c0.23	0.17			0.36	
v/s Ratio Perm				c0.25			c0.53					0.46
v/c Ratio	0.91	0.19		0.99	0.72		1.29	0.29			0.95	1.23
Uniform Delay, d1	56.2	27.3		44.4	40.7		38.2	12.4			36.2	37.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	51.4	0.1		62.7	3.2		158.8	0.1			11.7	124.0
Delay (s)	107.6	27.4		107.1	43.9		197.0	12.5			47.9	161.4
Level of Service	F	C		F	D		F	B			D	F
Approach Delay (s)		53.4			59.5			67.4			79.7	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	71.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Section 4:
Secondary Plan Area (2031 Horizon), Phase 2
Alternative #3 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	1127	3005	1008	1127	2775		1127	3005	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1127	3005	1008	1127	3005	1008	1127	2775		1127	3005	
Volume (vph)	7	618	326	256	497	152	146	108	113	254	360	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	7	651	343	269	523	160	154	114	119	267	379	0
RTOR Reduction (vph)	0	0	250	0	0	102	0	97	0	0	0	0
Lane Group Flow (vph)	7	651	93	269	523	58	154	136	0	267	379	0
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	0.8	20.3	20.3	8.0	27.5	27.5	18.7	13.0		20.7	15.0	
Effective Green, g (s)	0.8	22.3	22.3	8.0	29.5	29.5	18.7	15.0		20.7	17.0	
Actuated g/C Ratio	0.01	0.27	0.27	0.10	0.36	0.36	0.23	0.18		0.25	0.21	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	11	817	274	110	1081	363	257	508		284	623	
v/s Ratio Prot	0.01	c0.22		c0.24	0.17		c0.14	0.05		c0.24	0.13	
v/s Ratio Perm			0.09			0.06						
v/c Ratio	0.64	0.80	0.34	2.45	0.48	0.16	0.60	0.27		0.94	0.61	
Uniform Delay, d1	40.5	27.7	23.9	37.0	20.3	17.8	28.3	28.8		30.0	29.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	81.7	5.4	0.7	677.1	0.3	0.2	3.7	1.3		37.6	4.4	
Delay (s)	122.2	33.2	24.7	714.1	20.7	18.0	32.0	30.1		67.6	33.9	
Level of Service	F	C	C	F	C	B	C	C		E	C	
Approach Delay (s)		30.9			216.2			30.8			47.8	
Approach LOS		C			F			C			D	

Intersection Summary			
HCM Average Control Delay	93.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor				1.00		1.00		0.95	1.00	1.00	0.95	
Frt				1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected				0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1572		1406		3144	1406	1572	3144	
Flt Permitted				0.95		1.00		1.00	1.00	0.59	1.00	
Satd. Flow (perm)				1572		1406		3144	1406	972	3144	
Volume (vph)	0	0	0	186	0	138	0	253	103	334	487	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	196	0	145	0	266	108	352	513	0
RTOR Reduction (vph)	0	0	0	0	0	104	0	0	45	0	0	0
Lane Group Flow (vph)	0	0	0	196	0	41	0	266	63	352	513	0
Turn Type				Prot		custom			Perm	Perm		
Protected Phases				8				2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)				17.0		17.0		35.0	35.0	35.0	35.0	
Effective Green, g (s)				17.0		17.0		35.0	35.0	35.0	35.0	
Actuated g/C Ratio				0.28		0.28		0.58	0.58	0.58	0.58	
Clearance Time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)				445		398		1834	820	567	1834	
v/s Ratio Prot				c0.12				0.08			0.16	
v/s Ratio Perm						0.03			0.04	c0.36		
v/c Ratio				0.44		0.10		0.15	0.08	0.62	0.28	
Uniform Delay, d1				17.6		15.9		5.7	5.5	8.2	6.2	
Progression Factor				1.00		1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2				3.1		0.5		0.2	0.2	5.0	0.4	
Delay (s)				20.8		16.4		5.9	5.6	13.2	6.6	
Level of Service				C		B		A	A	B	A	
Approach Delay (s)		0.0			18.9			5.8			9.3	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98		1.00	0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1572	3095		2186	3121		1572	2913		1127	3005	1406
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1572	3095		2186	3121		1572	2913		1127	3005	1406
Volume (vph)	35	231	27	395	776	39	24	415	107	25	908	184
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	243	28	416	817	41	25	437	113	26	956	194
RTOR Reduction (vph)	0	11	0	0	4	0	0	27	0	0	0	126
Lane Group Flow (vph)	37	260	0	416	854	0	25	523	0	26	956	68
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	2.2	13.4		16.0	27.2		1.4	24.2		2.7	25.5	25.5
Effective Green, g (s)	2.2	13.4		16.0	27.2		1.4	24.2		2.7	25.5	25.5
Actuated g/C Ratio	0.03	0.19		0.22	0.38		0.02	0.33		0.04	0.35	0.35
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	48	574		484	1174		30	975		42	1060	496
v/s Ratio Prot	0.02	0.08		c0.19	c0.27		0.02	0.18		c0.02	c0.32	
v/s Ratio Perm												0.05
v/c Ratio	0.77	0.45		0.86	0.73		0.83	0.54		0.62	0.90	0.14
Uniform Delay, d1	34.8	26.2		27.1	19.4		35.3	19.5		34.3	22.2	15.9
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	53.1	0.6		14.1	2.3		95.9	0.6		24.2	10.6	0.1
Delay (s)	87.9	26.8		41.2	21.6		131.2	20.1		58.5	32.8	16.0
Level of Service	F	C		D	C		F	C		E	C	B
Approach Delay (s)		34.1			28.0			24.9			30.6	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	29.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	72.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3002		1572	3144	1406	1127	3144	1008
Flt Permitted	0.95	1.00	1.00	0.58	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1406	968	3002		1572	3144	1406	1127	3144	1008
Volume (vph)	99	257	42	134	1022	8	60	415	56	36	1034	399
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	104	271	44	141	1076	8	63	437	59	38	1088	420
RTOR Reduction (vph)	0	0	27	0	1	0	0	0	39	0	0	99
Lane Group Flow (vph)	104	271	17	141	1083	0	63	437	20	38	1088	321
Confl. Peds. (#/hr)										1		
Turn Type	Prot		Perm	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2	6					8			4
Actuated Green, G (s)	10.0	41.6	41.6	43.6	37.6		5.0	37.4	37.4	6.9	39.3	39.3
Effective Green, g (s)	10.0	44.0	44.0	46.0	40.0		5.0	37.4	37.4	9.2	41.6	41.6
Actuated g/C Ratio	0.09	0.39	0.39	0.41	0.36		0.04	0.33	0.33	0.08	0.37	0.37
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	100	1174	549	428	1066		70	1044	467	92	1162	372
v/s Ratio Prot	c0.09	c0.09		0.02	c0.36		c0.04	0.14		0.03	c0.35	
v/s Ratio Perm			0.01	0.12					0.01			0.32
v/c Ratio	1.04	0.23	0.03	0.33	1.02		0.90	0.42	0.04	0.41	0.94	0.86
Uniform Delay, d1	51.3	23.0	21.2	21.6	36.3		53.6	29.2	25.5	49.1	34.2	32.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	101.2	0.5	0.1	0.5	31.7		73.7	0.3	0.0	3.0	13.7	18.2
Delay (s)	152.5	23.4	21.3	22.1	68.0		127.3	29.4	25.5	52.1	47.9	51.1
Level of Service	F	C	C	C	E		F	C	C	D	D	D
Approach Delay (s)		55.2			62.7			40.0			48.9	
Approach LOS		E			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	112.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	1.00	0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005		1127	3005	1008		3005	1008	2186	3003	
Flt Permitted	0.71	1.00		0.48	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (perm)	840	3005		564	3005	1008		3005	1008	2186	3003	
Volume (vph)	10	190	0	2	67	89	0	85	17	117	195	1
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	200	0	2	71	94	0	89	18	123	205	1
RTOR Reduction (vph)	0	0	0	0	0	63	0	0	12	0	0	0
Lane Group Flow (vph)	11	200	0	2	71	31	0	89	6	123	206	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	11.3	11.3		16.0	16.0	16.0		17.4	17.4	4.5	25.9	
Effective Green, g (s)	12.6	12.6		17.3	17.3	17.3		19.0	19.0	4.5	27.5	
Actuated g/C Ratio	0.24	0.24		0.33	0.33	0.33		0.36	0.36	0.09	0.52	
Clearance Time (s)	5.3	5.3		4.0	5.3	5.3		5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	200	717		192	985	330		1081	363	186	1564	
v/s Ratio Prot		c0.07		0.00	0.02			0.03		c0.06	c0.07	
v/s Ratio Perm	0.01			0.00		c0.03			0.01			
v/c Ratio	0.06	0.28		0.01	0.07	0.09		0.08	0.02	0.66	0.13	
Uniform Delay, d1	15.5	16.4		12.1	12.2	12.3		11.1	10.9	23.4	6.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.2		0.0	0.0	0.1		0.1	0.1	8.5	0.2	
Delay (s)	15.6	16.6		12.1	12.3	12.4		11.3	11.0	31.9	6.7	
Level of Service	B	B		B	B	B		B	B	C	A	
Approach Delay (s)		16.6			12.4			11.2			16.1	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	52.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1127	4517	1008	1572	4517	1406	1127	2945		1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.37	1.00		0.65	1.00	1.00
Satd. Flow (perm)	1127	4517	1008	1572	4517	1406	438	2945		1081	3005	1008
Volume (vph)	345	670	82	46	348	96	36	128	20	61	292	133
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	363	705	86	48	366	101	38	135	21	64	307	140
RTOR Reduction (vph)	0	0	42	0	0	81	0	15	0	0	0	115
Lane Group Flow (vph)	363	705	44	48	366	20	38	141	0	64	307	25
Turn Type	Prot		Perm	Prot		Perm	pm+pt			Perm		Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2			6		6
Actuated Green, G (s)	24.4	34.4	34.4	3.0	13.0	13.0	17.8	17.8		11.8	11.8	11.8
Effective Green, g (s)	24.4	34.4	34.4	3.0	13.0	13.0	17.8	17.8		11.8	11.8	11.8
Actuated g/C Ratio	0.36	0.51	0.51	0.04	0.19	0.19	0.26	0.26		0.18	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	409	2312	516	70	874	272	137	780		190	528	177
v/s Ratio Prot	c0.32	0.16		0.03	c0.08		c0.01	0.05			c0.10	
v/s Ratio Perm			0.04			0.01	0.07			0.06		0.02
v/c Ratio	0.89	0.30	0.09	0.69	0.42	0.07	0.28	0.18		0.34	0.58	0.14
Uniform Delay, d1	20.1	9.5	8.4	31.6	23.8	22.2	19.0	19.1		24.3	25.4	23.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	20.1	0.1	0.1	24.3	0.3	0.1	1.1	0.1		1.1	1.6	0.4
Delay (s)	40.2	9.6	8.4	56.0	24.1	22.3	20.1	19.2		25.3	27.1	23.8
Level of Service	D	A	A	E	C	C	C	B		C	C	C
Approach Delay (s)		19.1			26.7			19.4			25.9	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	67.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	47	435	173	428	522	91	80	409	207	36	865	82
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	49	458	182	451	549	96	84	431	218	38	911	86
RTOR Reduction (vph)	0	0	156	0	0	65	0	0	122	0	0	50
Lane Group Flow (vph)	49	458	26	451	549	31	84	431	96	38	911	36
Confl. Peds. (#/hr)				1								
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	6.9	17.0	17.0	28.1	38.2	38.2	8.7	53.0	53.0	5.9	50.2	50.2
Effective Green, g (s)	6.9	17.0	17.0	28.1	38.2	38.2	8.7	53.0	53.0	5.9	50.2	50.2
Actuated g/C Ratio	0.06	0.14	0.14	0.23	0.32	0.32	0.07	0.44	0.44	0.05	0.42	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	90	640	199	512	1438	321	114	1327	445	55	1257	588
v/s Ratio Prot	0.03	c0.10		c0.21	0.12		c0.05	c0.14		0.03	c0.30	
v/s Ratio Perm			0.02			0.03			0.10			0.03
v/c Ratio	0.54	0.72	0.13	0.88	0.38	0.10	0.74	0.32	0.22	0.69	0.72	0.06
Uniform Delay, d1	55.0	49.2	45.0	44.3	31.7	28.8	54.5	21.8	20.7	56.2	29.1	20.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.95	1.03
Incremental Delay, d2	6.6	3.8	0.3	16.1	0.2	0.1	21.7	0.7	1.1	29.3	3.4	0.2
Delay (s)	61.6	53.0	45.3	60.5	31.9	28.9	76.3	22.5	21.8	82.9	31.0	21.6
Level of Service	E	D	D	E	C	C	E	C	C	F	C	C
Approach Delay (s)		51.6			43.4			28.4			32.1	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	38.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	57	556	84	225	1218	250	41	361	110	124	737	37
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	585	88	237	1282	263	43	380	116	131	776	39
RTOR Reduction (vph)	0	0	68	0	0	173	0	0	88	0	0	27
Lane Group Flow (vph)	60	585	20	237	1282	90	43	380	28	131	776	12
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	5.0	16.0	16.0	13.0	24.0	24.0	4.0	17.0	17.0	8.0	21.0	21.0
Effective Green, g (s)	5.0	16.0	16.0	13.0	24.0	24.0	4.0	17.0	17.0	8.0	21.0	21.0
Actuated g/C Ratio	0.07	0.23	0.23	0.19	0.34	0.34	0.06	0.24	0.24	0.11	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	112	1032	321	292	1549	482	90	764	341	180	943	422
v/s Ratio Prot	0.04	0.13		c0.15	c0.28		0.03	0.12		c0.08	c0.25	
v/s Ratio Perm			0.01			0.06			0.02			0.01
v/c Ratio	0.54	0.57	0.06	0.81	0.83	0.19	0.48	0.50	0.08	0.73	0.82	0.03
Uniform Delay, d1	31.4	23.9	21.1	27.3	21.1	16.2	32.0	22.8	20.5	29.9	22.8	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.1	2.3	0.4	21.2	5.2	0.9	17.1	2.3	0.5	22.6	8.1	0.1
Delay (s)	48.5	26.2	21.5	48.6	26.3	17.0	49.0	25.1	20.9	52.5	30.8	17.4
Level of Service	D	C	C	D	C	B	D	C	C	D	C	B
Approach Delay (s)		27.5			27.9			26.1			33.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.91		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2748		1127	3005	1008	1127	3005	1008	2186	3005	
Flt Permitted		1.00		0.70	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2748		833	3005	1008	1127	3005	1008	2186	3005	
Volume (vph)	0	26	34	23	30	39	6	63	62	34	163	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	27	36	24	32	41	6	66	65	36	172	0
RTOR Reduction (vph)	0	35	0	0	0	36	0	0	23	0	0	0
Lane Group Flow (vph)	0	28	0	24	32	5	6	66	42	36	172	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		1.7		6.9	6.9	6.9	1.2	36.0	36.0	1.2	36.0	
Effective Green, g (s)		1.7		6.9	6.9	6.9	1.2	36.0	36.0	1.2	36.0	
Actuated g/C Ratio		0.03		0.12	0.12	0.12	0.02	0.64	0.64	0.02	0.64	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		83		109	370	124	24	1928	647	47	1928	
v/s Ratio Prot		0.01		c0.00	0.01		0.01	0.02		c0.02	c0.06	
v/s Ratio Perm				c0.02		0.01			0.04			
v/c Ratio		0.34		0.22	0.09	0.04	0.25	0.03	0.06	0.77	0.09	
Uniform Delay, d1		26.6		22.2	21.8	21.7	27.0	3.7	3.8	27.3	3.8	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		2.4		1.0	0.1	0.1	5.4	0.0	0.0	52.3	0.0	
Delay (s)		29.1		23.2	21.9	21.8	32.4	3.7	3.8	79.6	3.8	
Level of Service		C		C	C	C	C	A	A	E	A	
Approach Delay (s)		29.1			22.2			5.0			16.9	
Approach LOS		C			C			A			B	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.13		
Actuated Cycle Length (s)	56.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0			
Lane Util. Factor		0.95	1.00	1.00	0.95		1.00		1.00			
Frpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00			
Flpb, ped/bikes		1.00	1.00	1.00	1.00		1.00		1.00			
Frt		1.00	0.85	1.00	1.00		1.00		0.85			
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00			
Satd. Flow (prot)		3005	1008	1127	3005		1127		1008			
Flt Permitted		1.00	1.00	0.95	1.00		0.54		1.00			
Satd. Flow (perm)		3005	1008	1127	3005		638		1008			
Volume (vph)	0	95	232	200	107	0	44	0	212	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	100	244	211	113	0	46	0	223	0	0	0
RTOR Reduction (vph)	0	0	206	0	0	0	0	0	152	0	0	0
Lane Group Flow (vph)	0	100	38	211	113	0	46	0	71	0	0	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	Perm		
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)		7.5	7.5	13.0	24.5		15.2		15.2			
Effective Green, g (s)		7.5	7.5	13.0	24.5		15.2		15.2			
Actuated g/C Ratio		0.16	0.16	0.27	0.51		0.32		0.32			
Clearance Time (s)		4.0	4.0	4.0	4.0		4.0		4.0			
Vehicle Extension (s)		3.0	3.0	3.0	3.0		3.0		3.0			
Lane Grp Cap (vph)		472	158	307	1543		218		321			
v/s Ratio Prot		0.03		c0.19	0.04		0.01					
v/s Ratio Perm			c0.04				0.06		c0.07			
v/c Ratio		0.21	0.24	0.69	0.07		0.21		0.22			
Uniform Delay, d1		17.5	17.6	15.5	5.9		11.7		11.9			
Progression Factor		1.00	1.00	1.00	1.00		1.00		1.00			
Incremental Delay, d2		0.2	0.8	6.3	0.0		0.5		0.4			
Delay (s)		17.7	18.4	21.8	5.9		12.2		12.3			
Level of Service		B	B	C	A		B		B			
Approach Delay (s)		18.2			16.2			12.3			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	47.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88		0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.98		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1127	3005		1127	3005	1775		2950		2186	2866	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		1.00		0.48	1.00	
Satd. Flow (perm)	1127	3005		1127	3005	1775		2950		1096	2866	
Volume (vph)	74	343	0	3	76	54	0	128	18	290	98	44
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	361	0	3	80	57	0	135	19	305	103	46
RTOR Reduction (vph)	0	0	0	0	0	43	0	14	0	0	26	0
Lane Group Flow (vph)	78	361	0	3	80	14	0	140	0	305	123	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	3.4	10.0		0.6	7.2	10.1		10.7		17.6	17.6	
Effective Green, g (s)	3.4	10.0		0.6	7.2	10.1		10.7		17.6	17.6	
Actuated g/C Ratio	0.08	0.25		0.01	0.18	0.25		0.27		0.44	0.44	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)	95	748		17	538	623		785		558	1255	
v/s Ratio Prot	c0.07	c0.12		0.00	0.03	0.00		0.05		c0.04	0.04	
v/s Ratio Perm						0.01				c0.20		
v/c Ratio	0.82	0.48		0.18	0.15	0.02		0.18		0.55	0.10	
Uniform Delay, d1	18.1	12.9		19.6	13.9	11.3		11.4		8.2	6.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	41.0	0.5		4.9	0.1	0.0		0.1		1.1	0.0	
Delay (s)	59.1	13.4		24.5	14.0	11.3		11.5		9.3	6.7	
Level of Service	E	B		C	B	B		B		A	A	
Approach Delay (s)		21.5			13.2			11.5			8.5	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	40.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.89		1.00	0.85	1.00	1.00
Flt Protected	0.99		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1045		3005	1008	1127	3005
Flt Permitted	0.99		1.00	1.00	0.44	1.00
Satd. Flow (perm)	1045		3005	1008	520	3005
Volume (vph)	13	62	482	55	257	1050
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	65	507	58	271	1105
RTOR Reduction (vph)	61	0	0	15	0	0
Lane Group Flow (vph)	18	0	507	43	271	1105
Turn Type				Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases				2	6	
Actuated Green, G (s)	7.3		89.1	89.1	104.7	104.7
Effective Green, g (s)	7.3		89.1	89.1	104.7	104.7
Actuated g/C Ratio	0.06		0.74	0.74	0.87	0.87
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	64		2231	748	512	2622
v/s Ratio Prot	c0.02		0.17		c0.05	0.37
v/s Ratio Perm				0.04	c0.41	
v/c Ratio	0.28		0.23	0.06	0.53	0.42
Uniform Delay, d1	53.8		4.8	4.2	1.5	1.5
Progression Factor	1.00		0.22	0.01	1.00	1.00
Incremental Delay, d2	2.4		0.2	0.1	1.0	0.5
Delay (s)	56.2		1.3	0.2	2.5	2.0
Level of Service	E		A	A	A	A
Approach Delay (s)	56.2		1.2			2.1
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	1127	4235		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	1127	4235		2186	4318	1008	1127	4318	1775
Volume (vph)	211	242	295	96	705	104	701	832	58	21	815	645
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	222	255	311	101	742	109	738	876	61	22	858	679
RTOR Reduction (vph)	0	0	243	0	16	0	0	0	31	0	0	31
Lane Group Flow (vph)	222	255	68	101	835	0	738	876	30	22	858	648
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	15.0	26.4	26.4	13.6	25.0		36.0	59.2	59.2	4.8	28.0	43.0
Effective Green, g (s)	15.0	26.4	26.4	13.6	25.0		36.0	59.2	59.2	4.8	28.0	43.0
Actuated g/C Ratio	0.12	0.22	0.22	0.11	0.21		0.30	0.49	0.49	0.04	0.23	0.36
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	273	661	222	128	882		656	2130	497	45	1008	636
v/s Ratio Prot	0.10	0.08		0.09	c0.20		c0.34	0.20		0.02	0.20	c0.37
v/s Ratio Perm			0.07						0.03			
v/c Ratio	0.81	0.39	0.31	0.79	0.95		1.12	0.41	0.06	0.49	0.85	1.02
Uniform Delay, d1	51.1	39.9	39.2	51.8	46.8		42.0	19.3	15.9	56.4	44.0	38.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.47	0.33	1.48
Incremental Delay, d2	16.7	0.4	0.8	26.8	18.5		74.8	0.6	0.2	5.9	6.7	35.3
Delay (s)	67.8	40.3	40.0	78.6	65.4		116.8	19.9	16.1	89.0	21.3	92.4
Level of Service	E	D	D	E	E		F	B	B	F	C	F
Approach Delay (s)		47.9			66.8			62.5			53.2	
Approach LOS		D			E			E			D	

Intersection Summary			
HCM Average Control Delay	58.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1140	1020	1140	4368	4368	1002
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1140	1020	1140	4368	4368	1002
Volume (vph)	50	39	218	928	1443	270
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	41	229	977	1519	284
RTOR Reduction (vph)	0	34	0	0	0	95
Lane Group Flow (vph)	53	7	229	977	1519	189
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	18.0	18.0	28.1	90.0	57.9	75.9
Effective Green, g (s)	19.6	19.6	28.1	92.4	60.3	79.9
Actuated g/C Ratio	0.16	0.16	0.23	0.77	0.50	0.67
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	186	167	267	3363	2195	701
v/s Ratio Prot	0.05		c0.20	0.22	c0.35	c0.04
v/s Ratio Perm		0.01				0.14
v/c Ratio	0.28	0.04	0.86	0.29	0.69	0.27
Uniform Delay, d1	44.1	42.3	44.0	4.1	22.8	8.2
Progression Factor	1.00	1.00	0.96	2.23	0.22	0.53
Incremental Delay, d2	3.8	0.4	20.2	0.2	0.2	0.1
Delay (s)	47.9	42.7	62.6	9.3	5.2	4.4
Level of Service	D	D	E	A	A	A
Approach Delay (s)	45.6			19.4	5.1	
Approach LOS	D			B	A	

Intersection Summary			
HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1127	2830		1127	3005		1127	4263			4318	998
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)	1127	2830		1127	3005		1127	4263			4318	998
Volume (vph)	110	144	81	172	505	0	291	633	54	0	1460	567
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	116	152	85	181	532	0	306	666	57	0	1537	597
RTOR Reduction (vph)	0	66	0	0	0	0	0	7	0	0	0	58
Lane Group Flow (vph)	116	171	0	181	532	0	306	716	0	0	1537	539
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases												6
Actuated Green, G (s)	13.0	24.2		14.0	25.2		26.8	64.9			34.1	47.1
Effective Green, g (s)	13.0	27.0		14.0	28.0		26.8	67.0			36.2	49.2
Actuated g/C Ratio	0.11	0.22		0.12	0.23		0.22	0.56			0.30	0.41
Clearance Time (s)	4.0	6.8		4.0	6.8		4.0	6.1			6.1	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	122	637		131	701		252	2380			1303	442
v/s Ratio Prot	0.10	0.06		c0.16	c0.18		c0.27	0.17			0.36	c0.13
v/s Ratio Perm												0.41
v/c Ratio	0.95	0.27		1.38	0.76		1.21	0.30			1.18	1.22
Uniform Delay, d1	53.2	38.4		53.0	42.9		46.6	14.1			41.9	35.4
Progression Factor	1.00	1.00		1.00	1.00		1.06	0.44			1.00	1.00
Incremental Delay, d2	65.9	0.2		212.0	4.7		126.4	0.3			89.0	117.9
Delay (s)	119.1	38.6		265.0	47.6		176.0	6.4			130.9	153.3
Level of Service	F	D		F	D		F	A			F	F
Approach Delay (s)		65.1			102.8			56.9			137.2	
Approach LOS		E			F			E			F	

