Red River Exhibition Master Plan / Precinct R
Traffic Impact Study

FINAL REPORT

April 2014

Prepared By

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Senior Project Engineer

Approved By

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Manager of Civil / Municipal Services

KGS Group
Winnipeg, Manitoba

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April 23, 2014

File No. 12-2214-001

Shindico
200-1355 Taylor Avenue
Winnipeg, Manitoba
R3M 3Y9

ATTENTION: Mr. John Pearson

RE: Red River Exhibition Master Plan / Precinct R
Traffic Impact Study – Final Report

Dear Mr. Pearson:

Please find enclosed a copy of a revised Traffic Impact Study for the proposed Red River Exhibition Master Plan and Precinct R development.

This report supercedes a previous issue (April 2013) addressing comments from Manitoba Infrastructure and Transportation (MIT) and scope refinements including:

- Adjustment of peak hour traffic during the Red River Exhibition;
- Removal of joint trips as a trip generation modification;
- Modified background traffic redistribution following development;
- Updated intersection improvements;
- Updated cost estimates;
- Removal of alternative: Right-in, right-out only option at the Race Track Road Intersection;
- Removal of alternative: Optional development on Red River Exhibition property; and
- Updated intersection capacity analyses for the Race Track Road, Camp Manitou Road and PR 425 intersections.

Please contact the undersigned with any questions or comments.

Regards,

Craig Rowbotham, P.Eng.
Senior Project Engineer

CR/hi
Enclosure

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April 22, 2014

File No. 12-2214-001

Landmark Planning & Design
298 Waterfront Drive
Winnipeg, Manitoba
R3B 0G5

ATTENTION: Mr. Curwood Ateah
Planner

RE: Red River Exhibition Master Plan / Precinct R
Traffic Impact Study – Final Report

Dear Mr. Ateah:

Please find enclosed a copy of a revised Traffic Impact Study for the proposed Red River Exhibition Master Plan and Precinct R development.

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Please contact the undersigned with any questions or comments.

Regards,

Craig Rowbotham, P.Eng.
Senior Project Engineer

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April 23, 2014

File No. 12-2214-001

Red River Exhibition Park
3977 Portage Avenue
Winnipeg, Manitoba
R3K 2E8

ATTENTION: Garth Rogerson, CEO

RE: Red River Exhibition Master Plan / Precinct R
Traffic Impact Study – Final Report

Dear Mr. Rogerson:

Please find enclosed three (3) copies of a revised Traffic Impact Study for the proposed Red River Exhibition Master Plan and Precinct R development.

This report supercedes a previous issue (April 2013) addressing comments from Manitoba Infrastructure and Transportation (MIT) and scope refinements including:

- Adjustment of peak hour traffic during the Red River Exhibition;
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Please contact the undersigned with any questions or comments.

Regards,

Craig Rowbotham, P.Eng.
Senior Project Engineer

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April 23, 2014

File No. 12-2214-001

Manitoba Infrastructure and Transportation
Highway Planning and Design Branch
1420 – 215 Garry Street
Winnipeg, Manitoba
R3C 3P3

ATTENTION: Mr. Eric Christiansen
Director of Highway Planning and Design

RE: Red River Exhibition Master Plan / Precinct R
Traffic Impact Study – Final Report

Dear Mr. Christiansen:

Please find enclosed four (4) copies of a revised Traffic Impact Study for the proposed Red River Exhibition Master Plan and Precinct R development.

This report supercedes a previous issue (April 2013) addressing comments from Manitoba Infrastructure and Transportation (MIT) and scope refinements including:

- Adjustment of peak hour traffic during the Red River Exhibition;
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- Modified background traffic redistribution following development;
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Please contact the undersigned with any questions or comments.

Regards,

Craig Rowbotham, P.Eng.
Senior Project Engineer

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April 22, 2014

File No. 12-2214-001

City of Winnipeg
Transportation Division
101-1155 Pacific Avenue
Winnipeg, Manitoba
R3E 3P1

ATTENTION: Mr. Stephen Chapman
Traffic Management Engineer

RE: Red River Exhibition Master Plan / Precinct R
Traffic Impact Study – Final Report

Dear Mr. Chapman:

Please find enclosed two (2) copies of a revised Traffic Impact Study for the proposed Red River Exhibition Master Plan and Precinct R development.

This report supercedes a previous issue (April 2013) addressing comments from Manitoba Infrastructure and Transportation (MIT) and scope refinements including:

- Adjustment of peak hour traffic during the Red River Exhibition;
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Regards,

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Senior Project Engineer

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April 22, 2014

File No. 12-2214-001

Birchwood Automotive Group
Unit 35C – 3965 Portage Avenue
Winnipeg, Manitoba
R3K 2H7

ATTENTION: Mr. Rene Nicholson
Special Projects Manager

RE: Red River Exhibition Master Plan / Precinct R
Traffic Impact Study – Final Report

Dear Mr. Nicholson:

Please find enclosed a copy of a revised Traffic Impact Study for the proposed Red River Exhibition Master Plan and Precinct R development.

This report supercedes a previous issue (April 2013) addressing comments from Manitoba Infrastructure and Transportation (MIT) and scope refinements including:

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Please contact the undersigned with any questions or comments.

Regards,

Craig Rowbotham, P.Eng.
Senior Project Engineer

CR/jr
Enclosure

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1.0 STUDY PURPOSE AND OBJECTIVES

1.1 PURPOSE

Red River Exhibition Park (RREX) is investigating the feasibility of developing their 467.0-acre (189.0-hectare) site west of PTH 101 in Winnipeg. The potential full build-out is expected to include variety of new land uses such as recreation, lodging, office, retail and other services. As a requirement of both the City of Winnipeg and Province of Manitoba to investigate impacts on the existing roadway infrastructure by new developments, RREX has authorized KGS Group to undertake a Traffic Impact Study (TIS). The intent of this study is to identify the potential impacts resulting from future developments.

This evaluation includes:

- Information gathered regarding existing traffic counts and movements;
- Analysis of existing flow patterns, determination of historical traffic growth and calculations of future traffic flow patterns with a 10-year time horizon;
- Analysis of existing capacity and level-of-service on the existing road network;
- Determination of existing transit routes;
- Determination of proposed development density;
- Determination of anticipated traffic generation volumes and trip assignments expected to and from the proposed development;
- Analysis of trip assignments generated from the proposed development; and
- Recommendations for improvements to mitigate adverse impacts and allow the existing transportation system to operate at a satisfactory level of service.

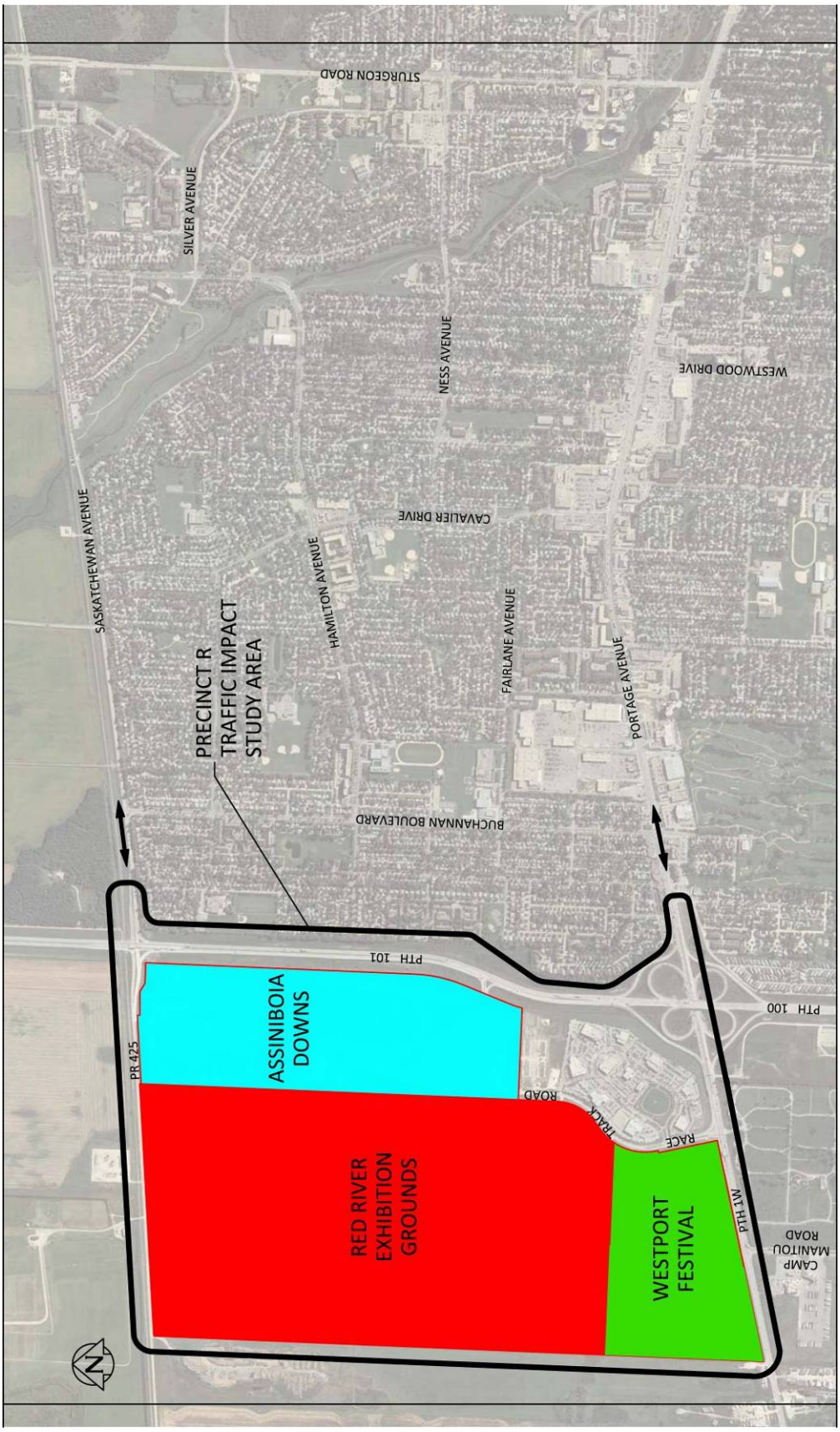

Figure 1 – Location / Context Plan

2.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 LAND USE

Currently, Red River Exhibition Park is zoned Agricultural with the majority of the site set aside for harvesting of hay. RREX now proposes to construct new facilities on their undeveloped land and allocate a separate parcel along PTH 1W for Shindico to develop commercially. It is RREX's intent to proceed within the framework set out by *OurWinnipeg and the Complete Communities Direction Strategy* which is covered in further detail below.

2.1.1 Red River Exhibition Park

The 467-acre (189-hectare) site, which is adjacent to the Assiniboia Downs Racetrack, is used each year in June as the site of the Red River Exhibition. In past years, access to the site included the signalized intersections of Race Track Road at PTH 1W and the Assiniboia Downs (AD) access off PTH 101. The 10-day fair, held in conjunction with the regularly scheduled horse races at the Downs, generates a large amount of traffic which has resulted in high levels of congestion on adjacent roadways. This past year, over 215,000 attendees arrived over the course of the event.

Interim events have been held at the Red River Exhibition Park site throughout the year including the Red River Farmers' Market, CanadInns Winter Wonderland, Horse Shows, Cottage Living Show and others. The traffic generated during these events is significantly less than that from the main exhibition.

RREX intends to develop a site with multiple uses. The latest site plan associated with the proposed development is illustrated in Figure 2. It is expected to be built out over several years and include the following new elements:

- 5000-seat Multi-Purpose Arena / Event Centre;
- 150,000 ft^2 Expansion to existing Exposition Hall;
- Commodity Campus with 120,000ft^2 of agricultural office buildings (Typical Operation: 8 A.M. to 5 P.M.);
- 2,000-stall expansion to existing 6,000-stall parking lot; and
- Extension of Camp Manitou Road northward to PR 425 (Saskatchewan Avenue)



Figure 2 – Proposed Site Plan - RREX Master Plan

2.1.2 Westport Festival

At this point in time, actual tenants for much of the commercial development area have not been finalized. For the purposes of this study, any as-yet undetermined retail space was designated as general retail. It is expected that approximately 563,000ft^2 of commercial space will be constructed along PTH 1W including:

- 100-room Hotel;
- Movie Theatre;
- Restaurant;
- Gas Bar; and
- 401,000ft^2 of additional general retail

The space is expected to operate as a typical commercial development between 8/9 A.M. to 9/10 P.M.

An internal road, running parallel to PTH 1W is expected to be built connecting Race Track Road westerly to the new extension of Camp Manitou Road.

2.2 OURWINNIPEG

Red River Exhibition Park, along with Assiniboia Downs makes up the two tenants of "Precinct R", an area earmarked in *OurWinnipeg*.

OurWinnipeg and the Complete Communities Direction Strategy presents a 25-year vision for the entire city. It positions Winnipeg for sustainable growth, key to its future competitiveness. The plan is required by the City of Winnipeg *Charter* that requires the City to adopt, by by-law, a development plan that sets out long-term plans and policies. The development plan guides and informs more detailed planning on specific topics or for specific areas.

Within the *Complete Communities Direction Strategy*, Precinct R is categorized as a 'New Community', with a large undeveloped land area identified for future urban development. This commercial site has been identified as serviceable, of sufficient size and contiguous with existing developed areas. The planning document also earmarks an area listed as PTH 1W West at Racetrack Road, as an emerging Mixed-Use Centre. Development of the Precinct R site will have direct and indirect impact on the existing mixed-use area.

The design of any roadway improvements within the study area is expected to be based on a clear understanding of the land use context.

2.3 LOCATION

Precinct R is located on the west side of Winnipeg, north of PTH 1W, south of PR 425, east of Headingley and west of PTH 101.

The area bounded by the traffic impact study is illustrated in Figures 1 and 2.

2.4 SITE PLAN

The latest development plan presented by RREX / Shindico (current July 2012) is illustrated in Figure 3.

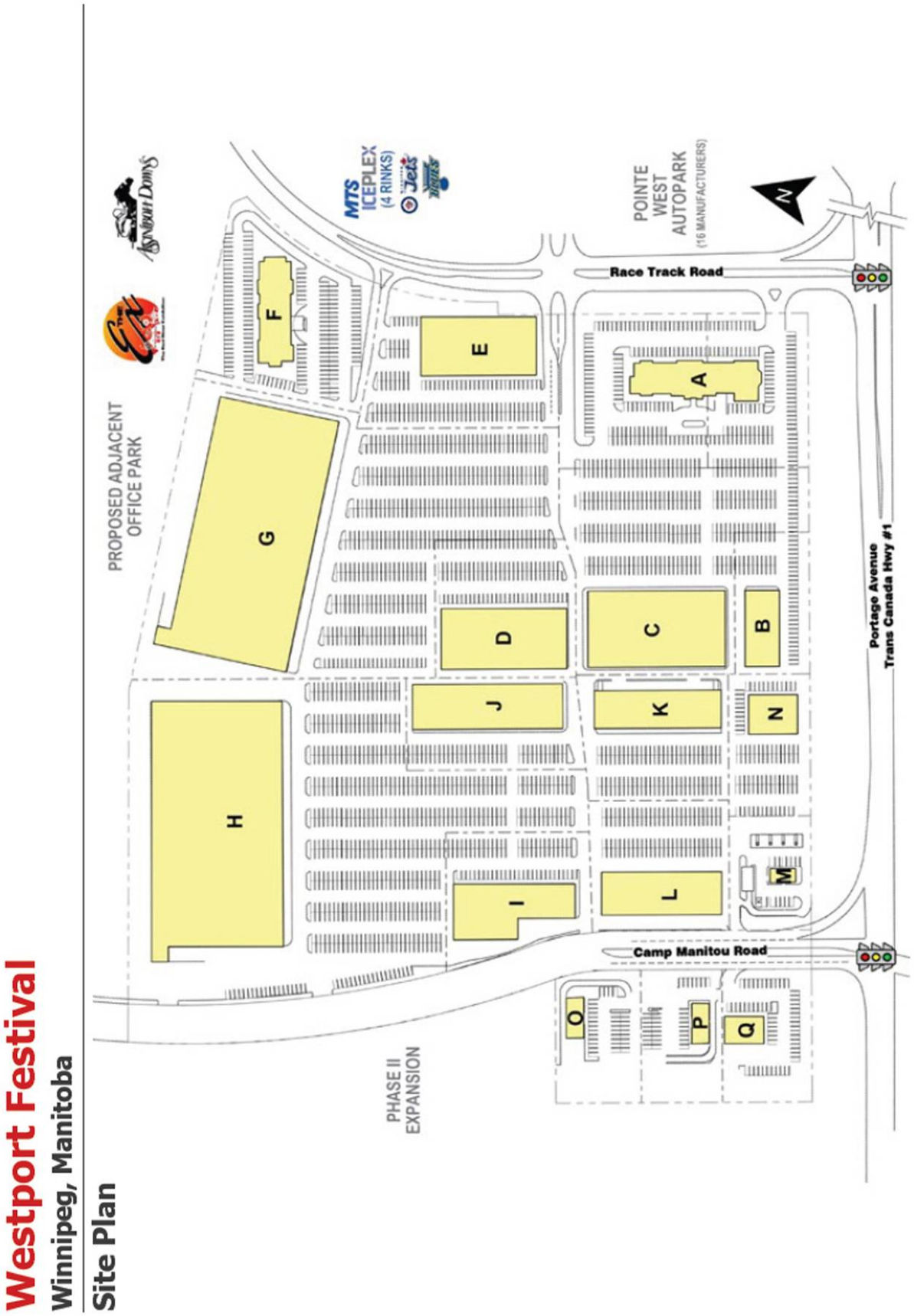

Figure 3 – Proposed Site Plan - Westport Festival (Shindico Development)

2.5 ADJACENT SITES / HIGHWAY CONDITIONS

2.5.1 PTH 1W (Portage Avenue, Trans-Canada Highway)

PTH 1W is a 4-lane divided expressway with raised median west of PTH 101 (Perimeter Highway to just west of Camp Manitou Road). Note that within Winnipeg, this route is referred to as Portage Avenue. Two lanes run both eastbound and westbound with posted speed limits of 70 kilometers per hour. PTH 1W west of Camp Manitou Road to the Blumberg Park access is four-lane undivided with plans to upgrade to 4-lane divided with raised median. The major intersections at Race Track Road and Camp Manitou Road are both signalized. PTH 1W and Portage Avenue are designated as part of the truck route network and is a major economic route for the City of Winnipeg and the Province of Manitoba.

Current daily traffic volumes on PTH 1W were found in *Traffic on Manitoba Highways 2010* provided through Manitoba Infrastructure and Transportation (MIT) & The University of Manitoba Transport Information Group (UMTIG). The average annual daily traffic (AADT) is estimated at 17,260 for year 2011. East of St. Charles Street, Portage Avenue was found to be 24,500 in 2009 (The City of Winnipeg's *2009 Traffic Flow Map*)

Originally, MIT's long-range plans were to include the closure of the median opening at Race Track Road and PTH 1W. This was dependant on the traffic generated by the proposed development and the impact to the highway system. Following a meeting July 19th, 2012, MIT indicated that this intersection would continue to operate as it does today. No closure of the median is expected in the near future.

MIT expects that an internal road be constructed connecting Camp Manitou Road to Race Track Road with provision to extend westward in the future. MIT also expects a secondary access back to PR 425 (Saskatchewan Avenue) further on in the development of the site.

2.5.2 PTH 101 (Perimeter Highway)

PTH 101 is a 4-lane divided expressway running north from PTH 1W along the west side of Winnipeg. South of the interchange at PTH 1W, this route is known as PTH 100 and together with PTH 101 make up the City's Perimeter Highway. Two lanes run both northbound and

southbound with a posted speed limit of 100 kilometers per hour. PTH 101 has a rural cross section with ditching and a concrete curb median.

Current daily traffic volumes on PTH 101 between PR 425 and the PTH 1W interchange were found in *Traffic on Manitoba Highways 2010* provided through Manitoba Infrastructure and Transportation (MIT) & The University of Manitoba Transport Information Group (UMTIG). The average annual daily traffic (AADT) is estimated at 15,790 for year 2010.

MIT's long-range plans for PTH 101 are to eliminate all at-grade intersections and replace with strategically placed interchanges.

Four existing and one future crossing exist within the scope limits of this project.

- A grade-separated interchange is currently under construction with CentrePort Canada Way. Loop ramps exist in both the northwest and southwest quadrants.
- A grade-separated crossing is currently under construction with PTH 101 running over PR 425 Avenue and the CPR Glenboro Subdivision rail line. No access or egress will be available on or off either roadway.
- A T-intersection connects the Assiniboia Downs directly with PTH 101. This operates as a right-in, right-out off of PTH 101. Up until now, the intersection was temporarily signalized with added left turns both in and off the access during the 10-day Red River Exhibition. The median is now closed and does not permit movements for special events.
- A cloverleaf interchange exists between PTH 101 and PTH 1W. MIT's long-range plans include a conversion of this to a Parclo interchange with PTH 101 turning movements requiring signalized intersections along PTH 1W. The intent is to eliminate the weaving zone on PTH 101.

2.5.3 PR 425 (Saskatchewan Avenue)

PR 425 is a two-lane undivided roadway (Collector "A") that runs west of PTH 101. East of PTH 101, this route is known as Saskatchewan Avenue. Considered a minor arterial within Winnipeg, it connects to the west side of James A. Richardson International Airport. One lane runs both eastbound and westbound with posted speed limits of 60 kilometers per hour. PR 425 has a rural cross section with ditching. The intersection at the approach to Assiniboia Downs is unsignalized with stop control for the approach. The crossing at PTH 101 is currently closed as a grade separation is being constructed with PTH 101 running as an overpass over PR 425. No routes connect PR 425 directly to PTH 101. It is currently listed as a truck route within

Winnipeg's city limits, but may be re-evaluated following commissioning of CentrePort Canada Way (anticipated 2013). It is expected that the section from Summit Road west will lose the designation. West of PTH 101 it is designated a B1 Provincial Highway.

Expected daily traffic volumes on PR 425 are provided through traffic data from Manitoba Infrastructure and Transportation (MIT) & The University of Manitoba Transport Information Group (UMTIG). The average annual daily traffic is estimated at 120 for the year 2011.

Expected daily traffic volumes on Saskatchewan Avenue (east of PTH 101) are provided through the Traffic Impact Study prepared for the CentrePort Canada Way Project. The average annual daily traffic (AADT) is estimated at 270 for the year 2013, following completion of the first phase of work. This is a significant decrease from 2009 when the average annual daily traffic was 5400 as it operated as a truck route.

It is anticipated that PR 425 will be abandoned as a Provincial Road when CentrePort Canada Way is extended westward as a by-pass of Headingley.

2.5.4 Race Track Road

Race Track Road is a private roadway in the west end of Winnipeg. Race Track Road is currently a four-lane divided roadway connecting PTH 1W to the Autopark and a two-lane undivided roadway further on to Assiniboia Downs. Equivalent lanes run both northbound and southbound (2 or 1 respectively). Race Track Road has an urban cross section. North of the intersection with the Pointe West Auto Mall, the road converges to two-lane with one lane in both the northbound and southbound directions. Currently this route serves as the main access the Pointe West Auto Mall, MTS Iceplex, Assiniboia Downs and the Red River Exhibition Grounds.

South of PTH 1W, this road acts as the main access to the Assumption Cemetery & Mausoleum and Chapel Lawn Memorial Gardens.

As noted in 2.5.1, MIT's long-range plan (PTH 1W, Proposed Highway Upgrading and Access Management Plan, May 2001) does not include the closure of the median opening at Race Track Road and PTH 1W.

2.5.5 Camp Manitou Road

Camp Manitou Road is a municipal roadway in the Rural Municipality of Headingley. Camp Manitou Road is currently a four-lane divided roadway connecting from PTH 1W south to the Flying J commercial approach and two-lane undivided further south to the Assiniboine River. Two lanes run both northbound and southbound with speed limits of 50 kilometers per hour. Camp Manitou Road has a rural cross section with ditching, south of the Flying J Restaurant.

As part of developing Precinct R, future plans call for a private, 2000 metre long 4-lane road extension from PTH 1W northward to PR 425.

2.5.6 CentrePort Canada Way

CentrePort Canada Way (CCW), running north of PR 425, provides a four-lane divided expressway that links the inland port to PTH 101, PR 221 (Inkster Boulevard), James Armstrong Richardson International Airport and the CP Weston Rail intermodal facility. Two lanes run both eastbound and westbound with a posted speed limit of 80 kilometers per hour. CCW has a rural cross section with ditching and a depressed median.