Intersection Summary			
HCM Average Control Delay	105.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Section 5:
Secondary + Additional Plan Area (Beyond 2031)
Alternative #1 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1008	1127	3005	1008	1127	2814		1127	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1008	1127	3005	1008	1127	2814		1127	3005	1008
Volume (vph)	86	737	330	233	1112	152	181	140	104	251	445	307
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	91	776	347	245	1171	160	191	147	109	264	468	323
RTOR Reduction (vph)	0	0	260	0	0	99	0	93	0	0	0	177
Lane Group Flow (vph)	91	776	87	245	1171	61	191	163	0	264	468	146
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.0	23.0	23.0	21.0	36.0	36.0	17.0	13.0		23.0	19.0	19.0
Effective Green, g (s)	8.0	25.0	25.0	21.0	38.0	38.0	17.0	15.0		23.0	21.0	21.0
Actuated g/C Ratio	0.08	0.25	0.25	0.21	0.38	0.38	0.17	0.15		0.23	0.21	0.21
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	90	751	252	237	1142	383	192	422		259	631	212
v/s Ratio Prot	0.08	0.26		c0.22	c0.39		c0.17	0.06		c0.23	0.16	
v/s Ratio Perm			0.09			0.06						0.14
v/c Ratio	1.01	1.03	0.34	1.03	1.03	0.16	0.99	0.39		1.02	0.74	0.69
Uniform Delay, d1	46.0	37.5	30.8	39.5	31.0	20.5	41.5	38.4		38.5	37.0	36.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	97.9	41.7	0.8	67.5	33.3	0.2	63.1	2.7		61.0	7.7	16.8
Delay (s)	143.9	79.2	31.6	107.0	64.3	20.6	104.6	41.0		99.5	44.6	53.3
Level of Service	F	E	C	F	E	C	F	D		F	D	D
Approach Delay (s)		70.4			66.5			68.2			61.0	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM Average Control Delay	66.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.95		1.00	0.93		1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1572	1572		1572	1536		1572	3022		1572	3036	
Flt Permitted	0.56	1.00		0.59	1.00		0.37	1.00		0.30	1.00	
Satd. Flow (perm)	919	1572		974	1536		608	3022		492	3036	
Volume (vph)	20	21	10	184	170	155	82	294	102	336	548	162
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	22	11	194	179	163	86	309	107	354	577	171
RTOR Reduction (vph)	0	9	0	0	41	0	0	43	0	0	35	0
Lane Group Flow (vph)	21	24	0	194	301	0	86	373	0	354	713	0
Turn Type	Perm			pm+pt			Perm			pm+pt		
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	16.0	16.0		36.0	36.0		17.0	17.0		36.0	36.0	
Effective Green, g (s)	16.0	16.0		36.0	36.0		17.0	17.0		36.0	36.0	
Actuated g/C Ratio	0.20	0.20		0.45	0.45		0.21	0.21		0.45	0.45	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)	184	314		558	691		129	642		424	1366	
v/s Ratio Prot		0.02		0.07	c0.20			0.12		c0.16	0.23	
v/s Ratio Perm	0.02			0.09			0.14			c0.22		
v/c Ratio	0.11	0.08		0.35	0.44		0.67	0.58		0.83	0.52	
Uniform Delay, d1	26.2	26.0		13.9	15.0		28.9	28.3		16.4	15.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	0.5		1.7	2.0		24.1	3.8		17.4	1.4	
Delay (s)	27.5	26.5		15.6	17.0		53.0	32.1		33.8	17.2	
Level of Service	C	C		B	B		D	C		C	B	
Approach Delay (s)		26.9			16.5			35.7			22.6	
Approach LOS		C			B			D			C	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98		1.00	0.99		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1572	3095		2186	3121		1572	2885		1127	3005	1406
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1572	3095		2186	3121		1572	2885		1127	3005	1406
Volume (vph)	35	229	27	523	781	39	24	462	169	25	976	185
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	241	28	551	822	41	25	486	178	26	1027	195
RTOR Reduction (vph)	0	8	0	0	3	0	0	29	0	0	0	110
Lane Group Flow (vph)	37	261	0	551	860	0	25	635	0	26	1027	85
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	4.2	15.9		33.1	44.8		2.6	50.2		4.8	52.4	52.4
Effective Green, g (s)	4.2	15.9		33.1	44.8		2.6	50.2		4.8	52.4	52.4
Actuated g/C Ratio	0.04	0.13		0.28	0.37		0.02	0.42		0.04	0.44	0.44
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	55	410		603	1165		34	1207		45	1312	614
v/s Ratio Prot	0.02	0.08		c0.25	c0.28		0.02	0.22		c0.02	c0.34	
v/s Ratio Perm												0.06
v/c Ratio	0.67	0.64		0.91	0.74		0.74	0.53		0.58	0.78	0.14
Uniform Delay, d1	57.2	49.3		42.1	32.5		58.4	26.0		56.6	28.9	20.3
Progression Factor	1.00	1.00		1.00	1.00		1.19	0.49		1.00	1.00	1.00
Incremental Delay, d2	27.8	3.2		18.4	2.5		56.0	1.6		16.7	4.7	0.5
Delay (s)	85.1	52.6		60.4	35.0		125.6	14.3		73.3	33.6	20.7
Level of Service	F	D		E	D		F	B		E	C	C
Approach Delay (s)		56.5			44.9			18.4			32.5	
Approach LOS		E			D			B			C	

Intersection Summary			
HCM Average Control Delay	36.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3003		1572	3144	1406	1127	3144	1008
Flt Permitted	0.95	1.00	1.00	0.55	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1406	909	3003		1572	3144	1406	1127	3144	1008
Volume (vph)	96	319	42	136	1162	8	60	428	57	36	1059	392
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	101	336	44	143	1223	8	63	451	60	38	1115	413
RTOR Reduction (vph)	0	0	25	0	1	0	0	0	41	0	0	87
Lane Group Flow (vph)	101	336	19	143	1230	0	63	451	19	38	1115	326
Confl. Peds. (#/hr)										1		
Turn Type	Prot		Perm	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2	6					8			4
Actuated Green, G (s)	10.0	50.6	50.6	52.6	46.6		5.0	38.2	38.2	7.0	40.2	40.2
Effective Green, g (s)	10.0	53.0	53.0	55.0	49.0		5.0	38.2	38.2	9.3	42.5	42.5
Actuated g/C Ratio	0.08	0.43	0.43	0.45	0.40		0.04	0.31	0.31	0.08	0.35	0.35
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	92	1300	608	441	1201		64	980	438	86	1091	350
v/s Ratio Prot	c0.09	c0.11		0.02	c0.41		c0.04	0.14		0.03	c0.35	
v/s Ratio Perm			0.01	0.13					0.01			0.32
v/c Ratio	1.10	0.26	0.03	0.32	1.02		0.98	0.46	0.04	0.44	1.02	0.93
Uniform Delay, d1	56.2	22.2	20.0	20.5	36.8		58.7	33.9	29.4	54.1	40.0	38.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	122.8	0.5	0.1	0.4	32.4		106.4	0.3	0.0	3.6	32.9	31.0
Delay (s)	179.0	22.7	20.1	20.9	69.1		165.1	34.2	29.4	57.7	72.9	69.6
Level of Service	F	C	C	C	E		F	C	C	E	E	E
Approach Delay (s)		55.3			64.1			48.1			71.7	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	63.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	122.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	2965		1127	3005	1008	1127	3005	1008	2186	3003	
Flt Permitted	0.70	1.00		0.41	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	830	2965		486	3005	1008	1127	3005	1008	2186	3003	
Volume (vph)	53	223	22	164	80	227	7	486	100	440	1105	6
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	56	235	23	173	84	239	7	512	105	463	1163	6
RTOR Reduction (vph)	0	10	0	0	0	162	0	0	75	0	0	0
Lane Group Flow (vph)	56	248	0	173	84	77	7	512	30	463	1169	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	11.9	11.9		23.9	23.9	23.9	0.8	20.5	20.5	18.9	38.6	
Effective Green, g (s)	13.2	13.2		25.2	25.2	25.2	0.8	22.1	22.1	18.9	40.2	
Actuated g/C Ratio	0.17	0.17		0.32	0.32	0.32	0.01	0.28	0.28	0.24	0.51	
Clearance Time (s)	5.3	5.3		4.0	5.3	5.3	4.0	5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	140	500		222	968	325	12	849	285	528	1544	
v/s Ratio Prot		0.08		c0.08	0.03		0.01	0.17		c0.21	c0.39	
v/s Ratio Perm	0.07			c0.17		0.08			0.03			
v/c Ratio	0.40	0.50		0.78	0.09	0.24	0.58	0.60	0.10	0.88	0.76	
Uniform Delay, d1	29.0	29.5		22.3	18.5	19.4	38.5	24.3	20.7	28.5	15.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.9	0.8		15.8	0.0	0.4	56.2	3.2	0.7	15.1	3.5	
Delay (s)	30.8	30.3		38.1	18.5	19.8	94.8	27.4	21.5	43.6	18.6	
Level of Service	C	C		D	B	B	F	C	C	D	B	
Approach Delay (s)		30.4			26.0			27.2			25.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1127	4517	1008	1572	4517	1406	1127	2787		1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.37	1.00		0.59	1.00	1.00
Satd. Flow (perm)	1127	4517	1008	1572	4517	1406	437	2787		974	3005	1008
Volume (vph)	366	805	145	214	743	115	76	129	122	64	280	201
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	385	847	153	225	782	121	80	136	128	67	295	212
RTOR Reduction (vph)	0	0	96	0	0	96	0	95	0	0	0	177
Lane Group Flow (vph)	385	847	57	225	782	25	80	169	0	67	295	35
Turn Type	Prot		Perm	Prot		Perm	pm+pt			Perm		Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2			6		6
Actuated Green, G (s)	27.3	27.6	27.6	14.9	15.2	15.2	19.3	19.3		12.3	12.3	12.3
Effective Green, g (s)	27.3	27.6	27.6	14.9	15.2	15.2	19.3	19.3		12.3	12.3	12.3
Actuated g/C Ratio	0.37	0.37	0.37	0.20	0.21	0.21	0.26	0.26		0.17	0.17	0.17
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	417	1689	377	317	930	290	142	729		162	501	168
v/s Ratio Prot	c0.34	0.19		0.14	c0.17		c0.02	0.06			0.10	
v/s Ratio Perm			0.06			0.02	c0.12			0.07		0.04
v/c Ratio	0.92	0.50	0.15	0.71	0.84	0.09	0.56	0.23		0.41	0.59	0.21
Uniform Delay, d1	22.2	17.8	15.3	27.4	28.1	23.7	23.4	21.4		27.5	28.4	26.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	25.9	0.2	0.2	7.1	6.9	0.1	5.0	0.2		1.7	1.8	0.6
Delay (s)	48.1	18.0	15.5	34.5	35.1	23.8	28.4	21.6		29.2	30.2	27.2
Level of Service	D	B	B	C	D	C	C	C		C	C	C
Approach Delay (s)		26.1			33.8			23.2			29.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	73.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	162	578	164	433	886	91	77	403	211	36	843	299
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	171	608	173	456	933	96	81	424	222	38	887	315
RTOR Reduction (vph)	0	0	144	0	0	71	0	0	129	0	0	189
Lane Group Flow (vph)	171	608	29	456	933	25	81	424	93	38	887	126
Confl. Peds. (#/hr)				1								
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	16.4	19.8	19.8	28.2	31.6	31.6	8.0	50.1	50.1	5.9	48.0	48.0
Effective Green, g (s)	16.4	19.8	19.8	28.2	31.6	31.6	8.0	50.1	50.1	5.9	48.0	48.0
Actuated g/C Ratio	0.14	0.17	0.17	0.23	0.26	0.26	0.07	0.42	0.42	0.05	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	215	745	232	514	1189	265	105	1255	421	55	1202	562
v/s Ratio Prot	0.11	0.13		c0.21	c0.21		c0.05	0.14		0.03	c0.30	
v/s Ratio Perm			0.02			0.03			0.09			0.09
v/c Ratio	0.80	0.82	0.12	0.89	0.78	0.10	0.77	0.34	0.22	0.69	0.74	0.22
Uniform Delay, d1	50.2	48.3	42.7	44.4	41.0	33.4	55.1	23.7	22.4	56.2	30.6	23.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.34	0.82	0.78
Incremental Delay, d2	18.1	6.9	0.2	16.7	3.5	0.2	28.8	0.7	1.2	28.1	3.6	0.8
Delay (s)	68.3	55.2	42.9	61.1	44.5	33.6	83.9	24.4	23.6	103.6	28.8	19.4
Level of Service	E	E	D	E	D	C	F	C	C	F	C	B
Approach Delay (s)		55.3			48.9			30.8			28.7	
Approach LOS		E			D			C			C	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	58	699	86	232	1584	251	42	374	114	124	760	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	61	736	91	244	1667	264	44	394	120	131	800	42
RTOR Reduction (vph)	0	0	68	0	0	158	0	0	93	0	0	29
Lane Group Flow (vph)	61	736	23	244	1667	106	44	394	27	131	800	13
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	20.0	20.0	16.0	32.0	32.0	4.0	18.0	18.0	10.0	24.0	24.0
Effective Green, g (s)	4.0	20.0	20.0	16.0	32.0	32.0	4.0	18.0	18.0	10.0	24.0	24.0
Actuated g/C Ratio	0.05	0.25	0.25	0.20	0.40	0.40	0.05	0.22	0.22	0.12	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	79	1129	352	314	1807	562	79	707	316	197	943	422
v/s Ratio Prot	0.04	0.16		c0.16	c0.37		0.03	0.13		c0.08	c0.25	
v/s Ratio Perm			0.02			0.08			0.02			0.01
v/c Ratio	0.77	0.65	0.06	0.78	0.92	0.19	0.56	0.56	0.09	0.66	0.85	0.03
Uniform Delay, d1	37.5	26.9	22.9	30.3	22.8	15.6	37.1	27.5	24.5	33.4	26.3	19.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	51.4	2.9	0.4	17.1	9.4	0.7	25.4	3.2	0.5	16.4	9.4	0.1
Delay (s)	89.0	29.8	23.2	47.4	32.2	16.3	62.5	30.6	25.0	49.8	35.7	19.9
Level of Service	F	C	C	D	C	B	E	C	C	D	D	B
Approach Delay (s)		33.2			32.0			31.9			36.9	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2904		1127	3005	1008	1127	3005	1008	2186	3005	
Flt Permitted		1.00		0.37	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2904		439	3005	1008	1127	3005	1008	2186	3005	
Volume (vph)	0	182	53	275	62	193	12	323	405	607	348	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	192	56	289	65	203	13	340	426	639	366	0
RTOR Reduction (vph)	0	31	0	0	0	131	0	0	309	0	0	0
Lane Group Flow (vph)	0	217	0	289	65	72	13	340	117	639	366	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		11.3		30.4	30.4	30.4	0.7	17.1	17.1	26.5	42.9	
Effective Green, g (s)		11.3		30.4	30.4	30.4	0.7	17.1	17.1	26.5	42.9	
Actuated g/C Ratio		0.13		0.35	0.35	0.35	0.01	0.20	0.20	0.31	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		382		276	1062	356	9	598	200	674	1499	
v/s Ratio Prot		0.07		c0.18	0.02		0.01	0.11		c0.29	0.12	
v/s Ratio Perm				c0.19		0.07			c0.12			
v/c Ratio		0.57		1.05	0.06	0.20	1.44	0.57	0.58	0.95	0.24	
Uniform Delay, d1		35.1		25.3	18.4	19.4	42.6	31.1	31.2	29.1	12.3	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.9		67.0	0.0	0.3	474.2	1.2	4.3	22.5	0.1	
Delay (s)		37.0		92.3	18.4	19.6	516.8	32.4	35.5	51.5	12.4	
Level of Service		D		F	B	B	F	C	D	D	B	
Approach Delay (s)		37.0			57.2			42.2			37.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	43.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	1127	3005	985	1127	1582	1008	1127	2880	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.50	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	1127	3005	1008	1127	3005	985	599	1582	1008	658	2880	
Volume (vph)	151	133	595	312	273	155	297	326	235	37	71	28
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	159	140	626	328	287	163	313	343	247	39	75	29
RTOR Reduction (vph)	0	0	516	0	0	119	0	0	139	0	26	0
Lane Group Flow (vph)	159	140	110	328	287	44	313	343	108	39	78	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	Perm		
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)	17.6	17.7	17.7	26.9	27.0	27.0	44.0	44.0	44.0	11.1	11.1	
Effective Green, g (s)	17.6	17.7	17.7	26.9	27.0	27.0	44.0	44.0	44.0	11.1	11.1	
Actuated g/C Ratio	0.17	0.18	0.18	0.27	0.27	0.27	0.44	0.44	0.44	0.11	0.11	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	197	529	177	301	807	264	414	692	441	73	318	
v/s Ratio Prot	0.14	0.05		c0.29	0.10		c0.22	0.22			0.03	
v/s Ratio Perm			c0.11			0.04	c0.11		0.11	0.06		
v/c Ratio	0.81	0.26	0.62	1.09	0.36	0.17	0.76	0.50	0.24	0.53	0.25	
Uniform Delay, d1	39.9	35.8	38.4	36.8	29.8	28.2	22.2	20.3	17.8	42.3	40.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.9	0.3	6.6	78.0	0.3	0.3	7.7	0.6	0.3	7.3	0.4	
Delay (s)	60.8	36.1	45.0	114.8	30.0	28.5	29.9	20.9	18.1	49.6	41.3	
Level of Service	E	D	D	F	C	C	C	C	B	D	D	
Approach Delay (s)		46.4			65.5			23.2			43.6	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM Average Control Delay	44.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88	1.00	0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1127	3002		1127	3005	1775	1127	2978		2186	2848	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.60	1.00		0.18	1.00	
Satd. Flow (perm)	1127	3002		1127	3005	1775	715	2978		418	2848	
Volume (vph)	261	690	6	5	796	927	16	377	25	558	148	80
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	275	726	6	5	838	976	17	397	26	587	156	84
RTOR Reduction (vph)	0	1	0	0	0	131	0	4	0	0	54	0
Lane Group Flow (vph)	275	731	0	5	838	845	17	419	0	587	186	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	28.0	62.4		0.8	35.2	62.2	21.0	19.4		50.4	44.8	
Effective Green, g (s)	28.0	62.4		0.8	35.2	62.2	21.0	19.4		50.4	44.8	
Actuated g/C Ratio	0.22	0.50		0.01	0.28	0.50	0.17	0.15		0.40	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	251	1491		7	842	936	125	460		548	1016	
v/s Ratio Prot	c0.24	0.24		0.00	c0.28	c0.19	0.00	0.14		c0.23	0.07	
v/s Ratio Perm						0.28	0.02			c0.20		
v/c Ratio	1.10	0.49		0.71	1.00	0.90	0.14	0.91		1.07	0.18	
Uniform Delay, d1	48.8	21.0		62.3	45.1	28.9	44.2	52.2		36.1	27.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	84.7	0.3		159.1	29.6	11.8	0.5	22.0		58.9	0.1	
Delay (s)	133.5	21.3		221.4	74.8	40.8	44.7	74.3		95.0	27.9	
Level of Service	F	C		F	E	D	D	E		F	C	
Approach Delay (s)		51.9			56.9			73.1			75.5	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	61.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	125.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.89		1.00	0.85	1.00	1.00
Flt Protected	0.99		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1045		3005	1008	1127	3005
Flt Permitted	0.99		1.00	1.00	0.38	1.00
Satd. Flow (perm)	1045		3005	1008	445	3005
Volume (vph)	13	62	591	55	258	1246
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	65	622	58	272	1312
RTOR Reduction (vph)	61	0	0	18	0	0
Lane Group Flow (vph)	18	0	622	40	272	1312
Turn Type				Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases				2	6	
Actuated Green, G (s)	7.3		82.2	82.2	104.7	104.7
Effective Green, g (s)	7.3		82.2	82.2	104.7	104.7
Actuated g/C Ratio	0.06		0.69	0.69	0.87	0.87
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	64		2058	690	493	2622
v/s Ratio Prot	c0.02		0.21		c0.08	0.44
v/s Ratio Perm				0.04	c0.40	
v/c Ratio	0.28		0.30	0.06	0.55	0.50
Uniform Delay, d1	53.8		7.5	6.2	1.9	1.7
Progression Factor	1.00		0.96	1.29	1.28	0.56
Incremental Delay, d2	2.4		0.3	0.1	0.8	0.4
Delay (s)	56.2		7.6	8.1	3.3	1.4
Level of Service	E		A	A	A	A
Approach Delay (s)	56.2		7.6			1.7
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	2186	4249		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	2186	4249		2186	4318	1008	1127	4318	1775
Volume (vph)	299	296	301	138	860	104	710	858	66	21	925	856
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	315	312	317	145	905	109	747	903	69	22	974	901
RTOR Reduction (vph)	0	0	247	0	13	0	0	0	33	0	0	12
Lane Group Flow (vph)	315	312	70	145	1001	0	747	903	36	22	974	889
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	13.0	26.4	26.4	10.6	24.0		30.0	62.2	62.2	4.8	37.0	50.0
Effective Green, g (s)	13.0	26.4	26.4	10.6	24.0		30.0	62.2	62.2	4.8	37.0	50.0
Actuated g/C Ratio	0.11	0.22	0.22	0.09	0.20		0.25	0.52	0.52	0.04	0.31	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	237	661	222	193	850		547	2238	522	45	1331	740
v/s Ratio Prot	c0.14	0.10		0.07	c0.24		c0.34	0.21		0.02	0.23	c0.50
v/s Ratio Perm			0.07						0.04			
v/c Ratio	1.33	0.47	0.31	0.75	1.18		1.37	0.40	0.07	0.49	0.73	1.20
Uniform Delay, d1	53.5	40.7	39.2	53.4	48.0		45.0	17.6	14.4	56.4	37.1	35.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.30	0.36	0.74
Incremental Delay, d2	174.2	0.5	0.8	15.1	92.2		176.0	0.5	0.3	4.5	2.0	98.0
Delay (s)	227.7	41.3	40.0	68.6	140.2		221.0	18.1	14.7	77.8	15.3	123.8
Level of Service	F	D	D	E	F		F	B	B	E	B	F
Approach Delay (s)		103.1			131.3			106.2			67.5	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	97.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1140	1020	1140	4368	4368	1002
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1140	1020	1140	4368	4368	1002
Volume (vph)	50	39	219	1042	1763	271
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	41	231	1097	1856	285
RTOR Reduction (vph)	0	34	0	0	0	94
Lane Group Flow (vph)	53	7	231	1097	1856	191
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	18.0	18.0	27.5	90.0	58.5	76.5
Effective Green, g (s)	19.6	19.6	27.5	92.4	60.9	80.5
Actuated g/C Ratio	0.16	0.16	0.23	0.77	0.51	0.67
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	186	167	261	3363	2217	706
v/s Ratio Prot	0.05		c0.20	0.25	c0.42	c0.04
v/s Ratio Perm		0.01				0.15
v/c Ratio	0.28	0.04	0.89	0.33	0.84	0.27
Uniform Delay, d1	44.1	42.3	44.7	4.2	25.3	7.9
Progression Factor	1.00	1.00	1.13	0.86	0.20	0.51
Incremental Delay, d2	3.8	0.4	21.9	0.2	0.4	0.1
Delay (s)	47.9	42.7	72.5	3.8	5.5	4.2
Level of Service	D	D	E	A	A	A
Approach Delay (s)	45.6			15.8	5.3	
Approach LOS	D			B	A	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1127	2837		1127	3005		1127	4254			4318	998
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)	1127	2837		1127	3005		1127	4254			4318	998
Volume (vph)	164	154	81	213	557	0	292	727	73	0	1740	657
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	162	85	224	586	0	307	765	77	0	1832	692
RTOR Reduction (vph)	0	59	0	0	0	0	0	8	0	0	0	42
Lane Group Flow (vph)	173	188	0	224	586	0	307	834	0	0	1832	650
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases												6
Actuated Green, G (s)	13.0	24.8		15.0	26.8		23.2	63.3			36.1	49.1
Effective Green, g (s)	13.0	27.6		15.0	29.6		23.2	65.4			38.2	51.2
Actuated g/C Ratio	0.11	0.23		0.12	0.25		0.19	0.55			0.32	0.43
Clearance Time (s)	4.0	6.8		4.0	6.8		4.0	6.1			6.1	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	122	653		141	741		218	2318			1375	459
v/s Ratio Prot	0.15	0.07		c0.20	c0.19		c0.27	0.20			0.42	c0.15
v/s Ratio Perm												0.50
v/c Ratio	1.42	0.29		1.59	0.79		1.41	0.36			1.33	1.42
Uniform Delay, d1	53.5	38.1		52.5	42.3		48.4	15.5			40.9	34.4
Progression Factor	1.00	1.00		1.00	1.00		0.77	0.63			1.00	1.00
Incremental Delay, d2	229.2	0.2		295.8	5.8		207.9	0.4			154.6	199.4
Delay (s)	282.7	38.3		348.3	48.1		245.2	10.1			195.5	233.8
Level of Service	F	D		F	D		F	B			F	F
Approach Delay (s)		139.0			131.1			72.9			206.0	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	156.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Section 6:
Secondary + Additional Plan Area (Beyond 2031)
Alternative #2 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1008	1127	3005	1008	1127	3005	1008	1127	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1008	1127	3005	1008	1127	3005	1008	1127	3005	1008
Volume (vph)	86	737	330	233	1112	152	181	140	104	251	445	307
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	91	776	347	245	1171	160	191	147	109	264	468	323
RTOR Reduction (vph)	0	0	260	0	0	99	0	0	93	0	0	177
Lane Group Flow (vph)	91	776	87	245	1171	61	191	147	16	264	468	146
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	8.0	23.0	23.0	21.0	36.0	36.0	17.0	13.0	13.0	23.0	19.0	19.0
Effective Green, g (s)	8.0	25.0	25.0	21.0	38.0	38.0	17.0	15.0	15.0	23.0	21.0	21.0
Actuated g/C Ratio	0.08	0.25	0.25	0.21	0.38	0.38	0.17	0.15	0.15	0.23	0.21	0.21
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	90	751	252	237	1142	383	192	451	151	259	631	212
v/s Ratio Prot	0.08	0.26		c0.22	c0.39		c0.17	0.05		c0.23	0.16	
v/s Ratio Perm			0.09			0.06			0.02			0.14
v/c Ratio	1.01	1.03	0.34	1.03	1.03	0.16	0.99	0.33	0.11	1.02	0.74	0.69
Uniform Delay, d1	46.0	37.5	30.8	39.5	31.0	20.5	41.5	38.0	36.7	38.5	37.0	36.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	97.9	41.7	0.8	67.5	33.3	0.2	63.1	1.9	1.4	61.0	7.7	16.8
Delay (s)	143.9	79.2	31.6	107.0	64.3	20.6	104.6	39.9	38.2	99.5	44.6	53.3
Level of Service	F	E	C	F	E	C	F	D	D	F	D	D
Approach Delay (s)		70.4			66.5			67.1			61.0	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM Average Control Delay	66.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor				1.00		1.00		0.95	1.00	1.00	0.95	
Frt				1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected				0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1572		1406		3144	1406	1572	3144	
Flt Permitted				0.95		1.00		1.00	1.00	0.51	1.00	
Satd. Flow (perm)				1572		1406		3144	1406	848	3144	
Volume (vph)	0	0	0	214	0	283	0	388	110	346	707	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	225	0	298	0	408	116	364	744	0
RTOR Reduction (vph)	0	0	0	0	0	219	0	0	46	0	0	0
Lane Group Flow (vph)	0	0	0	225	0	79	0	408	70	364	744	0
Turn Type				Prot		custom			Perm	Perm		
Protected Phases				8				2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)				16.0		16.0		36.0	36.0	36.0	36.0	
Effective Green, g (s)				16.0		16.0		36.0	36.0	36.0	36.0	
Actuated g/C Ratio				0.27		0.27		0.60	0.60	0.60	0.60	
Clearance Time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)				419		375		1886	844	509	1886	
v/s Ratio Prot				c0.14				0.13			0.24	
v/s Ratio Perm						0.06			0.05	c0.43		
v/c Ratio				0.54		0.21		0.22	0.08	0.72	0.39	
Uniform Delay, d1				18.8		17.1		5.5	5.0	8.4	6.3	
Progression Factor				0.86		3.38		1.00	1.00	1.00	1.00	
Incremental Delay, d2				3.8		1.0		0.3	0.2	8.3	0.6	
Delay (s)				20.0		58.7		5.8	5.2	16.7	6.9	
Level of Service				B		E		A	A	B	A	
Approach Delay (s)		0.0			42.1			5.7			10.1	
Approach LOS		A			D			A			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	2186	3144	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	3144	1406	2186	3144	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	35	229	27	523	781	39	24	462	169	25	976	185
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	241	28	551	822	41	25	486	178	26	1027	195
RTOR Reduction (vph)	0	0	24	0	0	26	0	0	103	0	0	109
Lane Group Flow (vph)	37	241	4	551	822	15	25	486	75	26	1027	86
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.2	15.3	15.3	33.1	44.2	44.2	2.8	50.8	50.8	4.8	52.8	52.8
Effective Green, g (s)	4.2	15.3	15.3	33.1	44.2	44.2	2.8	50.8	50.8	4.8	52.8	52.8
Actuated g/C Ratio	0.04	0.13	0.13	0.28	0.37	0.37	0.02	0.42	0.42	0.04	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	55	401	179	603	1158	371	37	1272	427	45	1322	619
v/s Ratio Prot	0.02	0.08		c0.25	c0.26		0.02	0.16		c0.02	c0.34	
v/s Ratio Perm			0.00			0.01			0.07			0.06
v/c Ratio	0.67	0.60	0.02	0.91	0.71	0.04	0.68	0.38	0.18	0.58	0.78	0.14
Uniform Delay, d1	57.2	49.5	45.8	42.1	32.4	24.3	58.1	23.8	21.6	56.6	28.6	20.0
Progression Factor	0.97	0.86	0.96	1.00	1.00	1.00	1.32	0.31	0.85	1.00	1.00	1.00
Incremental Delay, d2	23.5	2.1	0.0	18.4	2.0	0.0	36.9	0.8	0.8	16.7	4.5	0.5
Delay (s)	78.9	44.8	43.9	60.4	34.4	24.3	113.5	8.2	19.3	73.3	33.1	20.5
Level of Service	E	D	D	E	C	C	F	A	B	E	C	C
Approach Delay (s)		48.8			44.3			14.8			32.0	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	34.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3005	1008	1572	3144	1406	1127	3144	1008
Flt Permitted	0.09	1.00	1.00	0.51	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	106	3005	1406	841	3005	1008	1572	3144	1406	1127	3144	1008
Volume (vph)	96	319	42	136	1162	8	60	428	57	36	1059	392
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	101	336	44	143	1223	8	63	451	60	38	1115	413
RTOR Reduction (vph)	0	0	26	0	0	5	0	0	41	0	0	92
Lane Group Flow (vph)	101	336	18	143	1223	3	63	451	19	38	1115	321
Confl. Peds. (#/hr)										1		
Turn Type	pm+pt		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6			8			4
Actuated Green, G (s)	48.5	42.5	42.5	48.5	42.5	42.5	5.0	36.5	36.5	6.9	38.4	38.4
Effective Green, g (s)	50.9	44.9	44.9	50.9	44.9	44.9	5.0	36.5	36.5	9.2	40.7	40.7
Actuated g/C Ratio	0.45	0.40	0.40	0.45	0.40	0.40	0.04	0.32	0.32	0.08	0.36	0.36
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4	6.4	4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	102	1198	561	419	1198	402	70	1019	456	92	1136	364
v/s Ratio Prot	c0.05	0.11		0.02	c0.41		c0.04	0.14		0.03	c0.35	
v/s Ratio Perm	0.39		0.01	0.14		0.00			0.01			0.32
v/c Ratio	0.99	0.28	0.03	0.34	1.02	0.01	0.90	0.44	0.04	0.41	0.98	0.88
Uniform Delay, d1	25.5	22.9	20.6	18.7	33.8	20.4	53.6	30.0	26.1	49.1	35.6	33.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	85.8	0.6	0.1	0.5	31.4	0.0	73.7	0.3	0.0	3.0	22.2	21.3
Delay (s)	111.3	23.5	20.7	19.2	65.2	20.5	127.3	30.3	26.1	52.1	57.8	55.0
Level of Service	F	C	C	B	E	C	F	C	C	D	E	E
Approach Delay (s)		41.7			60.2			40.5			56.9	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM Average Control Delay	53.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	112.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	2965		1127	3005	1008	1127	3005	1008	2186	3003	
Flt Permitted	0.70	1.00		0.41	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	830	2965		486	3005	1008	1127	3005	1008	2186	3003	
Volume (vph)	53	223	22	164	80	327	7	486	100	440	1105	6
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	56	235	23	173	84	344	7	512	105	463	1163	6
RTOR Reduction (vph)	0	10	0	0	0	233	0	0	75	0	0	0
Lane Group Flow (vph)	56	248	0	173	84	111	7	512	30	463	1169	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	11.9	11.9		23.9	23.9	23.9	0.8	20.5	20.5	18.9	38.6	
Effective Green, g (s)	13.2	13.2		25.2	25.2	25.2	0.8	22.1	22.1	18.9	40.2	
Actuated g/C Ratio	0.17	0.17		0.32	0.32	0.32	0.01	0.28	0.28	0.24	0.51	
Clearance Time (s)	5.3	5.3		4.0	5.3	5.3	4.0	5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	140	500		222	968	325	12	849	285	528	1544	
v/s Ratio Prot		0.08		c0.08	0.03		0.01	0.17		c0.21	c0.39	
v/s Ratio Perm	0.07			c0.17		0.11			0.03			
v/c Ratio	0.40	0.50		0.78	0.09	0.34	0.58	0.60	0.10	0.88	0.76	
Uniform Delay, d1	29.0	29.5		22.3	18.5	20.2	38.5	24.3	20.7	28.5	15.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.9	0.8		15.8	0.0	0.6	56.2	3.2	0.7	15.1	3.5	
Delay (s)	30.8	30.3		38.1	18.5	20.8	94.8	27.4	21.5	43.6	18.6	
Level of Service	C	C		D	B	C	F	C	C	D	B	
Approach Delay (s)		30.4			25.5			27.2			25.7	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	78.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	4517	1008	1572	4517	1406	2186	3005	1406	1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	4517	1008	1572	4517	1406	2186	3005	1406	1572	3005	1008
Volume (vph)	366	805	145	214	743	115	76	129	122	64	280	201
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	385	847	153	225	782	121	80	136	128	67	295	212
RTOR Reduction (vph)	0	0	97	0	0	96	0	0	106	0	0	174
Lane Group Flow (vph)	385	847	56	225	782	25	80	136	22	67	295	38
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	27.7	28.0	28.0	15.2	15.5	15.5	3.1	12.8	12.8	4.0	13.7	13.7
Effective Green, g (s)	27.7	28.0	28.0	15.2	15.5	15.5	3.1	12.8	12.8	4.0	13.7	13.7
Actuated g/C Ratio	0.36	0.37	0.37	0.20	0.20	0.20	0.04	0.17	0.17	0.05	0.18	0.18
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	411	1664	371	314	921	287	89	506	237	83	542	182
v/s Ratio Prot	c0.34	0.19		0.14	c0.17		0.04	0.05		c0.04	c0.10	
v/s Ratio Perm			0.06			0.02			0.02			0.04
v/c Ratio	0.94	0.51	0.15	0.72	0.85	0.09	0.90	0.27	0.09	0.81	0.54	0.21
Uniform Delay, d1	23.3	18.7	16.1	28.4	29.1	24.5	36.3	27.5	26.7	35.6	28.3	26.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.7	0.2	0.2	7.6	7.4	0.1	62.4	0.3	0.2	41.7	1.1	0.6
Delay (s)	52.0	18.9	16.2	36.0	36.5	24.6	98.7	27.8	26.9	77.3	29.4	27.1
Level of Service	D	B	B	D	D	C	F	C	C	E	C	C
Approach Delay (s)		27.8			35.1			43.9			34.2	
Approach LOS		C			D			D			C	

Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	76.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	1127	3144	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.10	1.00	1.00	0.41	1.00	1.00	0.08	1.00	1.00	0.42	1.00	1.00
Satd. Flow (perm)	160	3144	1406	490	3144	1008	135	3005	1008	503	3005	1406
Volume (vph)	162	578	164	33	886	91	77	453	161	36	1058	299
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	171	608	173	35	933	96	81	477	169	38	1114	315
RTOR Reduction (vph)	0	0	92	0	0	64	0	0	100	0	0	127
Lane Group Flow (vph)	171	608	81	35	933	32	81	477	69	38	1114	188
Confl. Peds. (#/hr)				1								
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	56.6	50.2	50.2	42.3	39.9	39.9	53.5	49.0	49.0	49.3	46.9	46.9
Effective Green, g (s)	56.6	50.2	50.2	42.3	39.9	39.9	53.5	49.0	49.0	49.3	46.9	46.9
Actuated g/C Ratio	0.47	0.42	0.42	0.35	0.33	0.33	0.45	0.41	0.41	0.41	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	225	1315	588	185	1045	335	114	1227	412	219	1174	550
v/s Ratio Prot	c0.08	0.19		0.00	c0.30		c0.03	0.16		0.00	c0.37	
v/s Ratio Perm	0.28		0.06	0.06		0.03	0.29		0.07	0.07		0.13
v/c Ratio	0.76	0.46	0.14	0.19	0.89	0.10	0.71	0.39	0.17	0.17	0.95	0.34
Uniform Delay, d1	26.1	25.2	21.5	26.0	38.0	27.6	25.2	25.0	22.5	21.8	35.4	25.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.83	0.85	0.59
Incremental Delay, d2	14.0	0.3	0.1	0.5	9.8	0.1	18.8	0.9	0.9	0.3	13.3	1.2
Delay (s)	40.1	25.4	21.7	26.5	47.8	27.7	43.9	25.9	23.4	18.4	43.5	16.4
Level of Service	D	C	C	C	D	C	D	C	C	B	D	B
Approach Delay (s)		27.4			45.3			27.3			37.0	
Approach LOS		C			D			C			D	

Intersection Summary			
HCM Average Control Delay	35.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	3049	3144	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	3144	1406	3049	3144	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	58	649	86	417	1034	51	42	374	114	124	760	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	61	683	91	439	1088	54	44	394	120	131	800	42
RTOR Reduction (vph)	0	0	67	0	0	33	0	0	93	0	0	30
Lane Group Flow (vph)	61	683	24	439	1088	21	44	394	27	131	800	12
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	20.0	20.0	13.0	29.0	29.0	4.0	17.0	17.0	9.0	22.0	22.0
Effective Green, g (s)	4.0	20.0	20.0	13.0	29.0	29.0	4.0	17.0	17.0	9.0	22.0	22.0
Actuated g/C Ratio	0.05	0.27	0.27	0.17	0.39	0.39	0.05	0.23	0.23	0.12	0.29	0.29
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	84	838	375	528	1216	544	84	713	319	189	922	412
v/s Ratio Prot	0.04	0.22		c0.14	c0.35		0.03	0.13		c0.08	c0.25	
v/s Ratio Perm			0.02			0.01			0.02			0.01
v/c Ratio	0.73	0.82	0.06	0.83	0.89	0.04	0.52	0.55	0.09	0.69	0.87	0.03
Uniform Delay, d1	35.0	25.8	20.5	29.9	21.6	14.3	34.6	25.6	22.9	31.7	25.1	18.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	42.3	8.6	0.3	14.2	10.3	0.1	21.4	3.1	0.5	18.9	10.8	0.1
Delay (s)	77.3	34.3	20.9	44.1	31.9	14.5	56.0	28.7	23.4	50.6	36.0	19.0
Level of Service	E	C	C	D	C	B	E	C	C	D	D	B
Approach Delay (s)		36.0			34.7			29.7			37.2	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM Average Control Delay	34.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2904		1127	3005	1008	1127	3005	1008	2186	3005	
Flt Permitted		1.00		0.37	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2904		439	3005	1008	1127	3005	1008	2186	3005	
Volume (vph)	0	182	53	275	62	193	12	323	405	607	348	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	192	56	289	65	203	13	340	426	639	366	0
RTOR Reduction (vph)	0	31	0	0	0	131	0	0	309	0	0	0
Lane Group Flow (vph)	0	217	0	289	65	72	13	340	117	639	366	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		11.3		30.4	30.4	30.4	0.7	17.1	17.1	26.5	42.9	
Effective Green, g (s)		11.3		30.4	30.4	30.4	0.7	17.1	17.1	26.5	42.9	
Actuated g/C Ratio		0.13		0.35	0.35	0.35	0.01	0.20	0.20	0.31	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		382		276	1062	356	9	598	200	674	1499	
v/s Ratio Prot		0.07		c0.18	0.02		0.01	0.11		c0.29	0.12	
v/s Ratio Perm				c0.19		0.07			c0.12			
v/c Ratio		0.57		1.05	0.06	0.20	1.44	0.57	0.58	0.95	0.24	
Uniform Delay, d1		35.1		25.3	18.4	19.4	42.6	31.1	31.2	29.1	12.3	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.9		67.0	0.0	0.3	474.2	1.2	4.3	22.5	0.1	
Delay (s)		37.0		92.3	18.4	19.6	516.8	32.4	35.5	51.5	12.4	
Level of Service		D		F	B	B	F	C	D	D	B	
Approach Delay (s)		37.0			57.2			42.2			37.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	43.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	1127	3005	986	2186	1582	1008	1127	2880	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.50	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	1127	3005	1008	1127	3005	986	1141	1582	1008	658	2880	
Volume (vph)	151	133	595	312	273	155	297	326	235	37	71	28
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	159	140	626	328	287	163	313	343	247	39	75	29
RTOR Reduction (vph)	0	0	405	0	0	109	0	0	172	0	24	0
Lane Group Flow (vph)	159	140	221	328	287	54	313	343	75	39	80	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	Perm		
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)	12.5	18.4	18.4	16.1	22.0	22.0	20.4	20.4	20.4	10.4	10.4	
Effective Green, g (s)	12.5	18.4	18.4	16.1	22.0	22.0	20.4	20.4	20.4	10.4	10.4	
Actuated g/C Ratio	0.19	0.28	0.28	0.24	0.33	0.33	0.30	0.30	0.30	0.16	0.16	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	211	826	277	271	988	324	442	482	307	102	448	
v/s Ratio Prot	0.14	0.05		c0.29	c0.10		0.06	c0.22			0.03	
v/s Ratio Perm			c0.22			0.05	0.15		0.07	0.06		
v/c Ratio	0.75	0.17	0.80	1.21	0.29	0.17	0.71	0.71	0.25	0.38	0.18	
Uniform Delay, d1	25.7	18.4	22.5	25.4	16.7	15.9	19.9	20.6	17.5	25.4	24.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	14.1	0.1	14.6	123.9	0.2	0.2	5.1	4.9	0.4	2.4	0.2	
Delay (s)	39.9	18.5	37.2	149.3	16.8	16.2	25.0	25.6	17.9	27.7	24.7	
Level of Service	D	B	D	F	B	B	C	C	B	C	C	
Approach Delay (s)		34.8			72.5			23.3			25.6	
Approach LOS		C			E			C			C	

Intersection Summary			
HCM Average Control Delay	41.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	66.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88	1.00	0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1127	3002		1127	3005	1775	1127	2978		2186	2848	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.60	1.00		0.18	1.00	
Satd. Flow (perm)	1127	3002		1127	3005	1775	715	2978		418	2848	
Volume (vph)	261	690	6	5	796	927	16	377	25	558	148	80
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	275	726	6	5	838	976	17	397	26	587	156	84
RTOR Reduction (vph)	0	1	0	0	0	131	0	4	0	0	54	0
Lane Group Flow (vph)	275	731	0	5	838	845	17	419	0	587	186	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	28.0	62.4		0.8	35.2	62.2	21.0	19.4		50.4	44.8	
Effective Green, g (s)	28.0	62.4		0.8	35.2	62.2	21.0	19.4		50.4	44.8	
Actuated g/C Ratio	0.22	0.50		0.01	0.28	0.50	0.17	0.15		0.40	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	251	1491		7	842	936	125	460		548	1016	
v/s Ratio Prot	c0.24	0.24		0.00	c0.28	c0.19	0.00	0.14		c0.23	0.07	
v/s Ratio Perm						0.28	0.02			c0.20		
v/c Ratio	1.10	0.49		0.71	1.00	0.90	0.14	0.91		1.07	0.18	
Uniform Delay, d1	48.8	21.0		62.3	45.1	28.9	44.2	52.2		36.1	27.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	84.7	0.3		159.1	29.6	11.8	0.5	22.0		58.9	0.1	
Delay (s)	133.5	21.3		221.4	74.8	40.8	44.7	74.3		95.0	27.9	
Level of Service	F	C		F	E	D	D	E		F	C	
Approach Delay (s)		51.9			56.9			73.1			75.5	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	61.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	125.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1127	1008	3005	1008	1127	3005
Flt Permitted	0.95	1.00	1.00	1.00	0.32	1.00
Satd. Flow (perm)	1127	1008	3005	1008	381	3005
Volume (vph)	228	62	591	105	258	1246
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	240	65	622	111	272	1312
RTOR Reduction (vph)	0	49	0	58	0	0
Lane Group Flow (vph)	240	16	622	53	272	1312
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	28.9	28.9	57.1	57.1	83.1	83.1
Effective Green, g (s)	28.9	28.9	57.1	57.1	83.1	83.1
Actuated g/C Ratio	0.24	0.24	0.48	0.48	0.69	0.69
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	271	243	1430	480	401	2081
v/s Ratio Prot	c0.21		0.21		c0.12	0.44
v/s Ratio Perm		0.02		0.05	c0.35	
v/c Ratio	0.89	0.06	0.43	0.11	0.68	0.63
Uniform Delay, d1	44.0	35.1	20.8	17.4	9.3	10.1
Progression Factor	1.00	1.00	0.73	0.50	0.78	0.45
Incremental Delay, d2	27.2	0.1	0.9	0.4	2.7	0.9
Delay (s)	71.1	35.2	16.0	9.1	10.0	5.4
Level of Service	E	D	B	A	A	A
Approach Delay (s)	63.5		14.9			6.2
Approach LOS	E		B			A

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	1127	4249		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	1127	4249		2186	4318	1008	1127	4318	1775
Volume (vph)	249	296	301	138	860	104	445	1123	66	21	925	631
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	262	312	317	145	905	109	468	1182	69	22	974	664
RTOR Reduction (vph)	0	0	244	0	13	0	0	0	28	0	0	38
Lane Group Flow (vph)	262	312	73	145	1001	0	468	1182	41	22	974	626
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	15.9	27.7	27.7	18.1	29.9		26.8	53.4	53.4	4.8	31.4	47.3
Effective Green, g (s)	15.9	27.7	27.7	18.1	29.9		26.8	53.4	53.4	4.8	31.4	47.3
Actuated g/C Ratio	0.13	0.23	0.23	0.15	0.25		0.22	0.44	0.44	0.04	0.26	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	290	694	233	170	1059		488	1922	449	45	1130	700
v/s Ratio Prot	c0.12	0.10		0.13	c0.24		c0.21	0.27		0.02	0.23	c0.35
v/s Ratio Perm			0.07						0.04			
v/c Ratio	0.90	0.45	0.31	0.85	0.95		0.96	0.61	0.09	0.49	0.86	0.89
Uniform Delay, d1	51.3	39.6	38.3	49.7	44.2		46.1	25.4	19.3	56.4	42.2	34.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.58	0.24	1.34
Incremental Delay, d2	29.2	0.5	0.8	31.6	16.1		30.1	1.5	0.4	4.0	4.5	7.5
Delay (s)	80.5	40.1	39.0	81.2	60.3		76.2	26.9	19.7	93.1	14.7	52.9
Level of Service	F	D	D	F	E		E	C	B	F	B	D
Approach Delay (s)		51.6			63.0			40.1			31.0	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	44.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	2212	1020	2212	4368	4368	1011
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	2212	1020	2212	4368	4368	1011
Volume (vph)	100	39	484	992	1538	496
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	41	509	1044	1619	522
RTOR Reduction (vph)	0	31	0	0	0	25
Lane Group Flow (vph)	105	10	509	1044	1619	497
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	26.4	26.4	29.3	81.6	48.3	74.7
Effective Green, g (s)	28.0	28.0	29.3	84.0	50.7	78.7
Actuated g/C Ratio	0.23	0.23	0.24	0.70	0.42	0.66
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	516	238	540	3058	1845	697
v/s Ratio Prot	0.05		c0.23	0.24	c0.37	c0.17
v/s Ratio Perm		0.01				0.33
v/c Ratio	0.20	0.04	0.94	0.34	0.88	0.71
Uniform Delay, d1	37.0	35.6	44.5	7.1	31.8	13.4
Progression Factor	1.00	1.00	0.90	2.36	0.27	0.96
Incremental Delay, d2	0.9	0.3	20.3	0.2	0.6	0.6
Delay (s)	37.9	35.9	60.4	17.0	9.3	13.3
Level of Service	D	D	E	B	A	B
Approach Delay (s)	37.4			31.2	10.3	
Approach LOS	D			C	B	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	2186	2837		1127	3005		1127	4254			4318	998
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)	2186	2837		1127	3005		1127	4254			4318	998
Volume (vph)	164	154	81	213	557	0	292	727	73	0	1740	657
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	162	85	224	586	0	307	765	77	0	1832	692
RTOR Reduction (vph)	0	59	0	0	0	0	0	8	0	0	0	42
Lane Group Flow (vph)	173	188	0	224	586	0	307	834	0	0	1832	650
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases												6
Actuated Green, G (s)	13.0	24.8		15.0	26.8		23.2	63.3			36.1	49.1
Effective Green, g (s)	13.0	27.6		15.0	29.6		23.2	65.4			38.2	51.2
Actuated g/C Ratio	0.11	0.23		0.12	0.25		0.19	0.55			0.32	0.43
Clearance Time (s)	4.0	6.8		4.0	6.8		4.0	6.1			6.1	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	237	653		141	741		218	2318			1375	459
v/s Ratio Prot	0.08	0.07		c0.20	c0.19		c0.27	0.20			0.42	c0.15
v/s Ratio Perm												0.50
v/c Ratio	0.73	0.29		1.59	0.79		1.41	0.36			1.33	1.42
Uniform Delay, d1	51.8	38.1		52.5	42.3		48.4	15.5			40.9	34.4
Progression Factor	1.00	1.00		1.00	1.00		1.18	0.44			1.00	1.00
Incremental Delay, d2	10.7	0.2		295.8	5.8		207.9	0.4			154.6	199.4
Delay (s)	62.5	38.3		348.3	48.1		265.1	7.3			195.5	233.8
Level of Service	E	D		F	D		F	A			F	F
Approach Delay (s)		48.3			131.1			76.2			206.0	
Approach LOS		D			F			E			F	

Intersection Summary			
HCM Average Control Delay	149.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Section 7:
Secondary + Additional Plan Area (Beyond 2031)
Alternative #3 AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1008	1127	3005	1008	1127	2814		1127	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1008	1127	3005	1008	1127	2814		1127	3005	1008
Volume (vph)	86	737	242	171	1112	152	181	140	104	251	445	307
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	91	776	255	180	1171	160	191	147	109	264	468	323
RTOR Reduction (vph)	0	0	181	0	0	99	0	93	0	0	0	177
Lane Group Flow (vph)	91	776	74	180	1171	61	191	163	0	264	468	146
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)	8.0	27.0	27.0	17.0	36.0	36.0	17.0	13.0		23.0	19.0	19.0
Effective Green, g (s)	8.0	29.0	29.0	17.0	38.0	38.0	17.0	15.0		23.0	21.0	21.0
Actuated g/C Ratio	0.08	0.29	0.29	0.17	0.38	0.38	0.17	0.15		0.23	0.21	0.21
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	90	871	292	192	1142	383	192	422		259	631	212
v/s Ratio Prot	0.08	0.26		c0.16	c0.39		c0.17	0.06		c0.23	0.16	
v/s Ratio Perm			0.07			0.06						0.14
v/c Ratio	1.01	0.89	0.25	0.94	1.03	0.16	0.99	0.39		1.02	0.74	0.69
Uniform Delay, d1	46.0	34.0	27.2	41.0	31.0	20.5	41.5	38.4		38.5	37.0	36.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	97.9	11.3	0.5	46.8	33.3	0.2	63.1	2.7		61.0	7.7	16.8
Delay (s)	143.9	45.3	27.7	87.8	64.3	20.6	104.6	41.0		99.5	44.6	53.3
Level of Service	F	D	C	F	E	C	F	D		F	D	D
Approach Delay (s)		49.3			62.5			68.2			61.0	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	59.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor				1.00		1.00		0.95	1.00	1.00	0.95	
Frt				1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected				0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1572		1406		3144	1406	1572	3144	
Flt Permitted				0.95		1.00		1.00	1.00	0.54	1.00	
Satd. Flow (perm)				1572		1406		3144	1406	892	3144	
Volume (vph)	0	0	0	263	0	246	0	338	102	336	623	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	277	0	259	0	356	107	354	656	0
RTOR Reduction (vph)	0	0	0	0	0	186	0	0	45	0	0	0
Lane Group Flow (vph)	0	0	0	277	0	73	0	356	62	354	656	0
Turn Type				Prot		custom			Perm	Perm		
Protected Phases				8				2			6	
Permitted Phases						8			2	6		
Actuated Green, G (s)				17.0		17.0		35.0	35.0	35.0	35.0	
Effective Green, g (s)				17.0		17.0		35.0	35.0	35.0	35.0	
Actuated g/C Ratio				0.28		0.28		0.58	0.58	0.58	0.58	
Clearance Time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)				445		398		1834	820	520	1834	
v/s Ratio Prot				c0.18				0.11			0.21	
v/s Ratio Perm						0.05			0.04	c0.40		
v/c Ratio				0.62		0.18		0.19	0.08	0.68	0.36	
Uniform Delay, d1				18.7		16.3		5.9	5.5	8.6	6.6	
Progression Factor				0.89		2.96		1.00	1.00	1.00	1.00	
Incremental Delay, d2				4.9		0.8		0.2	0.2	7.0	0.5	
Delay (s)				21.6		48.9		6.1	5.6	15.7	7.1	
Level of Service				C		D		A	A	B	A	
Approach Delay (s)		0.0			34.8			6.0			10.1	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95		1.00	0.95	1.00
Frt	1.00	0.98		1.00	0.99		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1572	3095		2186	3121		1572	2885		1127	3005	1406
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1572	3095		2186	3121		1572	2885		1127	3005	1406
Volume (vph)	35	229	27	523	781	39	24	462	169	25	976	185
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	37	241	28	551	822	41	25	486	178	26	1027	195
RTOR Reduction (vph)	0	8	0	0	3	0	0	28	0	0	0	110
Lane Group Flow (vph)	37	261	0	551	860	0	25	636	0	26	1027	85
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	4.2	15.7		33.1	44.6		2.6	50.4		4.8	52.6	52.6
Effective Green, g (s)	4.2	15.7		33.1	44.6		2.6	50.4		4.8	52.6	52.6
Actuated g/C Ratio	0.04	0.13		0.28	0.37		0.02	0.42		0.04	0.44	0.44
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	55	405		603	1160		34	1212		45	1317	616
v/s Ratio Prot	0.02	0.08		c0.25	c0.28		0.02	0.22		c0.02	c0.34	
v/s Ratio Perm												0.06
v/c Ratio	0.67	0.64		0.91	0.74		0.74	0.52		0.58	0.78	0.14
Uniform Delay, d1	57.2	49.5		42.1	32.7		58.4	25.9		56.6	28.8	20.2
Progression Factor	0.97	0.85		1.00	1.00		1.19	0.50		1.00	1.00	1.00
Incremental Delay, d2	24.0	3.0		18.4	2.6		56.0	1.6		16.7	4.6	0.5
Delay (s)	79.5	45.3		60.4	35.3		125.7	14.6		73.3	33.4	20.6
Level of Service	E	D		E	D		F	B		E	C	C
Approach Delay (s)		49.4			45.1			18.6			32.2	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	36.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3003		1572	3144	1406	1127	3144	1008
Flt Permitted	0.95	1.00	1.00	0.55	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1406	909	3003		1572	3144	1406	1127	3144	1008
Volume (vph)	96	319	42	136	1162	8	60	428	57	36	1059	392
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	101	336	44	143	1223	8	63	451	60	38	1115	413
RTOR Reduction (vph)	0	0	25	0	1	0	0	0	41	0	0	87
Lane Group Flow (vph)	101	336	19	143	1230	0	63	451	19	38	1115	326
Confl. Peds. (#/hr)										1		
Turn Type	Prot		Perm	pm+pt			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2	6					8			4
Actuated Green, G (s)	10.0	50.6	50.6	52.6	46.6		5.0	38.2	38.2	7.0	40.2	40.2
Effective Green, g (s)	10.0	53.0	53.0	55.0	49.0		5.0	38.2	38.2	9.3	42.5	42.5
Actuated g/C Ratio	0.08	0.43	0.43	0.45	0.40		0.04	0.31	0.31	0.08	0.35	0.35
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	92	1300	608	441	1201		64	980	438	86	1091	350
v/s Ratio Prot	c0.09	c0.11		0.02	c0.41		c0.04	0.14		0.03	c0.35	
v/s Ratio Perm			0.01	0.13					0.01			0.32
v/c Ratio	1.10	0.26	0.03	0.32	1.02		0.98	0.46	0.04	0.44	1.02	0.93
Uniform Delay, d1	56.2	22.2	20.0	20.5	36.8		58.7	33.9	29.4	54.1	40.0	38.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	122.8	0.5	0.1	0.4	32.4		106.4	0.3	0.0	3.6	32.9	31.0
Delay (s)	179.0	22.7	20.1	20.9	69.1		165.1	34.2	29.4	57.7	72.9	69.6
Level of Service	F	C	C	C	E		F	C	C	E	E	E
Approach Delay (s)		55.3			64.1			48.1			71.7	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	63.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	122.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	2965		1127	3005	1008	1127	3005	1008	2186	3003	
Flt Permitted	0.70	1.00		0.41	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	830	2965		490	3005	1008	1127	3005	1008	2186	3003	
Volume (vph)	53	223	22	164	80	327	7	486	100	40	1255	6
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	56	235	23	173	84	344	7	512	105	42	1321	6
RTOR Reduction (vph)	0	10	0	0	0	241	0	0	51	0	0	0
Lane Group Flow (vph)	56	248	0	173	84	103	7	512	54	42	1327	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	11.9	11.9		20.9	20.9	20.9	0.7	38.3	38.3	2.8	40.4	
Effective Green, g (s)	13.2	13.2		22.2	22.2	22.2	0.7	39.9	39.9	2.8	42.0	
Actuated g/C Ratio	0.17	0.17		0.29	0.29	0.29	0.01	0.52	0.52	0.04	0.55	
Clearance Time (s)	5.3	5.3		4.0	5.3	5.3	4.0	5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	142	509		183	868	291	10	1559	523	80	1640	
v/s Ratio Prot		0.08		c0.06	0.03		0.01	0.17		c0.02	c0.44	
v/s Ratio Perm	0.07			c0.21		0.10			0.05			
v/c Ratio	0.39	0.49		0.95	0.10	0.35	0.70	0.33	0.10	0.53	0.81	
Uniform Delay, d1	28.3	28.8		26.3	20.0	21.7	38.0	10.7	9.4	36.4	14.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.8	0.7		50.4	0.0	0.7	117.6	0.6	0.4	6.1	4.4	
Delay (s)	30.1	29.5		76.8	20.1	22.4	155.6	11.3	9.8	42.5	18.6	
Level of Service	C	C		E	C	C	F	B	A	D	B	
Approach Delay (s)		29.6			37.7			12.7			19.3	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	76.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95		1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1127	4517	1008	1572	4517	1406	1127	2787		1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.37	1.00		0.59	1.00	1.00
Satd. Flow (perm)	1127	4517	1008	1572	4517	1406	437	2787		974	3005	1008
Volume (vph)	366	805	145	214	743	115	76	129	122	64	280	201
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	385	847	153	225	782	121	80	136	128	67	295	212
RTOR Reduction (vph)	0	0	96	0	0	96	0	95	0	0	0	177
Lane Group Flow (vph)	385	847	57	225	782	25	80	169	0	67	295	35
Turn Type	Prot		Perm	Prot		Perm	pm+pt			Perm		Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2			6		6
Actuated Green, G (s)	27.3	27.6	27.6	14.9	15.2	15.2	19.3	19.3		12.3	12.3	12.3
Effective Green, g (s)	27.3	27.6	27.6	14.9	15.2	15.2	19.3	19.3		12.3	12.3	12.3
Actuated g/C Ratio	0.37	0.37	0.37	0.20	0.21	0.21	0.26	0.26		0.17	0.17	0.17
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	417	1689	377	317	930	290	142	729		162	501	168
v/s Ratio Prot	c0.34	0.19		0.14	c0.17		c0.02	0.06			0.10	
v/s Ratio Perm			0.06			0.02	c0.12			0.07		0.04
v/c Ratio	0.92	0.50	0.15	0.71	0.84	0.09	0.56	0.23		0.41	0.59	0.21
Uniform Delay, d1	22.2	17.8	15.3	27.4	28.1	23.7	23.4	21.4		27.5	28.4	26.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	25.9	0.2	0.2	7.1	6.9	0.1	5.0	0.2		1.7	1.8	0.6
Delay (s)	48.1	18.0	15.5	34.5	35.1	23.8	28.4	21.6		29.2	30.2	27.2
Level of Service	D	B	B	C	D	C	C	C		C	C	C
Approach Delay (s)		26.1			33.8			23.2			29.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	73.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	2186	4517	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	162	578	164	433	886	91	77	403	211	36	843	299
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	171	608	173	456	933	96	81	424	222	38	887	315
RTOR Reduction (vph)	0	0	145	0	0	71	0	0	129	0	0	188
Lane Group Flow (vph)	171	608	28	456	933	25	81	424	93	38	887	127
Confl. Peds. (#/hr)				1								
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	16.3	19.6	19.6	28.2	31.5	31.5	8.0	50.3	50.3	5.9	48.2	48.2
Effective Green, g (s)	16.3	19.6	19.6	28.2	31.5	31.5	8.0	50.3	50.3	5.9	48.2	48.2
Actuated g/C Ratio	0.14	0.16	0.16	0.23	0.26	0.26	0.07	0.42	0.42	0.05	0.40	0.40
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	214	738	230	514	1186	265	105	1260	423	55	1207	565
v/s Ratio Prot	0.11	0.13		c0.21	c0.21		c0.05	0.14		0.03	c0.30	
v/s Ratio Perm			0.02			0.02			0.09			0.09
v/c Ratio	0.80	0.82	0.12	0.89	0.79	0.10	0.77	0.34	0.22	0.69	0.73	0.22
Uniform Delay, d1	50.3	48.5	42.9	44.4	41.1	33.5	55.1	23.6	22.3	56.2	30.5	23.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.35	0.81	0.78
Incremental Delay, d2	18.5	7.4	0.2	16.7	3.5	0.2	28.8	0.7	1.2	28.1	3.5	0.8
Delay (s)	68.8	56.0	43.1	61.1	44.6	33.6	83.9	24.3	23.5	104.2	28.2	19.1
Level of Service	E	E	D	E	D	C	F	C	C	F	C	B
Approach Delay (s)		55.9			49.0			30.7			28.2	
Approach LOS		E			D			C			C	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	4517	1406	1572	4517	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	58	699	86	232	1584	251	42	374	114	124	760	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	61	736	91	244	1667	264	44	394	120	131	800	42
RTOR Reduction (vph)	0	0	68	0	0	158	0	0	93	0	0	29
Lane Group Flow (vph)	61	736	23	244	1667	106	44	394	27	131	800	13
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	20.0	20.0	16.0	32.0	32.0	4.0	18.0	18.0	10.0	24.0	24.0
Effective Green, g (s)	4.0	20.0	20.0	16.0	32.0	32.0	4.0	18.0	18.0	10.0	24.0	24.0
Actuated g/C Ratio	0.05	0.25	0.25	0.20	0.40	0.40	0.05	0.22	0.22	0.12	0.30	0.30
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	79	1129	352	314	1807	562	79	707	316	197	943	422
v/s Ratio Prot	0.04	0.16		c0.16	c0.37		0.03	0.13		c0.08	c0.25	
v/s Ratio Perm			0.02			0.08			0.02			0.01
v/c Ratio	0.77	0.65	0.06	0.78	0.92	0.19	0.56	0.56	0.09	0.66	0.85	0.03
Uniform Delay, d1	37.5	26.9	22.9	30.3	22.8	15.6	37.1	27.5	24.5	33.4	26.3	19.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	51.4	2.9	0.4	17.1	9.4	0.7	25.4	3.2	0.5	16.4	9.4	0.1
Delay (s)	89.0	29.8	23.2	47.4	32.2	16.3	62.5	30.6	25.0	49.8	35.7	19.9
Level of Service	F	C	C	D	C	B	E	C	C	D	D	B
Approach Delay (s)		33.2			32.0			31.9			36.9	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2904		1127	3005	1008	1127	3005	1008	2186	3005	
Flt Permitted		1.00		0.37	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2904		439	3005	1008	1127	3005	1008	2186	3005	
Volume (vph)	0	182	53	275	62	193	12	323	405	607	348	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	192	56	289	65	203	13	340	426	639	366	0
RTOR Reduction (vph)	0	31	0	0	0	131	0	0	309	0	0	0
Lane Group Flow (vph)	0	217	0	289	65	72	13	340	117	639	366	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		11.3		30.4	30.4	30.4	0.7	17.1	17.1	26.5	42.9	
Effective Green, g (s)		11.3		30.4	30.4	30.4	0.7	17.1	17.1	26.5	42.9	
Actuated g/C Ratio		0.13		0.35	0.35	0.35	0.01	0.20	0.20	0.31	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		382		276	1062	356	9	598	200	674	1499	
v/s Ratio Prot		0.07		c0.18	0.02		0.01	0.11		c0.29	0.12	
v/s Ratio Perm				c0.19		0.07			c0.12			
v/c Ratio		0.57		1.05	0.06	0.20	1.44	0.57	0.58	0.95	0.24	
Uniform Delay, d1		35.1		25.3	18.4	19.4	42.6	31.1	31.2	29.1	12.3	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		1.9		67.0	0.0	0.3	474.2	1.2	4.3	22.5	0.1	
Delay (s)		37.0		92.3	18.4	19.6	516.8	32.4	35.5	51.5	12.4	
Level of Service		D		F	B	B	F	C	D	D	B	
Approach Delay (s)		37.0			57.2			42.2			37.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	43.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	86.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	1127	3005	986	1127	1582	1008	1127	2880	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.50	1.00	1.00	0.55	1.00	
Satd. Flow (perm)	1127	3005	1008	1127	3005	986	590	1582	1008	658	2880	
Volume (vph)	151	133	595	312	273	155	297	326	235	37	71	28
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	159	140	626	328	287	163	313	343	247	39	75	29
RTOR Reduction (vph)	0	0	432	0	0	109	0	0	166	0	25	0
Lane Group Flow (vph)	159	140	194	328	287	54	313	343	81	39	79	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	pm+pt		Perm	Perm		
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases			4			8	2		2	6		
Actuated Green, G (s)	16.3	19.0	19.0	25.1	27.8	27.8	27.5	27.5	27.5	10.5	10.5	
Effective Green, g (s)	16.3	19.0	19.0	25.1	27.8	27.8	27.5	27.5	27.5	10.5	10.5	
Actuated g/C Ratio	0.19	0.23	0.23	0.30	0.33	0.33	0.33	0.33	0.33	0.13	0.13	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	220	683	229	338	999	328	278	520	332	83	362	
v/s Ratio Prot	0.14	0.05		c0.29	0.10		c0.18	0.22			0.03	
v/s Ratio Perm			c0.19			0.05	c0.20		0.08	0.06		
v/c Ratio	0.72	0.20	0.85	0.97	0.29	0.17	1.13	0.66	0.24	0.47	0.22	
Uniform Delay, d1	31.5	26.2	30.9	28.9	20.6	19.7	26.6	24.0	20.5	34.0	32.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.1	0.1	24.0	40.9	0.2	0.2	92.2	3.0	0.4	4.2	0.3	
Delay (s)	42.7	26.3	55.0	69.7	20.7	19.9	118.9	27.1	20.9	38.1	33.2	
Level of Service	D	C	D	E	C	B	F	C	C	D	C	
Approach Delay (s)		48.5			41.2			57.2			34.5	
Approach LOS		D			D			E			C	

Intersection Summary			
HCM Average Control Delay	48.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	83.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88	1.00	0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	0.99		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1127	3002		1127	3005	1775	1127	2978		2186	2848	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.60	1.00		0.18	1.00	
Satd. Flow (perm)	1127	3002		1127	3005	1775	715	2978		418	2848	
Volume (vph)	261	690	6	5	796	927	16	377	25	558	148	80
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	275	726	6	5	838	976	17	397	26	587	156	84
RTOR Reduction (vph)	0	1	0	0	0	131	0	4	0	0	54	0
Lane Group Flow (vph)	275	731	0	5	838	845	17	419	0	587	186	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	28.0	62.4		0.8	35.2	62.2	21.0	19.4		50.4	44.8	
Effective Green, g (s)	28.0	62.4		0.8	35.2	62.2	21.0	19.4		50.4	44.8	
Actuated g/C Ratio	0.22	0.50		0.01	0.28	0.50	0.17	0.15		0.40	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	251	1491		7	842	936	125	460		548	1016	
v/s Ratio Prot	c0.24	0.24		0.00	c0.28	c0.19	0.00	0.14		c0.23	0.07	
v/s Ratio Perm						0.28	0.02			c0.20		
v/c Ratio	1.10	0.49		0.71	1.00	0.90	0.14	0.91		1.07	0.18	
Uniform Delay, d1	48.8	21.0		62.3	45.1	28.9	44.2	52.2		36.1	27.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	84.7	0.3		159.1	29.6	11.8	0.5	22.0		58.9	0.1	
Delay (s)	133.5	21.3		221.4	74.8	40.8	44.7	74.3		95.0	27.9	
Level of Service	F	C		F	E	D	D	E		F	C	
Approach Delay (s)		51.9			56.9			73.1			75.5	
Approach LOS		D			E			E			E	

Intersection Summary			
HCM Average Control Delay	61.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	125.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	1.00		0.95	1.00	1.00	0.95
Frt	0.89		1.00	0.85	1.00	1.00
Flt Protected	0.99		1.00	1.00	0.95	1.00
Satd. Flow (prot)	1045		3005	1008	1127	3005
Flt Permitted	0.99		1.00	1.00	0.38	1.00
Satd. Flow (perm)	1045		3005	1008	446	3005
Volume (vph)	13	62	591	55	258	1246
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	65	622	58	272	1312
RTOR Reduction (vph)	61	0	0	18	0	0
Lane Group Flow (vph)	18	0	622	40	272	1312
Turn Type				Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases				2	6	
Actuated Green, G (s)	7.3		82.4	82.4	104.7	104.7
Effective Green, g (s)	7.3		82.4	82.4	104.7	104.7
Actuated g/C Ratio	0.06		0.69	0.69	0.87	0.87
Clearance Time (s)	4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	64		2063	692	493	2622
v/s Ratio Prot	c0.02		0.21		c0.08	0.44
v/s Ratio Perm				0.04	c0.40	
v/c Ratio	0.28		0.30	0.06	0.55	0.50
Uniform Delay, d1	53.8		7.4	6.1	1.9	1.7
Progression Factor	1.00		0.96	1.26	1.40	0.46
Incremental Delay, d2	2.4		0.3	0.1	0.8	0.4
Delay (s)	56.2		7.5	7.9	3.5	1.2
Level of Service	E		A	A	A	A
Approach Delay (s)	56.2		7.5			1.6
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	2186	4249		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	2186	4249		2186	4318	1008	1127	4318	1775
Volume (vph)	299	296	301	138	860	104	594	858	66	21	925	717
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	315	312	317	145	905	109	625	903	69	22	974	755
RTOR Reduction (vph)	0	0	234	0	13	0	0	0	36	0	0	26
Lane Group Flow (vph)	315	312	83	145	1001	0	625	903	33	22	974	729
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	16.0	31.4	31.4	10.6	26.0		31.0	57.2	57.2	4.8	31.0	47.0
Effective Green, g (s)	16.0	31.4	31.4	10.6	26.0		31.0	57.2	57.2	4.8	31.0	47.0
Actuated g/C Ratio	0.13	0.26	0.26	0.09	0.22		0.26	0.48	0.48	0.04	0.26	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	291	786	264	193	921		565	2058	480	45	1115	695
v/s Ratio Prot	c0.14	0.10		0.07	c0.24		c0.29	0.21		0.02	0.23	c0.41
v/s Ratio Perm			0.08						0.03			
v/c Ratio	1.08	0.40	0.31	0.75	1.09		1.11	0.44	0.07	0.49	0.87	1.05
Uniform Delay, d1	52.0	36.5	35.6	53.4	47.0		44.5	20.8	17.0	56.4	42.6	36.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.48	0.25	1.34
Incremental Delay, d2	76.5	0.3	0.7	15.1	56.3		70.3	0.7	0.3	2.3	2.9	32.3
Delay (s)	128.5	36.8	36.3	68.6	103.3		114.8	21.5	17.3	86.0	13.8	81.2
Level of Service	F	D	D	E	F		F	C	B	F	B	F
Approach Delay (s)		67.2			99.0			57.8			43.7	
Approach LOS		E			F			E			D	

Intersection Summary			
HCM Average Control Delay	63.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1140	1020	1140	4368	4368	1003
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1140	1020	1140	4368	4368	1003
Volume (vph)	50	39	335	1042	1763	410
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	41	353	1097	1856	432
RTOR Reduction (vph)	0	34	0	0	0	100
Lane Group Flow (vph)	53	7	353	1097	1856	332
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	18.0	18.0	37.0	90.0	49.0	67.0
Effective Green, g (s)	19.6	19.6	37.0	92.4	51.4	71.0
Actuated g/C Ratio	0.16	0.16	0.31	0.77	0.43	0.59
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	186	167	352	3363	1871	627
v/s Ratio Prot	0.05		c0.31	0.25	c0.42	c0.09
v/s Ratio Perm		0.01				0.24
v/c Ratio	0.28	0.04	1.00	0.33	0.99	0.53
Uniform Delay, d1	44.1	42.3	41.5	4.2	34.1	14.6
Progression Factor	1.00	1.00	1.07	2.15	0.32	0.75
Incremental Delay, d2	3.8	0.4	44.1	0.2	4.7	0.3
Delay (s)	47.9	42.7	88.3	9.3	15.6	11.2
Level of Service	D	D	F	A	B	B
Approach Delay (s)	45.6			28.6	14.8	
Approach LOS	D			C	B	