Current daily traffic volumes along CentrePort Canada Way are not available as the project neared completion at the time of this report. The majority of PR 221 traffic previously accessing PTH 101 will now use the route once it is opened.

It is expected that CentrePort Canada Way will ultimately extend further westward, connecting to PTH 1 east of St. Francois Xavier. A grade-separated interchange is expected north of Headingley, near the northerly extension of PR 334 (Lyons Street or Dodds Road).

2.5.7 Associated City of Winnipeg Roadways

In addition to Saskatchewan Avenue and Portage Avenue, there are three roads running in the west end of Winnipeg that are expected to be impacted by the development of Precinct R.

Buchannan Boulevard is a collector that runs north-south from Portage Avenue to Saskatchewan Avenue. Buchanan Boulevard is currently four-lane divided including parking in

each non-median lane. The average annual daily traffic is estimated at 5,600 for the year 2013 at Portage Avenue.

Cavalier Drive is a minor arterial (regional street) that runs north-south from Portage Avenue to Ness Avenue. Cavalier Drive is currently two-lane undivided and continues north to Saskatchewan Avenue as a collector. The average annual daily traffic is estimated at 20,900 for the year 2013 at Portage Avenue.

Sturgeon Road is a minor arterial (regional street) that runs north-south from Portage Avenue to PTH 101. Sturgeon Road is currently four-lane divided from Portage to Ness Avenue and two-lane undivided further north. This road operates as a full-time truck route. The average annual daily traffic (AADT) is estimated at 11,400 at Portage Avenue for the year 2013.

2.6 PHASING AND/OR TIMING OF DEVELOPMENT OR REDEVELOPMENT

The development is anticipated to be built out over several years. Opening of the first agricultural business building is expected in Winter 2013. Construction of the Camp Manitou intersection's fourth leg is expected during the summer of 2013. Shindico's Westport Festival is expected to be constructed starting in 2013 through to 2017.

3.0 TRAFFIC VOLUMES

3.1 ASSESSMENT SCENARIOS

Timeframes

- Year 2013 (Background), Year 2013 (Opening Day); Year 2022 (Full Build-Out)
- A.M., P.M. and Saturday Peak Hours

Development / Infrastructure Status

- Background (No Development);
- Opening Day (RREX – Office Building, Westport – Hotel, Restaurant, Gas Bar);
- Full Build-Out (RREX and Westport Fully Developed); and

Special Events

- Non-Major Event; and Major Event (Red River Exhibition)

Intersection Locations

- Race Track Road @ PTH 1W (Noted as RTR);
- Camp Manitou Road @ PTH 1W (Noted as CMR); and
- Camp Manitou Road @ PR 425 (Noted as PR425)

TABLE 1
TRAFFIC ASSESSMENT SCENARIOS

Int	2013 Background	2013 Opening Day	2022 Full Build-Out
RTR	✓	✓	✓
CMR	✓	✓	✓
PR425	x	x	✓

- Each selected scenario assessed at A.M., P.M., and Saturday Peak Hours
- Each selected scenario assessed at Non-Major and Major Event Peaks

3.2 EXISTING TRAFFIC VOLUMES

Existing traffic volumes were established using data from different sources. Traffic volumes on the Provincial highway network were obtained from the University of Manitoba Transport Information Group (UMTIG) which maintains the Manitoba Highway Traffic Information System (MHTIS). Traffic volumes on the City of Winnipeg road network were obtained from the City of Winnipeg Public Works Department. Supplementary information was developed through manual traffic counts at the intersections of PTH 1W with Race Track Road and Camp Manitou Road.

3.2.1 Existing Provincial Traffic Data

Data collected from UMTIG includes Average Annual Daily Traffic (AADT) through permanent count stations and tube counts. Previous turning counts were also available through the UMTIG website including:

- PTH 1W / Camp Manitou Road (2001)
- PTH 1W / Race Track Road (2001)
- PTH 101 / PR 425 (2001 – prior to grade separation)

As the source data collected came from different dates and times of the year, reconciliation was required to balance volumes at selected intersections.

The traffic data provided by UMTIG can be found in Appendix A.

3.2.2 Existing City of Winnipeg Traffic Data

Data collected from Public Works includes Average Annual Daily Traffic (AADT) through tube counts. Previous turning counts were also available including:

- Portage Avenue / Buchannan Boulevard (2011)
- Portage Avenue / Cavalier Avenue (2009)
- Portage Avenue / Sturgeon Road (2009)

As the source data collected came from different dates and times of the year, reconciliation was required to balance volumes at selected intersections.
The traffic data provided by the City of Winnipeg Public Works Department can be found in Appendix A.

3.2.3 Traffic Counts

Manual traffic counts were performed at the PTH 1W/Race Track Road and PTH 1W/Camp Manitou intersections July 31 and August 1, 2012 respectively (Tuesday/Wednesday). The counts focused on peak-hour conditions including 7:00am to 9:00am and 3:30pm to 5:30pm. Due to the high traffic numbers, video imaging was acquired with 2 cameras for each

intersection. Manual counts were completed within an office environmental following the video recording of each site. The weekday A.M. and P.M. peak periods were selected for analysis, as these are generally the busiest and therefore most critical periods for traffic along PTH 1W.

Summaries of traffic volumes manually counted at each intersection can be found in Appendix B.

3.2.4 Saturday Traffic

Manual traffic counts were not performed over the weekend, however this period is expected to be impacted by the new commercial development. To establish a background baseline for the Saturday peak, 8% of the AADT along PTH 1W (17,400) was used. Distribution was set to follow an average weighting of the A.M. and P.M. peak counts.

3.3 TRAFFIC GROWTH RATE

Annual traffic growth rates were calculated from historical traffic obtained from UMTIG. This includes AADT values for PTH 1W, PTH 101, PTH 100 and PR 425.

Based on the aggregate average of the four segments over 10 years (2001-2010), one can expect a continued annual growth rate of 1.20% over the duration of the study.

Peak hour traffic volumes are considered in all 2022 projections.

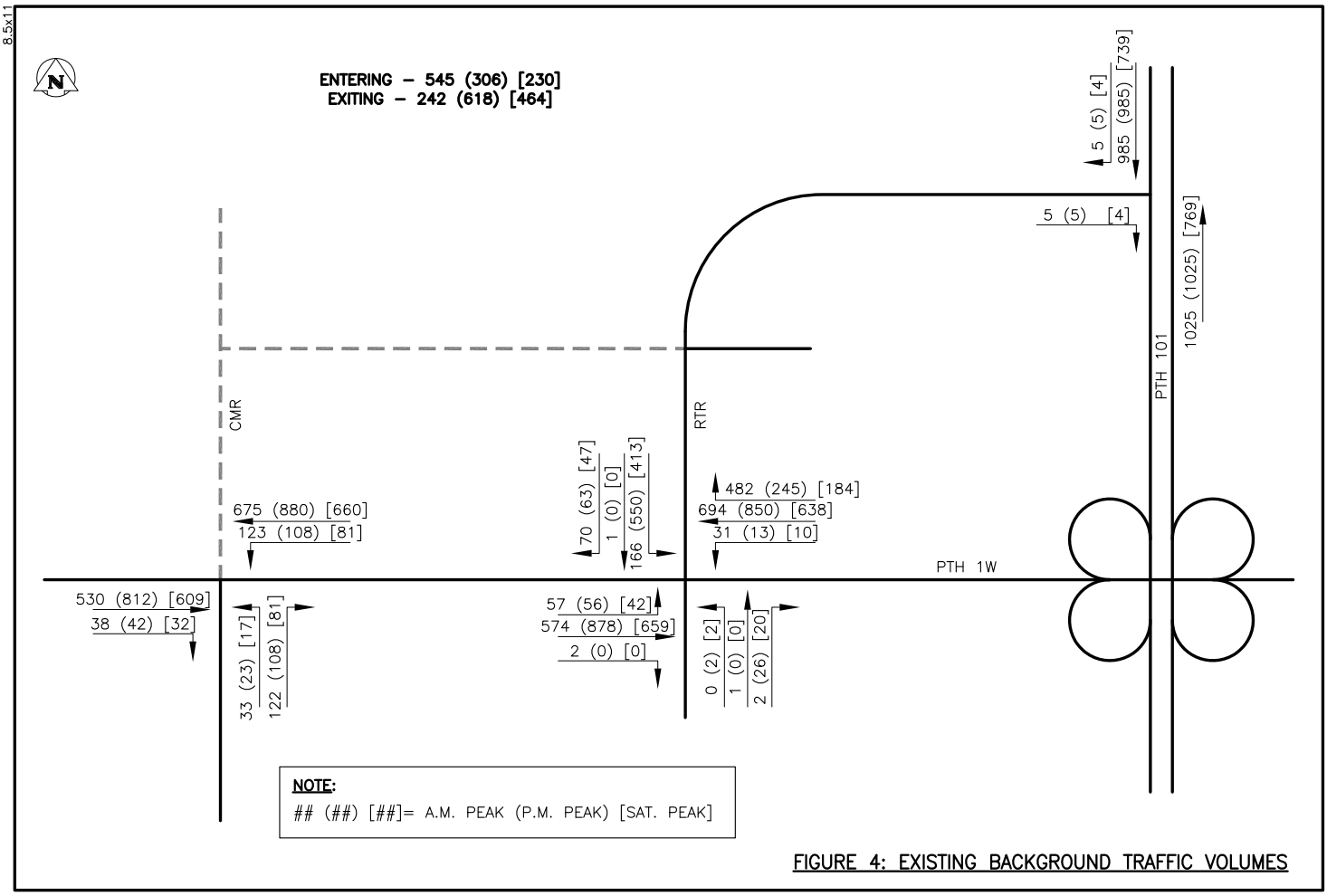

FIGURE 4: EXISTING BACKGROUND TRAFFIC VOLUMES

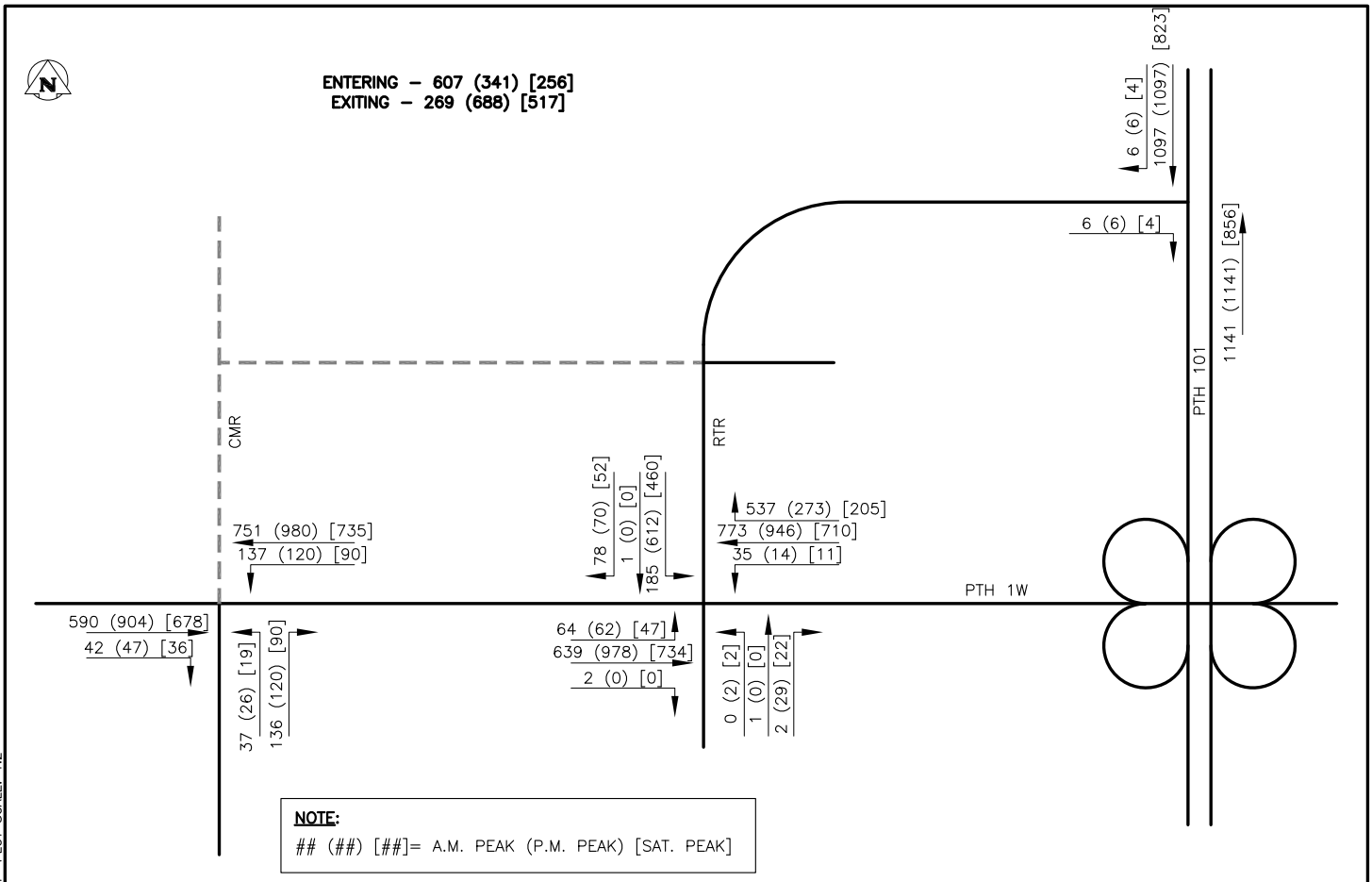

FIGURE 5: 2022 BACKGROUND TRAFFIC VOLUMES

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3.4 SITE GENERATED TRAFFIC

3.4.1 Trip Generation

Trips generated by the proposed development were estimated based on trip generation rates provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual. RREX has developed a site plan, shown in Figure 2, which illustrates the current (June 2012) conceptual layout. This layout was used for the generation and distribution of origin / destination trips as per ITE trip generation methodologies.

The actual tenants for the proposed retail and office spaces have not been finalized for this development. For the purposes of the study, most of the commercial area was designated as general retail (Land Use 820 – Shopping Centre). Other land uses applicable to this study include Hotel (Land Use 310), Multiplex Movie Theater (Land Use 445), General Office Building (Land Use 710), Office Park (Land Use 750), Gas Bar (Land Use 944) and Multi-Purpose Exposition Center (Not defined ITE Land Use Code).

The Hotel land use (Land Use 310) was used to determine trips generated by the proposed development. ITE defines a hotel as “places of lodging that provide sleeping accommodations and supporting facilities such as restaurants, cocktail lounges, meeting and banquet rooms or convention facilities, limited recreational facilities and / or other retail and service shops”. The average trip generation rate is based on a fitted curve equation of the rooms available.

The Multiplex Movie Theatre (Land Use 445) was used to determine trips generated by the proposed development. ITE defines a multiplex movie theater as a building that “consists of audience seating, a minimum of ten screens, a lobby and a refreshment area”. The average trip generation rate for a multiplex movie theatre is based on a fitted curve equation of the overall square footage.

The General Office Building land use (Land Use 710) was used to determine trips generated by the proposed development. ITE defines a general office building as “a building or buildings that can contain a mixture of tenants including professional services, insurance companies, investment brokers and tenant services such as a bank, restaurant, cafeteria and / or service

retail facility". The average trip generation rate for a general office building is based on a fitted curve equation of the overall square footage.

The Office Park land use (Land Use 750) was used to determine trips generated by the proposed development. ITE defines an office park as "planned unit developments containing general office buildings and support services, such as banks, restaurants and service stations. The average trip generation rate for a general office building is based on a fitted curve equation of the overall square footage.

The Shopping Centre land use (Land Use 820) was used to determine trips generated by the proposed development. ITE defines a shopping center as "an integrated group of commercial establishments that is planned, developed, owned and managed as a unit". The average trip generation rate for a shopping center is based on a fitted curve equation of the overall square footage.

The Gas Bar land use (Land Use 944) was used to determine trips generated by the proposed development. ITE defines a gas bar land use as "a station where the primary business is the fuelling of motor vehicles". The average trip generation rate for a gas bar is based on a fitted curve equation of number of vehicle fuelling positions.

3.4.2 Trip Generation Modification

No reductions were made to the trip generation estimates to account for transit, cyclist or pedestrian mode split.

Drop-in trips were considered for each land use type. These trips involve existing background traffic that divert from their original commute to drop-in at a business, then continue on. As such, these are discounted from the generated total (already exist within the background traffic) and are reapplied to any intersection turning movements.

3.4.3 Opening Day Generated Traffic

Table 2 summarizes the trips generated by the proposed development on opening day (2013). A total of 230 trips (135 entering and 95 exiting) are anticipated during the weekday A.M. peak

hour while a total of 280 trips (180 entering and 100 exiting) are anticipated during the weekday P.M. peak hour. For Saturday a total of 285 trips (165 entering and 120 exiting) are anticipated during the peak hour of generation.

Forecast trip generation for the proposed development is summarized in Table 2 for the weekday p.m. peak hour. All trips shown are net new trips generated by the development. A detailed spreadsheet including trip equations, trip direction and drop-ins is found in Appendix C.

TABLE 2
OPENING DAY TRIP GENERATION

Development Type	Land Use	Size	AM Peak Hour	PM Peak Hour	Saturday Peak Hour
WESTPORT					
Hotel	310	100 rooms	35 – Entering 25 – Exiting	30 – Entering 30 – Exiting	40 – Entering 30 – Exiting
Restaurant	932	8,000 ft^2	45 – Entering 40 – Exiting	50 – Entering 30 – Exiting	90 – Entering 55 – Exiting
Gas Bar	944	8 fuelling positions	25 – Entering 25 – Exiting	30 – Entering 30 – Exiting	30 – Entering 30 – Exiting
RED RIVER EXHBITION					
General Office Building	710	18,000 ft^2	30 – Entering 5 – Exiting	70 – Entering 10 – Exiting	5 – Entering 5 – Exiting
Total Trip Generation			**135 – Entering 95 – Exiting**	**180 – Entering 100 – Exiting**	**165 – Entering 120 – Exiting**

3.4.4 Full Build-Out Generated Traffic

Table 3 summarizes the trips generated by the proposed development. A total of 720 trips (490 entering and 230 exiting) are anticipated during the weekday A.M. peak hour while a total of 1,905 trips (895 entering and 1,010 exiting) are anticipated during the weekday P.M. peak hour. For Saturday a total of 2,895 trips (1,525 entering and 1,370 exiting) are anticipated during the peak hour of generation.

The site plan illustrated in Figure 2 was used for the trip generation forecasts and is the most up-to-date information available as of December 2012. Forecast trip generation for the proposed development is summarized in Table 3 for the weekday P.M. peak hour. All trips shown are net new trips generated by the development. A detailed spreadsheet including trip equations, trip direction and drop-ins is found in Appendix C.

TABLE 3
FULL BUILD-OUT TRIP GENERATION

Development Type	Land Use	Size	AM Peak Hour	PM Peak Hour	Saturday Peak Hour
WESTPORT					
Hotel	310	100 rooms	35 – Entering 25 – Exiting	30 – Entering 30 – Exiting	40 – Entering 30 – Exiting
Multiplex Movie Theatre	445	16 screens	0 – Entering 0 – Exiting	85 – Entering 90 – Exiting	460 – Entering 425 – Exiting
Restaurant	932	8,000 ft^2	45 – Entering 40 – Exiting	50 – Entering 30 – Exiting	90 – Entering 55 – Exiting
Shopping Center	820	401,000 ft^2	175 – Entering 110 – Exiting	600 – Entering 650 – Exiting	890 – Entering 820 – Exiting
Gas Bar	944	8 fuelling positions	25 – Entering 25 – Exiting	30 – Entering 30 – Exiting	30 – Entering 30 – Exiting
RED RIVER EXHIBITION					
General Office Building	710	18,000 ft^2	30 – Entering 5 – Exiting	70 – Entering 10 – Exiting	5 – Entering 5 – Exiting
Office Park	750	120,000 ft^2	135 – Entering 15 – Exiting	30 – Entering 170 – Exiting	10 – Entering 5 – Exiting
Total Trip Generation			**490 – Entering 230 – Exiting**	**895 – Entering 1010 – Exiting**	**1525–Entering 1370–Exiting**

3.5 SPECIAL EVENT TRAFFIC

For this study, special events are expected to occur concurrently with the Saturday peak hour.

3.5.1 Red River Exhibition

In 2012, the Ex hosted 215,000 patrons over 10 days. The largest daily attendance of 48,000 on a Saturday correlates well with events held in the past.

Traffic generated by the event is based on an average per-vehicle occupancy (AVO) of 3.0. This estimate is considered conservative for major events of this type. The United States Environmental Protection Agency's (EPA) Control Measure Information Document suggests 3.5 for "State Fair" special events. A review of other similar events suggests an average of 2.5 to 3.5.

Traffic generated by the event is based on Winnipeg Transit bus service shuttling approximately 8% of attendees to the Ex. In 2012, Winnipeg Transit ran 97 busses with a seating capacity of 40 during the busiest day (Saturday).

Daily vehicles = [Daily attendance – Transit Ridership] / AVO
= [48,000 – (97 x 40)] / 3.0
= 14,700

The peak hour for this event is calculated for the maximum Saturday generator where traffic generated is expected to be approximately 25% of the daily total. Peak hour trip generation is estimated at 4,595 vehicles where 80% are entering and 20% exiting. All trips shown in Table 4 are net trips generated exclusively by the event. A detailed spreadsheet including trip equations, trip direction and drop-ins is found in Appendix C.

Anecdotal information from RREX suggests that flows are inconsistent from day-to-day, depending on weather conditions and marketing campaigns, which tend to flatten out the peak flows. Spikes are witnessed after 6 P.M. during the week and 1 hour after opening on the weekends.

3.5.2 Non-Major Events

The Multi-Purpose Exposition Centre and Agriculture Buildings are not defined in the ITE Trip Generation Manual. Trip generation rates are developed based on the number of employees, service/support staff and patrons. Traffic generated by employees is expected to be minimal as these trips typically occur outside conventional commuter peak hours of adjacent streets. Deliveries are expected to generally occur outside of normal peak hour periods and are distributed randomly throughout the day. Applying a land use similar to a Multiplex Movie Theatre (Land Use 445) is expected to give an acceptable approximation of the peak traffic generated by a non-major event. Peak hour generation is estimated at 1500 trips (1200 entering, 300 exiting). All trips shown in Table 4 are net trips generated exclusively by the event. A detailed spreadsheet including trip equations, trip direction and drop-ins is found in Appendix C.

TABLE 4
SPECIAL EVENT TRIP GENERATION

Development Type	Land Use	Size	Peak Hour of Generation
Non-Major Event	445 (apx)	5,000 seats	**1200 – Entering** **300 – Exiting**
Major Event - Red River Exhibition	N/A	48,000 max/day	**3675 – Entering** **920 – Exiting**

3.6 TRIP DISTRIBUTION

Trip distribution refers to the directional split of traffic entering and exiting a site while trip assignment assigns distributed trips to the adjacent road network. A number of scenarios are evaluated in this report, each with unique distributions based on the number of access/egress points, stage of development and type of event. Summarized below, details of each evaluated scenario can be found in Appendix D.

TABLE 5
TRIP DISTRIBUTION SCENARIOS

Development Type		
Opening Day	Background Development Event	Redistribution Distribution Distribution
Full Build-Out	Background Development Event	Redistribution Distribution Distribution

3.7 TOTAL FUTURE TRAFFIC

New trips generated by the proposed development were distributed and assigned to the intersections based on the splits noted above. Background and development traffic were combined to determine projections for the post development scenarios. The final traffic forecasts also included an annual growth rate of 1.20%.

Projected 2013 and 2022 traffic volumes are illustrated in Figures 6 through 10.