Intersection Summary			
HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1127	2837		1127	3005		1127	4254			4318	998
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)	1127	2837		1127	3005		1127	4254			4318	998
Volume (vph)	164	154	81	213	557	0	292	727	73	0	1740	657
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	162	85	224	586	0	307	765	77	0	1832	692
RTOR Reduction (vph)	0	59	0	0	0	0	0	8	0	0	0	42
Lane Group Flow (vph)	173	188	0	224	586	0	307	834	0	0	1832	650
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases												6
Actuated Green, G (s)	13.0	24.8		15.0	26.8		23.2	63.3			36.1	49.1
Effective Green, g (s)	13.0	27.6		15.0	29.6		23.2	65.4			38.2	51.2
Actuated g/C Ratio	0.11	0.23		0.12	0.25		0.19	0.55			0.32	0.43
Clearance Time (s)	4.0	6.8		4.0	6.8		4.0	6.1			6.1	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	122	653		141	741		218	2318			1375	459
v/s Ratio Prot	0.15	0.07		c0.20	c0.19		c0.27	0.20			0.42	c0.15
v/s Ratio Perm												0.50
v/c Ratio	1.42	0.29		1.59	0.79		1.41	0.36			1.33	1.42
Uniform Delay, d1	53.5	38.1		52.5	42.3		48.4	15.5			40.9	34.4
Progression Factor	1.00	1.00		1.00	1.00		1.02	0.49			1.00	1.00
Incremental Delay, d2	229.2	0.2		295.8	5.8		207.9	0.4			154.6	199.4
Delay (s)	282.7	38.3		348.3	48.1		257.1	8.0			195.5	233.8
Level of Service	F	D		F	D		F	A			F	F
Approach Delay (s)		139.0			131.1			74.6			206.0	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	157.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Section 8:
Secondary + Additional Plan Area (Beyond 2031)
Alternative #2 PM (Original Run)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1008	1127	3005	1008	1127	3005	1008	1127	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1008	1127	3005	1008	1127	3005	1008	1127	3005	1008
Volume (vph)	313	1210	194	154	848	318	340	474	307	198	156	90
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	297	1150	184	146	806	302	323	450	292	188	148	86
RTOR Reduction (vph)	0	0	100	0	0	229	0	0	229	0	0	75
Lane Group Flow (vph)	297	1150	84	146	806	73	323	450	63	188	148	11
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	28.0	40.0	40.0	15.0	27.0	27.0	31.0	24.0	24.0	21.0	14.0	14.0
Effective Green, g (s)	28.0	42.0	42.0	15.0	29.0	29.0	31.0	26.0	26.0	21.0	16.0	16.0
Actuated g/C Ratio	0.23	0.35	0.35	0.12	0.24	0.24	0.26	0.22	0.22	0.18	0.13	0.13
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	263	1052	353	141	726	244	291	651	218	197	401	134
v/s Ratio Prot	0.26	c0.38		0.13	c0.27		c0.29	0.15		c0.17	0.05	
v/s Ratio Perm			0.08			0.07			0.06			0.01
v/c Ratio	1.13	1.09	0.24	1.04	1.11	0.30	1.11	0.69	0.29	0.95	0.37	0.09
Uniform Delay, d1	46.0	39.0	27.7	52.5	45.5	37.2	44.5	43.3	39.3	49.0	47.4	45.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.77	1.80	1.00	1.00	1.00
Incremental Delay, d2	94.8	56.8	0.3	85.5	67.8	0.7	78.2	4.4	2.4	50.7	2.6	1.3
Delay (s)	140.8	95.8	28.0	138.0	113.3	37.9	111.4	37.8	73.3	99.7	50.0	46.8
Level of Service	F	F	C	F	F	D	F	D	E	F	D	D
Approach Delay (s)		96.3			98.0			69.9			71.5	
Approach LOS		F			F			E			E	

Intersection Summary			
HCM Average Control Delay	88.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor				1.00		1.00		0.95	1.00	1.00	0.95	
Frt				1.00		0.85		1.00	0.85	1.00	1.00	
Flt Protected				0.95		1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)				1572		1406		3144	1406	1572	3144	
Flt Permitted				0.95		1.00		1.00	1.00	0.18	1.00	
Satd. Flow (perm)				1572		1406		3144	1406	298	3144	
Volume (vph)	0	0	0	116	0	357	0	848	227	297	470	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	0	0	0	110	0	339	0	806	216	282	446	0
RTOR Reduction (vph)	0	0	0	0	0	249	0	0	140	0	0	0
Lane Group Flow (vph)	0	0	0	110	0	90	0	806	76	282	446	0
Turn Type				Prot		custom			Perm	pm+pt		
Protected Phases				8				2		1	6	
Permitted Phases						8			2	6		
Actuated Green, G (s)				16.0		16.0		21.0	21.0	36.0	36.0	
Effective Green, g (s)				16.0		16.0		21.0	21.0	36.0	36.0	
Actuated g/C Ratio				0.27		0.27		0.35	0.35	0.60	0.60	
Clearance Time (s)				4.0		4.0		4.0	4.0	4.0	4.0	
Lane Grp Cap (vph)				419		375		1100	492	412	1886	
v/s Ratio Prot				c0.07				0.26		c0.13	0.14	
v/s Ratio Perm						0.06			0.05	c0.28		
v/c Ratio				0.26		0.24		0.73	0.15	0.68	0.24	
Uniform Delay, d1				17.3		17.2		17.0	13.4	8.2	5.6	
Progression Factor				0.65		3.71		1.00	1.00	0.83	0.53	
Incremental Delay, d2				1.5		1.5		4.3	0.7	8.4	0.3	
Delay (s)				12.8		65.4		21.4	14.1	15.3	3.2	
Level of Service				B		E		C	B	B	A	
Approach Delay (s)		0.0			52.5			19.8			7.9	
Approach LOS		A			D			B			A	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	2186	3144	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	3144	1406	2186	3144	1008	1572	3005	1008	1127	3005	1406
Volume (vph)	184	828	25	187	259	27	34	1234	581	40	613	37
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	175	787	24	178	246	26	32	1172	552	38	582	35
RTOR Reduction (vph)	0	0	18	0	0	20	0	0	176	0	0	19
Lane Group Flow (vph)	175	787	6	178	246	6	32	1172	376	38	582	16
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	17.7	32.1	32.1	11.8	26.2	26.2	4.2	54.5	54.5	5.6	55.9	55.9
Effective Green, g (s)	17.7	32.1	32.1	11.8	26.2	26.2	4.2	54.5	54.5	5.6	55.9	55.9
Actuated g/C Ratio	0.15	0.27	0.27	0.10	0.22	0.22	0.04	0.45	0.45	0.05	0.47	0.47
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	232	841	376	215	686	220	55	1365	458	53	1400	655
v/s Ratio Prot	c0.11	c0.25		0.08	0.08		0.02	c0.39		c0.03	0.19	
v/s Ratio Perm			0.00			0.01			0.37			0.01
v/c Ratio	0.75	0.94	0.02	0.83	0.36	0.03	0.58	0.86	0.82	0.72	0.42	0.02
Uniform Delay, d1	49.1	42.9	32.3	53.1	39.8	36.9	57.0	29.3	28.5	56.4	21.2	17.3
Progression Factor	1.06	0.95	0.90	1.00	1.00	1.00	1.19	0.47	0.46	1.00	1.00	1.00
Incremental Delay, d2	12.7	17.0	0.0	22.3	0.3	0.0	10.1	5.0	10.6	36.9	0.9	0.1
Delay (s)	64.5	57.9	29.2	75.4	40.1	36.9	77.8	18.9	23.9	93.4	22.1	17.4
Level of Service	E	E	C	E	D	D	E	B	C	F	C	B
Approach Delay (s)		58.3			53.9			21.5			26.0	
Approach LOS		E			D			C			C	

Intersection Summary			
HCM Average Control Delay	35.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1800	1800	1800	1350	1800	1800	1800	1350	1800	1350
Lane Width	3.3	3.3	3.7	3.7	3.3	3.3	3.7	3.7	3.7	3.3	3.7	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3005	1406	1572	3005	1008	1572	3144	1406	1127	3144	1008
Flt Permitted	0.95	1.00	1.00	0.24	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1127	3005	1406	390	3005	1008	1572	3144	1406	1127	3144	1008
Volume (vph)	440	1231	63	67	352	37	43	1239	151	10	533	110
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	418	1169	60	64	334	35	41	1177	143	10	506	104
RTOR Reduction (vph)	0	0	28	0	0	27	0	0	71	0	0	71
Lane Group Flow (vph)	418	1169	32	64	334	8	41	1177	72	10	506	33
Confl. Peds. (#/hr)										1		
Turn Type	Prot		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2	6		6			8			4
Actuated Green, G (s)	28.1	47.1	47.1	25.4	22.2	22.2	4.1	33.6	33.6	1.8	31.3	31.3
Effective Green, g (s)	28.1	49.5	49.5	27.8	24.6	24.6	4.1	33.6	33.6	4.1	33.6	33.6
Actuated g/C Ratio	0.26	0.47	0.47	0.26	0.23	0.23	0.04	0.32	0.32	0.04	0.32	0.32
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4	6.4	4.0	4.0	4.0	6.3	6.3	6.3
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	298	1398	654	137	695	233	61	993	444	43	993	318
v/s Ratio Prot	c0.37	c0.39		0.01	0.11		c0.03	c0.37		0.01	0.16	
v/s Ratio Perm			0.02	0.11		0.01			0.05			0.03
v/c Ratio	1.40	0.84	0.05	0.47	0.48	0.03	0.67	1.19	0.16	0.23	0.51	0.10
Uniform Delay, d1	39.2	24.9	15.6	30.3	35.4	31.7	50.5	36.4	26.2	49.6	29.7	25.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	200.2	6.1	0.1	2.5	2.4	0.3	25.4	93.7	0.2	2.8	0.4	0.1
Delay (s)	239.4	31.0	15.7	32.8	37.7	32.0	75.9	130.1	26.4	52.4	30.1	25.9
Level of Service	F	C	B	C	D	C	E	F	C	D	C	C
Approach Delay (s)		83.3			36.5			117.6			29.7	
Approach LOS		F			D			F			C	

Intersection Summary			
HCM Average Control Delay	81.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	106.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	2971		1127	3005	1008	1127	3005	1008	2186	2963	
Flt Permitted	0.60	1.00		0.69	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	710	2971		814	3005	1008	1127	3005	1008	2186	2963	
Volume (vph)	6	101	8	103	260	469	24	930	176	342	517	54
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	6	96	8	98	247	446	23	884	167	325	491	51
RTOR Reduction (vph)	0	6	0	0	0	211	0	0	103	0	9	0
Lane Group Flow (vph)	6	98	0	98	247	235	23	884	64	325	533	0
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)	17.5	17.5		17.5	17.5	17.5	1.9	25.0	25.0	11.7	34.8	
Effective Green, g (s)	18.8	18.8		18.8	18.8	18.8	1.9	26.6	26.6	11.7	36.4	
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.27	0.03	0.38	0.38	0.17	0.53	
Clearance Time (s)	5.3	5.3		5.3	5.3	5.3	4.0	5.6	5.6	4.0	5.6	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	193	808		221	818	274	31	1157	388	370	1561	
v/s Ratio Prot		0.03			0.08		0.02	c0.29		c0.15	0.18	
v/s Ratio Perm	0.01			0.12		c0.23			0.06			
v/c Ratio	0.03	0.12		0.44	0.30	0.86	0.74	0.76	0.17	0.88	0.34	
Uniform Delay, d1	18.5	18.9		20.8	19.9	23.9	33.4	18.5	14.0	28.0	9.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.1		1.4	0.2	22.3	64.1	4.8	0.9	20.3	0.6	
Delay (s)	18.5	19.0		22.2	20.2	46.1	97.5	23.3	14.9	48.3	10.0	
Level of Service	B	B		C	C	D	F	C	B	D	B	
Approach Delay (s)		19.0			35.1			23.6			24.4	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM Average Control Delay	26.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	69.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1800	1800	1800	1350	1800	1800	1800	1800	1350
Lane Width	3.3	3.7	3.3	3.7	3.7	3.7	3.3	3.3	3.7	3.7	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1127	3144	1008	1572	3144	1406	2186	3005	1406	1572	3005	1008
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.52	1.00	1.00
Satd. Flow (perm)	1127	3144	1008	1572	3144	1406	2186	3005	1406	864	3005	1008
Volume (vph)	209	843	100	142	959	66	401	409	247	116	203	372
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	199	801	95	135	911	63	381	389	235	110	193	353
RTOR Reduction (vph)	0	0	61	0	0	44	0	0	169	0	0	220
Lane Group Flow (vph)	199	801	34	135	911	19	381	389	66	110	193	133
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2	6		6
Actuated Green, G (s)	16.0	31.7	31.7	10.3	26.0	26.0	15.0	24.8	24.8	20.8	15.3	15.3
Effective Green, g (s)	16.0	31.7	31.7	10.3	26.0	26.0	15.0	24.8	24.8	20.8	15.3	15.3
Actuated g/C Ratio	0.18	0.36	0.36	0.12	0.29	0.29	0.17	0.28	0.28	0.24	0.17	0.17
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	204	1129	362	183	926	414	371	844	395	248	521	175
v/s Ratio Prot	c0.18	0.25		0.09	c0.29		c0.17	0.13		0.03	0.06	
v/s Ratio Perm			0.03			0.01			0.05	0.08		c0.13
v/c Ratio	0.98	0.71	0.09	0.74	0.98	0.04	1.03	0.46	0.17	0.44	0.37	0.76
Uniform Delay, d1	36.0	24.3	18.8	37.7	30.9	22.3	36.6	26.2	24.0	27.7	32.2	34.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	55.5	2.1	0.1	14.4	25.4	0.0	53.8	0.4	0.2	1.3	0.4	17.5
Delay (s)	91.4	26.4	18.9	52.0	56.4	22.3	90.5	26.6	24.2	29.0	32.7	52.3
Level of Service	F	C	B	D	E	C	F	C	C	C	C	D
Approach Delay (s)		37.6			53.9			50.2			42.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	46.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	88.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1350	1800	1350	1800	1800	1350	1350	1800	1800
Lane Width	3.7	3.7	3.7	3.3	3.7	3.3	3.7	3.3	3.3	3.3	3.3	3.7
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	1127	3144	1008	1572	3005	1008	1127	3005	1406
Flt Permitted	0.29	1.00	1.00	0.29	1.00	1.00	0.30	1.00	1.00	0.09	1.00	1.00
Satd. Flow (perm)	473	3144	1406	339	3144	1008	497	3005	1008	105	3005	1406
Volume (vph)	317	985	112	225	669	37	8	1341	116	95	614	180
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	301	936	106	214	636	35	8	1274	110	90	583	171
RTOR Reduction (vph)	0	0	71	0	0	26	0	0	56	0	0	95
Lane Group Flow (vph)	301	936	35	214	636	9	8	1274	54	90	583	76
Confl. Peds. (#/hr)				1								
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	33.0	33.0	33.0	31.0	31.0	31.0	45.8	45.8	45.8	53.2	53.2	53.2
Effective Green, g (s)	33.0	33.0	33.0	31.0	31.0	31.0	45.8	45.8	45.8	53.2	53.2	53.2
Actuated g/C Ratio	0.28	0.28	0.28	0.26	0.26	0.26	0.38	0.38	0.38	0.44	0.44	0.44
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	304	865	387	199	812	260	197	1147	385	116	1332	623
v/s Ratio Prot	0.16	c0.30		c0.15	0.20		0.00	c0.42		c0.05	0.19	
v/s Ratio Perm	0.12		0.02	0.13		0.01	0.02		0.05	0.29		0.05
v/c Ratio	0.99	1.08	0.09	1.08	0.78	0.03	0.04	1.11	0.14	0.78	0.44	0.12
Uniform Delay, d1	52.6	43.5	32.3	46.3	41.4	33.3	23.9	37.1	24.2	48.8	23.1	19.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.72	0.67	0.65
Incremental Delay, d2	48.8	55.3	0.1	85.3	5.0	0.1	0.1	62.4	0.8	26.1	1.0	0.4
Delay (s)	101.4	98.8	32.4	131.6	46.3	33.4	23.9	99.5	25.0	61.4	16.5	13.1
Level of Service	F	F	C	F	D	C	C	F	C	E	B	B
Approach Delay (s)		94.1			66.4			93.2			20.6	
Approach LOS		F			E			F			C	

Intersection Summary			
HCM Average Control Delay	74.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1572	3144	1406	3049	3144	1406	1572	3144	1406	1572	3144	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1572	3144	1406	3049	3144	1406	1572	3144	1406	1572	3144	1406
Volume (vph)	42	1208	55	147	887	129	106	940	572	47	482	59
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	40	1148	52	140	843	123	101	893	543	45	458	56
RTOR Reduction (vph)	0	0	32	0	0	75	0	0	120	0	0	42
Lane Group Flow (vph)	40	1148	20	140	843	48	101	893	423	45	458	14
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	4.0	34.0	34.0	5.0	35.0	35.0	13.0	31.0	31.0	4.0	22.0	22.0
Effective Green, g (s)	4.0	34.0	34.0	5.0	35.0	35.0	13.0	31.0	31.0	4.0	22.0	22.0
Actuated g/C Ratio	0.04	0.38	0.38	0.06	0.39	0.39	0.14	0.34	0.34	0.04	0.24	0.24
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	70	1188	531	169	1223	547	227	1083	484	70	769	344
v/s Ratio Prot	0.03	c0.37		0.05	c0.27		0.06	0.28		0.03	c0.15	
v/s Ratio Perm			0.01			0.03			c0.30			0.01
v/c Ratio	0.57	0.97	0.04	0.83	0.69	0.09	0.44	0.82	0.87	0.64	0.60	0.04
Uniform Delay, d1	42.2	27.4	17.7	42.1	23.0	17.4	35.2	27.0	27.7	42.3	30.1	25.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	29.7	19.2	0.1	35.3	3.2	0.3	6.2	7.2	19.3	37.5	3.4	0.2
Delay (s)	71.9	46.6	17.8	77.4	26.2	17.7	41.4	34.2	46.9	79.8	33.5	26.2
Level of Service	E	D	B	E	C	B	D	C	D	E	C	C
Approach Delay (s)		46.2			31.7			39.2			36.5	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM Average Control Delay	38.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		0.95		1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	
Frt		0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected		1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		2934		1127	3005	1008	1127	3005	1008	2186	2996	
Flt Permitted		1.00		0.48	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)		2934		572	3005	1008	1127	3005	1008	2186	2996	
Volume (vph)	0	67	13	441	196	440	58	543	303	46	498	11
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	0	64	12	419	186	418	55	516	288	44	473	10
RTOR Reduction (vph)	0	11	0	0	0	123	0	0	214	0	2	0
Lane Group Flow (vph)	0	65	0	419	186	295	55	516	74	44	481	0
Turn Type	Perm			pm+pt		Perm	Prot		Perm	Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases	4			8		8			2			
Actuated Green, G (s)		4.3		27.4	27.4	27.4	2.3	14.2	14.2	1.9	13.8	
Effective Green, g (s)		4.3		27.4	27.4	27.4	2.3	14.2	14.2	1.9	13.8	
Actuated g/C Ratio		0.08		0.49	0.49	0.49	0.04	0.26	0.26	0.03	0.25	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		227		473	1484	498	47	769	258	75	745	
v/s Ratio Prot		0.02		c0.30	0.06		c0.05	c0.17		0.02	0.16	
v/s Ratio Perm				c0.13		0.29			0.07			
v/c Ratio		0.29		0.89	0.13	0.59	1.17	0.67	0.29	0.59	0.65	
Uniform Delay, d1		24.2		11.6	7.6	10.1	26.6	18.6	16.6	26.4	18.7	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.7		17.7	0.0	1.9	185.4	2.3	0.6	11.2	1.9	
Delay (s)		24.8		29.3	7.6	12.0	212.0	20.9	17.2	37.6	20.6	
Level of Service		C		C	A	B	F	C	B	D	C	
Approach Delay (s)		24.8			18.3			31.9			22.0	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	55.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1127	3005	1008	1127	3005	986	2186	1582	1008	1127	2860	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.71	1.00	
Satd. Flow (perm)	1127	3005	1008	1127	3005	986	2186	1582	1008	844	2860	
Volume (vph)	30	296	328	254	143	38	658	74	340	157	338	161
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	28	281	312	241	136	36	625	70	323	149	321	153
RTOR Reduction (vph)	0	0	257	0	0	24	0	0	206	0	65	0
Lane Group Flow (vph)	28	281	55	241	136	12	625	70	117	149	409	0
Confl. Peds. (#/hr)						1						
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2	6		
Actuated Green, G (s)	3.1	15.6	15.6	18.0	30.5	30.5	24.1	32.1	32.1	22.0	15.0	
Effective Green, g (s)	3.1	15.6	15.6	18.0	30.5	30.5	24.1	32.1	32.1	22.0	15.0	
Actuated g/C Ratio	0.03	0.18	0.18	0.20	0.34	0.34	0.27	0.36	0.36	0.25	0.17	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	39	529	177	229	1033	339	594	573	365	232	484	
v/s Ratio Prot	0.02	c0.09		c0.21	0.05		c0.29	0.04		0.05	c0.14	
v/s Ratio Perm			0.05			0.01			0.12	0.11		
v/c Ratio	0.72	0.53	0.31	1.05	0.13	0.04	1.05	0.12	0.32	0.64	0.85	
Uniform Delay, d1	42.4	33.2	31.9	35.4	20.0	19.3	32.3	18.9	20.4	29.0	35.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	47.4	1.0	1.0	73.9	0.1	0.0	51.4	0.1	0.5	6.0	12.8	
Delay (s)	89.8	34.3	32.9	109.3	20.1	19.4	83.7	19.0	20.9	35.0	48.5	
Level of Service	F	C	C	F	C	B	F	B	C	D	D	
Approach Delay (s)		36.1			72.1			59.3			45.3	
Approach LOS		D			E			E			D	