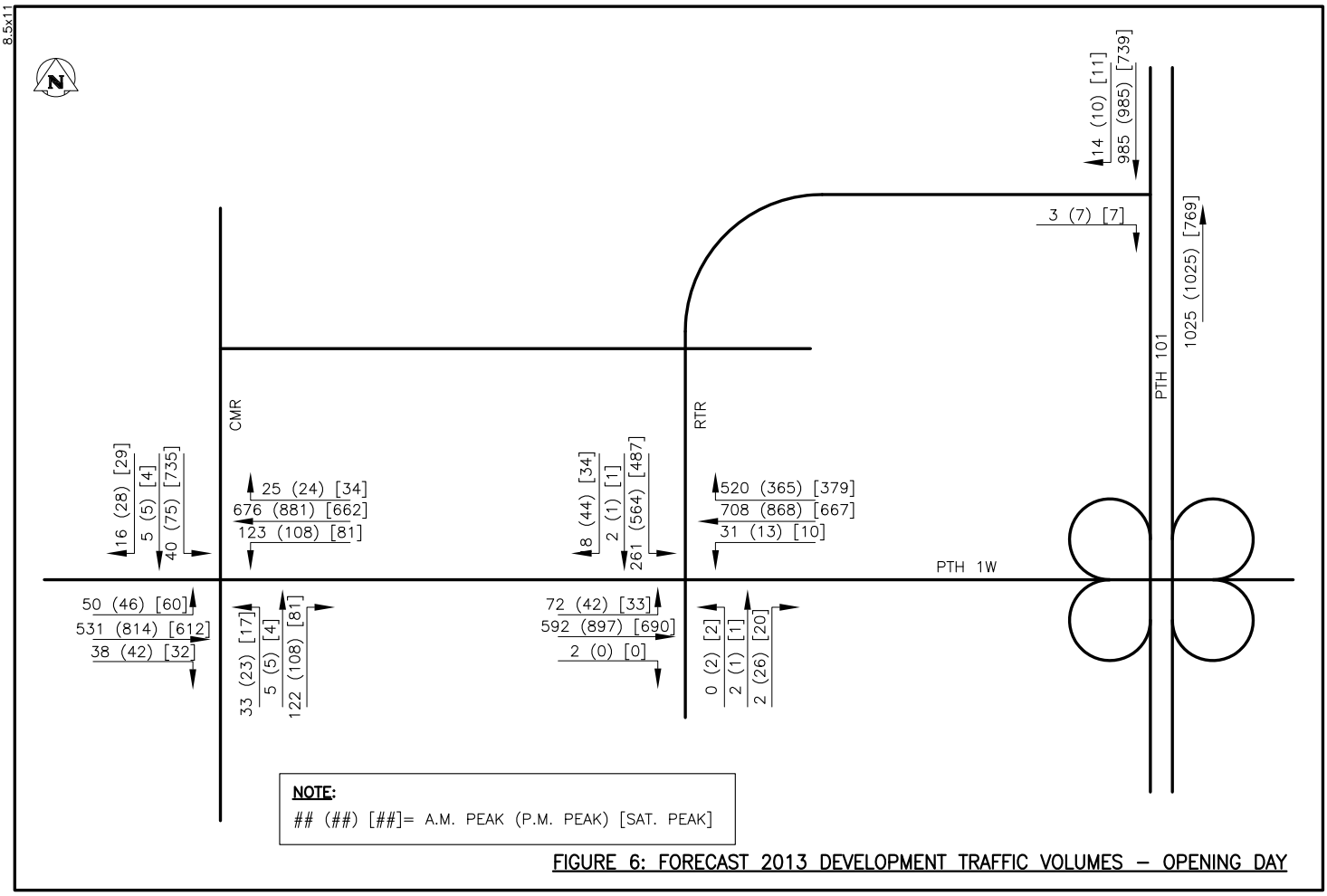

FIGURE 6: FORECAST 2013 DEVELOPMENT TRAFFIC VOLUMES – OPENING DAY

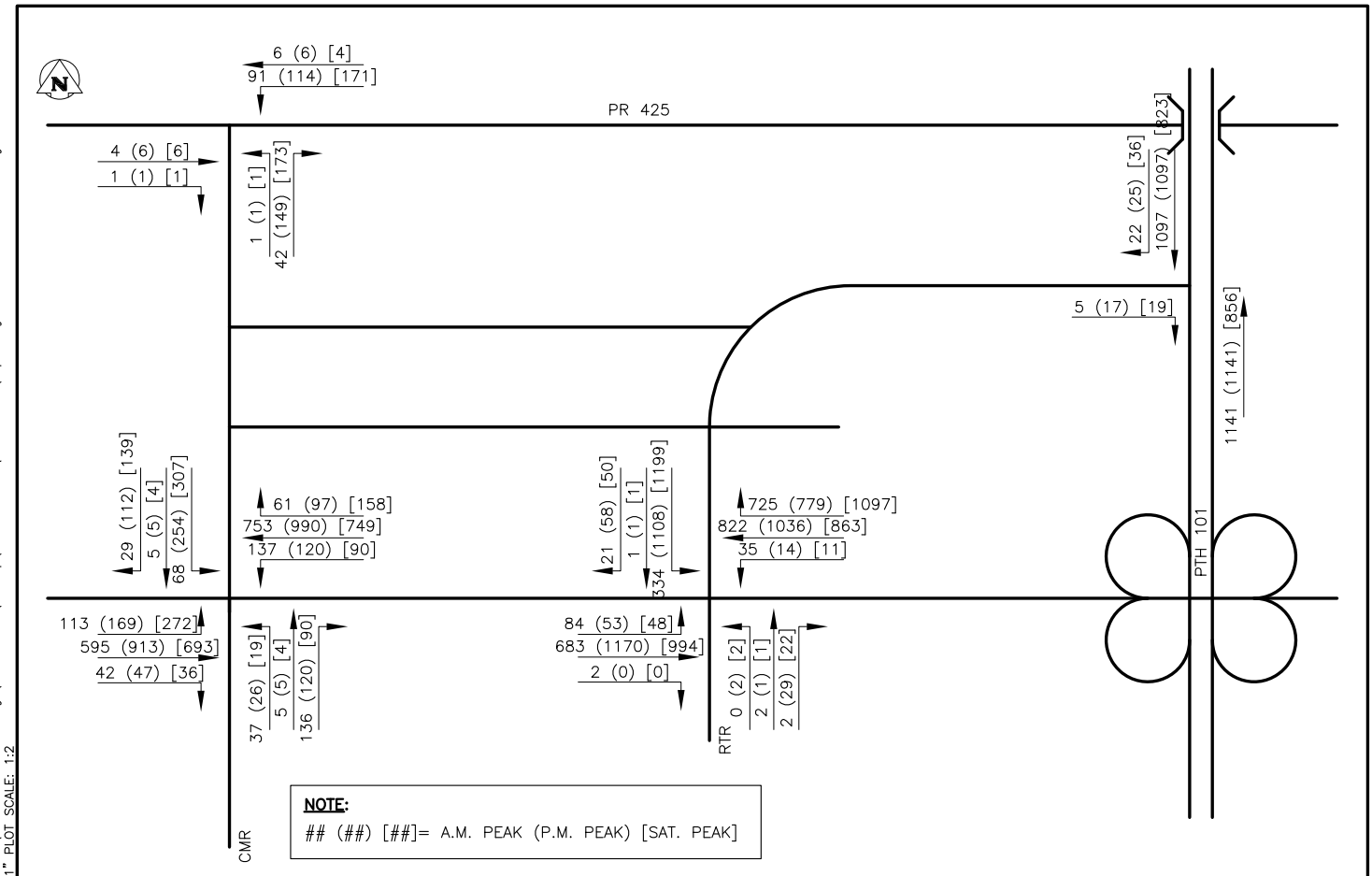

FIGURE 7: FORECAST 2022 DEVELOPMENT TRAFFIC VOLUMES – FULL BUILD-OUT

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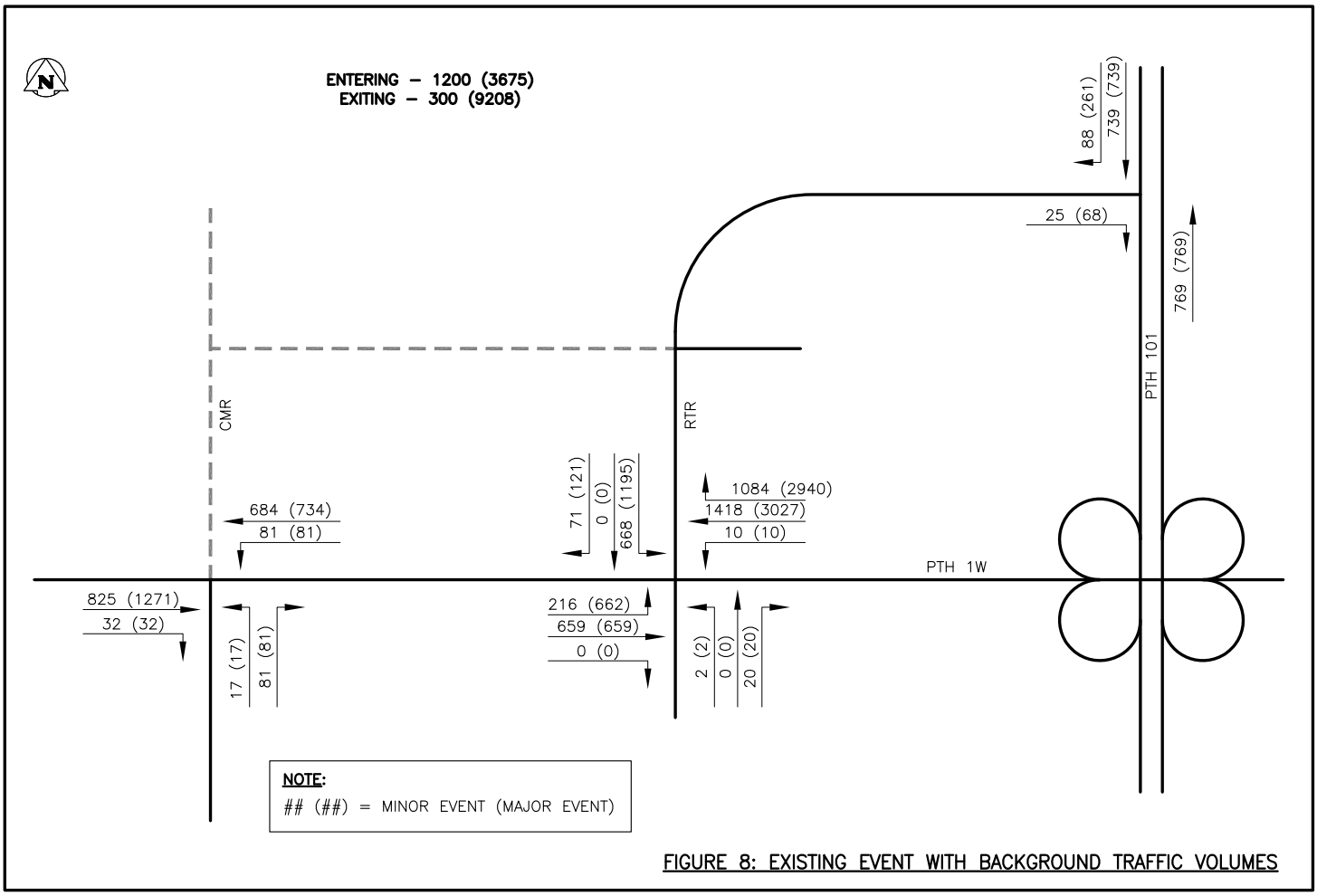

FIGURE 8: EXISTING EVENT WITH BACKGROUND TRAFFIC VOLUMES

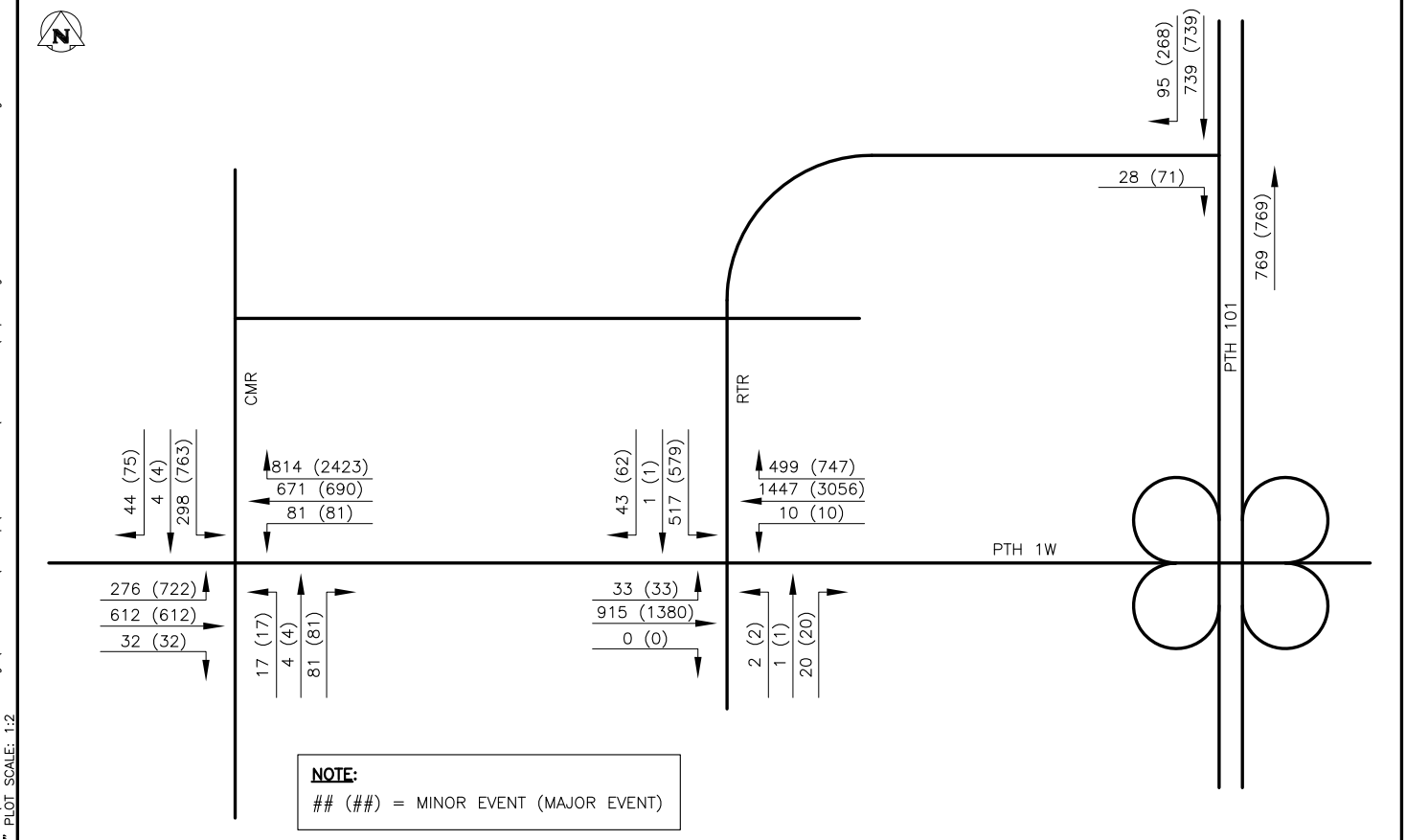

FIGURE 9: FORECAST 2013 EVENT TRAFFIC VOLUMES – OPENING DAY

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8.5"X11" PLOT SCALE: 1:2

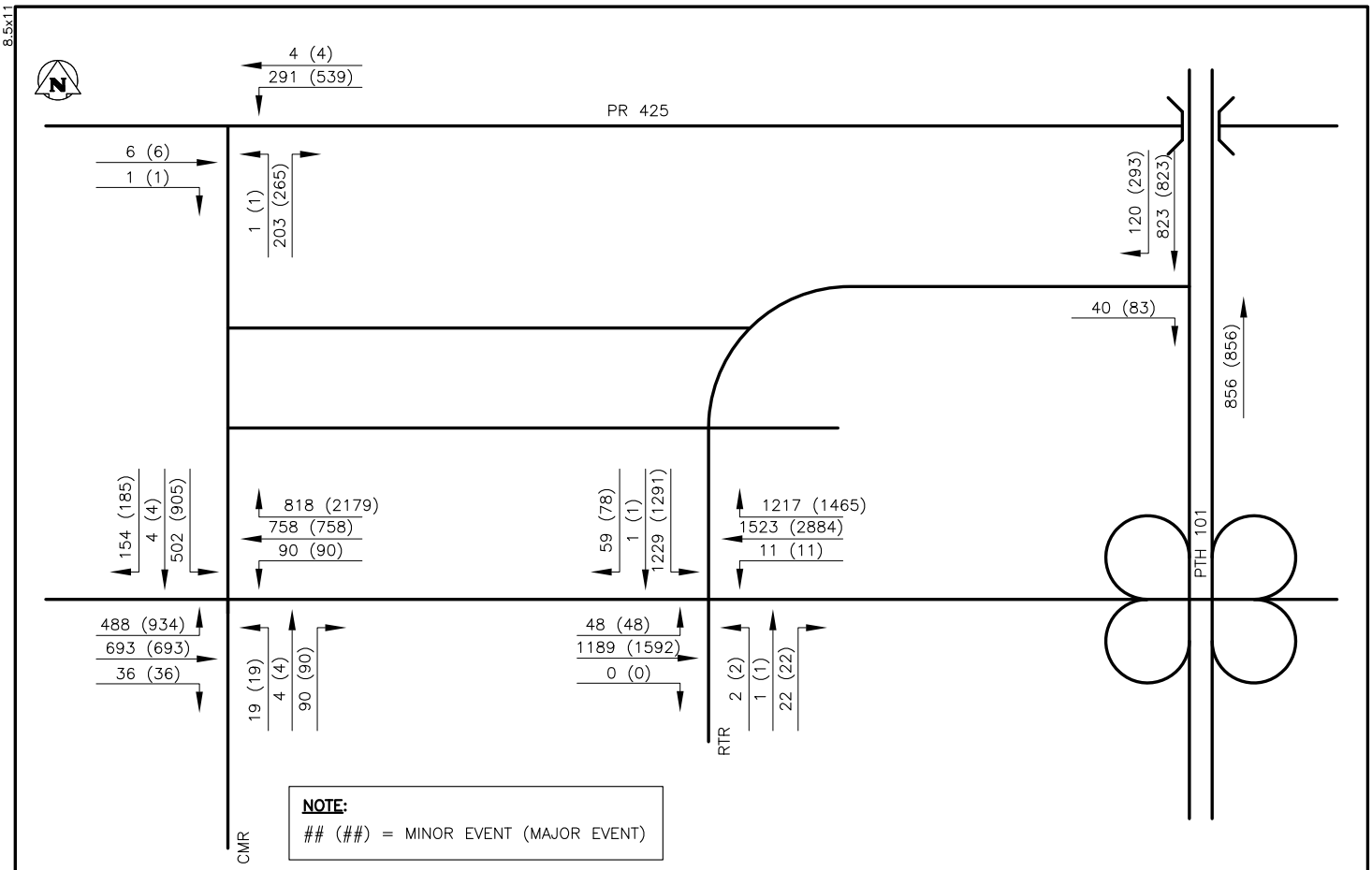

FIGURE 10: FORECAST 2022 EVENT TRAFFIC VOLUMES – FULL BUILD-OUT

8.5x11
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8.5"X11" PLOT SCALE: 1:2

4.0 TRAFFIC ANALYSIS

Traffic analyses have been carried out examining existing, opening day and full build-out conditions. Identified are intersection performance scores, critical intersection movements and possible side-effects like excessive queuing.

4.1 SITE ACCESS

The operations of access points to the development are examined with the expected traffic volumes for 2013, 2022 and 2032. Access scenarios include:

- Existing: Race Track Road and Assiniboia Downs intersections
- Opening Day : Fourth leg of Camp Manitou Road intersection added along PTH 1W
- Full Build-Out (2022): Camp Manitou Road intersection added along PR 425

4.2 INTERSECTION CAPACITY AND LEVEL OF SERVICE

The relative performance of an intersection is measured in terms of level-of-service (LOS), which range from A (optimum) to F (beyond capacity). LOS C is generally considered acceptable for traffic operations. For peak hour urban traffic operations, LOS D is generally considered acceptable because driver expectations allow for heavier congestion during this time. Level of service for signalized intersections is defined in terms of delay, which measures driver comfort, maneuverability and lost travel time. Delay is dependent on the quality of progression, cycle length, green ratio and ratio for the lane in question. Level of service for unsignalized intersections is also defined in terms of delay. Delay is the total time from when a vehicle stops at the end of a queue until the vehicle leaves the stop line.

Intersection capacity utilization level of service (ICU LOS) can provide additional information suggesting how well an intersection is performing and how much more capacity it has to handle incidents. ICU is based on the volume to capacity ratio and may not match the LOS generated due to delay. Intersection capacity utilization levels of service range from A (excellent) to H (beyond capacity), and provide insight into how much extra capacity is available to handle traffic fluctuations and incidents. ICU LOS E is generally considered to be at the intersection's practical capacity. ICU LOS D or better is desirable in urban areas during peak hours.

The traffic analysis for the proposed development was completed using Synchro and SimTraffic traffic analysis and modeling software. Traffic signal timings were recorded onsite. For the future scenarios, signal timings were optimized.

4.2.1 PTH 1W / Race Track Road

The intersection of PTH 1W and Race Track Road is a four-legged signalized intersection.

Westbound PTH 1W consists of a left-turn lane, two thru lanes and a right-turn auxiliary lane. Eastbound PTH 1W consists of a left-turn lane, thru lane and a thru/right-turn lane. Northbound Race Track Road consists of a shared left-turn/thru/right-turn lane. Southbound Race Track Road consists of two left-turn lanes and a shared thru/right-turn lane.

Table 6 summarizes the results of the background and post development intersection analysis for PTH 1W and Race Track Road.

TABLE 6
PTH 1W / RACE TRACK ROAD INTERSECTION ANALYSIS

Scenario	Overall Intersection		Thru Movement			Critical Movement		
	ICU LOS	Intersection Utilization (%)	Movement	LOS	Delay (Sec)	Movement	LOS	Delay (Sec)
A.M. Peak Hour								
Existing Background	A	47.5	WB Thru	A	8.9	SB Left	C	20.1
2013 Opening Day	A	48.5	WB Thru	B	13.7	SB Left	B	16.3
2022 Background	A	51.1	WB Thru	B	12.9	SB Left	B	18.3
2022 Full Build-Out	A	54.6	WB Thru	B	15.1	SB Left	B	18.8
P.M. Peak Hour								
Existing Background	C	67.0	EB Thru	C	27.6	SB Left/Thru/Rt	D	38.2
2013 Opening Day	B	62.0	EB Thru	B	17.9	SB Left	C	23.0
2022 Background	C	72.3	EB Thru	C	34.0	SB Left/Thru/Rt	E	63.7
2022 Full Build-Out	E	86.2	EB Thru	D	40.9	SB Left	E	67.4
Saturday Peak Hour								
Existing Background	B	55.3	EB Thru	B	16.2	SB Left/Thru/Rt	C	21.7
2013 Opening Day	A	53.9	EB Thru	B	15.7	SB Left	B	16.9
2022 Background	B	59.3	EB Thru	B	18.8	SB Left/Thru/Rt	C	24.4
2022 Full Build-Out	E	84.1	WB Thru	D	40.3	SB Left	B	18.8
Non-Major Event								
Existing Background	F	92.5	WB Thru	D	53.7	EB Left	F	125.2
2013 Opening Day	C	69.1	WB Thru	C	34.6	SB Left	C	27.4
2022 Full Build-Out	F	93.6	WB Thru	F	101.7	SB Left	F	149.5
Major Event								
Existing Background	H	182.0	WB Thru	F	537.1	EB Left	F	603.7
2013 Opening Day	H	115.5	WB Thru	F	425.5	SB Left	D	38.8
2022 Full Build-Out	H	132.5	WB Thru	F	465.4	SB Left	F	274.4

4.2.2 PTH 1W / Camp Manitou Road

The intersection of PTH 1W and Camp Manitou Road is proposed as a four-legged signalized intersection.

Westbound PTH 1W is to consist of a left-turn lane, two thru lanes and a right-turn cut-off lane. Eastbound PTH 1W is to consist of a left-turn lane, thru lane and a thru/right-turn lane. Northbound Camp Manitou Road is to consist of a left-turn/thru lane and right-turn/thru lane. Southbound Camp Manitou Road is to consist of a left-turn lane and a shared left-turn/ thru lane and a right-turn lane.

Table 7 summarizes the results of the background and post development intersection analysis for PTH 1W and Camp Manitou Road.

TABLE 7
PTH 1W / CAMP MANITOU ROAD INTERSECTION ANALYSIS

Scenario	Overall Intersection		Thru Movement			Critical Movement		
	ICU LOS	Intersection Utilization (%)	Movement	LOS	Delay (Sec)	Movement	LOS	Delay (Sec)
A.M. Peak Hour								
Existing Background	A	37.6	EB Thru	A	8.1	NB Left	B	16.1
2013 Opening Day	A	47.7	EB Thru	C	21.5	NB Thru/Right	C	27.4
2022 Background	A	46.6	EB Thru	A	8.9	NB Left	B	18.9
2022 Full Build-Out	A	54.2	WB Thru	B	13.3	NB Thru/Right	B	22.1
P.M. Peak Hour								
Existing Background	A	45.2	EB Thru	A	8.1	NB Left	B	19.2
2013 Opening Day	A	48.1	WB Thru	A	8.3	SB Thru/Left	C	20.6
2022 Background	A	48.8	EB Thru	A	8.0	NB Left	C	22.1
2022 Full Build-Out	C	67.8	WB Thru	C	21.4	NB Thru/Right	C	28.3
Saturday Peak Hour								
Existing Background	A	37.2	EB Thru	A	6.0	NB Left	B	16.0
2013 Opening Day	B	62.1	WB Thru	C	26.7	SB Thru/Left	C	28.9
2022 Background	A	40.0	EB Thru	A	8.0	NB Left	B	16.5
2022 Full Build-Out	B	63.4	WB Thru	C	23.0	NB Thru/Right	C	26.9
Non-Major Event								
Existing Background	A	43.6	EB Thru	A	8.1	NB Left	B	18.2
2013 Opening Day	B	61.2	WB Thru	C	21.5	NB Thru/Right	C	25.0
2022 Full Build-Out	E	82.7	WB Thru	D	40.1	SB Thru/Left	D	50.7
Major Event								
Existing Background	B	56.8	EB Thru	A	9.2	NB Left	C	25.7
2013 Opening Day	G	103.0	WB Thru	E	58.7	WB Right	F	404.9
2022 Full Build-Out	H	122.0	WB Thru	F	144.1	WB Right	F	321.6

4.2.3 PR 425 / Camp Manitou Road

The intersection of the PR 425 and Camp Manitou Road is proposed as a three-legged unsignalized intersection.

Westbound PR 425 is to consist of a shared left-turn/thru lane. Eastbound PR 425 is proposed as a shared right-turn/thru lane. Northbound Camp Manitou Road is proposed with left-turn and right-turn lanes.

TABLE 8
PR 425 / CAMP MANITOU ROAD INTERSECTION ANALYSIS

Scenario	Overall Intersection					Critical Movement		
	ICU LOS	Intersection Utilization (%)				Movement	LOS	Delay (Sec)
A.M. Peak Hour								
2022 Full Build-Out	A	21.8				NB	A	8.6
P.M. Peak Hour								
2022 Full Build-Out	A	23.0				NB	A	9.1
Saturday Peak Hour								
2022 Full Build-Out	A	25.9				NB	A	9.2
Non-Major Event								
2022 Full Build-Out	A	32.2				NB	A	9.4
Major Event								
2022 Full Build-Out	A	45.2				NB	A	9.8

4.3 SITE CIRCULATION AND ON-SITE QUEUING REQUIREMENTS

The size and scale of the proposed mixed-use development within Precinct R requires multiple vehicular access points into the site. The proposed access locations are illustrated in Figure 2.

The major existing access to the Precinct is Race Track Road which connects to PTH 1W as a four-legged signalized intersection. Race Track Road is a route operated by private interests, not directly associated with any Precinct R land.

A new major access to the development is proposed on PTH 1W as a northerly extension of Camp Manitou Road, which is currently a three-legged signalized T-intersection. The intersection at Camp Manitou Road is proposed to become a four-legged intersection, with access to the Exhibition and Office Park forming the fourth leg on the north side of PTH 1W.

MIT has requested road connectivity between Race Track Road and Camp Manitou Road. This route would be expected to head further west, ultimately becoming an internal road paralleling PTH 1W.

There are two existing minor approaches to the Assiniboia Downs and Red River Exhibition Park on PR 425 located approximately 265 and 540 metres west of PTH 101. These access points are used primarily by Assiniboia Downs and RREX staff.

An additional PR 425 access could be added at the north extension of Camp Manitou Road approximately 1150 metres west of PTH 101. It is expected this intersection will become a three-legged unsignalized T-intersection.

It should be noted that there are no existing plans to provide access from Precinct R to CentrePort Canada Way.

4.4 IMPACT TO EXISTING ROAD NETWORK

AADT figures for each scenario is based on the Weekday PM Peak hour making up 8% of the overall daily generation.

TABLE 9
FUTURE AADT OF ROAD NETWORK

Scenario	PTH 1W West of CMR	PTH 1W CMR to RTR	PTH 1W RTR to PTH 101	Portage Avenue to Buch / Cav / Sturgeon*			Saskatchewan Ave
2013 Bkgnd	17,680	17,680	21,690	25,700	45,900	54,600	2010 – 5,400 2012 - 270
2013 Opening Day	+513 18,193	+500 18,180	+2,688 24,378	+1,613 27,313	+1,532 47,432	+1,452 56,052	+0 270
2022 Bkgnd	19,920	19,920	24,438	28,956	51,715	61,517	304
2022 Full Build-Out	+3,163 23,083	+3,763 23,683	+16,688 41,126	+10,013 38,969	+9,512 61,227	+9,012 70,529	+5,750 6,054

*Buch / Cav / Sturgeon refers to the segment immediately west of Buchannan, Cavalier & Sturgeon respectively
- Green text reflects forecasted additional traffic due to development

4.5 PEDESTRIAN AND OTHER ROAD USER REQUIREMENTS

Pedestrian infrastructure connections are lacking to Precinct R. Sidewalks from Winnipeg end at the east side of PTH 101 interchange. Pedestrians must walk 720 metres across 4 vehicular yields to reach the south end of Race Track Road. Race Track Road (owned by others) also is without sidewalk or other alternative transportation infrastructure. RREX has expressed interest in building alternative transportation routes including multi-use pathways and/or bridge to cross PTH 101. Concepts have not been developed at this time and are not included with this report.

4.5.1 Transit Service

Most times of the year, Precinct R is not serviced by Winnipeg Transit. The closest stop exists at PTH 1W & St. Charles Street, approximately 850 metres east of the intersection of Race Track Road. Improved service and dedicated routes during major events would transfer mode share, relieving pressure on overall vehicular trips. Winnipeg Transit does provide a dedicated route during the Red River Exhibition which runs the length of PTH 1W and terminates at the gate entrance.

5.0 IMPROVEMENT ANALYSIS

To minimize throw-away construction costs, Precinct R should be developed conceptually. A number of different alternatives have been developed to address access issues and minimize congestion due to the proposed development.

The most effective long-term strategy is achieving access from as many sides of the site to centrally located parking lots servicing the exhibition, Assiniboia Downs and Westport Festival. In summary, the concept would include:

- PTH 1W / Camp Manitou Road Intersection – add fourth leg northward to connect newly constructed building. Camp Manitou Road to be 4-lanes. Develop with extra capacity to minimize negative traffic impacts due to isolated major events like the Red River Exhibition.
- PTH 1W / Race Track Road Intersection – Complete minor geometric improvements to provide extra capacity for isolated major events like the Red River Exhibition.
- Westport Festival Road – connect Camp Manitou Road to Race Track Road, approximately parallel to PTH 1W. Run further west to extent of RREX property to become part of future internal road.
- Camp Manitou Road – extend northward to PR 425 with stop-control intersection. North-end of Camp Manitou Road to constrict to 2-lanes.

5.1 INTERSECTION TREATMENT WARRANT ANALYSIS

No existing unsignalized intersections were assessed as part of this study.

If the Camp Manitou Road / PR 425 intersection is planned in the future a Canadian Matrix Signal Warrant should be conducted for the resulting intersection. The warrants are based on a 100-point scale, where the installation of signals is warranted when the priority points total surpass this value.

Based on a cursory review of this method, it is expected that the potential Camp Manitou Road / PR 425 intersection is unlikely to become a candidate for signalization. During event peak flows, additional Red River Exhibition staff is expected to be available to direct traffic at this location.

5.2 FUNCTIONAL / CONCEPTUAL DESIGN

With the proposed development an internal road network will be constructed including an extension of Camp Manitou Road northward to PR 425. Two internal roads, one north of Westport Festival and another north of the RREX site will connect Camp Manitou Road to Race Track Road. Although not projected for the full build-out scenario, optional improvements include the westerly extensions of the noted internal roads into Headingley and the northerly extension of Race Track Road to PR 425. A sketch of the proposed road network can be found in Figure 11.

On-highway improvements are identified upstream and downstream of the proposed new and modified intersections. These modifications are further detailed below.

5.2.1 PTH 1W / Race Track Road Intersection

Figure 12 identifies on-highway improvements upstream and downstream of the intersection proposed for the new development. With the full build-out scenario, the following upgrades are currently projected:

- Paint and sign two existing southbound lanes as left-turn only;
- Construct additional southbound thru/right-turn lane; and
- Extend northernmost westbound lane through to Camp Manitou Road.

5.2.2 PTH 1W / Camp Manitou Road Intersection

Figure 13 identifies on-highway improvements upstream and downstream of the intersection proposed for the new development.

Construction works include:

- Decommission existing access on north side of PTH 1W;
- Construct northerly extension of 4-lane Camp Manitou Road. Southbound lanes to include one left, one left/thru and one right turning lane.
- Construct lengthened median west of intersection with left-turn lane. Develop eastbound left-turn queue;
- Widen westbound paved area west of intersection to accommodate new median; and

- Install new signals to accommodate new traffic movements.

5.2.3 PR 425 / Camp Manitou Road Intersection

Figure 14 identifies on-highway improvements upstream and downstream of the intersection proposed for the new development.

Construction works include:

- Construct 2-lane Camp Manitou Road tying into PR 425;
- Construct northbound right-turn lane with island; and
- Install signage.



Figure 11 – Proposed Road Network

FileName: C:\Documents and Settings\CRowbotham\Desktop\RREX TIS Files\Source Files\Intersections.dwg – Tab: FIG 12 Plotted By: CRowbotham 14/04/19 [Sat 8:54pm]
8.5"X11" PLOT SCALE: 1:2
8.5x11

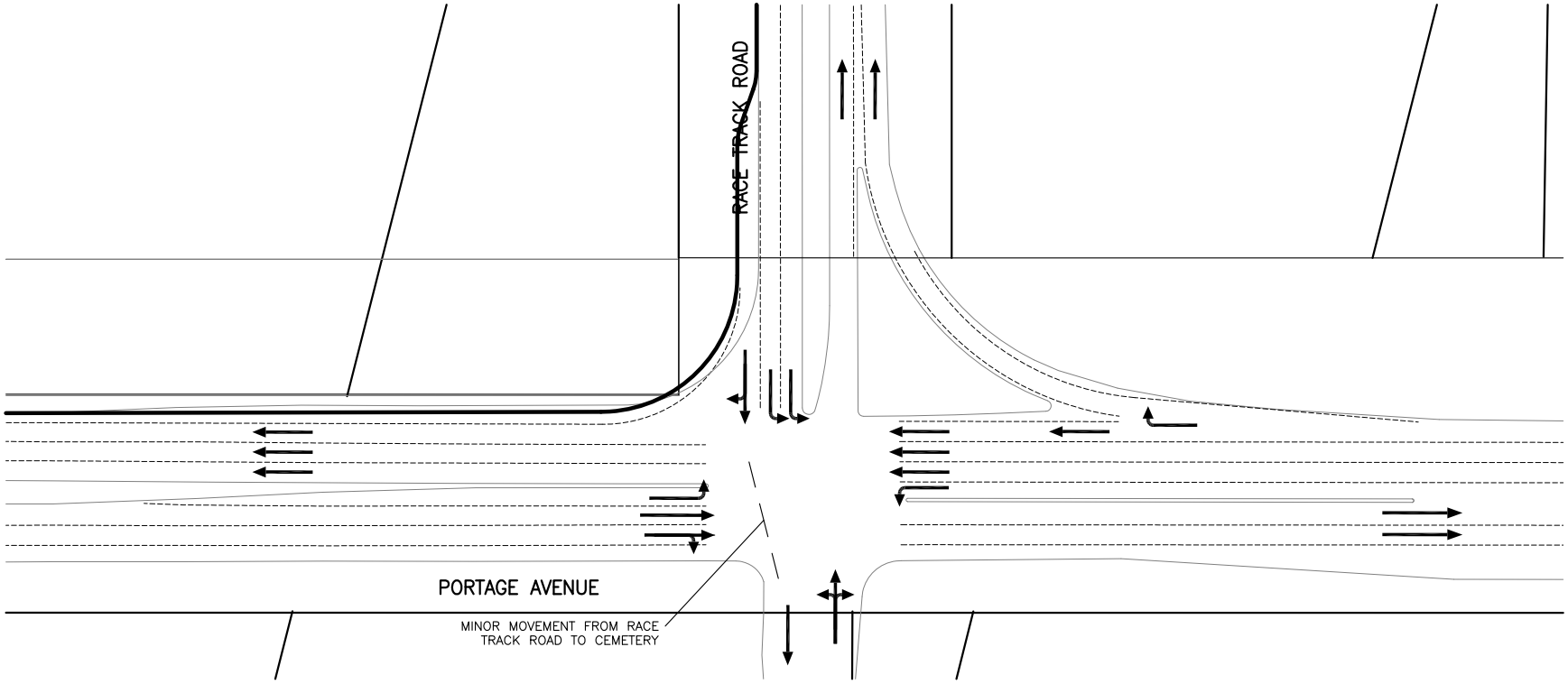


FIGURE 12: CONCEPTUAL DESIGN – PTH 1W @ RACE TRACK ROAD

FileName: C:\Documents and Settings\CRowbotham\Desktop\RREX TIS Files\Source Files\Intersections.dwg – Tab: FIG 13 Plotted By: CRowbotham 14/04/19 [Sat 8:56pm]
8.5"X11" PLOT SCALE: 1:2
8.5x11

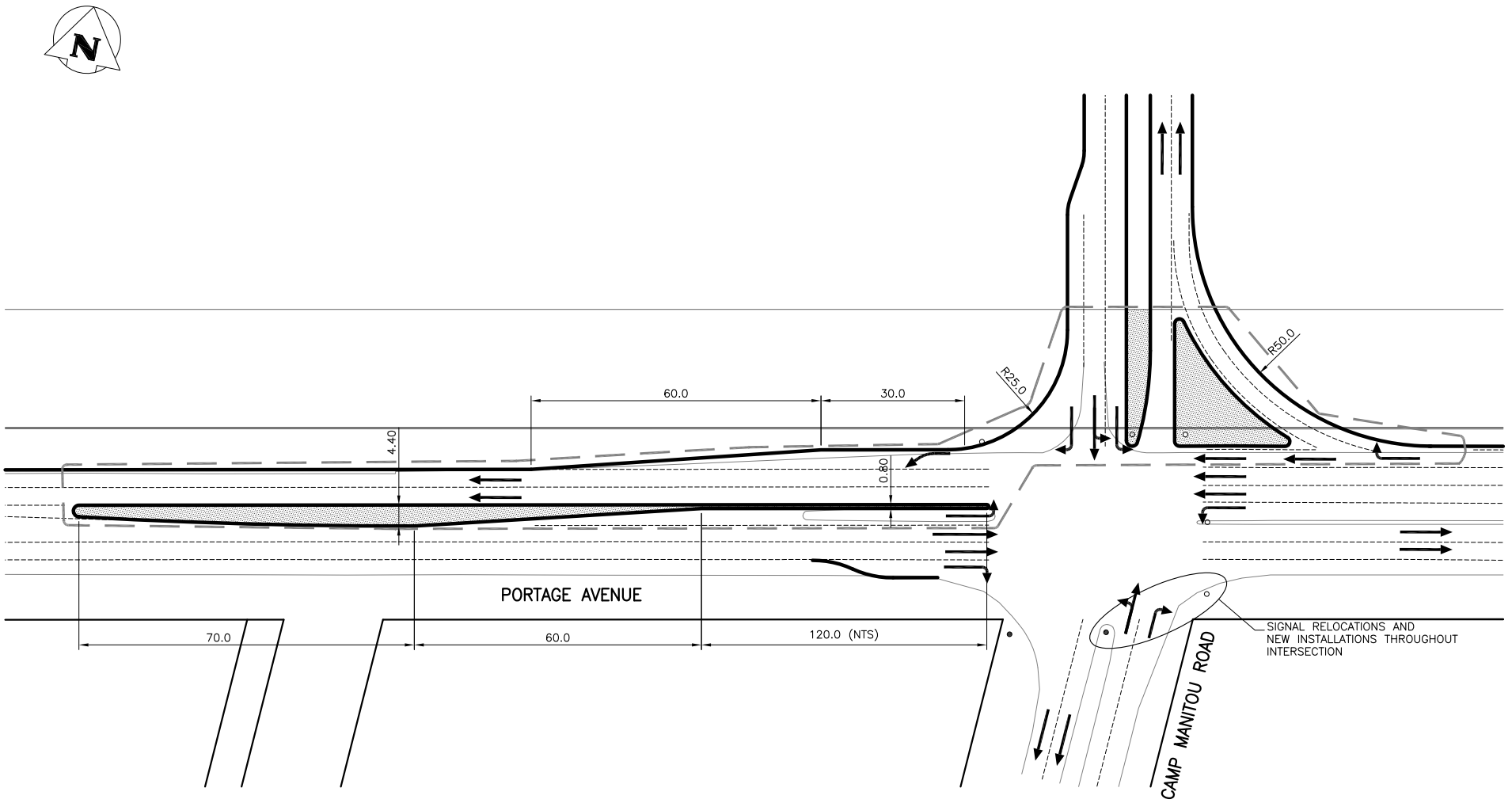


FIGURE 13: CONCEPTUAL DESIGN – PTH 1W @ CAMP MANITOU ROAD

FileName: C:\Documents and Settings\CRowbotham\Desktop\RREX TIS Files\Intersections.dwg – Tab: FIG 14 Plotted By: CRowbotham 14/04/19 [Sat 3:53pm]
8.5"X11" PLOT SCALE: 1:2
8.5x11

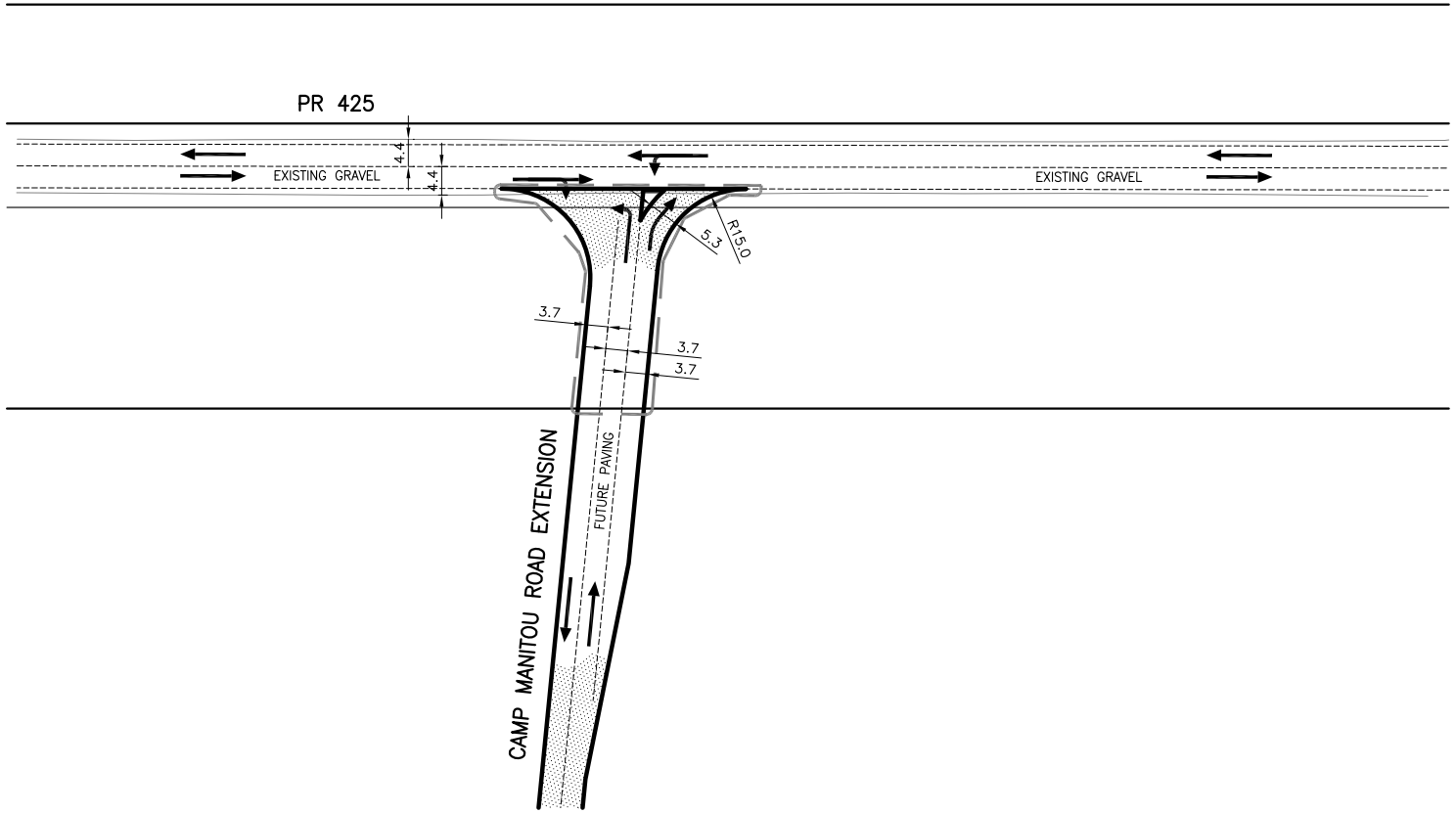


FIGURE 14: CONCEPTUAL DESIGN – PR 425 @ CAMP MANITOU ROAD EXTENSION

5.3 PRELIMINARY COST ESTIMATES

5.3.1 PTH 1W / Camp Manitou Road Intersection

Construct fourth leg of Camp Manitou Road intersection to the property line, including new median along PTH 1W: $260,000.

Allowance for new signals: $400,000 including AAWD Active Warning Device.

5.3.2 PTH 1W / Race Track Road Intersection

Construct southbound right-turn lane and eastbound right-turn: $35,000.

5.3.3 PR 425 / Camp Manitou Road Intersection

Construction cost of unsignalized intersection for PR 425 with extension of Camp Manitou Road: $75,000.

5.3.4 Construction Cost

In most cases, the full cost to construct the recommended improvements is borne by the party proposing the development/redevelopment. This follows the statement provided by Manitoba Infrastructure and Transportation's General Guideline for the Preparation of Traffic Impact Studies.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The following conclusions are made:

- Within the Complete Communities Direction Strategy, Precinct R is categorized as a 'New Community', with a large undeveloped land area identified for future urban development. This commercial site has been identified as serviceable, of sufficient size and contiguous with existing developed areas. The planning document also earmarks an area listed as PTH 1W West at Racetrack Road, as an emerging Mixed-Use Centre.

- RREX intends to develop their existing site with a number of new uses adjacent to their existing exhibition grounds. The development is planned to consist of a multi-purpose arena/event centre, exposition hall expansion and commodity campus (office park).

- A commercial development is proposed for approximately 563,000ft^2 of retail space along the north side of PTH 1W, west of Race Track Road. The development is planned to consist of a combination of retail, restaurant, gas bar, hotel and movie theatre.

- Multiple vehicular access points are proposed for the mixed-use development. A major new access to the development is proposed on PTH 1W opposite Camp Manitou Road. Minor modifications are proposed at the existing intersection of PTH 1W with Race Track Road. No modifications are proposed for the existing Assiniboia Downs access road off PTH 101. An additional access point (unsignalized t-intersection) is proposed along Saskatchewan at the northerly extension of Camp Manitou Road.

- Traffic generated during the P.M. peak hour will have a significant impact on the existing network. The PTH 1W / Race Track Road intersection is projected to meet its practical capacity in 2022.

- The proposed developments are anticipated to generate a total of 18,190 new trips per day (ADT), 1,455 during the weekday P.M. peak hour and 2,265 during the Saturday peak for the proposed full build-out scenario.

- Traffic generated during the Red River Exhibition will have the most significant impact on the existing network, but is expected to be limited to a few discrete times per year.

- The Red River Exhibition is anticipated to generate a total of 29,400 new trips per Saturday event day (ADT) and 4,595 during the Saturday peak generated hour.

- The level of service at the Camp Manitou intersection is projected to drop from A to H in 2022. This reflects the intent to absorb much of the traffic currently using Race Track Road as the access/egress for the Red River Exhibition.

- The level of service at the Race Track Road intersection is projected to improve its intersection utilization from 182.0% to 132.5% during the Red River Exhibition.