Intersection Summary			
HCM Average Control Delay	52.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	88.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	0.88	1.00	0.95		0.97	0.95	
Frt	1.00	1.00		1.00	1.00	0.85	1.00	1.00		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1127	2998		1127	3005	1775	1127	2991		2186	2821	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.40	1.00		0.49	1.00	
Satd. Flow (perm)	1127	2998		1127	3005	1775	480	2991		1139	2821	
Volume (vph)	86	1029	18	27	758	612	6	159	5	842	404	281
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	82	978	17	26	720	581	6	151	5	800	384	267
RTOR Reduction (vph)	0	1	0	0	0	247	0	3	0	0	139	0
Lane Group Flow (vph)	82	994	0	26	720	334	6	153	0	800	512	0
Turn Type	Prot			Prot		pm+ov	pm+pt			pm+pt		
Protected Phases	7	4		3	8	1	5	2		1	6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	7.0	31.3		1.5	25.8	47.9	13.2	12.5		38.6	33.9	
Effective Green, g (s)	7.0	31.3		1.5	25.8	47.9	13.2	12.5		38.6	33.9	
Actuated g/C Ratio	0.08	0.38		0.02	0.31	0.57	0.16	0.15		0.46	0.41	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	95	1125		20	930	1105	81	448		805	1147	
v/s Ratio Prot	c0.07	c0.33		0.02	0.24	0.08	0.00	0.05		c0.26	0.18	
v/s Ratio Perm						0.11	0.01			c0.20		
v/c Ratio	0.86	0.88		1.30	0.77	0.30	0.07	0.34		0.99	0.45	
Uniform Delay, d1	37.7	24.3		41.0	26.2	9.1	29.7	31.8		20.0	17.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	50.8	8.4		306.7	4.1	0.2	0.4	0.5		30.0	0.3	
Delay (s)	88.5	32.8		347.6	30.2	9.3	30.1	32.2		50.0	18.2	
Level of Service	F	C		F	C	A	C	C		D	B	
Approach Delay (s)		37.0			27.3			32.1			35.7	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM Average Control Delay	33.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	83.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1800	1350	1350	1800
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1127	1008	3005	1008	1127	3005
Flt Permitted	0.95	1.00	1.00	1.00	0.12	1.00
Satd. Flow (perm)	1127	1008	3005	1008	140	3005
Volume (vph)	111	271	1534	244	60	759
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	105	257	1457	232	57	721
RTOR Reduction (vph)	0	102	0	77	0	0
Lane Group Flow (vph)	105	155	1457	155	57	721
Turn Type		Perm		Perm	pm+pt	
Protected Phases	8		2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	21.7	21.7	80.4	80.4	90.3	90.3
Effective Green, g (s)	21.7	21.7	80.4	80.4	90.3	90.3
Actuated g/C Ratio	0.18	0.18	0.67	0.67	0.75	0.75
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	204	182	2013	675	154	2261
v/s Ratio Prot	0.09		c0.48		0.02	c0.24
v/s Ratio Perm		c0.15		0.15	0.26	
v/c Ratio	0.51	0.85	0.72	0.23	0.37	0.32
Uniform Delay, d1	44.4	47.6	12.7	7.7	8.8	4.8
Progression Factor	1.00	1.00	0.39	0.21	0.56	0.79
Incremental Delay, d2	2.2	29.1	0.7	0.2	1.3	0.3
Delay (s)	46.6	76.6	5.7	1.8	6.3	4.2
Level of Service	D	E	A	A	A	A
Approach Delay (s)	67.9		5.1			4.3
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	0.88
Frt	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	2186	3005	1008	1127	4277		2186	4318	1008	1127	4318	1775
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	2186	3005	1008	1127	4277		2186	4318	1008	1127	4318	1775
Volume (vph)	684	997	513	85	371	25	368	1109	171	106	1140	282
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	650	947	487	81	352	24	350	1054	162	101	1083	268
RTOR Reduction (vph)	0	0	211	0	6	0	0	0	78	0	0	38
Lane Group Flow (vph)	650	947	276	81	370	0	350	1054	84	101	1083	230
Turn Type	Prot		Perm	Prot			Prot		Perm	Prot		pt+ov
Protected Phases	7	4		3	8		5	2		1	6	6 7
Permitted Phases			4						2			
Actuated Green, G (s)	37.4	42.7	42.7	9.3	14.6		20.3	38.4	38.4	13.6	31.7	69.1
Effective Green, g (s)	37.4	42.7	42.7	9.3	14.6		20.3	38.4	38.4	13.6	31.7	69.1
Actuated g/C Ratio	0.31	0.36	0.36	0.08	0.12		0.17	0.32	0.32	0.11	0.26	0.58
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	681	1069	359	87	520		370	1382	323	128	1141	1022
v/s Ratio Prot	c0.30	0.32		c0.07	c0.09		c0.16	0.24		0.09	c0.25	0.13
v/s Ratio Perm			0.27						0.08			
v/c Ratio	0.95	0.89	0.77	0.93	0.71		0.95	0.76	0.26	0.79	0.95	0.23
Uniform Delay, d1	40.5	36.4	34.3	55.0	50.7		49.3	36.7	30.3	51.8	43.4	12.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.16	0.80	0.34
Incremental Delay, d2	23.7	9.0	9.5	73.6	4.6		32.8	4.0	2.0	19.4	12.9	0.1
Delay (s)	64.1	45.3	43.8	128.6	55.2		82.1	40.7	32.2	79.4	47.5	4.3
Level of Service	E	D	D	F	E		F	D	C	E	D	A
Approach Delay (s)		50.8			68.2			49.1			41.7	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	49.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1350	1350	1350	1800	1800	1350
Lane Width	3.4	3.4	3.4	3.4	3.4	3.4
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.91	0.91	1.00
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	2212	1020	2212	4368	4368	1014
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	2212	1020	2212	4368	4368	1014
Volume (vph)	521	511	44	1933	1193	110
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	495	485	42	1836	1133	104
RTOR Reduction (vph)	0	118	0	0	0	24
Lane Group Flow (vph)	495	367	42	1836	1133	80
Confl. Peds. (#/hr)						1
Turn Type		Perm	Prot			pm+ov
Protected Phases	4		5	2	6	4
Permitted Phases		4				6
Actuated Green, G (s)	22.4	22.4	1.6	25.6	20.0	42.4
Effective Green, g (s)	24.0	24.0	1.6	28.0	22.4	46.4
Actuated g/C Ratio	0.40	0.40	0.03	0.47	0.37	0.77
Clearance Time (s)	5.6	5.6	4.0	6.4	6.4	5.6
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	885	408	59	2038	1631	852
v/s Ratio Prot	0.22		0.02	c0.42	0.26	0.04
v/s Ratio Perm		c0.36				0.04
v/c Ratio	0.56	0.90	0.71	0.90	0.69	0.09
Uniform Delay, d1	13.9	16.9	29.0	14.7	15.9	1.7
Progression Factor	1.00	1.00	1.08	0.78	1.33	5.06
Incremental Delay, d2	2.5	25.2	22.0	4.5	1.9	0.2
Delay (s)	16.5	42.1	53.2	15.9	23.1	8.6
Level of Service	B	D	D	B	C	A
Approach Delay (s)	29.2			16.7	21.9	
Approach LOS	C			B	C	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1350	1800	1350	1350	1800	1350	1350	1800	1350	1350	1800	1350
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	0.97	0.95		1.00	0.95		1.00	0.91			0.91	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.95		1.00	1.00		1.00	0.98			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)	2186	2845		1127	3005		1127	4244			4318	999
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)	2186	2845		1127	3005		1127	4244			4318	999
Volume (vph)	670	620	302	85	188	0	85	1974	234	0	862	174
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Growth Factor (vph)	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Adj. Flow (vph)	636	589	287	81	179	0	81	1875	222	0	819	165
RTOR Reduction (vph)	0	51	0	0	0	0	0	11	0	0	0	75
Lane Group Flow (vph)	636	825	0	81	179	0	81	2086	0	0	819	90
Confl. Peds. (#/hr)			1						1			1
Turn Type	Prot			Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases												6
Actuated Green, G (s)	24.0	37.4		11.2	24.6		11.2	54.5			39.3	63.3
Effective Green, g (s)	24.0	40.2		11.2	27.4		11.2	56.6			41.4	65.4
Actuated g/C Ratio	0.20	0.34		0.09	0.23		0.09	0.47			0.34	0.55
Clearance Time (s)	4.0	6.8		4.0	6.8		4.0	6.1			6.1	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	437	953		105	686		105	2002			1490	578
v/s Ratio Prot	c0.29	c0.29		0.07	0.06		0.07	c0.49			0.19	0.03
v/s Ratio Perm												0.06
v/c Ratio	1.46	0.87		0.77	0.26		0.77	1.04			0.55	0.16
Uniform Delay, d1	48.0	37.4		53.1	38.0		53.1	31.7			31.8	13.6
Progression Factor	1.00	1.00		1.00	1.00		1.02	0.70			1.00	1.00
Incremental Delay, d2	217.3	8.3		28.8	0.2		16.8	27.2			1.5	0.1
Delay (s)	265.3	45.7		82.0	38.2		71.1	49.3			33.2	13.7
Level of Service	F	D		F	D		E	D			C	B
Approach Delay (s)		138.1			51.8			50.1			30.0	
Approach LOS		F			D			D			C	

Intersection Summary			
HCM Average Control Delay	73.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX C
MODELLING METHODOLOGY

APPENDIX C: MODELING METHODOLOGY

In determining future transportation demands within Hamilton's Airport Employment Growth District (AEGD), a modified 4-step transportation demand modeling process was employed. Trip generation rates were developed for the AEGD in consideration of study area employment density targets and mode choice goals. The trip generation process was followed by traditional trip distribution and assignment steps.

This document details the steps taken to carry out operational analysis and determine levels of service for the AEGD study area. The steps were as follows:

- Determine transportation modeling software packages;
- Establish road network and "traffic zone" development within the AEGD;
- Develop trip generation rates and mode choice assumptions;
- Adjust trip distribution to account for new AEGD employment;
- Run model trip assignment to obtain roadway volumes; and
- Develop study area road network scenarios and construction staging.

This appendix is sub-divided into the above-noted sections.

Modeling Software Packages

Three tiers of modeling were used to assess transportation alternatives within the AEGD study area. We started with a high-level (macroscopic) model, using EMME/2, to look at the AEGD impact at a regional scale. While providing a good regional picture, the macroscopic model was not detailed enough to forecast roadway volume approximations within the AEGD itself. In order to account for this, an AEGD area model was developed using another software package – Dowling's Traffix.

AEGD operational analysis was carried out once more realistic roadway volumes were developed using Traffix. As a third step, Trafficware's Synchro software package was used to analyze traffic operations and forecast the level of service (LOS) at study area intersections (e.g. volume to capacity ratios, delay, etc.). LOS definitions are provided in **Appendix B**.

Road Network and Traffic Zone Development

An EMME/2 network model was obtained from the City of Hamilton for 2031 (referred to as IBI 2005 base model). The model contained a road network representing rural conditions and six study area traffic zones. Modifications were made to the road network to add more roadway links and increase the number of zones to represent the full build-out Secondary Plan Area + Additional (beyond 2031) conditions in the AEGD.

We began by examining the *2007 Hamilton TMP* which details several road infrastructure improvements planned in the AEGD area by 2031. **Table 1** lists the proposed improvements within the AEGD.

Table 1 – Hamilton TMP Proposed Road Infrastructure Improvements within the AEGD[1]

Road Name	From	To	Description	Anticipated Timing
Garner Road	Fiddler's Green Rd	Glancaster Rd	Road Widening	2012-2021
Garth Street	Twenty Road	Dickenson Road	New Road	>2021
Twenty Road	Glancaster Road	Upper James St	Two-way left turn lane	2012-2021

Note: Infrastructure improvements in the *2007 Hamilton TMP* may extend beyond the AEGD area.

Within the AEGD, land use plan changes required significant transportation infrastructure and road network modifications beyond those identified in the city-wide Hamilton TMP.

Several geographic barriers within the AEGD make it a challenging area to service from a transportation perspective, including the Greenbelt and a number of natural environment features. The Hydro Easement traversing the northern portion of the area from east to west presents challenges in the development of roadway connections. The Hamilton Airport itself is one of the biggest transportation barriers within the AEGD making north-south travel difficult. Finally, the Provincial Highway 6 corridor creates an impasse on the western and southern edges of the AEGD with limited vehicular access. Interchanges are planned at Book Road, Butter Road, and to access Hamilton International Airport.

A number of changes were made to the 2031 model to reflect the Hamilton TMP and transportation infrastructure decisions made as a consequence of a finalized land use plan for the AEGD. Various road network modifications were made to account for the urbanization of the AEGD (e.g. addition of new collector and arterial roads) based on the proposed land uses (i.e. Airside Industrial, Airport-Related Business, Light Industrial, Prestige Business Park).

In addition, the major corridors of Red Hill Valley Parkway and the future Trinity-Church Connection to Highway 6 were added to more accurately reflect the City of Hamilton infrastructure proposed to be in place by 2031. **Table 2** details the EMME/2 network modifications made and **Figure 1** illustrates the EMME/2 network utilized in the AEGD full build-out Secondary Plan Area + Additional Study Area Lands.

Table 2 - EMME/2 AEGD Sub-Area Network Modifications (Secondary Plan Area + Additional)

Road Link	From	To	Modification
Garner Road	Fiddler's Green Rd	Glancaster Road	• Speed limit reduced to 60 km/h
Garden Avenue	Fiddler's Green Rd	Miller Drive	• Speed limit reduced to 50 km/h
Twenty Road	Glancaster Road	Upper James St	• Capacity increased to 1000 vph
Dickenson Road	Book Road	Glancaster Road	• Link added with 60 km/h speed and 1600 vph capacity
Dickenson Road	Glancaster Road	Upper James St	• Speed limit reduced to 60 km/h • Capacity increased to 1600 vph
Book Road	Dickenson Road	Glancaster Road	• Link removed
Book Road	Fiddler's Green Rd	Dickenson Road	• Speed limit reduced to 60 km/h • Capacity increased to 1600 vph
Butter Road	Fiddler's Green Rd	Airport Road	• Speed limit reduced to 60 km/h
Airport Road	Butter Road	Glancaster Road	• Speed limit reduced to 50 km/h
Carluke Road	Fiddler's Green Rd	Glancaster Road	• Speed limit reduced to 70 km/h
White Church Road	Glancaster Road	Upper James St	• Speed limit reduced to 70 km/h
Fiddler's Green Rd	Book Road	Carluke Road	• Speed limit reduced to 70 km/h
Fiddler's Green	Carluke Road	Glancaster Road	• Link added with 70 km/h speed and 1000 vph capacity
Garth Street	Dickenson Road	Rymal Road	• Speed limit reduced to 50 km/h
Homestead Drive	Upper James St (north access)	Upper James St (south access)	• Restrict network access to southbound direction at Upper James
Trinity Church Connection	Upper James St	Red Hill Valley Parkway	• Link added with 70 km/h speed and 1000 vph capacity
Upper James St	Twenty Road	Homestead Drive (north access)	• Speed limit reduced to 60 km/h
Upper James St	Homestead Drive (north access)	Homestead Drive (south access)	• Speed limit reduced to 50 km/h
Upper James St	Homestead Drive (south access)	Highway 6	• Speed limit reduced to 60 km/h

Note: Listed roadway capacities are uni-directional.

It must be noted that alignments for two of the above roadway links have yet to be determined, but have been included for modeling purposes with the following assumptions:

- Airport Road – Between Glancaster Road and Highway 6 airport access
  - During future runway expansion at the Hamilton International Airport (prior to 2031), the current alignment of Airport Road will be realigned south from its existing location.
  - The roadway link was left in its existing location which did not significantly affect model results.
- Trinity Church Connection – Between Upper James Street and the Red Hill Valley / Lincoln Alexander Interchange
  - This corridor has been identified in the Rymal Road Planning Area Study (ROPA 9) and the Trinity Church Arterial Corridor Class EA; however the exact alignment has yet to be determined.
  - The connection to the AEGD study area has been approximated at Upper James Street between Airport Road and White Church Road.
  - The location of this roadway connection to the AEGD did not significantly affect model results.

The Highway 6 corridor through the AEGD area was reviewed to ensure that modelled speed and capacity were consistent with the type of facility expected by 2031. For the 2031 horizon network, Highway 6 between Highway 403 and Upper James Street was coded in the model as a 4-lane highway/expressway facility (e.g. 2-lanes per direction) with a speed limit of 80 km/h. Capacity constraints resulting from AEGD development were reviewed within the EMME/2 model analysis and the above-noted lane configuration was deemed sufficient for the 2031 horizon..

The traffic zone system in the 2031 IBI EMME/2 model was sub-divided to better represent the future AEGD study area employment and reflect the road network detail. **Table 3** contains the original traffic zones and the updated AEGD sub-area traffic zones with original and Secondary Plan Area + Additional Lands employment figures, based on the final AEGD land use plan. These employment figures replace the values included in the base 2031 EMME/2 model provided by the City and represent the full build-out of the AEGD (i.e. beyond the 2031 horizon) for the Secondary Plan and Additional Study Area Lands.

Figure 1 – Modified EMME/2 Free Flow Speed and Road Capacity (Secondary Plan Area + Additional)

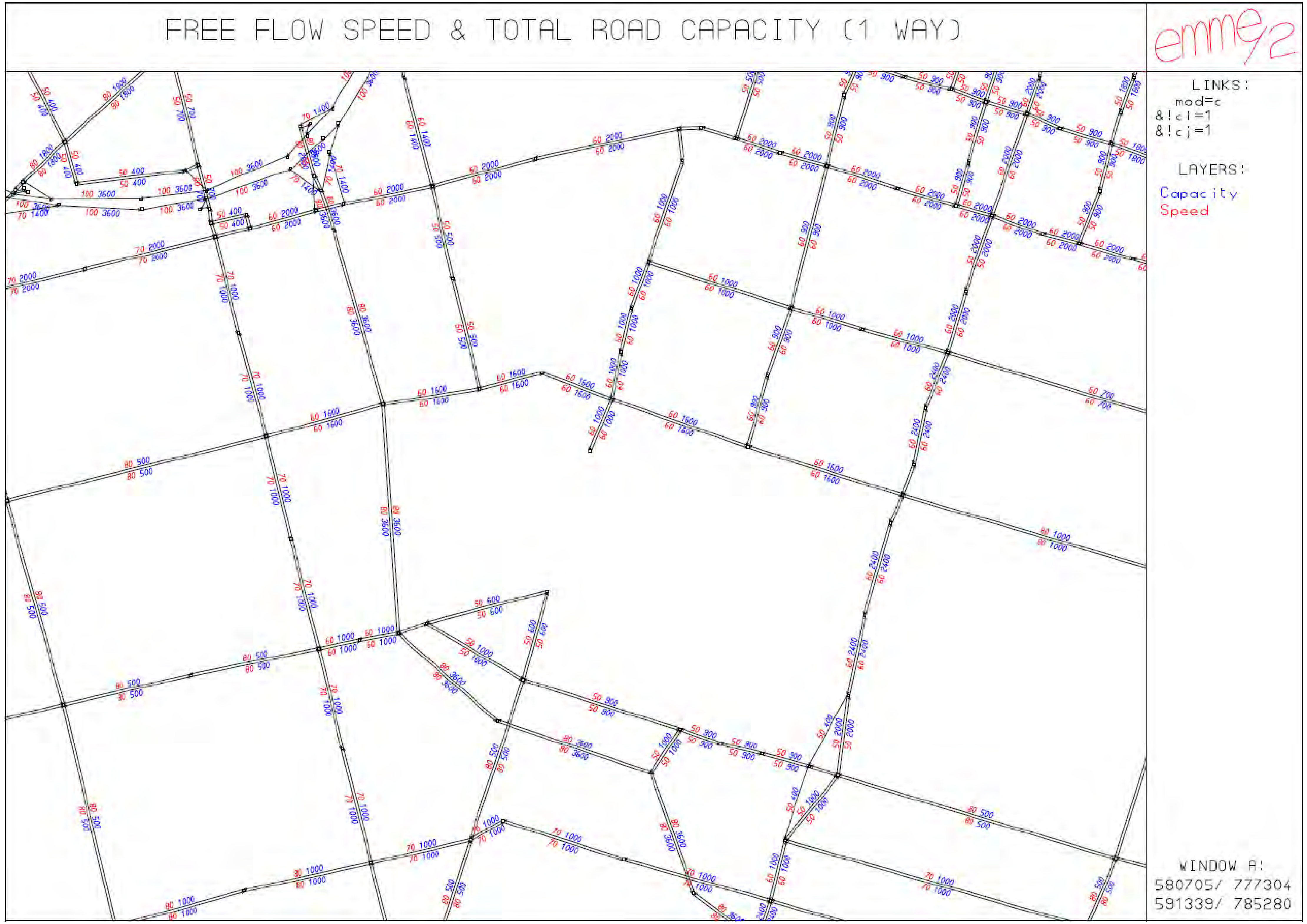


Table 3 - EMME/2 AEGD Sub-Area Zone Modifications and Employment (Secondary Plan Area + Additional)

Original Zone Number	Sub-Area Zone Number	Area Description	Original Employment (2031 Model)	Sub-Area Employment (Secondary + Additional)	Included in AEGD?
2645	2645	Glancaster Airport Northwest	7,168	2,511	Yes
	6002	Airport Butter West		5,169	Yes
2647	2647	Garth Dickenson North	666	8,124	Yes
2649	2649	Hamilton International Airport	10,932	n/a*	Yes
	5001	Glancaster Airport Northeast		3,326	Yes
	5002	Upper James Airport		1,083	Yes
	5003	Airport South		5,507	Yes
	5004	Homestead		0	No
2681	2681	Northwest of AEGD	1,344	0	No
	6003	Garner Book Northwest		5,929	Yes
2682	2682	Southcote North	3,918	10,669	Yes
2683	2683	Southwest of AEGD	5,256	0	No
	6001	Fiddler's Green Southwest		6,092	Yes
Employment Total			**29,284**	**48,410**	

* Airport trips based on passenger volumes, not employment figures (see *Trip Generation and Mode Choice* section)

Figure 2 illustrates the AEGD sub-zones used in EMME/2.

In the EMME/2 model, trips to/from each traffic zone access the roadway network via several "links" connecting to the traffic zone. In reality, traffic access is generally dispersed amongst a number of local and collector roads rather than concentrated onto a single access point. This characteristic of the EMME/2 model results in a greater degree of traffic fluctuation and variability along a corridor.

In order to address some of the EMME/2 model "coarseness", more traffic zones were added in the Traffix model and zone connections to the roadway network and were generally placed at access points consistent with proposed collector roadways. **Figure 3** illustrates the more detailed roadway network and traffic zones developed in Traffix.

Hamilton

Figure 2 – EMME/2 AEGD Sub-Zones

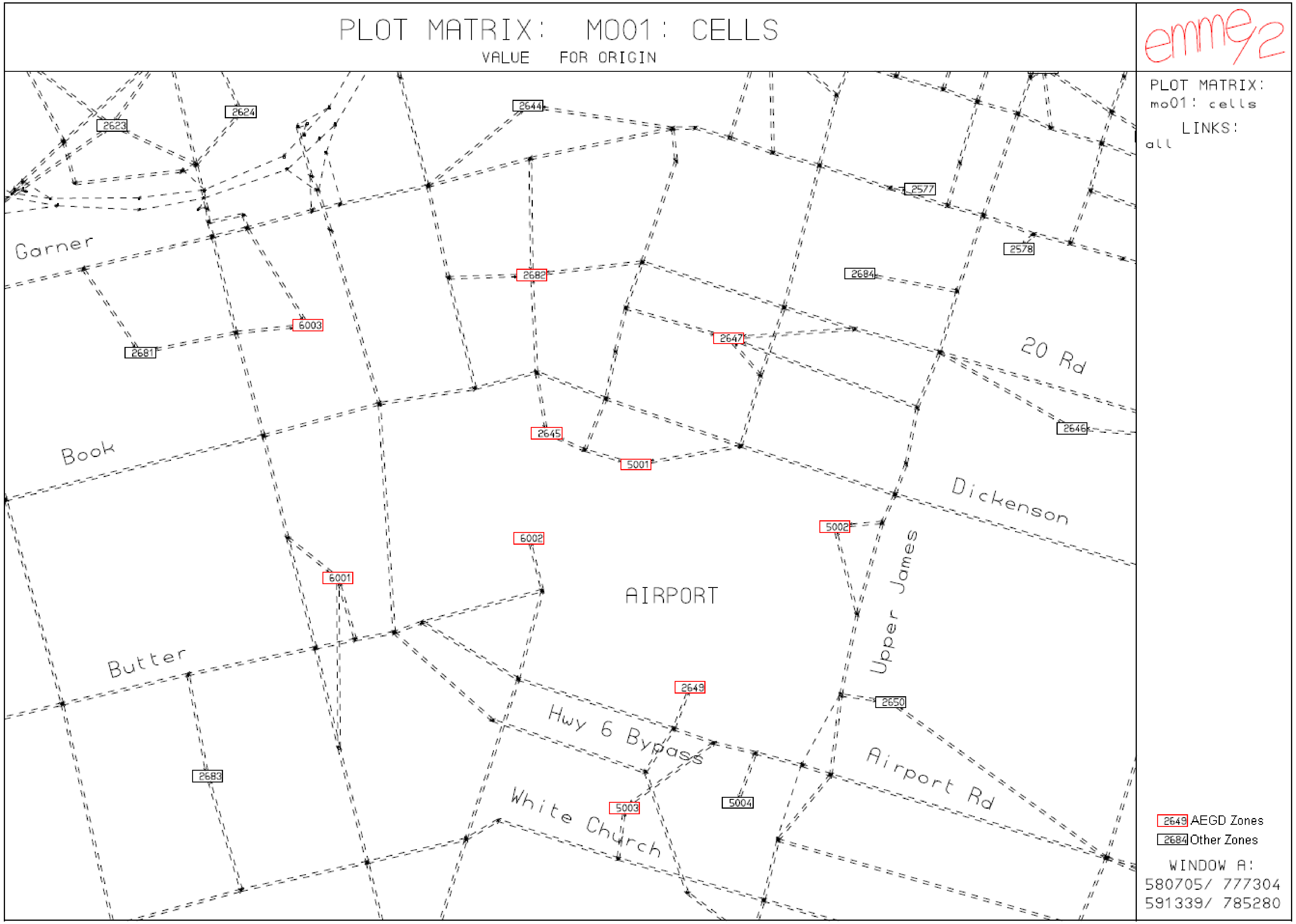


Figure 3 – Traffix Model Roadway Network and Traffic Zones with Screenlines

Trip Generation and Mode Choice

A number of steps were followed in order to generate employment trips within the AEGD study area. These included:

1) Designate trip generators within each of four land use types that were defined within the AEGD;
2) Measuring the development size for each land use type in each sub-zone; and
3) Calculating the number of auto trips generated within each sub-zone.

The study area is divided into the following types of land uses and employment densities:

- Airside Industrial (ASI) – 36 employees per net hectare;
- Airport-Related Business (ARB) – 81 employees per net hectare;
- Light Industrial (IND) – 24 employees per net hectare;
- Prestige Business Park (PBP) – 39 employees per net hectare; and
- Hamilton International Airport & Expansion Area (HIA).

For each of the above land use types, specific business types (e.g. warehouse, office, commercial, etc.) were interpreted from existing documentation[2] and generic trip rates were obtained from trip generation manuals[3]. In the case of the HIA, airport trip generation white papers and airport traffic counts were used in trip generation calculations.

For the four primary AEGD land use types (e.g. ASI, ARB, IND, and PBP), a weighted average trip rate was developed based on the sensitivities of each land use type using the employment density targets as a guiding factor. In order to calculate the number of vehicle trips generated, employment figures were used as the independent variable.

Table 4 demonstrates the vehicle trip generation rate calculations based on land use sensitivities, prior to any mode choice adjustments.