6.2 RECOMMENDATIONS

6.2.1 PTH 1W / Race Track Road Intersection

Prior to the opening of the first retail store, the intersection of PTH 1W and Race Track Road should include some modifications. A southbound right-turn/thru lane should be added to Race Track Road.

6.2.2 PTH 1W / Camp Manitou Road Intersection

Prior to the opening of the first retail store, the intersection of PTH 1W and Camp Manitou Road should be modified to become a four-legged, fully signalized intersection, with the north extension becoming the fourth leg on the north side of PTH 1W. An eastbound left-turn lane (60 metres storage length) should be added on PTH 1W. A westbound right-turn auxiliary lane should be added on PTH 1W with 50 metre radius. The southbound approach should include a left-turn lane, a shared left-turn/through lane and a right-turn lane.

6.2.3 PR 425 / Camp Manitou Road Intersection

Prior to the closing the Assiniboia Downs Access Road intersection with PTH 101, the intersection of Saskatchewan and Camp Manitou Road should be constructed as a three-legged, unsignalized t-intersection, with the south extension to Camp Manitou Road as the third leg. Northbound traffic is to have stop control at PR 425 with yield control for right-turns. No geometric modifications are recommended along PR 425.

6.2.4 Internal Road Network Improvements

Prior to the opening of the first retail store, a roadway should be completed connecting Race Track Road westward to Camp Manitou Road. Ultimately this route should be carried further to the west limits of RREX property, with anticipated connections further on into Headingley.

6.3 OTHER RECOMMENDED IMPROVEMENTS

Other options exist that could improve overall traffic conditions in and around Precinct R. Some are physical modifications while some are identifying operational opportunities. Cost estimates have not been developed for these alternatives.

6.3.1 Race Track Road Widening

Consideration should be made to widen Race Track Road to 4-lanes north of the Autopark. The improvement could eliminate bottlenecking, easing congestion within and into the site. Note that this route is not within Precinct R and RREX shares ownership of the route with both Assiniboia Downs and the Autopark.

6.3.2 CentrePort Canada Way Connection

Consideration should be made to develop a 2-lane temporary connection to the west terminus of PTH 101 interchange. This provides a secondary access connected to PTH 101 that would relieve congestion more effectively than a t-intersection along PR 425. Note that this route does not lie with Precinct R and is not owned by either RREX or Assiniboia Downs. This option is also not supported by MIT's short or long-range plans.

6.3.3 Active Transportation Options

Consideration should be made to develop active transportation links connecting Winnipeg directly to RREX. Of particular interest is the construction of a multi-use path adjacent to PR 425 (Saskatchewan Avenue) and a pedestrian overpass at PTH 101. The interchange at PTH 1W / PTH 101 is recognized as a poor candidate to accommodate alternative transportation options.

6.3.4 Saskatchewan Avenue / Sturgeon Road Intersection

Following construction completion of CentrePort Canada Way, a stand-alone traffic study of the intersection at Saskatchewan and Sturgeon should be considered. The current CCW report does not indicate the expected impact at this location although the changes are expected to be significant. Saskatchewan Avenue no longer connects with PTH 101 and is expected to lose its

status as a truck route shortly after the opening of CCW. Existing traffic turning counts for the intersection are not available from the City of Winnipeg. Performing a traffic count at this time is premature as background numbers will not be representative until CCW is complete later in the year.

It is expected that the overall impact from Precinct R will be minimal with the exception being the 10-day Red River Exhibition.

6.3.5 Traffic Management Program

A comprehensive traffic management plan does not exist to handle event-related traffic operational strategies. During the 2012 Exhibition, some difficulties were encountered in the number and capabilities of parking staff (provided by the Assiniboia Downs). Operational strategies do not exist to address issues such as high-occupancy vehicles (busses), emergency vehicles and service vehicles.

To accommodate the heavy traffic associated with the Red River Exhibition, a comprehensive Traffic Management Plan should be established. Some elements of the plan could include:

- Develop of Park and Ride sites;
- Develop a Rideshare Program;
- Develop procedures to adjust number of access / egress lanes with delineators like pylons;
- Establish event-term contracts with parking specialists (i.e.: AuthentiGate);
- Develop procedures to accommodate high-capacity vehicles like busses;
- Consider new routes for busses (i.e.: Saskatchewan Avenue via Buchannan Boulevard)
- Develop procedures to accommodate emergency vehicles; and
- Develop procedures to accommodate service vehicles and staff.

The intent of a traffic management plan is to improve management of both pre- and post-event traffic.

7.0 REFERENCES

- OurWinnipeg and the Complete Communities Direction Strategy – City of Winnipeg (2012)
- Transportation Impact Assessments for Site Development – Institute of Transportation Engineers
- Manual of Transportation Engineering Studies (2nd Edition) – Institute of Transportation Engineers
- Geometric Design of Highways and Streets (6th Edition) – Institute of Transportation Engineers
- Trip Generation (7th Edition) – Institute of Transportation Engineers
- Geometric Design Guide for Canadian Roads (1999 Edition) – Transportation Association of Canada
- General Guidelines for the Preparation of Traffic Impact Studies – Manitoba Infrastructure and Transportation – Highway Planning and Design Branch.
- Highway Capacity Manual (2010) – Transportation Research Board

8.0 STATEMENT OF LIMITATIONS AND CONDITIONS

8.1 THIRD PARTY USE OF REPORT

This report has been prepared for the Client to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

8.2 CAPITAL COST ESTIMATE STATEMENT OF LIMITATIONS

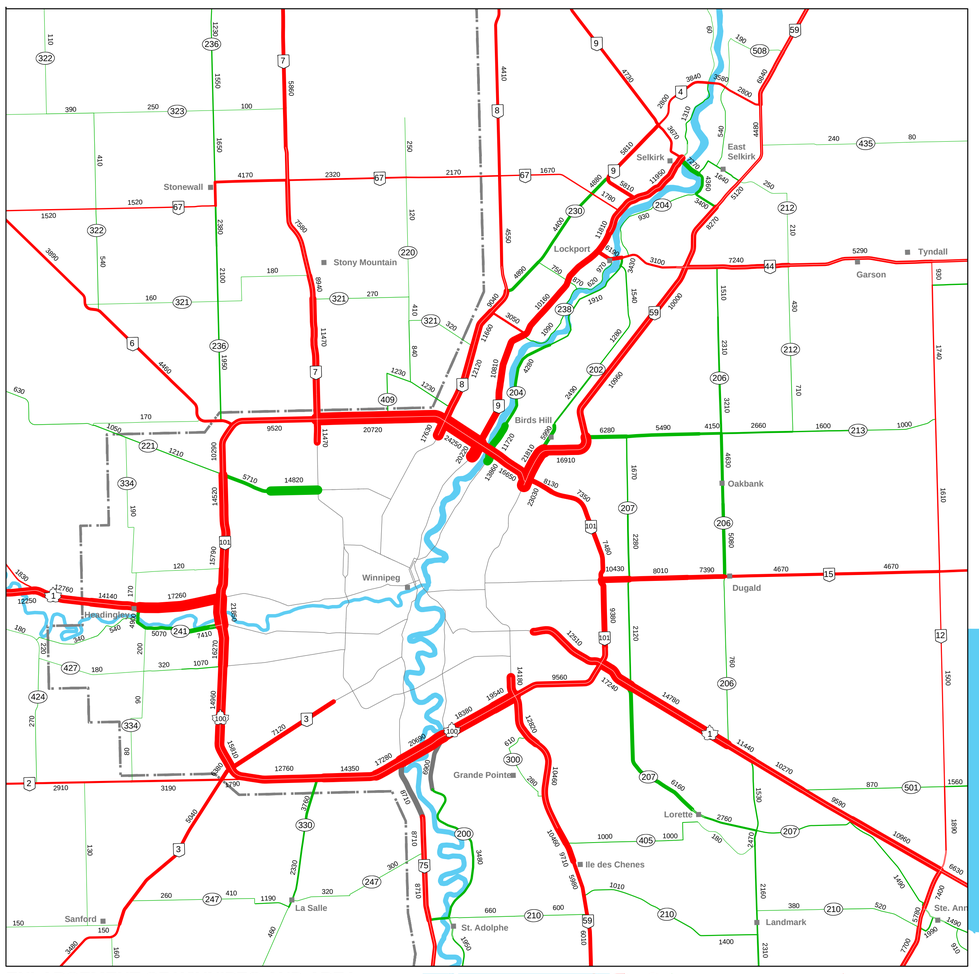
The cost estimates included with this report have been prepared by KGS Group using its professional judgement and exercizing due care consistent with the level of detail required for the stage of the project for which the estimate has been developed. These estimates represent KGS Group's opinion of the probable costs and are based on factors over which KGS has no control. These factors include, without limitation, site conditions, availability of qualified labour and materials, present workload of the Bidders at the time of tendering and overall market conditions. KGS does not assume any responsibility to the Client, in contract, tort or otherwise in connection with such estimates and shall not be liable to the Client if such estimates prove to be inaccurate or incorrect.

APPENDICES

APPENDIX A

EXISTING TRAFFIC – PROVINCIAL AND CITY SUPPLIED DATA

2011 Traffic Flow Map



ENLARGEMENT OF WINNIPEG AND AREA
(NOT TO SCALE)

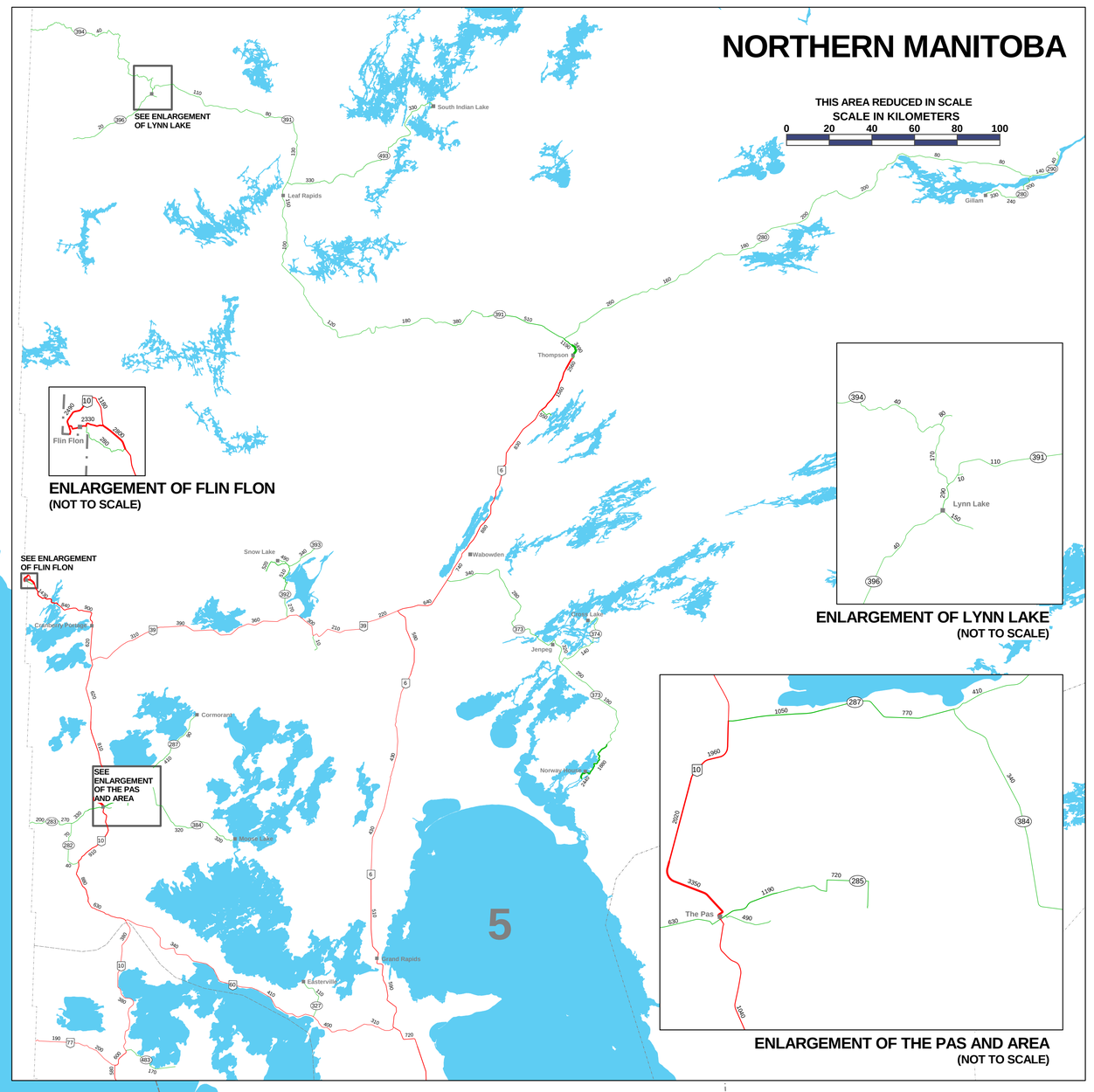
N
W E
S

SCALE IN KILOMETERS
0 10 20 30 40 50

Legend

AADT
20,000 10,000 5000

- Provincial Trunk Highways
- Provincial Roads
- Rivers and Streams
- Lakes
- National Parks



ENLARGEMENT OF FLIN FLON
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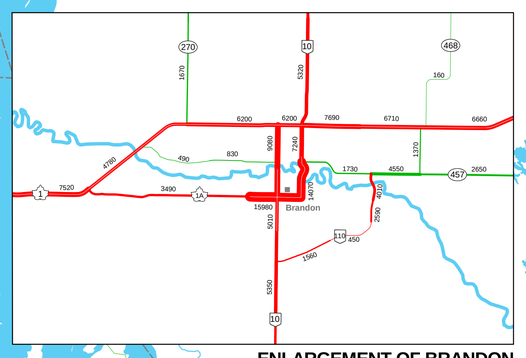
ENLARGEMENT OF LYNN LAKE
(NOT TO SCALE)

ENLARGEMENT OF THE PAS AND AREA
(NOT TO SCALE)



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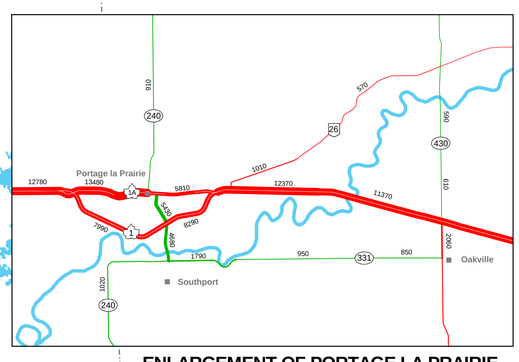
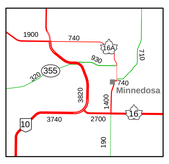


ENLARGEMENT OF PORTAGE LA PRAIRIE
(NOT TO SCALE)



ENLARGEMENT OF PTH 16 & PTH 10
(NOT TO SCALE)

Manitoba

Infrastructure and Transportation

Traffic Engineering Branch

Annual Average Daily Traffic on Provincial Trunk Highways and Provincial Roads

NOTE: Numbers on the map denote the combined Annual Average Daily Traffic (AADT) on each highway section. All traffic estimates are derived from the most recent vehicle counts, which may have been taken from 2006 through 2011 inclusive.

AADT is defined as the number of vehicles passing a given point on an average day of the year, as estimated using data collected over an entire year.

For official estimates of AADT on all highways in Manitoba please refer to Traffic on Manitoba Highways 2011, or the Manitoba Highway Traffic Information System website (www.mhtis.mb.ca).

Please note that the additional geographical features on this map, such as rivers, lakes and parks, are not meant to be exhaustive, and are provided for use as points of reference only. Additionally, due to map scale some AADT values are not show around towns. Consult the webmap at http://mhtis.mb.ca for AADT information at these locations.

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MHTIS Director

PRODUCED BY THE UNIVERSITY OF MANITOBA TRANSPORT INFORMATION GROUP, July 2012
This flow map was plotted using the UMTIG-KH double centreline compatible basemap (Version 1, January 2006) in Universal Transverse Mercator Projection (Zone 14, North) and NAD83 Datum

2009 Traffic Flow Map

CITY OF WINNIPEG PUBLIC WORKS DEPARTMENT
Transportation Division
Average Weekday Daily Traffic on Major Streets

Note: This traffic flow map is intended to be a general representation of traffic volumes on major streets in a given year. Traffic volumes shown are based on a variety of sources without seasonal variation adjustments and may reflect prevailing conditions including construction and operating conditions in place during the year.

The numbers on this map are two way traffic total on each street section, which are rounded and sometimes averaged. Actual traffic and counts can vary along a road segment.
All traffic is derived from most recent traffic counts that may have been taken from 2001 to 2009 inclusive.
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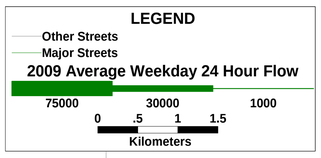
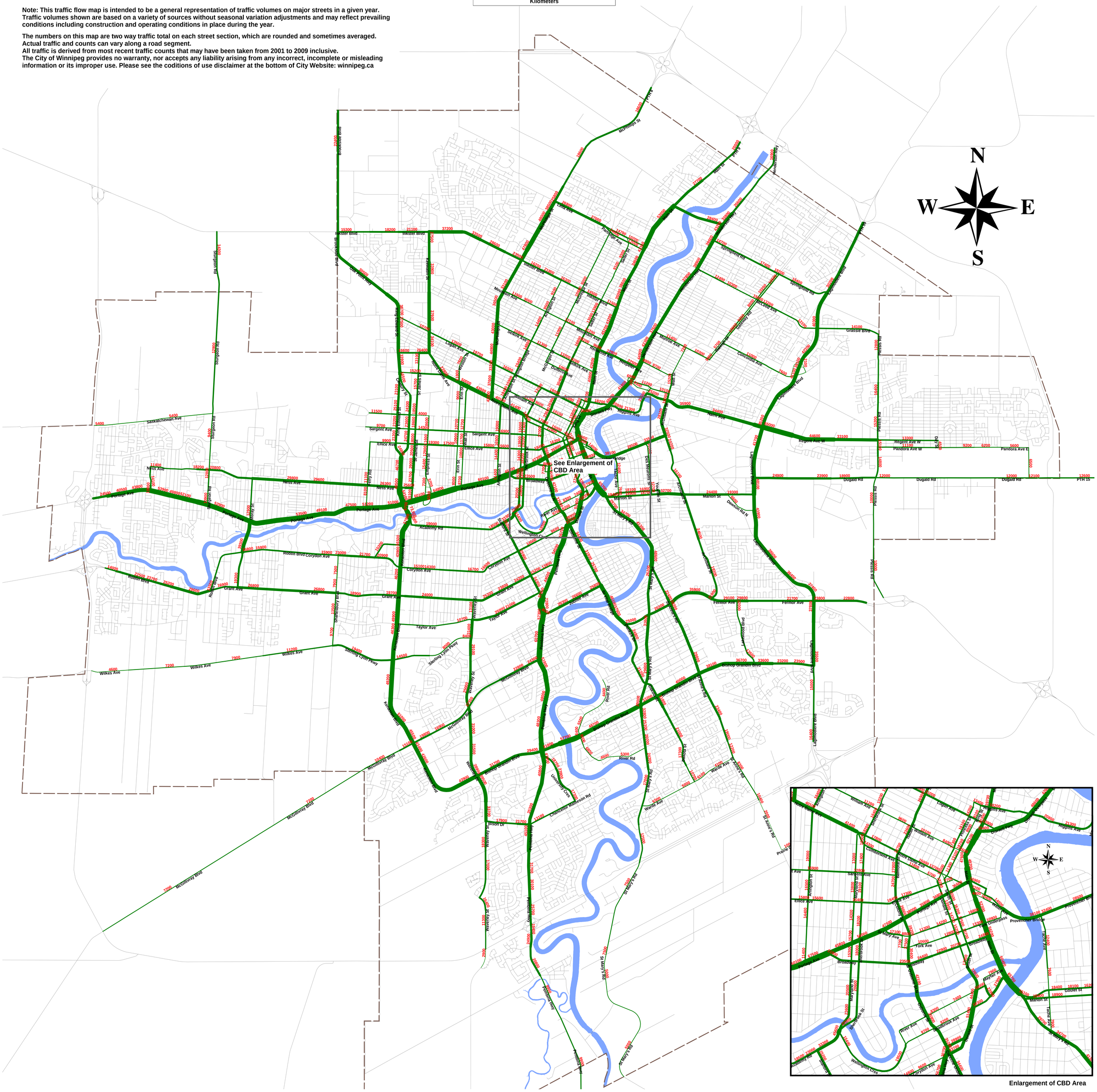




APPENDIX B

EXISTING TRAFFIC – MANUAL COUNTS

2012 Forecast Background Traffic Volumes
Location: Portage Avenue and Race Track Rd
Date: August 21, 2012

MOVEMEN	TYPE	7:00 to 7:14	7:15 to 7:29	7:30 to 7:44	7:45 to 7:59	8:00 to 8:14	8:15 to 8:29	8:30 to 8:44	8:45 to 8:59	3:30 to 3:44	3:45 to 3:59	4:00 to 4:14	4:15 to 4:29	4:30 to 4:44	4:45 to 4:59	5:00 to 5:14	5:15 to 5:29		AM PEAK	PM PEAK
SB - Left	PSGR	23	19	35	33	34	37	31	51	74	98	80	82	132	103	150	121	SB - Left	165	543
SB - Left	NONPSGP	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	1			
SB - Thru	PSGR	0	0	2	0	1	0	0	0	1	1	0	0	0	0	0	0	SB - Thru	1	0
SB - Thru	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
SB - Right	PSGR	8	14	18	12	15	13	18	18	17	19	18	10	10	21	15	11	SB - Right	70	63
SB - Right	NONPSGP	0	0	0	1	1	0	0	0	0	0	0	2	1	0	1	0			
WB - Left	PSGR	1	3	3	13	5	9	9	5	8	7	3	4	2	6	3	1	WB - Left	31	13
WB - Left	NONPSGP	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0			
WB - Thru	PSGR	127	91	120	157	131	144	146	148	142	190	181	177	161	169	208	168	WB - Thru	686	841
WB - Thru	NONPSGP	16	23	20	9	13	20	15	23	20	23	18	13	14	15	26	24			
WB - Right	PSGR	71	85	120	129	92	103	123	126	72	79	55	67	52	54	62	54	WB - Right	477	241
WB - Right	NONPSGP	1	0	0	1	0	0	1	0	0	1	0	3	1	1	0	1			
NB - Left	PSGR	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	NB - Left	0	2
NB - Left	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NB - Thru	PSGR	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	NB - Thru	1	0
NB - Thru	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NB - Right	PSGR	1	0	0	0	0	1	0	1	0	3	8	18	8	2	8	6	NB - Right	2	26
NB - Right	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
EB - Left	PSGR	5	11	8	13	10	9	20	13	14	7	10	8	10	21	11	10	EB - Left	57	56
EB - Left	NONPSGP	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0			
EB - Thru	PSGR	104	117	131	116	101	122	122	108	181	156	189	156	181	171	191	194	EB - Thru	570	869
EB - Thru	NONPSGP	17	27	20	14	21	21	18	19	20	29	16	20	23	15	18	18			
EB - Right	PSGR	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	EB - Right	2	0
EB - Right	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		374	390	478	501	424	482	503	515	549	615	580	560	596	578	694	609			
					1743	1793	1885	1910	1924				2304	2351	2314	2428	2477			

Peak Hour Flow = 333 x (15/15 minute intervals) 1924

Peak Hour Flow = 432 x (15/15 minute intervals) 2477

x 24hrs 59448

/ 2.40 factor 24770 AADT

2013 Forecast Background Traffic Volumes

Location: Portage Avenue and Race Track Rd

Growth Rate 1.20%

MOVEMENT	TYPE	7:00 to 7:14	7:15 to 7:29	7:30 to 7:44	7:45 to 7:59	8:00 to 8:14	8:15 to 8:29	8:30 to 8:44	8:45 to 8:59	3:30 to 3:44	3:45 to 3:59	4:00 to 4:14	4:15 to 4:29	4:30 to 4:44	4:45 to 4:59	5:00 to 5:14	5:15 to 5:29		AM PEAK	PM PEAK
SB - Left	PSGR	23	19	35	33	34	37	31	52	75	99	81	83	134	104	152	122	SB - Left	166	550
SB - Left	NONPSGP	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	1			
SB - Thru	PSGR	0	0	2	0	1	0	0	0	1	1	0	0	0	0	0	0	SB - Thru	1	0
SB - Thru	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
SB - Right	PSGR	8	14	18	12	15	13	18	18	17	19	18	10	10	21	15	11	SB - Right	70	63
SB - Right	NONPSGP	0	0	0	1	1	0	0	0	0	0	0	2	1	0	1	0			
WB - Left	PSGR	1	3	3	13	5	9	9	5	8	7	3	4	2	6	3	1	WB - Left	31	13
WB - Left	NONPSGP	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0			
WB - Thru	PSGR	129	92	121	159	133	146	148	150	144	192	183	179	163	171	210	170	WB - Thru	694	850
WB - Thru	NONPSGP	16	23	20	9	13	20	15	23	20	23	18	13	14	15	26	24			
WB - Right	PSGR	72	86	121	131	93	104	124	128	73	80	56	68	53	55	63	55	WB - Right	482	245
WB - Right	NONPSGP	1	0	0	1	0	0	1	0	0	1	0	3	1	1	0	1			
NB - Left	PSGR	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	NB - Left	0	2
NB - Left	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NB - Thru	PSGR	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	NB - Thru	1	0
NB - Thru	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NB - Right	PSGR	1	0	0	0	0	1	0	1	0	3	8	18	8	2	8	6	NB - Right	2	26
NB - Right	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
EB - Left	PSGR	5	11	8	13	10	9	20	13	14	7	10	8	10	21	11	10	EB - Left	57	56
EB - Left	NONPSGP	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0			
EB - Thru	PSGR	105	118	133	117	102	123	123	109	183	158	191	158	183	173	193	196	EB - Thru	574	878
EB - Thru	NONPSGP	17	27	20	14	21	21	18	19	20	29	16	20	23	15	18	18			
EB - Right	PSGR	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	EB - Right	2	0
EB - Right	NONPSGP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		378	393	482	506	428	486	507	521	555	621	586	566	603	584	701	615			
					1759	1809	1902	1927	1942				2328	2376	2339	2454	2503			

Peak Hour Flow = 333 x (15/15 minute intervals) 1942

Peak Hour Flow = 432 x (15/15 minute intervals) 2503

x 24hrs 60072

/ 2.40 factor 25030 AADT

2022 Forecast Background Traffic Volumes
Location: Portage Avenue and Race Track Rd
Growth Rate 1.20%

MOVEMENT	TYPE	7:00 to 7:14	7:15 to 7:29	7:30 to 7:44	7:45 to 7:59	8:00 to 8:14	8:15 to 8:29	8:30 to 8:44	8:45 to 8:59	3:30 to 3:44	3:45 to 3:59	4:00 to 4:14	4:15 to 4:29	4:30 to 4:44	4:45 to 4:59	5:00 to 5:14	5:15 to 5:29		AM PEAK	PM PEAK
SB - Left	PSGR	26	21	39	37	38	42	35	57	83	110	90	92	149	116	169	136	SB - Left	185	612
SB - Left	NONPSGR	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0	1			
SB - Thru	PSGR	0	0	2	0	1	0	0	0	1	1	0	0	0	0	0	0	SB - Thru	1	0
SB - Thru	NONPSGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
SB - Right	PSGR	9	16	20	14	17	15	20	20	19	21	20	11	11	24	17	12	SB - Right	78	71
SB - Right	NONPSGR	0	0	0	1	1	0	0	0	0	0	0	2	1	0	1	0			
WB - Left	PSGR	1	3	3	15	6	10	10	6	9	8	3	5	2	7	3	1	WB - Left	35	14
WB - Left	NONPSGR	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0			
WB - Thru	PSGR	143	103	135	177	148	162	164	167	160	214	204	199	181	190	234	189	WB - Thru	774	946
WB - Thru	NONPSGR	18	26	23	10	15	23	17	26	23	26	20	15	16	17	29	27			
WB - Right	PSGR	80	96	135	145	104	116	139	142	81	89	62	75	59	61	70	61	WB - Right	538	272
WB - Right	NONPSGR	1	0	0	1	0	0	1	0	0	1	0	3	1	1	0	1			
NB - Left	PSGR	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	NB - Left	0	2
NB - Left	NONPSGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NB - Thru	PSGR	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	NB - Thru	1	0
NB - Thru	NONPSGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
NB - Right	PSGR	1	0	0	0	0	1	0	1	0	3	9	20	9	2	9	7	NB - Right	2	29
NB - Right	NONPSGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
EB - Left	PSGR	6	12	9	15	11	10	23	15	16	8	11	9	11	24	12	11	EB - Left	64	62
EB - Left	NONPSGR	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0			
EB - Thru	PSGR	117	132	148	131	114	137	137	122	204	176	213	176	204	193	215	219	EB - Thru	642	979
EB - Thru	NONPSGR	19	30	23	16	24	24	20	21	23	33	18	23	26	17	20	20			
EB - Right	PSGR	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	0	EB - Right	2	0
EB - Right	NONPSGR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
		421	439	538	565	479	543	566	580	619	692	652	630	671	652	780	685			
					1963	2021	2125	2153	2168				2593	2645	2605	2733	2788			

Peak Hour Flow = 333 x (15/15 minute intervals) 2168

Peak Hour Flow = 432 x (15/15 minute intervals) 2788

x 24hrs 66912

/ 2.40 factor 27880 AADT

2012 Forecast Background Traffic Volumes
Location: Portage Avenue and Camp Manitou
Date: August 21, 2012

MOVEMENT	TYPE	7:00 to 7:14	7:15 to 7:29	7:30 to 7:44	7:45 to 7:59	8:00 to 8:14	8:15 to 8:29	8:30 to 8:44	8:45 to 8:59	3:30 to 3:44	3:45 to 3:59	4:00 to 4:14	4:15 to 4:29	4:30 to 4:44	4:45 to 4:59	5:00 to 5:14	5:15 to 5:29		AM PEAK	PM PEAK
SB - Left	PSGR																	SB - Left	0	0
SB - Left	NONPSGR																			
SB - Thru	PSGR																	SB - Thru	0	0
SB - Thru	NONPSGR																			
SB - Right	PSGR																	SB - Right	0	0
SB - Right	NONPSGR																			
WB - Left	PSGR	10	9	9	21	16	36	26	24	30	41	25	22	16	19	17	24	WB - Left	123	108
WB - Left	NONPSGR	1	2	5	6	5	2	4	2	4	5	2	6	6	8	3	8			
WB - Thru	PSGR	105	134	150	132	111	131	146	146	174	141	153	120	209	194	178	158	WB - Thru	668	863
WB - Thru	NONPSGR	10	20	6	11	21	22	22	24	21	22	25	9	13	26	12	15			
WB - Right	PSGR																	WB - Right	0	0
WB - Right	NONPSGR																			
NB - Left	PSGR	5	3	1	3	3	1	7	3	5	6	5	5	4	1	2	4	NB - Left	33	23
NB - Left	NONPSGR	2	3	1	6	4	3	6	4	2	1	4	6	2	4	3	1			
NB - Thru	PSGR																	NB - Thru	0	0
NB - Thru	NONPSGR																			
NB - Right	PSGR	10	10	19	18	25	15	23	26	10	14	43	33	38	18	12	11	NB - Right	122	108
NB - Right	NONPSGR	7	6	9	6	8	6	5	6	2	4	9	3	8	2	10	2			
EB - Left	PSGR																	EB - Left	0	0
EB - Left	NONPSGR																			
EB - Thru	PSGR	98	115	125	107	109	107	101	101	156	158	125	147	154	173	192	171	EB - Thru	526	804
EB - Thru	NONPSGR	10	17	16	15	20	19	19	15	23	31	18	13	15	15	23	7			
EB - Right	PSGR	3	3	4	5	5	7	8	5	11	6	6	5	6	4	8	10	EB - Right	38	42
EB - Right	NONPSGR	0	1	1	1	3	3	1	3	5	6	1	5	1	2	1	7			
		261	323	346	331	330	352	368	359	443	435	416	374	472	466	461	418			
					1261	1330	1359	1381	1409				1668	1697	1728	1773	1817			
		Peak Hour Flow = 333 x (15/15 minute intervals)						1409		Peak Hour Flow = 432 x (15/15 minute intervals)						1817				
															x 24hrs	43608				
															/ 2.40 fac	18170	AADT			

2013 Forecast Background Traffic Volumes
Location: Portage Avenue and Camp Manitou
Growth Rate 1.20%

MOVEMENT	TYPE	7:00 to 7:14	7:15 to 7:29	7:30 to 7:44	7:45 to 7:59	8:00 to 8:14	8:15 to 8:29	8:30 to 8:44	8:45 to 8:59	3:30 to 3:44	3:45 to 3:59	4:00 to 4:14	4:15 to 4:29	4:30 to 4:44	4:45 to 4:59	5:00 to 5:14	5:15 to 5:29		AM PEAK	PM PEAK
SB - Left	PSGR																	SB - Left	0	0
SB - Left	NONPSGR																			
SB - Thru	PSGR																	SB - Thru	0	0
SB - Thru	NONPSGR																			
SB - Right	PSGR																	SB - Right	0	0
SB - Right	NONPSGR																			
WB - Left	PSGR	10	9	9	21	16	36	26	24	30	41	25	22	16	19	17	24	WB - Left	123	108
WB - Left	NONPSGR	1	2	5	6	5	2	4	2	4	5	2	6	6	8	3	8			
WB - Thru	PSGR	106	136	152	134	112	133	148	148	176	143	155	121	212	196	180	160	WB - Thru	675	880
WB - Thru	NONPSGR	10	20	6	11	21	22	22	24	24	25	28	10	15	29	14	15			
WB - Right	PSGR																	WB - Right	0	0
WB - Right	NONPSGR																			
NB - Left	PSGR	5	3	1	3	3	1	7	3	5	6	5	5	4	1	2	4	NB - Left	33	23
NB - Left	NONPSGR	2	3	1	6	4	3	6	4	2	1	4	6	2	4	3	1			
NB - Thru	PSGR																	NB - Thru	0	0
NB - Thru	NONPSGR																			
NB - Right	PSGR	10	10	19	18	25	15	23	26	10	14	44	33	38	18	12	11	NB - Right	122	108
NB - Right	NONPSGR	7	6	9	6	8	6	5	6	2	4	9	3	8	2	10	2			
EB - Left	PSGR																	EB - Left	0	0
EB - Left	NONPSGR																			
EB - Thru	PSGR	99	116	127	108	110	108	102	102	158	160	127	149	156	175	194	173	EB - Thru	530	812
EB - Thru	NONPSGR	10	17	16	15	20	19	19	15	23	31	18	13	15	15	23	7			
EB - Right	PSGR	3	3	4	5	5	7	8	5	11	6	6	5	6	4	8	10	EB - Right	38	42
EB - Right	NONPSGR	0	1	1	1	3	3	1	3	5	6	1	5	1	2	1	7			
		263	326	350	334	332	355	371	362	450	442	424	378	479	473	467	422			
					1273	1342	1371	1392	1420				1694	1723	1754	1797	1841			

Peak Hour Flow = 333 x (15/15 minute intervals) 1420

Peak Hour Flow = 432 x (15/15 minute intervals) 1841

x 24hrs 44184

/ 2.40 fac 18410 AADT

2022 Forecast Background Traffic Volumes
Location: Portage Avenue and Camp Manitou
Growth Rate 1.20%

MOVEMENT	TYPE	7:00 to 7:14	7:15 to 7:29	7:30 to 7:44	7:45 to 7:59	8:00 to 8:14	8:15 to 8:29	8:30 to 8:44	8:45 to 8:59	3:30 to 3:44	3:45 to 3:59	4:00 to 4:14	4:15 to 4:29	4:30 to 4:44	4:45 to 4:59	5:00 to 5:14	5:15 to 5:29		AM PEAK	PM PEAK
SB - Left	PSGR																	SB - Left	0	0
SB - Left	NONPSGR																			
SB - Thru	PSGR																	SB - Thru	0	0
SB - Thru	NONPSGR																			
SB - Right	PSGR																	SB - Right	0	0
SB - Right	NONPSGR																			
WB - Left	PSGR	11	10	10	24	18	41	29	27	34	46	28	25	18	21	19	27	WB - Left	139	121
WB - Left	NONPSGR	1	2	6	7	6	2	5	2	5	6	2	7	7	9	3	9			
WB - Thru	PSGR	118	151	169	149	125	148	164	164	196	159	172	135	235	219	201	178	WB - Thru	752	973
WB - Thru	NONPSGR	11	23	7	12	24	25	25	27	24	25	28	10	15	29	14	17			
WB - Right	PSGR																	WB - Right	0	0
WB - Right	NONPSGR																			
NB - Left	PSGR	6	3	1	3	3	1	8	3	6	7	6	6	5	1	2	5	NB - Left	38	26
NB - Left	NONPSGR	2	3	1	7	5	3	7	5	2	1	5	7	2	5	3	1			
NB - Thru	PSGR																	NB - Thru	0	0
NB - Thru	NONPSGR																			
NB - Right	PSGR	11	11	21	20	28	17	26	29	11	16	48	37	43	20	14	12	NB - Right	138	121
NB - Right	NONPSGR	8	7	10	7	9	7	6	7	2	5	10	3	9	2	11	2			
EB - Left	PSGR																	EB - Left	0	0
EB - Left	NONPSGR																			
EB - Thru	PSGR	110	130	141	121	123	121	114	114	176	178	141	166	174	195	216	193	EB - Thru	594	906
EB - Thru	NONPSGR	11	19	18	17	23	21	21	17	26	35	20	15	17	17	26	8			
EB - Right	PSGR	3	3	5	6	6	8	9	6	12	7	7	6	7	5	9	11	EB - Right	42	47
EB - Right	NONPSGR	0	1	1	1	3	3	1	3	6	7	1	6	1	2	1	8			
		292	363	390	374	373	397	415	404	500	492	468	423	533	525	519	471			
					1419	1500	1534	1559	1589				1883	1916	1949	2000	2048			

Peak Hour Flow = 333 x (15/15 minute intervals) 1589

Peak Hour Flow = 432 x (15/15 minute intervals) 2048

x 24hrs 49152

/ 2.40 fac 20480 AADT

APPENDIX C

TRIP GENERATION SUMMARIES

Development Type	Land Use	Size		Trip Equation / Rate	Trips Gen	Joint Use	Trip Direction		Total Trips			Drop-In Trips				Total Trips		
							In	Out	In	Out	Total	Rate	In	Out	Total	In	Out	Total
Westport Festival																		
Hotel	310	100	rooms	0.58	60	0%	61%	39%	35	25	60	0%	0	0	0	35	25	60
Multiplex Movie Theatre	445	16	screens	PM Peak		0%	0%	0%	0	0	0	0%	0	0	0	0	0	0
Restaurant (High-Turnover)	932	8	000 ft^2	11.52	90	0%	52%	48%	50	45	95	10%	5	5	10	45	40	85
Shopping Center	820	401	000 ft^2	Ln(T) = 0.60 Ln(X) + 2.29	360	0%	61%	39%	220	140	360	20%	45	30	75	175	110	285
Gas Bar	944	8	fuel stations	12.07	95	0%	50%	50%	50	50	100	45%	25	25	50	25	25	50
Red River Exhibition Grounds																		
General Office Building	710	18	000 ft^2	Ln(T) = 0.80 Ln(X) + 1.55	50	0%	88%	12%	40	5	45	20%	10	0	10	30	5	35
Office Park	750	120	000 ft^2	Ln(T) = 0.84 Ln(X) + 1.51	255	0%	89%	11%	225	30	255	20%	45	5	50	180	25	205
					910													
2013 TOTAL TRIP GENERATION - WEEKDAY A.M. PEAK HOUR									620	295	915		130	65	195	**490**	**230**	**720**

Development Type	Land Use	Size		Trip Equation / Rate	Trips Gen	Joint Use	Trip Direction		Total Trips			Drop-In Trips				Total Trips		
							In	Out	In	Out	Total	Rate	In	Out	Total	In	Out	Total
Westport Festival																		
Hotel	310	100	rooms	0.59	60	0%	53%	47%	30	30	60	0%	0	0	0	30	30	60
Multiplex Movie Theatre	445	16	screens	13.64	220	0%	48%	52%	105	115	220	20%	20	25	45	85	90	175
Restaurant (High-Turnover)	932	8	000 ft^2	10.92	85	0%	61%	39%	55	35	90	10%	5	5	10	50	30	80
Shopping Center	820	401	000 ft^2	Ln(T) = 0.66 Ln(X) + 3.40	1565	0%	48%	52%	750	815	1565	20%	150	165	315	600	650	1250
Gas Bar	944	8	fuel stations	13.86	110	0%	50%	50%	55	55	110	45%	25	25	50	30	30	60
Red River Exhibition Grounds																		
General Office Building	710	18	000 ft^2	(T) = 1.12 (X) + 78.81	100	0%	88%	12%	85	10	95	20%	15	0	15	70	10	80
Office Park	750	120	000 ft^2	(T) = 1.21 (X) + 106.22	250	0%	14%	86%	35	215	250	20%	5	45	50	30	170	200
					2390													
2013 TOTAL TRIP GENERATION - WEEKDAY P.M. PEAK HOUR									1115	1275	2390		220	265	485	**895**	**1010**	**1905**

Development Type	Land Use	Size		Trip Equation / Rate	Trips Gen	Joint Use	Trip Direction		Total Trips			Drop-In Trips				Total Trips		
							In	Out	In	Out	Total	Rate	In	Out	Total	In	Out	Total
Westport Festival																		
Hotel	310	100	rooms	0.72	70	0%	56%	44%	40	30	70	0%	0	0	0	40	30	70
Multiplex Movie Theatre	445	16	screens	69.14	1105	0%	52%	48%	575	530	1105	20%	115	105	220	460	425	885
Restaurant (High-Turnover)	932	8	000 ft^2	20	160	0%	63%	37%	100	60	160	10%	10	5	15	90	55	145
Shopping Center	820	401	000 ft^2	Ln(T) = 0.65 Ln(X) + 3.77	2135	0%	52%	48%	1110	1025	2135	20%	220	205	425	890	820	1710
Gas Bar	944	8	fuel stations	13.86	110	0%	50%	50%	55	55	110	45%	25	25	50	30	30	60
Red River Exhibition Grounds																		
General Office Building	710	18	000 ft^2	Ln(T) = 0.81 Ln(X) - 0.12	10	0%	52%	48%	5	5	10	20%	0	0	0	5	5	10
Office Park	750	120	000 ft^2	0.14	15	0%	74%	26%	10	5	15	20%	0	0	0	10	5	15
					3605													
2013 TOTAL TRIP GENERATION - SATURDAY PEAK HOUR									1895	1710	3605		370	340	710	**1525**	**1370**	**2895**

Development Type	Land Use	Size		Trip Equation / Rate	Trips Gen	Joint Use	Trip Direction		Total Trips			Drop-In Trips				Total Trips		
							In	Out	In	Out	Total	Rate	In	Out	Total	In	Out	Total
Red River Exhibition Grounds																		
Non-Major Event (Multiplex)	445	5000	seats	0.3	1500	0%	80%	20%	1200	300	1500	0%	0	0	0	1200	300	1500
2013 TOTAL TRIP GENERATION - NON-MAJOR EVENT PEAK HOUR									1200	300	1500		0	0	0	**1200**	**300**	**1500**

Development Type	Land Use	Size		Trip Equation / Rate	Trips Gen	Joint Use	Trip Direction		Total Trips			Drop-In Trips				Total Trips		
							In	Out	In	Out	Total	Rate	In	Out	Total	In	Out	Total
Red River Exhibition Grounds																		
Red River Exhibition	n/a	48	000 patrons	T=(0.25(X)(1-0.08))/3.0	4600	0%	80%	20%	3680	920	4600	0%	0	0	0	3680	920	4600
2013 TOTAL TRIP GENERATION - MAJOR EVENT PEAK HOUR									3680	920	4600		0	0	0	**3680**	**920**	**4600**

APPENDIX D

TRIP DISTRIBUTION SUMMARIES

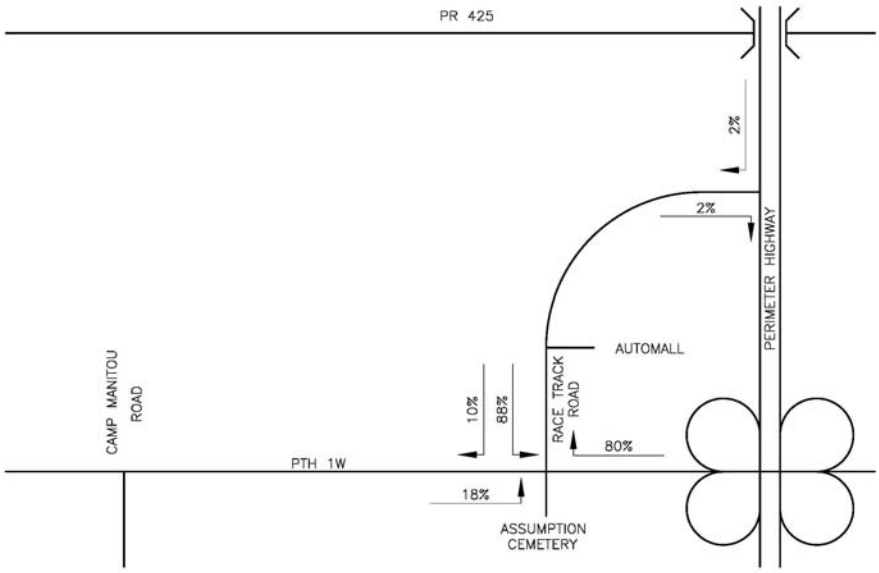
1.0 TRIP DISTRIBUTION

Trip distribution refers to the directional split of traffic entering and exiting a site while trip assignment assigns distributed trips to the adjacent road network. A number of scenarios are evaluated in this report, each with unique distributions based on the number of access/egress points, stage of development and type of event.