Table 4 – Vehicle Trip Generation Rate Assumptions without mode choice adjustments

	Land Use Sensitivity (Area)	Land Use Sensitivity (Employee)	ITE Trip Generation Rates (7th Edition) AM Peak Hour		
			Ave.	**In**	**Out**
ASI: Airside Industrial					
Adjacent Airport Related Industrial Lands					
030 Truck Terminal	22.5%	17.9%	0.66	40.0%	60.0%
110 General Light Industrial	22.5%	23.4%	0.48	87.0%	13.0%
150 Warehousing	22.5%	22.9%	0.55	50.0%	50.0%
151 Mini-Warehousing	22.5%	0.9%	7.00	50.0%	50.0%
170 Utilities	2.5%	2.5%	0.76	90.0%	10.0%
540 Junior/Community College	2.5%	8.4%	1.75	50.0%	50.0%
710 General Office Building	3.0%	12.5%	0.48	88.0%	12.0%
912 Drive-In Bank	2.0%	11.5%	9.65	51.0%	49.0%
	100.0%	**100.0%**			
Weighted Average			1.75	62.7%	37.3%
In/Out Rate			-	1.10	0.65
ARB: Airport-Related Business					
Office Buildings and Lodging					
310 Hotel	6.0%	10.2%	0.79	57.0%	43.0%
320 Motel	5.0%	1.3%	1.16	39.0%	61.0%
710 General Office Building	29.0%	30.3%	0.48	88.0%	12.0%
750 Office Park	29.0%	31.9%	0.43	92.0%	8.0%
760 Research and Development Centre	29.0%	23.5%	0.43	86.0%	14.0%
912 Drive-In Bank	2.0%	2.9%	9.65	51.0%	49.0%
	100.0%	**100.0%**			
Weighted Average			0.74	83.5%	15.3%
In/Out Rate			-	0.62	0.11
IND: Light Industrial					
General Industrial and Warehousing					
030 Truck Terminal	20.0%	23.3%	0.66	40.0%	60.0%
110 General Light Industrial	10.0%	15.2%	0.48	87.0%	13.0%
130 Industrial Park	35.0%	7.2%	0.43	87.0%	13.0%
150 Warehousing	10.0%	14.9%	0.55	50.0%	50.0%
151 Mini-Warehousing	15.0%	0.9%	7.00	50.0%	50.0%
170 Utilities	5.0%	7.3%	0.76	90.0%	10.0%
710 General Office Building	2.5%	15.2%	0.48	88.0%	12.0%
750 Office Park	2.5%	16.0%	0.43	92.0%	8.0%
	100.0%	**100.0%**			
Weighted Average			0.60	71.4%	28.6%
In/Out Rate			-	0.43	0.17
PBP: Prestige Business Park					
Low-Rise Business/Office Facilities					
110 General Light Industrial	30.0%	28.0%	0.48	87.0%	13.0%
130 Industrial Park	35.0%	4.4%	0.43	87.0%	13.0%
151 Mini-Warehousing	15.0%	0.5%	7.00	50.0%	50.0%
710 General Office Building	4.0%	14.9%	0.48	88.0%	12.0%
714 Corporate Headquarters Building	4.0%	15.2%	0.45	93.0%	7.0%
750 Office Park	4.0%	15.7%	0.43	92.0%	8.0%
760 Research and Development Centre	4.0%	11.5%	0.43	86.0%	14.0%
770 Business Park	4.0%	9.8%	0.45	85.0%	15.0%
	100.0%	**100.0%**			
Weighted Average			0.49	88.3%	11.7%
In/Out Rate			-	0.43	0.06

As shown in **Table 4**, the ITE Trip Generation Manual (7th Edition) was used to develop trip rates for the various development types proposed within the AEGD. However, due to the varying years and locations of the data compiled in these manuals, it was not possible to determine a vehicle occupancy rate. It is estimated that, aside from vehicle trips measured in each study, there were likely trips from other modes present, yet unaccounted for.

Given the lack of available ITE documentation, traditional transportation mode choice information from Hamilton was assumed as a starting point in mode choice calculations.

Historical 2001 Hamilton-area[4] mode choice information was as follows:

- Auto – 75%
- Transit – 6%
- Active Modes – 12%
- School Bus – 6%
- Other – 1%
- Vehicle Occupancy – 1.21

Due to the planned employment-focused nature of the study area, the only transportation modes considered in the development of the demand model were auto, transit, and active modes (e.g. walking and cycling). The utilization of transportation modes such as transit, cycling, and walking shall be encouraged through investment in transit and the implementation of transportation demand management (TDM) policies in order to reduce the traditional focus on the single occupant auto.

The scenario developed was consistent with Hamilton's *Transportation Master Plan*[5] and *Road Network Strategy Working Paper*[6]*.* The development of the AEGD model included a 20% Trip Reduction for auto mode due to transit use and TDM.

The following assumptions were made in the adjustment of trip generation calculations to account for mode choice targets:

- **Traditional (Initial) Conditions** – Assumed initial conditions to be 96% auto person trips, 3% transit trips, 1% active mode trips, and 1.21 vehicle occupancy. These values were chosen to be consistent with other Hamilton industrial developments and the specific location of the AEGD.
- **20% Auto Trips Reduced** – Reduction in auto vehicle trips was assumed in the model. In conjunction with transit and TDM, 20% vehicle kilometres travelled were reduced.
- **12% Transit Trips** – Assumed 12% transit mode split as goal which, though aggressive, is consistent with overall City targets and the vision for the AEGD.

- **Other Modes** - Assumed 6% mode split for walking and biking. Mode choices were determined by land use type.
- **TDM Measures** – Assumed modest effects from TDM, primarily based on peak-hour spreading (e.g. encouraging flexible work hours) and car-pooling.
  - Peak-hour spreading was taken into account by reducing the total number of trips during the peak hour by 2%.
  - To further reach the vehicle trip reduction goal, vehicle occupancy rate was increased by 3% (from 1.21 to 1.25) to account for car-pooling.

Using the weighted average vehicle trip generation rates developed in **Table 4**, the number of vehicle trips was calculated. **Table 5** denotes the trips generated based on traditional transportation mode choice conditions.

Table 5 – Vehicle Trips Generated (Traditional Conditions)

Land Use Type	Generated Auto Trips			
	AM Peak Hour		PM Peak Hour	
	# In	# Out	# In	# Out
ASI: Airside Industrial	6,020	3,576	3,536	7,254
ARB: Airport-Related Business	6,423	1,177	1,623	6,477
IND: Light Industrial	4,222	1,691	1,536	4,219
PBP: Prestige Business Park	9,836	1,299	2,033	8,569
Total Directional	26,501	7,742	8,728	26,519
Grand Total	34,243		35,247	

Note: Displayed values are for illustrative purposes only. Actual values may differ due to land use refinement.

The total number of person trips was then calculated from the traditional mode choice conditions, as shown in **Table 6**.

Table 6 – Total Peak Hour Person Trips (Traditional Conditions)

Land Use Type	Auto Person Trips			
	AM Peak Hour		PM Peak Hour	
	# In	# Out	# In	# Out
ASI: Airside Industrial	7,285	4,326	4,279	8,777
ARB: Airport-Related Business	7,772	1,424	1,964	7,837
IND: Light Industrial	5,108	2,046	1,859	5,105
PBP: Prestige Business Park	11,901	1,572	2,460	10,369
Total Directional	32,066	9,368	10,561	32,088
Grand Total	41,434		42,649	

Note: Displayed values are for illustrative purposes only. Actual values may differ due to land use refinement.

AEGD mode choice targets were applied (see **Table 7**) to account for 20% auto reduction and 12% transit mode share. The total trips are reduced by 2%, which accounts for the TDM measure of peak-hour spreading.

Table 7 – AEGD Desired Mode Choice Targets

Land Use Type	Mode Choice Percentage (Persons)			
	Auto	Transit	Active	Total
ASI: Airside Industrial	81.5%	12.0%	4.5%	98.0%
ARB: Airport-Related Business	76.5%	12.0%	9.5%	98.0%
IND: Light Industrial	85.5%	12.0%	0.5%	98.0%
PBP: Prestige Business Park	76.5%	12.0%	9.5%	98.0%
Average	80.0%	12.0%	6.0%	98.0%

Utilizing the AEGD mode choice targets and the TDM measure of increased vehicle occupancy, auto mode trips were reduced by 20% as illustrated in **Table 8**.

Table 8 – Vehicle Trips Generated with Mode Choice Targets

Land Use Type	Revised Generated Auto Trips			
	AM Peak Hour		PM Peak Hour	
	# In	# Out	# In	# Out
ASI: Airside Industrial	4,948	2,938	2,906	5,961
ARB: Airport-Related Business	4,955	908	1,252	4,996
IND: Light Industrial	3,640	1,458	1,324	3,637
PBP: Prestige Business Park	7,587	1,002	1,568	6,610
Total Directional	21,129	6,306	7,051	21,204
Grand Total	27,435		28,255	
Vehicle Trips Reduction (% of original)	80%		80%	

Note: Displayed values are for illustration only. Actual values may differ due to land use refinement.

Finally, the target auto trip generation rates were derived and used for modeling purposes within the AEGD. **Table 9** lists the final developed trip generation rates used.

Table 9 – AEGD Developed Trip Generation Rates

Land Use Type	Auto Trip Generation Rates			
	AM Peak Hour		PM Peak Hour	
	# In	# Out	# In	# Out
ASI: Airside Industrial	0.90	0.54	0.53	1.09
ARB: Airport-Related Business	0.48	0.09	0.12	0.48
IND: Light Industrial	0.37	0.15	0.13	0.37
PBP: Prestige Business Park	0.33	0.04	0.07	0.29

Using the derived trip generation rates, employment densities, and the net area of AEGD land, auto vehicle trips were calculated. Each traffic zone within the AEGD contains a unique combination of land use types and employment. These input values allowed trips to be calculated for each traffic zone in the study area.

The above-noted trip generation method was reviewed and approved by the City of Hamilton prior to use within the AEGD transportation model.

Airport Trip Generation

In the calculation of trips from Hamilton International Airport (HIA), a special generation method was developed. The number of annual passengers at HIA was used as the independent variable instead of employment. Methodology as laid out in the *ITE Airport Trip Generation*[7] white paper was utilized to project the number of trips for the forecasted passengers expected at HIA.

Based on LPS Avia's May 2009 *Airport Market Analysis and Land Needs* report, it is projected that HIA will achieve an annual volume of 9.4 million passengers and 178,100 tonnes of cargo (based on 2.5% annual growth rate) by 2030. **Table 10** denotes the projected passenger and cargo volumes over existing and future years.

Table 10 – Passenger and Cargo Airport Volumes

Year	Annual Passenger Numbers	Annual Tonnes of Cargo
2008	545,800	103,428
2021	2,400,000	137,042
2026	4,800,000	154,172
2030	9,400,000	178,059

The daily passenger volumes were then determined assuming more uniform passenger arrivals and departures as annual passenger volumes increase as noted in **Table 11**.

Table 11 – Percent Annual Flight Distribution by Weekday

Year	Percent Annual Flight Distributions by Weekday						
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2008	6.9%	17.2%	17.2%	17.2%	17.2%	17.2%	6.9%
2021	9.7%	16.1%	16.1%	16.1%	16.1%	16.1%	9.7%
2026	10.9%	15.6%	15.6%	15.6%	15.6%	15.6%	10.9%
2030	12.1%	15.2%	15.2%	15.2%	15.2%	15.2%	12.1%

Using the ITE airport white paper methodology, the number of weekday average daily traffic (ADT) vehicle trips was calculated based on daily passenger volumes. **Figure 4** shows the relationship developed in the white paper and **Table 12** lists the calculated values used in the HIA projections.

Figure 4 – Relationship between average daily traffic and daily origin/destination passengers (Source: ITE Airport Trip Generation)

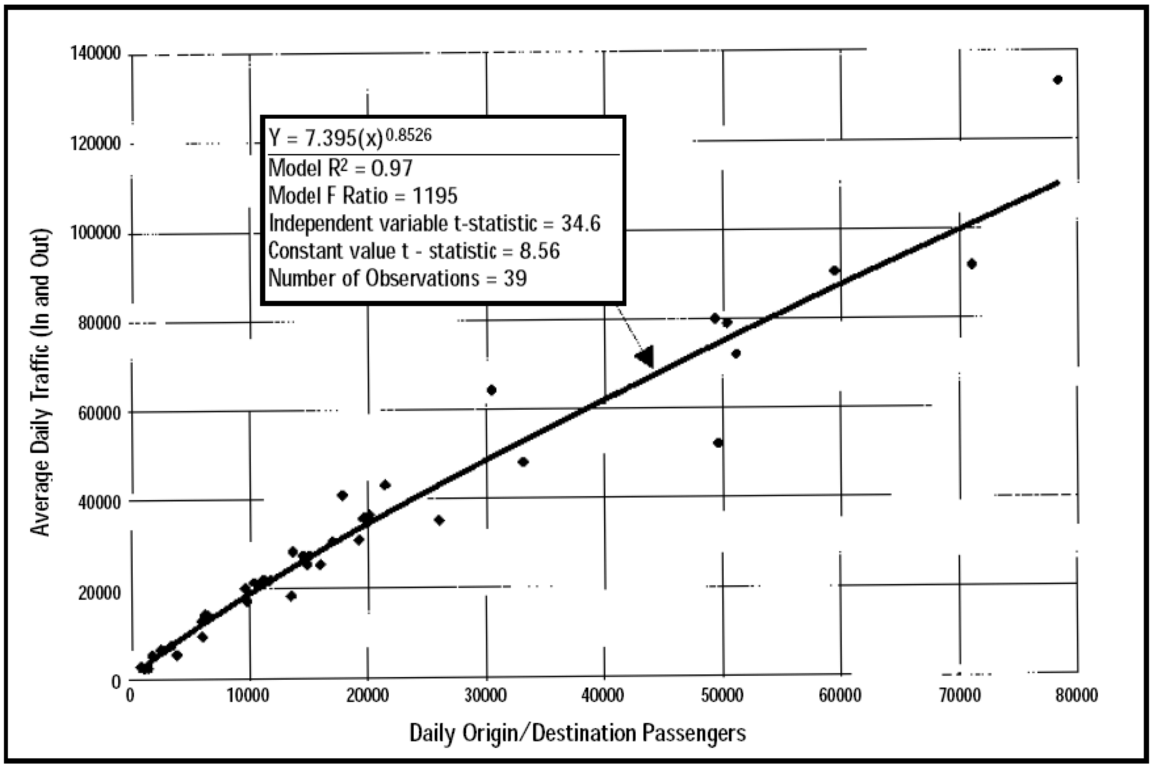


Table 12 – Daily Origin/Destination Passengers and Calculated Vehicle Trips

Year	Weekday O/D Passengers	Weekday ADT (In/Out)
2008	1,810	4,430
2021	7,444	14,793
2026	14,423	25,999
2030	27,389	44,918

Using the calculated ADT vehicle volumes and the ITE white paper assumptions, the peak hour volumes and inbound/outbound vehicles were then calculated. **Table 13** lists the projected HIA vehicle trips for future horizon years.

Table 13 – Projected Airport Vehicle Trips

Year	AM Peak Hour		PM Peak Hour	
	Trips In	Trips Out	Trips In	Trips Out
2021	348	392	556	627
2026	611	689	978	1,102
2030	1,056	1,190	1,689	1,905

Trip Distribution

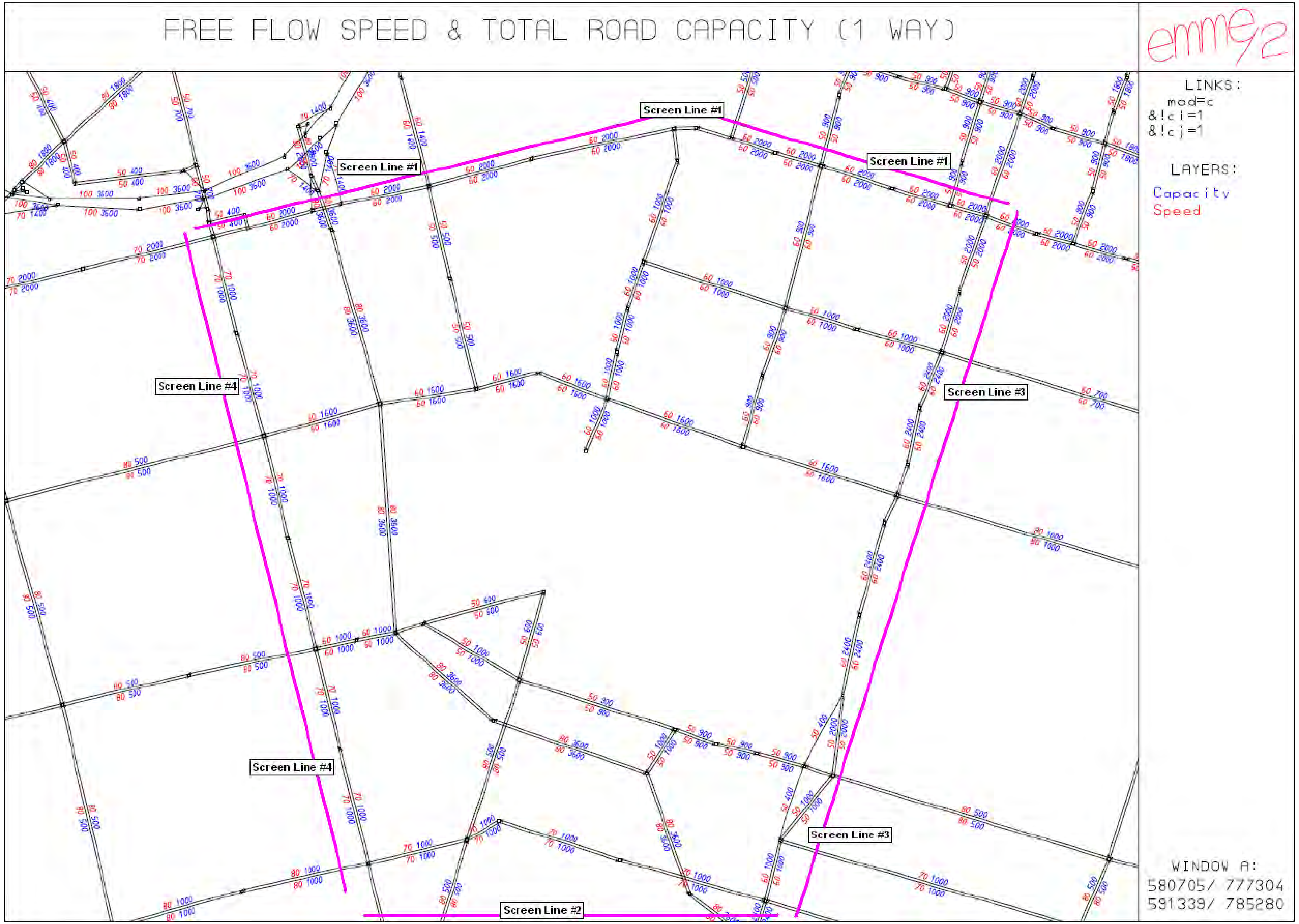
Once the revised trip matrices for the AEGD were input into EMME/2, they were "re-balanced" using revised trip end totals (e.g. trips generated) and the Fratar method within the Hamilton EMME/2 regional model.

The trip distribution within the Traffix model utilized screenlines produced by EMME/2 to direct inbound/outbound vehicle trips to/from the AEGD to various boundary "gates" around the study area. **Figure 5** shows the various EMME/2 screenlines surrounding the AEGD used in determining trip distributions in the Traffix model.

Internal study area trip distributions were further adjusted to account for likely Traffix gates utilized by various sub areas within the AEGD. For example, the northwest AEGD areas are more likely to use Highway 6 to head north compared to Upper James Street.

Due to the availability of only the AM Peak Hour EMME/2 Model and Traffix model software limitations, peak-direction trip distributions were used for both inbound and outbound travel directions. For example, in the AM peak hour, inbound trips to the AEGD are considered peak direction. Of all trips inbound to the AEGD, 11.5% enter from the north via Upper James Street. This value was also used for outbound trips from the AEGD, when in reality this percentage may differ (e.g. due to trip linking work to home trips may have different distributions).

Figure 5 – EMME/2 Screenline and Gate Locations



Trip Assignment

For the Hamilton AEGD sub-area model, the auto trip assignment was performed using EMME/2's standard equilibrium assignment and Tangent volume delay functions. Several iterations of the trip assignment algorithm were completed and analyzed for consistency with AEGD roadway network goals and assumptions. A final iteration of the EMME/2 model was also completed once the final AEGD land use was determined.

Using the Traffix software package, auto trip assignment is performed manually. In order to accomplish this task, each traffic zone is analyzed for the likely paths a vehicle would take to travel from each traffic zone to each AEGD boundary "gate". For every zone-to-gate path, a weight is assigned to signify the more likely and less likely paths taken by each trip.

Through analysis using both the EMME/2 and Traffix modeling packages, roadway volumes were examined to determine the transportation demand on the major roadways throughout the AEGD network. These volumes were analyzed through examination of available roadway capacity and constraints. Roadway volumes were adjusted using this process and intersection turning movements developed for operational analysis within the Synchro model.

Development Scenarios and Staging

At the full build-out Secondary Plan Area + Additional (i.e. beyond 2031 horizon) of the AEGD study area, the EMME/2 model identified a number of capacity constraints for roadway links, especially those connecting the east-west directions within the AEGD. Other constraints included limited Highway 6 access and the geographic barrier of the Hamilton International Airport. Many of the person trips originating from/ destined to the AEGD will be encouraged via non-auto mode choices. The remaining trips by auto mode will have to be managed through the construction of roadways.

In order to address identified problem areas and help determine the best locations to construct roadways, several possible alternatives were identified and assessed. These alternatives not only considered the management of vehicle trips, but also considered the effects on transit and active modes within the AEGD.

Alternative #1 – 6-Lane Dickenson Road with Enhanced Road Grid

In order to address both the problems of east-west connectivity and Highway 6 access, Book Road / Dickenson Road (between Highway 6 and Upper James Street) was identified as a major arterial. The location of this road connection passes through the middle of the AEGD and will connect to Highway 6 via a full-access interchange. Considering the strategic location and high-demand for this roadway, this alternative proposes an ultimate roadway capacity of six lanes to accommodate vehicle volumes.

This alternative also considered additional roadway connections through the hydro easement in the north end of the AEGD. This was done to provide extra roadway capacity and ease any possible future constraints due to traffic volumes.

Figure 6 illustrates the proposed Alternative #1.

Alternative #2 – 4-Lane Dickenson with Multi-Use Trail Connections

The Book/Dickenson corridor is still identified as a major arterial through the AEGD. Book Road will remain six lanes between Highway 6 and Smith Road, since there is a large volume demand to access one of the few full interchanges at Highway 6. However, for the Dickenson Road portion (between Smith Road and Upper James), a roadway capacity of four lanes is proposed.

In order to compensate for capacity constraints of Dickenson Road, two parallel east-west collector roadways (Collectors 1N and 6N) were identified for upgrade to four lane cross-sections. This will accommodate traffic volumes shifted from Dickenson Road originating from / destined to the northeast AEGD.

Compared to Alternative #1, additional roadway connections through the hydro easement will not be provided, except in the cases where it is critical to connectivity and/or where it supports transit use. However, multi-use trail connections for active modes (e.g. walking and cycling) will be provided through the hydro easement.

Figure 7 illustrates the proposed Alternative #2.

Alternative #3 – 6-Lane Dickenson with Multi-Use Trail Connections

This alternative represents a mixture of the previous two alternatives. The six lane Book/Dickenson cross-section is proposed for the same reasons as in Alternative #1. Similarly, multi-use trail connections were used through the hydro easement as in Alternative #2.

Figure 8 illustrates the proposed Alternative #3.