1.1 OPENING DAY

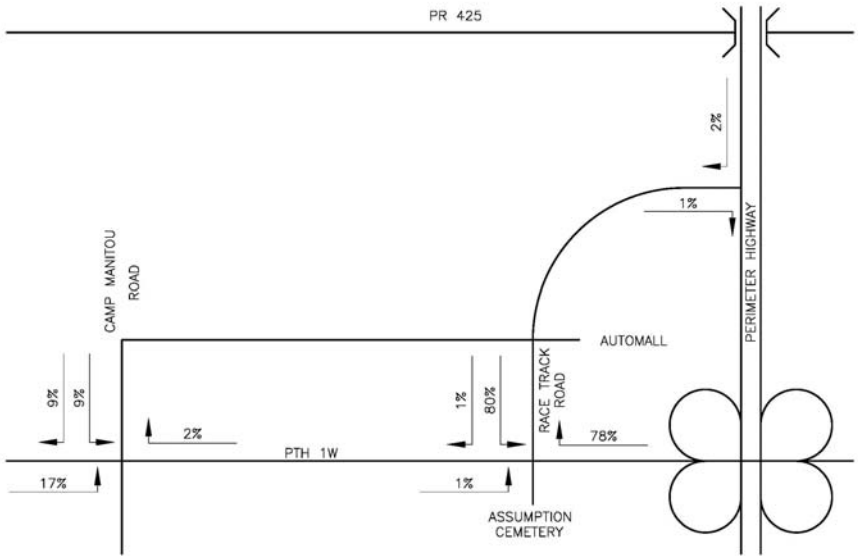
1.1.1 Existing Distribution

Traffic distribution based on manual traffic counts compiled in Appendix B are as follows:

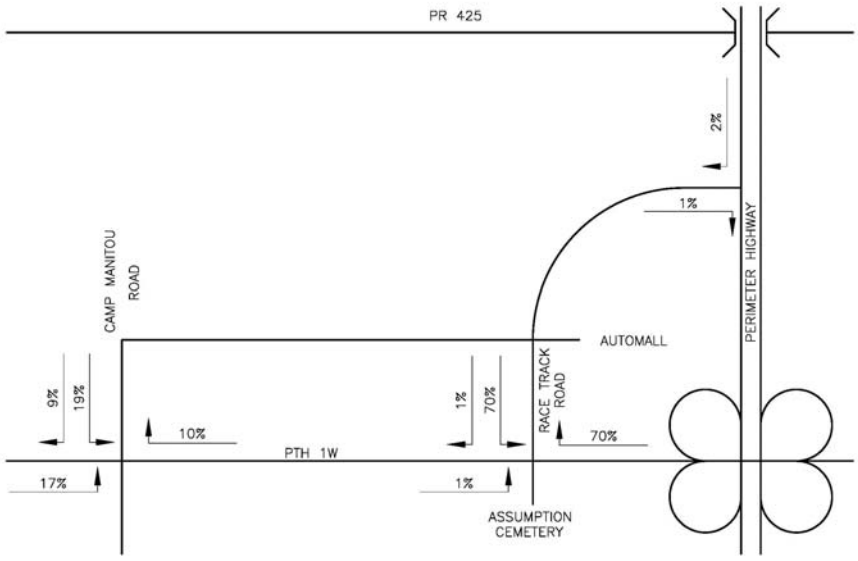


1.1.2 Background Traffic Redistribution – Opening Day

With the addition of the fourth leg to the intersection at Camp Manitou Road, traffic is expected to redistribute as follows:

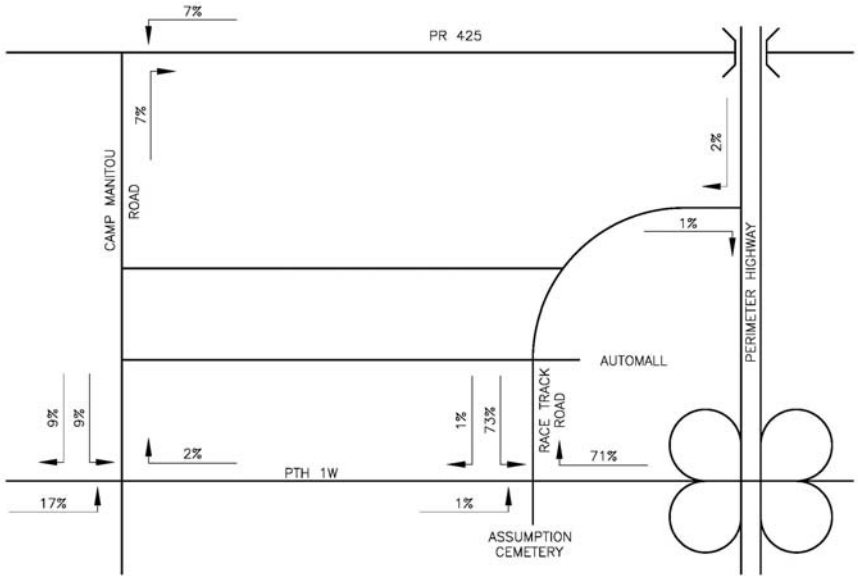


1.1.3 Development Traffic Distribution – Opening Day

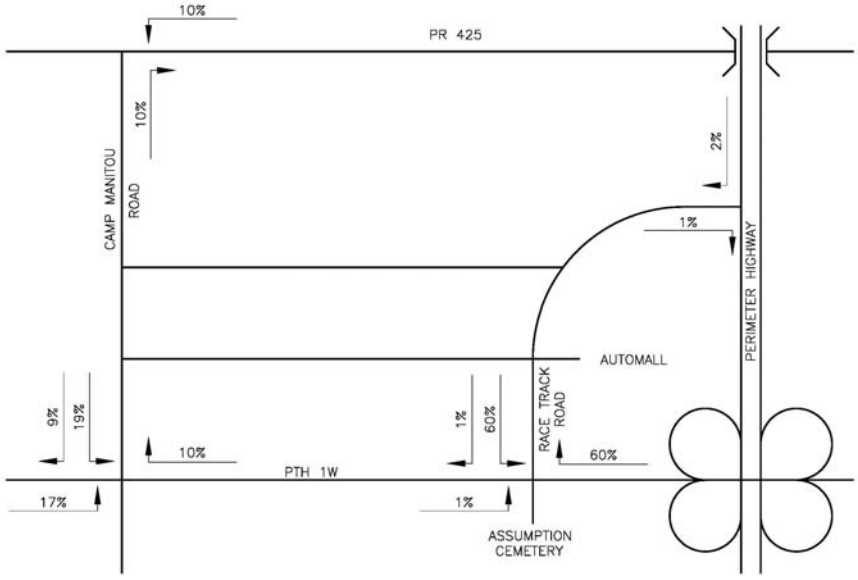


1.2 FULL BUILD-OUT

1.2.1 Background Traffic Redistribution – Full Build-Out



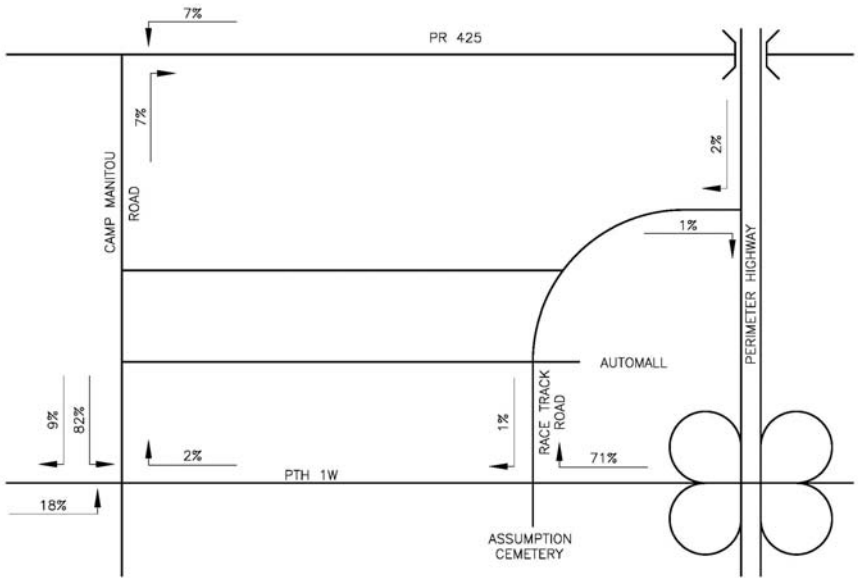
1.2.2 Development Traffic Distribution – Full Build-Out



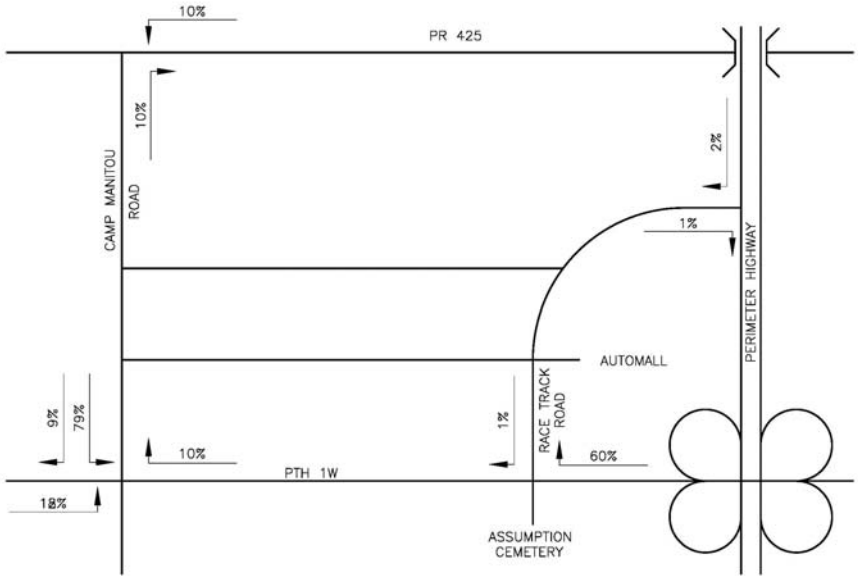
1.3 MEDIAN CLOSURE

With the closure of the median at Race Track Road and PTH 1W, the intersection will operate as a right-in, right-out only (RIRO). Traffic is expected to distribute as follows:

1.3.1 Background Traffic Redistribution - RIRO



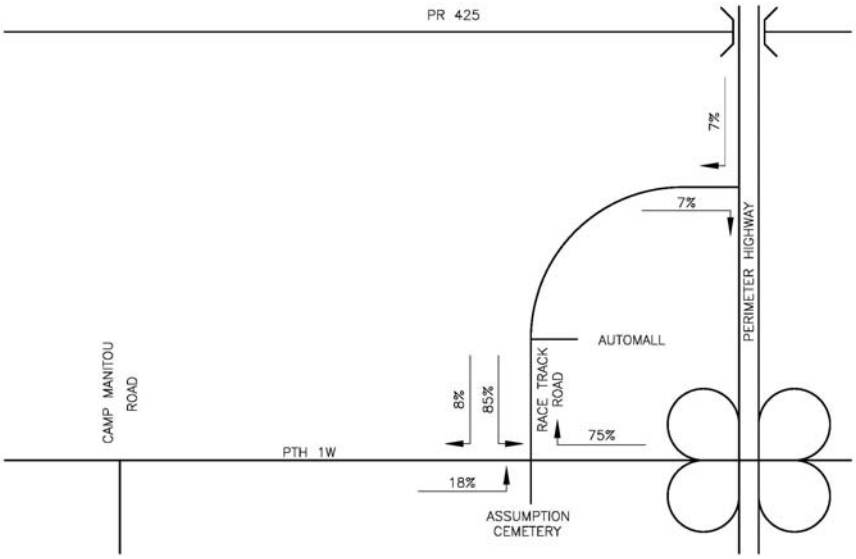
1.3.2 Development Traffic Distribution - RIRO



1.4 SPECIAL EVENTS

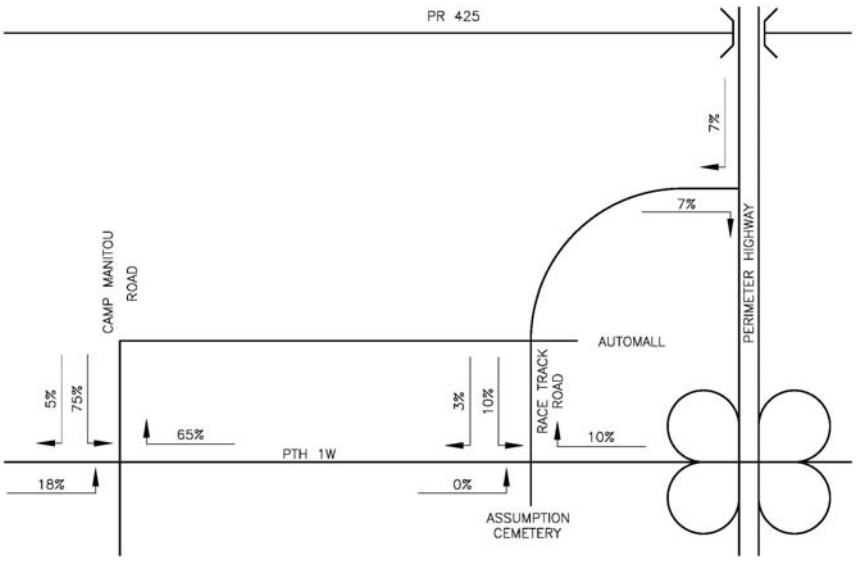
1.4.1 Existing Event Traffic Distribution

Existing traffic distribution patterns for minor and major events are as follows:

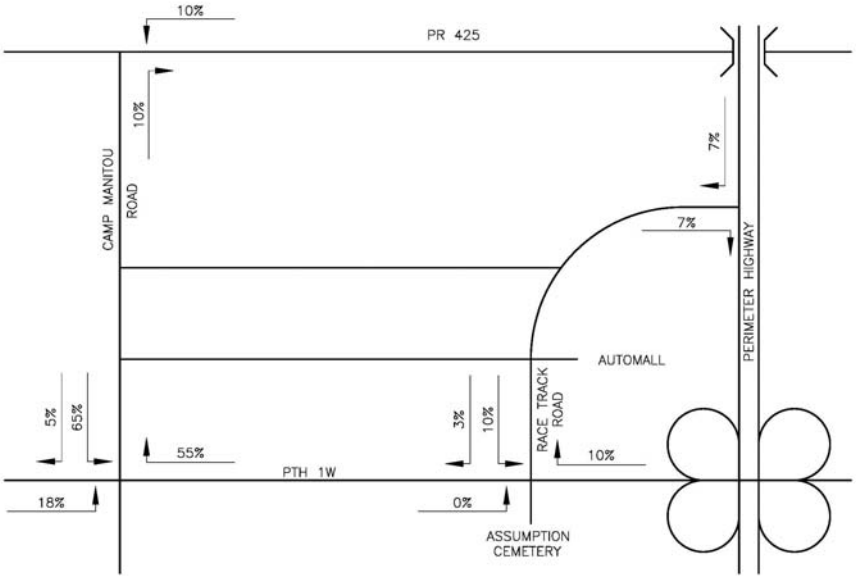


1.4.2 Background Event Traffic Redistribution – Opening Day

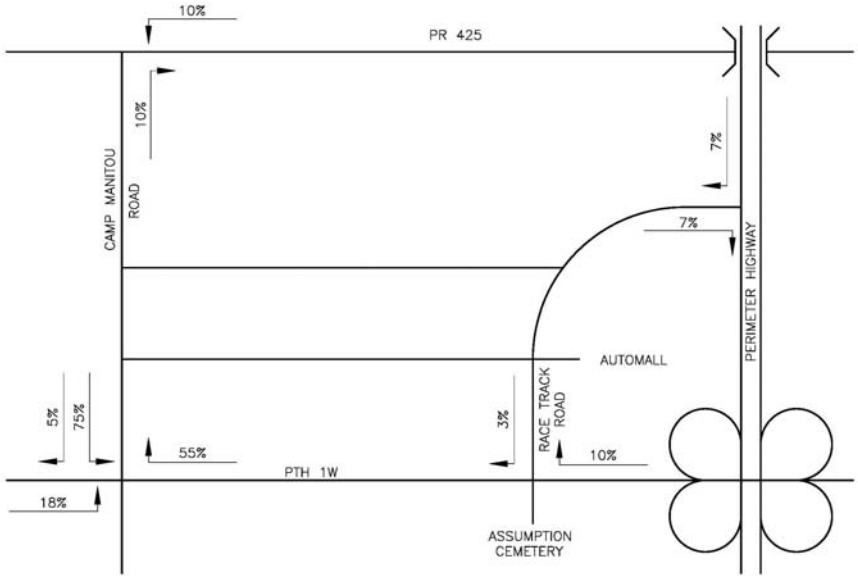
Following development, special events like the Red River Exhibition are expected to redistribute traffic as follows::



1.4.3 Development Event Traffic Distribution – Full Build-Out



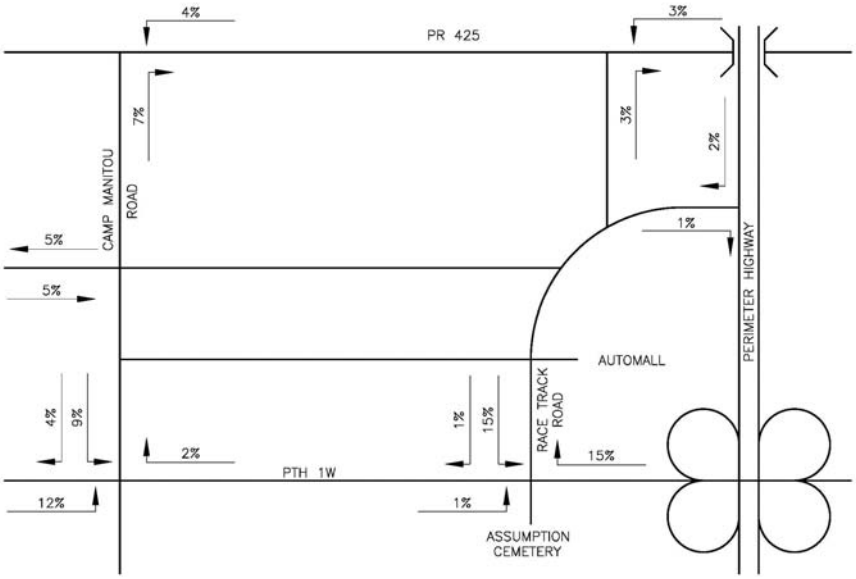
1.4.4 Development Event Traffic Distribution - RIRO



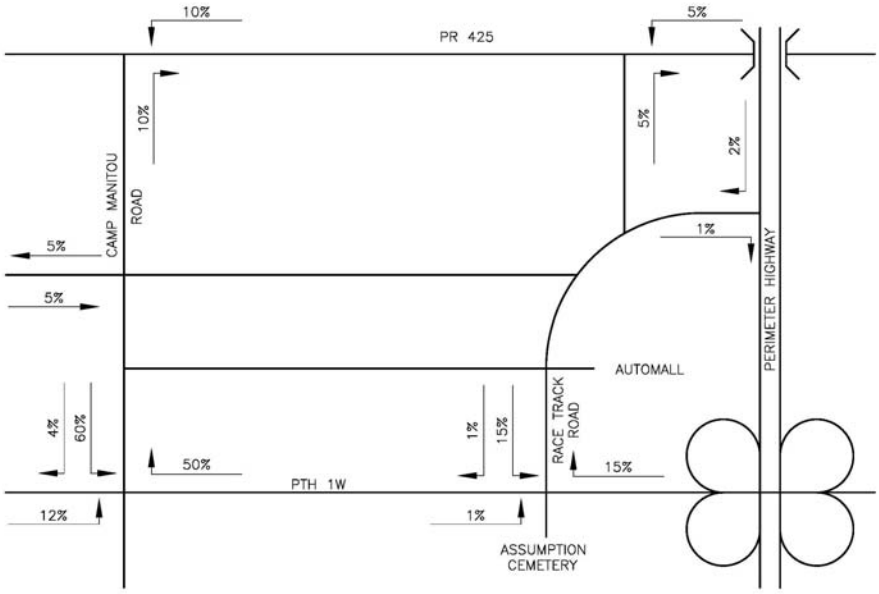
1.5 OPTIONAL DEVELOPMENT

Trip distribution for the optional developments is expected to be divided. The light industrial and commercial component along PTH 1W is expected to use intersections available along Camp Manitou Road. The commercial component associated with Assiniboia Downs is expected to use the Race Track Road / PTH 1W intersection exclusively.

1.5.1 Background Traffic Redistribution – Optional Development



1.5.2 Development Traffic Distribution – Optional Development



APPENDIX E

SYNCHRO TRAFFIC FORECASTS
PTH 1W (PTH 1) / RACE TRACK ROAD INTERSECTION

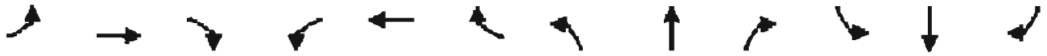
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	574	2	31	694	482	0	1	2	166	1	70
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1550	1000
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.91		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.98	
Satd. Flow (prot)	1506	3010		1506	3223	1328		1259		1430	1172	
Flt Permitted	0.32	1.00		0.39	1.00	1.00		1.00		0.76	0.89	
Satd. Flow (perm)	499	3010		610	3223	1328		1259		1138	1060	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	624	2	34	754	524	0	1	2	180	1	76
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	61	0
Lane Group Flow (vph)	62	626	0	34	754	524	0	1	0	133	63	0
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	24.7	21.4		24.7	21.4	46.0		9.3		9.3	9.3	
Effective Green, g (s)	24.7	21.4		24.7	21.4	46.0		9.3		9.3	9.3	
Actuated g/C Ratio	0.54	0.47		0.54	0.47	1.00		0.20		0.20	0.20	
Clearance Time (s)	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	
Lane Grp Cap (vph)	340	1400		392	1499	1328		255		230	214	
v/s Ratio Prot	0.01	0.21		0.01	c0.23			0.00				
v/s Ratio Perm	0.08			0.04		c0.39				c0.12	0.06	
v/c Ratio	0.18	0.45		0.09	0.50	0.39		0.01		0.58	0.30	
Uniform Delay, d1	5.2	8.3		5.1	8.6	0.0		14.7		16.6	15.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		0.1	0.3	0.9		0.0		3.5	0.8	
Delay (s)	5.5	8.5		5.2	8.9	0.9		14.7		20.1	16.3	
Level of Service	A	A		A	A	A		B		C	B	
Approach Delay (s)		8.3			5.6			14.7			18.3	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	46.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.5%	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												
Volume (vph)	57	878	0	13	850	245	2	0	26	550	0	63
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1550	1000
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		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.87		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.96	
Satd. Flow (prot)	1506	3011		1506	3223	1328		1206		1430	1226	
Flt Permitted	0.16	1.00		0.15	1.00	1.00		0.99		0.74	0.75	
Satd. Flow (perm)	258	3011		237	3223	1328		1192		1111	955	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	62	954	0	14	924	266	2	0	28	598	0	68
RTOR Reduction (vph)	0	0	0	0	0	0	0	17	0	0	10	0
Lane Group Flow (vph)	62	954	0	14	924	266	0	13	0	335	321	0
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	35.0	29.3		35.0	29.3	77.6		30.6		30.6	30.6	
Effective Green, g (s)	35.0	29.3		35.0	29.3	77.6		30.6		30.6	30.6	
Actuated g/C Ratio	0.45	0.38		0.45	0.38	1.00		0.39		0.39	0.39	
Clearance Time (s)	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	
Lane Grp Cap (vph)	208	1137		200	1217	1328		470		438	377	
v/s Ratio Prot	0.02	c0.32		0.01	0.29							
v/s Ratio Perm	0.11			0.03		c0.20		0.01		0.30	c0.34	
v/c Ratio	0.30	0.84		0.07	0.76	0.20		0.03		0.76	0.85	
Uniform Delay, d1	13.6	22.0		13.2	21.1	0.0		14.4		20.4	21.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.8	5.6		0.1	2.8	0.3		0.0		7.8	16.7	
Delay (s)	14.4	27.6		13.4	23.8	0.3		14.4		28.1	38.2	
Level of Service	B	C		B	C	A		B		C	D	
Approach Delay (s)		26.8			18.5			14.4			33.1	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	77.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



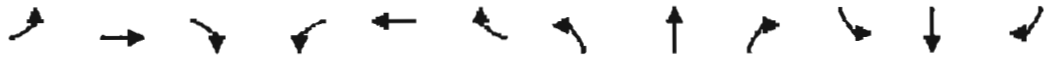
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	659	0	10	638	184	2	0	20	413	0	47
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1775	1000	1550	1000	1775	1550	1000
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.96	
Satd. Flow (prot)	1506	3011		1506	3223	1347		1208		1430	1226	
Flt Permitted	0.29	1.00		0.28	1.00	1.00		0.98		0.74	0.75	
Satd. Flow (perm)	466	3011		444	3223	1347		1191		1117	960	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	716	0	11	693	200	2	0	22	449	0	51
RTOR Reduction (vph)	0	0	0	0	0	0	0	14	0	0	10	0
Lane Group Flow (vph)	46	716	0	11	693	200	0	10	0	251	239	0
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	25.2	21.7		25.2	21.7	58.2		21.0		21.0	21.0	
Effective Green, g (s)	25.2	21.7		25.2	21.7	58.2		21.0		21.0	21.0	
Actuated g/C Ratio	0.43	0.37		0.43	0.37	1.00		0.36		0.36	0.36	
Clearance Time (s)	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	
Lane Grp Cap (vph)	264	1123		256	1202	1347		430		403	346	
v/s Ratio Prot	0.01	c0.24		0.00	0.22							
v/s Ratio Perm	0.06			0.02		c0.15		0.01		0.22	c0.25	
v/c Ratio	0.17	0.64		0.04	0.58	0.15		0.02		0.62	0.69	
Uniform Delay, d1	9.9	15.0		9.7	14.6	0.0		12.0		15.3	15.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.2		0.1	0.7	0.2		0.0		3.0	5.8	
Delay (s)	10.2	16.2		9.8	15.3	0.2		12.0		18.3	21.7	
Level of Service	B	B		A	B	A		B		B	C	
Approach Delay (s)		15.9			11.9			12.0			20.0	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	58.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