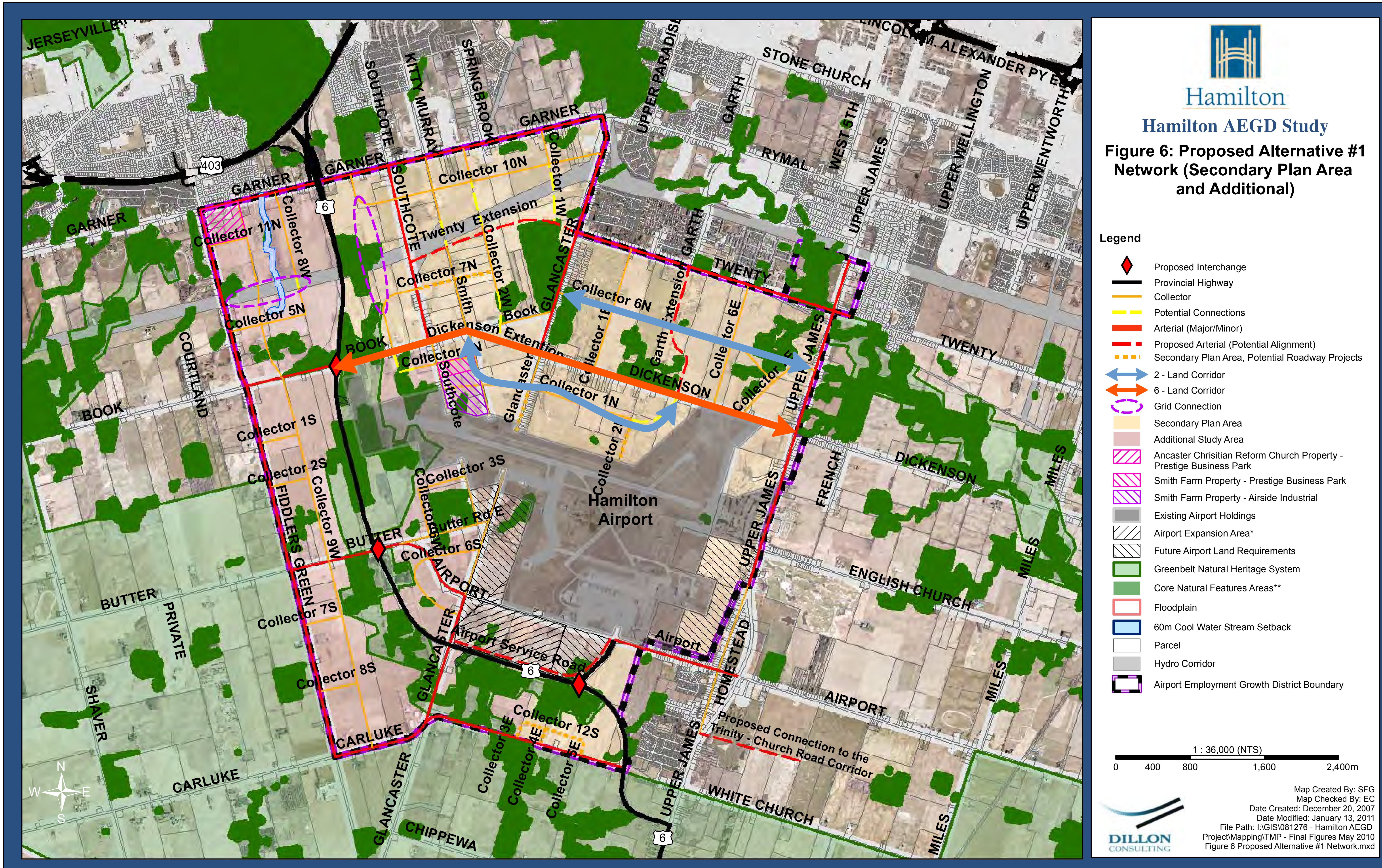

Hamilton
Hamilton AEGD Study
Figure 6: Proposed Alternative #1 Network (Secondary Plan Area and Additional)
Legend
Proposed Interchange
Provincial Highway
Collector
Potential Connections
Arterial (Major/Minor)
Proposed Arterial (Potential Alignment)
Secondary Plan Area, Potential Roadway Projects
2 - Land Corridor
6 - Land Corridor
Grid Connection
Secondary Plan Area
Additional Study Area
Ancaster Christian Reform Church Property - Prestige Business Park
Smith Farm Property - Prestige Business Park
Smith Farm Property - Airside Industrial
Existing Airport Holdings
Airport Expansion Area*
Future Airport Land Requirements
Greenbelt Natural Heritage System
Core Natural Features Areas**
Floodplain
60m Cool Water Stream Setback
Parcel
Hydro Corridor
Airport Employment Growth District Boundary
1 : 36,000 (NTS)
0 400 800 1,600 2,400m
Map Created By: SFG
Map Checked By: EC
Date Created: December 20, 2007
Date Modified: January 13, 2011
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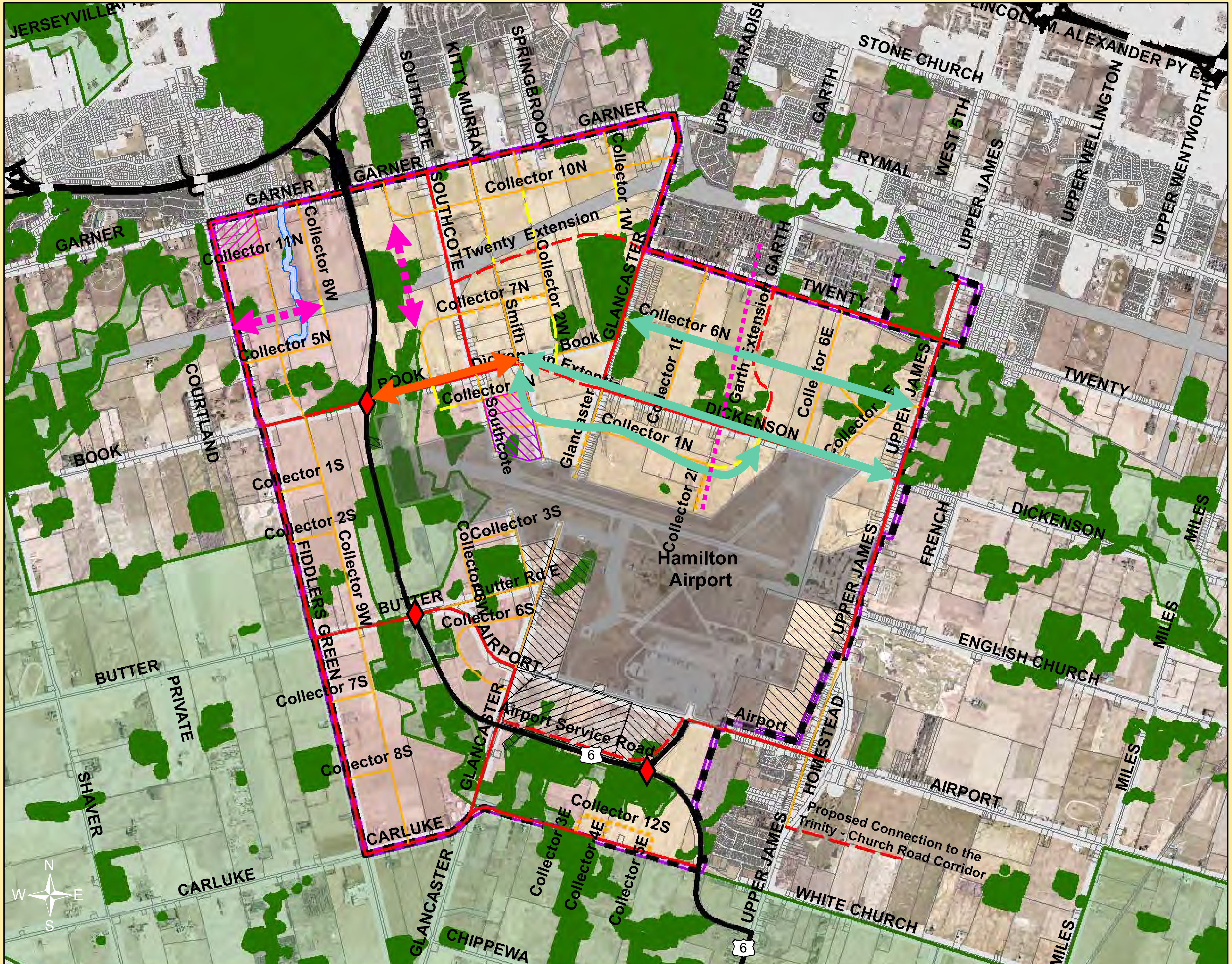
Figure 6 Proposed Alternative #1 Network.mxd
DILLON CONSULTING
Hamilton Airport
Proposed Connection to the Trinity - Church Road Corridor
Twenty Extension
Dickenson Extention
Garth Extension
Airport Service Road
Collector 10N
Collector 11N
Collector 8W
Collector 5N
Collector 7N
Collector 6N
Collector 1N
Collector 1S
Collector 2S
Collector 3S
Collector 6S
Collector 7S
Collector 8S
Collector 9W
Collector 12S
Collector 6E
Butter Rd E
GARNER
BOOK
BUTTER
CARLUKE
CHIPPEWA
TWENTY
DICKENSON
ENGLISH CHURCH
AIRPORT
WHITE CHURCH
RYMAL
STONE CHURCH
JERSEYVILLE
SOUTHCOTE
KITTY MURRAY
SPRINGBROOK
GLANCASTER
UPPER PARADISE
GARTH
WEST 5TH
UPPER JAMES
UPPER WELLINGTON
UPPER WENTWORTH
LINCOLN M. ALEXANDER PY E
COURTLAND
FIDDLERS GREEN
PRIVATE
SHAVER
HOMESTEAD
FRENCH
MILES
403
6



Hamilton

Hamilton AEGD Study

Figure 7: Proposed Alternative #2 Network (Secondary Plan Area and Additional)

Legend

- Proposed Interchange
- Provincial Highway
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area, Potential Roadway Projects
- 4 - Land Corridor
- 6 - Land Corridor
- Multi - Use Path
- Secondary Plan Area
- Additional Study Area
- Ancaster Chrisitian Reform Church Property - Prestige Business Park
- Smith Farm Property - Prestige Business Park
- Smith Farm Property - Airside Industrial
- Existing Airport Holdings
- Airport Expansion Area*
- Future Airport Land Requirements
- Greenbelt Natural Heritage System
- Core Natural Features Areas**
- Floodplain
- 60m Cool Water Stream Setback
- Parcel
- Hydro Corridor
- Airport Employment Growth District Boundary

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

Map Created By: SFG
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Date Modified: January 13, 2011
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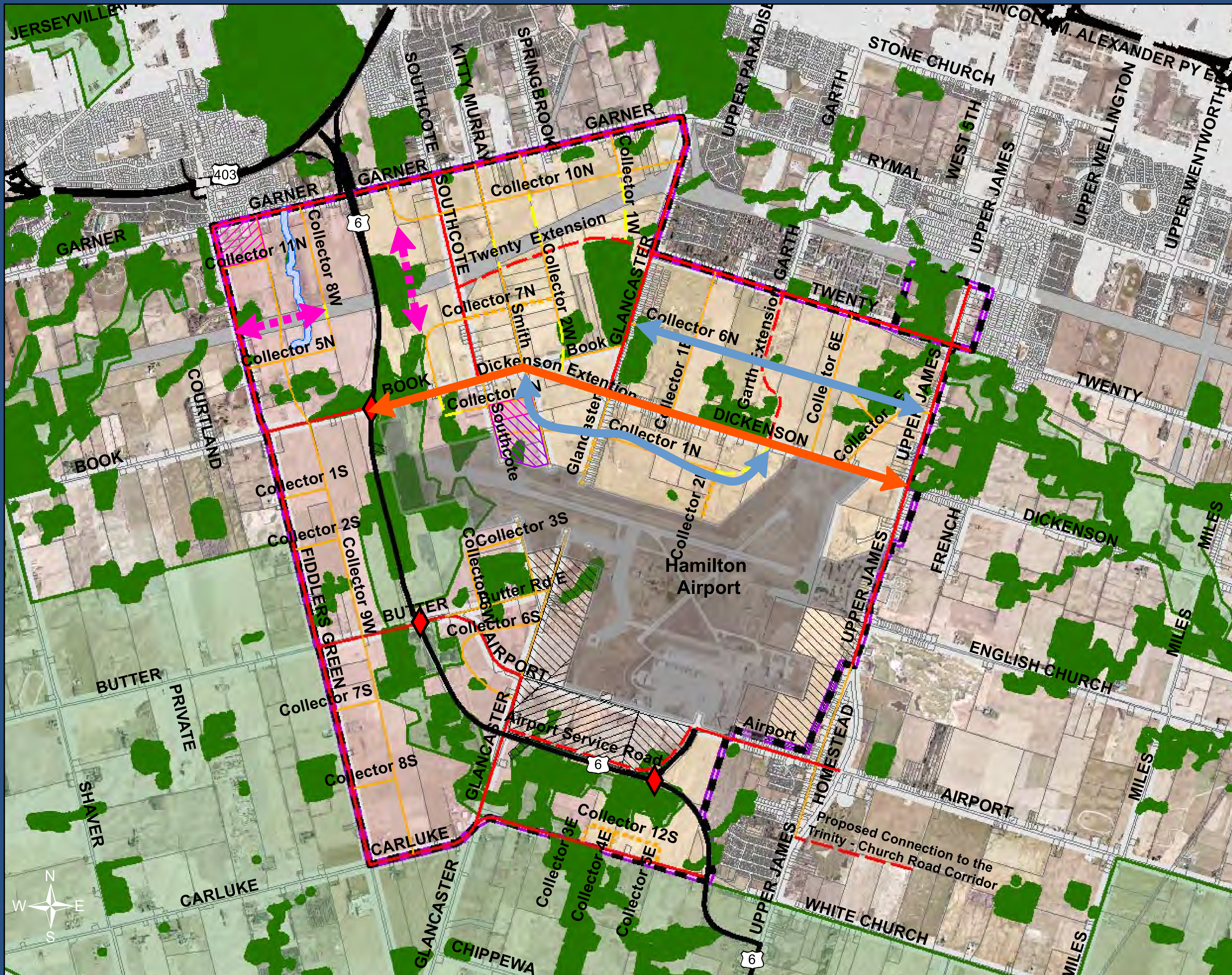
Figure 7 Proposed Alternative #2 Network.mxd

DILLON CONSULTING



Hamilton

Hamilton AEGD Study

Figure 8: Proposed Alternative #3 Network (Secondary Plan Area and Additional)

Legend

- Proposed Interchange
- Provincial Highway
- Collector
- Potential Connections
- Arterial (Major/Minor)
- Proposed Arterial (Potential Alignment)
- Secondary Plan Area, Potential Roadway Projects
- 2 - Land Corridor
- 6 - Land Corridor
- Multi - Use Path
- Secondary Plan Area
- Additional Study Area
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- Smith Farm Property - Airside Industrial
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- Greenbelt Natural Heritage System
- Core Natural Features Areas**
- Floodplain
- 60m Cool Water Stream Setback
- Parcel
- Hydro Corridor
- Airport Employment Growth District Boundary

1 : 36,000 (NTS)

0 400 800 1,600 2,400m

Map Created By: SFG
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Date Created: December 20, 2007
Date Modified: January 13, 2011
File Path: I:\GIS\081276 - Hamilton AEGD Project\Mapping\TMP - Final Figures May 2010 Figure 6 Proposed Alternative #1 Network.mxd

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In the analysis of the Hamilton AEGD, the study area has been divided into three developmental phases to coincide with the land use phasing of services (e.g. water / waste water) to the AEGD. Time horizons for each development phase were assumed for modeling purposes to account for the underlying background traffic and airport trip generation.

The three AEGD future horizons analyzed were as follows:

- Secondary Plan Area, Phase 1 – 2021 Horizon Year
    - Approximate employment of 10,000
- Secondary Plan Area, Phase 2 – 2031 Horizon Year
    - Approximate employment of 30,000
- Secondary Plan Area + Additional – Beyond 2031 Horizon
    - Approximate employment of 48,000

By 2031, the build-out of the Secondary Plan Area will contain employment in the Council Directed Additional Lands, including the Ancaster Christian Reform Church and Smith Farm.

In modeling the various development phases, both the EMME/2 and Traffix models were used. The EMME/2 model was used for only the Secondary Plan Area + Additional (beyond 2031). It was primarily used to examine the full Hamilton area impacts of the AEGD.

To study the AEGD area itself, the Traffix model was created, based on the EMME/2 model. The Traffix model could easily "turn off" various traffic zones in conjunction with the various phases of the AEGD. This allowed the testing of various servicing schemes for each phase.

From here, the models were able to calculate various roadway volumes for each scenario and stage tested. These volumes, along with the intersection turning movements exported from the Traffix model, were then used in Synchro to analyze AEGD traffic operations.

For more details on operational analysis, please see **Section 6.0** within the TMP report. To view the detailed Synchro analysis outputs created for the various time horizons and alternatives, please see **Appendix B**.

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[1] 2007 Hamilton TMP, Road Network Strategy, May 2007, p.25-29
[2] City of Hamilton AEGD – Phase 2 Draft Development Options, May 2009, p.9-10
[3] ITE Trip Generation Manual, 7th Edition
[4] NGTA Past Trends, p.3
[5] Hamilton TMP, Section 7.2.2 Development of Preferred Strategy, p.56
[6] Road Network Strategy Working Paper, Section 3.1.4 Trip Reduction Analysis, p.7
[7] Airport Trip Generation, ITE Journal, May 1998, p.24-31

APPENDIX D
ADDITIONAL STUDY AREA RECOMMENDED ROWS

APPENDIX D - ADDITIONAL STUDY AREA FUTURE ROAD WIDENINGS			
Road	**From**	**To**	**AEGD ROW (m)**
Airport Road	Butter Road	Glancaster Road	37.0
	Glancaster Road	Upper James Street	37.0
Book Road	Fiddlers Green Road	Highway 6	37.0
Butter Road	Fiddlers Green Road	Airport (HI)	37.0
Butter Road East	Airport Road	Glancaster Road	26.0
Carluke Road East	Fiddlers Green Road	Glancaster Road	37.0
Collector 3E	Collector 12S	White Church	26.0
Collector 2N	Collector 7N	Smith Road	26.0
Collector 5N	Fiddlers Green Road	Collector 8W	26.0
Collector 11N	Fiddlers Green Road	Collector 9W	26.0
Collector 1S	Fiddlers Green Road	Collector 9W	26.0
Collector 2S	Fiddlers Green Road	Collector 9W	26.0
Collector 3S	Collector 6W	Southcote Road	26.0
Collector 6S	Glancaster Road (north)	Airport Road	26.0
	Airport Road	Glancaster Road (south)	26.0
Collector 7S	Fiddlers Green Road	Collector 9W	26.0
Collector 8S	Fiddlers Green Road	Collector 9W	26.0
Collector 6W	Collector 3S	Butter Road	26.0
Collector 8W	Garner Road	Collector 5N	26.0
Collector 9W	Garner Road	Carluke	26.0
Fiddlers Green Road	Garner Road	Carluke	37.0
Glancaster Road	Airport (HI)	Carluke Road/White Church	37.0**
	Collector 1N	Airport (HI) / Cul-de-sac	26.0
Smith Road	Dickenson Road Extension	Airport (HI)	26.0
Southcote Road	Book Road	South end	33.0
	Butter Road	North end	33.0
	Book	Collector 1N	33.0
	Collector 3S	Butter Road	26.0
White Church Road	Upper James Street	Glancaster Road	37.0

** Identified as two projects on mapping - 26m Minor Collector between Airport (HI) and Airport Road W and 37m between Airport Road W and White ChurchRoad. Costed as one project at 37m. Additional need for 4 lanes between Airport (HI) and Airport Road will be determined later, as development occurs.*

APPENDIX E

ADDITIONAL STUDY AREA IMPLEMENTATION PLAN SUMMARY

Id	Road	From	To	Description	Total Road Cost* ($M)	Anticipated Timing**	EA Schedule
Additional Study Area Recommended Roadway Projects (Beyond 2031)							
North-South Arterial Roadways							
R46	Fiddlers Green Road	Garner Road	Carluke Road	Widening 2 to 4 lanes	**30.77**	**>2031**	**C**
R47	Southcote Road	Garner Road	Twenty Road Extension	Widening 2 to 4 lanes	**2.73**	**>2031**	**B**
R48	Southcote Road	Twenty Road Extension	Book Road	Widening 2 to 4 lanes	**2.74**	**>2031**	**B**
R49	Glancaster Road	Airport Road	White Church Road	Widening 2 to 4 lanes	**14.04**	**>2031**	**C**
East-West Arterial Roadways							
R50	Book Road	Fiddlers Green Road	Highway 6	Widening 2 to 4 lanes	**5.27**	**>2031**	**C**
R51	Book Road	Highway 6	Southcote Road	Widening 4 to 6 lanes	**5.48**	**>2031**	**C**
R52	Butter Road	Fiddlers Green Road	Airport Road	Widening 2 to 4 lanes	**10.87**	**>2031**	**C**
R53	Airport Road	Butter Road	Glancaster Road	Widening 2 to 4 lanes	**5.55**	**>2031**	**B**
R54	Dickenson Road Extension	Southcote Road	Smith Road	Widening 4 to 6 lanes	**2.08**	**>2031**	**B**
R55	Twenty Road Extension	Southcote Road	Glancaster Road	Widening 2 to 4 lanes	**4.78**	**>2031**	**C**
R56	Carluke Road E	Fiddlers Green Road	Glancaster Road	Widening 2 to 4 lanes	**4.41**	**>2031**	**C**
R57	White Church Road	Glancaster Road	Highway 6	Widening 2 to 4 lanes	**17.13**	**>2031**	**C**
East-West Collector Roadways							
R58	Collector 1N	Southcote Road	Smith Road	Widening 2 to 4 lanes	**3.70**	**>2031**	**C**
R59	Collector 5N	Fiddlers Green Road	Collector 8W	New 2 lane construction	**2.88**	**>2031**	**C**
R60	Collector 2S	Fiddlers Green Road	Collector 9W	New 2 lane construction	**1.40**	**>2031**	**B**
R61	Butter Road E	Airport Road	Glancaster	2 lane reconstruction	**2.82**	**>2031**	**C**
R62	Collector 8S	Fiddlers Green Road	Collector 9W	New 2 lane construction	**1.40**	**>2031**	**B**
North-South Collector Roadways							
R63	Southcote Road (south)	Book Road	Collector 1N	Widening 2 to 4 lanes	**3.45**	**>2031**	**C**
R64	Smith Road	Dickenson Road Extension	Collector 1N	2 lane reconstruction	**2.34**	**>2031**	**B**
R65	Smith Road	Garner Road	Dickenson Road Extension	Widening 2 to 4 lanes	**4.71**	**>2031**	**C**
R66	Smith Road Extension	Hydro Corridor North Crossing		Widening 2 to 4 lanes	**0.54**	**>2031**	**B**
R67	Collector 8W	Garner Road	Collector 5N	New 2 lane construction	**5.19**	**>2031**	**C**
R68	Collector 9W	Garner Road	Carluke Road	New 2 lane construction	**24.59**	**>2031**	**C**
(Beyond 2031) Additional Study Area Recommended Roadway Projects TOTAL					**158.87**		
Additional Study Area Potential Roadway Projects (Beyond 2031)							

Id	Road	From	To	Description	Total Road Cost* ($M)	Anticipated Timing**	EA Schedule
(May be omitted depending on Site Development Plans)							
East-West Collector Roadways							
P69	Collector 2N	Collector 7N	Smith Road	New 2 lane construction	**2.19**	**>2031**	**B**
P70	Collector 11N	Fiddlers Green Road	Collector 9W	New 2 lane construction	**1.74**	**>2031**	**B**
P71	Collector 1S	Fiddlers Green Road	Collector 9W	New 2 lane construction	**1.40**	**>2031**	**B**
P72	Collector 3S	Collector 6W	Southcote Road	New 2 lane construction	**1.76**	**>2031**	**B**
P73	Collector 6S	Glancaster Road (north)	Airport Road	New 2 lane construction	**2.48**	**>2031**	**C**
P74	Collector 6S	Airport Road	Glancaster Road (south)	New 2 lane construction	**3.10**	**>2031**	**C**
P75	Collector 7S	Fiddlers Green Road	Collector 9W	New 2 lane construction	**1.53**	**>2031**	**B**
P76	Collector 12S	Collector 3E	Collector 4E	New 2 lane construction	**1.14**	**>2031**	**B**
North-South Collector Roadways							
P77	Southcote Road (south)	Collector 1N	Butter Road	2 lane reconstruction	**2.72**	**>2031**	**C**
P78	Smith Road	Collector 1N	Airport Lands	2 lane reconstruction	**1.68**	**>2031**	**B**
P79	Collector 3E	Collector 12S	White Church Road	New 2 lane construction	**1.32**	**>2031**	**B**
P80	Collector 6W	Collector 3S	Butter Road	New 2 lane construction	**2.18**	**>2031**	**B**
(Beyond 2031) Additional Study Area Potential Roadway Projects TOTAL					**23.24**		

*** Road costs include property and exclude transit-related landscaping costs**

Table 1: Implementation Plan Summary: Transit Projects and Cost Estimates

TRANSIT PROJECTS AND COST ESTIMATES					
TRANSIT STOP & LANDSCAPING COST TOTALS – Secondary Plan Area (2009-2031)*					
Id	**Project**	**Intersection**		**Description**	**Cost ($M)**
34T	Enhanced transit stop	Southcote Road &	Garner Road	Major Enhanced transit stop	**0.34**
35T	Enhanced transit stop	Dickenson Road &	Upper James Road	Minor Enhanced transit stop	**0.22**
36T	Enhanced transit stop	Dickenson Road &	Glancaster Road	Minor Enhanced transit stop	**0.22**
37T	Enhanced transit stop	Glancaster Road &	Airport Road	Major Enhanced transit stop	**0.34**
38T		Transit Other (i.e. such as shelters, landscaping, etc.)			**0.36**
TOTAL REQUIRED TRANSIT PROJECTS					**1.48****
TRANSIT VEHICLE COSTS – Secondary Plan Area (2009-2031)					
a39T	Transit Vehicles Capital Cost				**6.08**
TRANSIT VEHICLE COST – Additional Study Area (>2031)					
b39T	Transit Vehicles Capital Cost				**6.08**
TOTAL BUS COSTS					**12.15**

* Transit Stop and Landscaping Costs were incorporated into Roadway Projects & Cost Estimates listed in *Table 15* but transit vehicle costs were not.