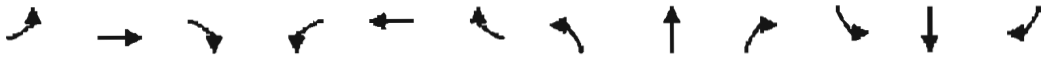
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	639	2	35	773	537	0	1	2	185	1	78
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1550	1000
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.91		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.98	
Satd. Flow (prot)	1506	3010		1506	3223	1328		1259		1430	1171	
Flt Permitted	0.25	1.00		0.32	1.00	1.00		1.00		0.76	0.90	
Satd. Flow (perm)	389	3010		506	3223	1328		1259		1138	1072	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	695	2	38	840	584	0	1	2	201	1	85
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	63	0
Lane Group Flow (vph)	70	697	0	38	840	584	0	2	0	149	75	0
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	27.2	22.1		27.2	22.1	52.7		13.5		13.5	13.5	
Effective Green, g (s)	27.2	22.1		27.2	22.1	52.7		13.5		13.5	13.5	
Actuated g/C Ratio	0.52	0.42		0.52	0.42	1.00		0.26		0.26	0.26	
Clearance Time (s)	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	
Lane Grp Cap (vph)	309	1262		358	1352	1328		323		292	275	
v/s Ratio Prot	0.02	0.23		0.01	c0.26			0.00				
v/s Ratio Perm	0.10			0.04		c0.44				0.13	0.07	
v/c Ratio	0.23	0.55		0.11	0.62	0.44		0.00		0.51	0.27	
Uniform Delay, d1	6.9	11.6		6.5	12.0	0.0		14.6		16.8	15.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.5		0.1	0.9	1.1		0.0		1.5	0.5	
Delay (s)	7.2	12.1		6.6	12.9	1.1		14.6		18.3	16.2	
Level of Service	A	B		A	B	A		B		B	B	
Approach Delay (s)		11.6			8.0			14.6			17.3	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	52.7	Sum of lost time (s)	4.0
Intersection Capacity Utilization	51.1%	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												
Volume (vph)	64	978	0	14	946	273	2	0	29	612	0	70
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1550	1000
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		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.87		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.96	
Satd. Flow (prot)	1506	3011		1506	3223	1328		1205		1430	1225	
Flt Permitted	0.13	1.00		0.13	1.00	1.00		0.99		0.73	0.75	
Satd. Flow (perm)	204	3011		204	3223	1328		1191		1107	952	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	1063	0	15	1028	297	2	0	32	665	0	76
RTOR Reduction (vph)	0	0	0	0	0	0	0	20	0	0	10	0
Lane Group Flow (vph)	70	1063	0	15	1028	297	0	14	0	372	359	0
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	37.2	31.1		37.2	31.1	80.3		31.1		31.1	31.1	
Effective Green, g (s)	37.2	31.1		37.2	31.1	80.3		31.1		31.1	31.1	
Actuated g/C Ratio	0.46	0.39		0.46	0.39	1.00		0.39		0.39	0.39	
Clearance Time (s)	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	
Lane Grp Cap (vph)	193	1166		193	1248	1328		461		429	369	
v/s Ratio Prot	0.03	c0.35		0.01	0.32							
v/s Ratio Perm	0.14			0.03		c0.22		0.01		0.34	c0.38	
v/c Ratio	0.36	0.91		0.08	0.82	0.22		0.03		0.87	0.97	
Uniform Delay, d1	14.3	23.3		13.8	22.1	0.0		15.3		22.7	24.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.2	10.7		0.2	4.5	0.4		0.0		16.6	39.5	
Delay (s)	15.5	34.0		14.0	26.7	0.4		15.3		39.3	63.7	
Level of Service	B	C		B	C	A		B		D	E	
Approach Delay (s)		32.9			20.7			15.3			51.5	
Approach LOS		C			C			B			D	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	80.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



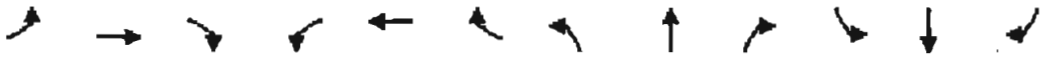
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	47	734	0	11	710	205	2	0	22	460	0	52
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1550	1000
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.96	
Satd. Flow (prot)	1506	3011		1506	3223	1328		1207		1430	1225	
Flt Permitted	0.24	1.00		0.23	1.00	1.00		0.98		0.74	0.75	
Satd. Flow (perm)	385	3011		363	3223	1328		1191		1115	959	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	51	798	0	12	772	223	2	0	24	500	0	57
RTOR Reduction (vph)	0	0	0	0	0	0	0	15	0	0	11	0
Lane Group Flow (vph)	51	798	0	12	772	223	0	11	0	280	266	0
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	25.5	21.8		25.5	21.8	59.7		22.2		22.2	22.2	
Effective Green, g (s)	25.5	21.8		25.5	21.8	59.7		22.2		22.2	22.2	
Actuated g/C Ratio	0.43	0.37		0.43	0.37	1.00		0.37		0.37	0.37	
Clearance Time (s)	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	
Lane Grp Cap (vph)	234	1099		226	1177	1328		443		415	357	
v/s Ratio Prot	0.01	c0.27		0.00	0.24							
v/s Ratio Perm	0.08			0.02		c0.17		0.01		0.25	c0.28	
v/c Ratio	0.22	0.73		0.05	0.66	0.17		0.02		0.67	0.74	
Uniform Delay, d1	10.6	16.4		10.4	15.8	0.0		11.9		15.7	16.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.5	2.4		0.1	1.3	0.3		0.0		4.3	8.2	
Delay (s)	11.1	18.8		10.5	17.1	0.3		11.9		20.0	24.4	
Level of Service	B	B		B	B	A		B		C	C	
Approach Delay (s)		18.3			13.3			11.9			22.2	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	59.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



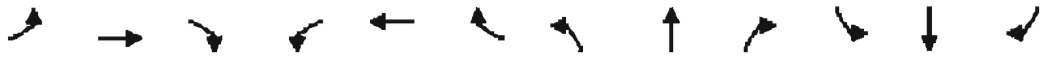
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	592	2	31	708	520	0	2	2	261	2	8
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1506	3223	1328	1506	3223	1328		1291		2921	1292	
Flt Permitted	0.27	1.00	1.00	0.34	1.00	1.00		1.00		1.00	1.00	
Satd. Flow (perm)	421	3223	1328	538	3223	1328		1291		3075	1292	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	643	2	34	770	565	0	2	2	284	2	9
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	7	0
Lane Group Flow (vph)	78	643	2	34	770	565	0	2	0	284	4	0
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	24.2	19.9	51.6	24.2	19.9	51.6		0.8		11.4	11.4	
Effective Green, g (s)	24.2	19.9	51.6	24.2	19.9	51.6		0.8		11.4	11.4	
Actuated g/C Ratio	0.47	0.39	1.00	0.47	0.39	1.00		0.02		0.22	0.22	
Clearance Time (s)	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	
Lane Grp Cap (vph)	288	1243	1328	333	1243	1328		20		648	386	
v/s Ratio Prot	0.02	0.20		0.01	c0.24			0.00		0.09	0.00	
v/s Ratio Perm	0.10		0.00	0.04		c0.43				0.01	0.00	
v/c Ratio	0.27	0.52	0.00	0.10	0.62	0.43		0.10		0.44	0.01	
Uniform Delay, d1	11.9	12.2	0.0	9.7	12.8	0.0		25.0		15.8	15.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.4	0.0	0.1	0.9	1.0		2.2		0.5	0.0	
Delay (s)	12.4	12.5	0.0	9.8	13.7	1.0		27.3		16.3	15.7	
Level of Service	B	B	A	A	B	A		C		B	B	
Approach Delay (s)		12.5			8.4			27.3			16.3	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	51.6	Sum of lost time (s)	4.0
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



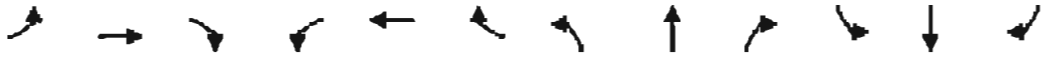
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	42	897	0	13	868	365	2	1	26	564	1	44
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1506	3223		1506	3223	1328		1211		2921	1257	
Flt Permitted	0.19	1.00		0.17	1.00	1.00		0.99		0.74	1.00	
Satd. Flow (perm)	298	3223		277	3223	1328		1206		2266	1257	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	975	0	14	943	397	2	1	28	613	1	48
RTOR Reduction (vph)	0	0	0	0	0	0	0	18	0	0	31	0
Lane Group Flow (vph)	46	975	0	14	943	397	0	13	0	613	18	0
Turn Type	pm+pt		Perm	pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2		2	2		Free	3			3		
Actuated Green, G (s)	30.9	28.1		30.9	28.1	66.7		23.8		23.8	23.8	
Effective Green, g (s)	30.9	28.1		30.9	28.1	66.7		23.8		23.8	23.8	
Actuated g/C Ratio	0.46	0.42		0.46	0.42	1.00		0.36		0.36	0.36	
Clearance Time (s)	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	
Lane Grp Cap (vph)	189	1358		180	1358	1328		430		809	449	
v/s Ratio Prot	0.01	c0.30		0.00	0.29						0.01	
v/s Ratio Perm	0.10			0.03		c0.30		0.01		c0.27		
v/c Ratio	0.24	0.72		0.08	0.69	0.30		0.03		0.76	0.04	
Uniform Delay, d1	17.9	16.0		17.2	15.8	0.0		13.9		18.9	14.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.7	1.8		0.2	1.6	0.6		0.0		4.1	0.0	
Delay (s)	18.6	17.9		17.4	17.3	0.6		14.0		23.0	14.0	
Level of Service	B	B		B	B	A		B		C	B	
Approach Delay (s)		17.9			12.4			14.0			22.3	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	66.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.0%	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												
Volume (vph)	33	690	0	10	667	379	2	1	20	487	1	34
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1506	3223		1506	3223	1328		1215		2921	1258	
Flt Permitted	0.28	1.00		0.26	1.00	1.00		0.97		1.00	1.00	
Satd. Flow (perm)	438	3223		416	3223	1328		1179		3075	1258	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	750	0	11	725	412	2	1	22	529	1	37
RTOR Reduction (vph)	0	0	0	0	0	0	0	21	0	0	26	0
Lane Group Flow (vph)	36	750	0	11	725	412	0	4	0	529	12	0
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	24.0	21.4		24.0	21.4	57.3		2.7		17.3	17.3	
Effective Green, g (s)	24.0	21.4		24.0	21.4	57.3		2.7		17.3	17.3	
Actuated g/C Ratio	0.42	0.37		0.42	0.37	1.00		0.05		0.30	0.30	
Clearance Time (s)	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	
Lane Grp Cap (vph)	232	1204		224	1204	1328		56		889	468	
v/s Ratio Prot	0.01	c0.23		0.00	0.22					c0.15	0.00	
v/s Ratio Perm	0.06			0.02		c0.31		0.00		0.03	0.01	
v/c Ratio	0.16	0.62		0.05	0.60	0.31		0.07		0.60	0.03	
Uniform Delay, d1	14.1	14.7		13.8	14.5	0.0		26.1		15.9	14.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.0		0.1	0.9	0.6		0.5		1.1	0.0	
Delay (s)	14.4	15.7		13.9	15.4	0.6		26.7		16.9	14.1	
Level of Service	B	B		B	B	A		C		B	B	
Approach Delay (s)		15.6			10.1			26.7			16.7	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	13.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	57.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



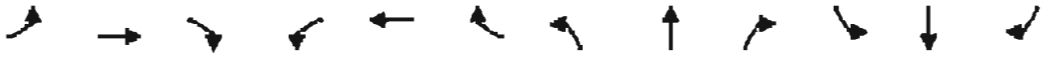
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	683	2	35	822	725	0	2	2	334	1	21
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1506	3223	1328	1506	3223	1328		1291		2921	1261	
Flt Permitted	0.21	1.00	1.00	0.29	1.00	1.00		1.00		1.00	1.00	
Satd. Flow (perm)	336	3223	1328	454	3223	1328		1291		3075	1261	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	742	2	38	893	788	0	2	2	363	1	23
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	18	0
Lane Group Flow (vph)	91	742	2	38	893	788	0	2	0	363	6	0
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	28.6	24.2	58.4	28.6	24.2	58.4		1.8		13.8	13.8	
Effective Green, g (s)	28.6	24.2	58.4	28.6	24.2	58.4		1.8		13.8	13.8	
Actuated g/C Ratio	0.49	0.41	1.00	0.49	0.41	1.00		0.03		0.24	0.24	
Clearance Time (s)	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	
Lane Grp Cap (vph)	253	1336	1328	302	1336	1328		40		695	384	
v/s Ratio Prot	0.03	0.23		0.01	0.28			0.00		0.11	0.00	
v/s Ratio Perm	0.15		0.00	0.05		c0.59				0.02	0.00	
v/c Ratio	0.36	0.56	0.00	0.13	0.67	0.59		0.05		0.52	0.02	
Uniform Delay, d1	15.0	13.0	0.0	11.4	13.9	0.0		27.5		18.1	17.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.9	0.5	0.0	0.2	1.3	2.0		0.5		0.7	0.0	
Delay (s)	15.9	13.5	0.0	11.6	15.1	2.0		28.0		18.8	17.1	
Level of Service	B	B	A	B	B	A		C		B	B	
Approach Delay (s)		13.7			9.0			28.0			18.7	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	58.4	Sum of lost time (s)	0.0
Intersection Capacity Utilization	54.6%	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												
Volume (vph)	53	1170	0	14	1036	779	2	1	29	1108	1	58
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1506	3223		1506	3223	1328		1210		2921	1256	
Flt Permitted	0.11	1.00		0.11	1.00	1.00		1.00		1.00	1.00	
Satd. Flow (perm)	173	3223		173	3223	1328		1213		3075	1256	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	1272	0	15	1126	847	2	1	32	1204	1	63
RTOR Reduction (vph)	0	0	0	0	0	0	0	31	0	0	38	0
Lane Group Flow (vph)	58	1272	0	15	1126	847	0	4	0	1204	26	0
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	38.1	36.6		38.1	36.6	88.8		1.5		34.7	34.7	
Effective Green, g (s)	38.1	36.6		38.1	36.6	88.8		1.5		34.7	34.7	
Actuated g/C Ratio	0.43	0.41		0.43	0.41	1.00		0.02		0.39	0.39	
Clearance Time (s)	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	
Lane Grp Cap (vph)	97	1328		97	1328	1328		20		1144	547	
v/s Ratio Prot	0.01	c0.39		0.00	0.35					c0.39	0.00	
v/s Ratio Perm	0.25			0.06		c0.64		0.00		0.02	0.02	
v/c Ratio	0.60	0.96		0.15	0.85	0.64		0.18		1.05	0.05	
Uniform Delay, d1	34.1	25.4		34.7	23.6	0.0		43.0		25.8	16.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	9.5	15.6		0.7	5.2	2.4		4.2		41.5	0.0	
Delay (s)	43.7	40.9		35.5	28.8	2.4		47.3		67.4	16.8	
Level of Service	D	D		D	C	A		D		E	B	
Approach Delay (s)		41.0			17.6			47.3			64.8	
Approach LOS		D			B			D			E	

Intersection Summary			
HCM Average Control Delay	37.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	88.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.2%	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												
Volume (vph)	48	994	0	11	863	1097	2	1	22	1199	1	50
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1506	3223		1506	3223	1328		1213		2921	1256	
Flt Permitted	0.15	1.00		0.09	1.00	1.00		0.97		1.00	1.00	
Satd. Flow (perm)	231	3223		147	3223	1328		1178		3075	1256	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	1080	0	12	938	1192	2	1	24	1303	1	54
RTOR Reduction (vph)	0	0	0	0	0	0	0	23	0	0	29	0
Lane Group Flow (vph)	52	1080	0	12	938	1192	0	4	0	1303	26	0
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	44.6	43.1		44.6	43.1	113.2		3.0		52.6	52.6	
Effective Green, g (s)	44.6	43.1		44.6	43.1	113.2		3.0		52.6	52.6	
Actuated g/C Ratio	0.39	0.38		0.39	0.38	1.00		0.03		0.46	0.46	
Clearance Time (s)	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	
Lane Grp Cap (vph)	108	1227		76	1227	1328		31		1361	628	
v/s Ratio Prot	0.01	0.34		0.00	0.29					0.42	0.00	
v/s Ratio Perm	0.18			0.06		c0.90		0.00		0.03	0.02	
v/c Ratio	0.48	0.88		0.16	0.76	0.90		0.12		0.96	0.04	
Uniform Delay, d1	41.1	32.6		42.7	30.6	0.0		53.8		28.1	16.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	3.4	7.6		1.0	2.9	9.8		1.7		15.2	0.0	
Delay (s)	44.4	40.3		43.7	33.5	9.8		55.5		43.4	16.6	
Level of Service	D	D		D	C	A		E		D	B	
Approach Delay (s)		40.5			20.4			55.5			42.3	
Approach LOS		D			C			E			D	

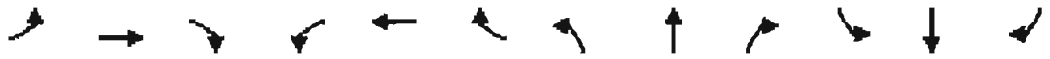
Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	113.2	Sum of lost time (s)	0.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	216	659	0	10	1418	1084	2	0	20	668	0	71
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.96	
Satd. Flow (prot)	1670	3011		1670	3223	1473		1208		1586	1448	
Flt Permitted	0.10	1.00		0.30	1.00	1.00		0.98		0.74	0.75	
Satd. Flow (perm)	167	3011		529	3223	1473		1186		1238	1132	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	235	716	0	11	1541	1178	2	0	22	726	0	77
RTOR Reduction (vph)	0	0	0	0	0	0	0	15	0	0	9	0
Lane Group Flow (vph)	235	716	0	11	1541	1178	0	9	0	407	387	0
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	49.0	42.0		49.0	42.0	90.0		29.0		29.0	29.0	
Effective Green, g (s)	49.0	42.0		49.0	42.0	90.0		29.0		29.0	29.0	
Actuated g/C Ratio	0.54	0.47		0.54	0.47	1.00		0.32		0.32	0.32	
Clearance Time (s)	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	
Lane Grp Cap (vph)	208	1405		377	1504	1473		382		399	365	
v/s Ratio Prot	0.09	0.24		0.00	0.48							
v/s Ratio Perm	c0.53			0.01		c0.80		0.01		0.33	c0.34	
v/c Ratio	1.13	0.51		0.03	1.02	0.80		0.02		1.02	1.06	
Uniform Delay, d1	23.5	16.8		9.8	24.0	0.0		20.8		30.5	30.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	101.7	0.3		0.0	29.7	4.6		0.0		50.2	63.5	
Delay (s)	125.2	17.1		9.9	53.7	4.6		20.9		80.7	94.0	
Level of Service	F	B		A	D	A		C		F	F	
Approach Delay (s)		43.8			32.3			20.9			87.3	
Approach LOS		D			C			C			F	

Intersection Summary					
HCM Average Control Delay	44.5	HCM Level of Service		D	
HCM Volume to Capacity ratio	1.06				
Actuated Cycle Length (s)	90.0	Sum of lost time (s)		8.0	
Intersection Capacity Utilization	92.5%	ICU Level of Service		F	
Analysis Period (min)	15				

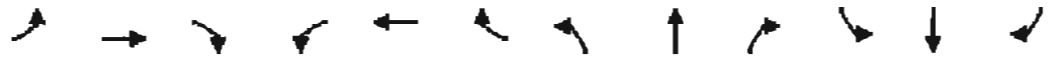
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	662	659	0	10	3027	2940	2	0	20	1195	0	121
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.95	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	0.96	
Satd. Flow (prot)	1670	3011		1670	3223	1473		1208		1586	1449	
Flt Permitted	0.09	1.00		0.30	1.00	1.00		0.70		0.74	0.75	
Satd. Flow (perm)	163	3011		536	3223	1473		844		1238	1131	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	720	716	0	11	3290	3196	2	0	22	1299	0	132
RTOR Reduction (vph)	0	0	0	0	0	0	0	17	0	0	9	0
Lane Group Flow (vph)	720	716	0	11	3290	3196	0	7	0	727	695	0
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt			pm+pt		Free	Perm			Perm		
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2			2		Free	3			3		
Actuated Green, G (s)	56.0	43.0		56.0	43.0	90.0		22.0		22.0	22.0	
Effective Green, g (s)	56.0	43.0		56.0	43.0	90.0		22.0		22.0	22.0	
Actuated g/C Ratio	0.62	0.48		0.62	0.48	1.00		0.24		0.24	0.24	
Clearance Time (s)	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	
Lane Grp Cap (vph)	319	1439		497	1540	1473		206		303	276	
v/s Ratio Prot	0.33	0.24		0.00	1.02							
v/s Ratio Perm	1.07			0.01		c2.17		0.01		0.59	0.61	
v/c Ratio	2.26	0.50		0.02	2.14	2.17		0.04		2.40	2.52	
Uniform Delay, d1	28.1	16.1		6.9	23.5	45.0		25.9		34.0	34.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	575.6	0.3		0.0	513.6	528.6		0.1		639.7	693.7	
Delay (s)	603.7	16.4		6.9	537.1	573.6		26.0		673.7	727.7	
Level of Service	F	B		A	F	F		C		F	F	
Approach Delay (s)		310.9			554.1			26.0			700.3	
Approach LOS		F			F			C			F	

Intersection Summary			
HCM Average Control Delay	537.9	HCM Level of Service	F
HCM Volume to Capacity ratio	2.17		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	182.0%	ICU Level of Service	H
Analysis Period (min)	15		

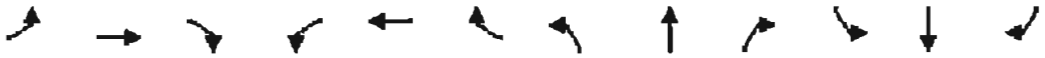
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	915	0	10	1447	499	2	1	20	517	1	43
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1670	3223		1670	3223	1473		1219		3239	1394	
Flt Permitted	0.11	1.00		0.20	1.00	1.00		0.97		1.00	1.00	
Satd. Flow (perm)	191	3223		354	3223	1473		1182		3409	1394	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	995	0	11	1573	542	2	1	22	562	1	47
RTOR Reduction (vph)	0	0	0	0	0	0	0	21	0	0	36	0
Lane Group Flow (vph)	36	995	0	11	1573	542	0	4	0	562	12	0
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	39.9	36.9		39.9	36.9	73.7		3.1		17.8	17.8	
Effective Green, g (s)	39.9	36.9		39.9	36.9	73.7		3.1		17.8	17.8	
Actuated g/C Ratio	0.54	0.50		0.54	0.50	1.00		0.04		0.24	0.24	
Clearance Time (s)	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	
Lane Grp Cap (vph)	164	1614		245	1614	1473		50		789	412	
v/s Ratio Prot	0.01	0.31		0.00	c0.49					c0.14	0.00	
v/s Ratio Perm	0.11			0.02		c0.37		0.00		0.03	0.01	
v/c Ratio	0.22	0.62		0.04	0.97	0.37		0.08		0.71	0.03	
Uniform Delay, d1	26.7	13.3		14.0	17.9	0.0		33.9		24.3	21.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.7		0.1	16.6	0.7		0.7		3.1	0.0	
Delay (s)	27.3	14.0		14.1	34.6	0.7		34.6		27.4	21.4	
Level of Service	C	B		B	C	A		C		C	C	
Approach Delay (s)		14.5			25.8			34.6			26.9	
Approach LOS		B			C			C			C	

Intersection Summary				
HCM Average Control Delay	23.0	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.79			
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	69.1%	ICU Level of Service	C	
Analysis Period (min)	15			

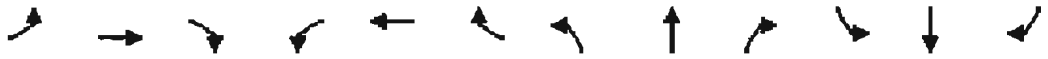
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	1380	0	10	3056	747	2	1	20	579	1	62
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1670	3223		1670	3223	1473		1219		3239	1392	
Flt Permitted	0.09	1.00		0.09	1.00	1.00		0.96		0.89	1.00	
Satd. Flow (perm)	151	3223		151	3223	1473		1179		3031	1392	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	1500	0	11	3322	812	2	1	22	629	1	67
RTOR Reduction (vph)	0	0	0	0	0	0	0	21	0	0	51	0
Lane Group Flow (vph)	36	1500	0	11	3322	812	0	4	0	629	17	0
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	49.6	46.5		49.6	46.5	85.6		4.5		20.0	20.0	
Effective Green, g (s)	49.6	46.5		49.6	46.5	85.6		4.5		20.0	20.0	
Actuated g/C Ratio	0.58	0.54		0.58	0.54	1.00		0.05		0.23	0.23	
Clearance Time (s)	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	
Lane Grp Cap (vph)	143	1751		143	1751	1473		62		746	390	
v/s Ratio Prot	0.01	0.47		0.00	c1.03					c0.15	0.00	
v/s Ratio Perm	0.14			0.04		c0.55		0.00		0.04	0.01	
v/c Ratio	0.25	0.86		0.08	1.90	0.55		0.07		0.84	0.04	
Uniform Delay, d1	36.7	16.7		23.6	19.5	0.0		38.6		30.2	25.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	0.9	4.4		0.2	405.9	1.5		0.5		8.6	0.0	
Delay (s)	37.7	21.1		23.8	425.5	1.5		39.0		38.8	25.4	
Level of Service	D	C		C	F	A		D		D	C	
Approach Delay (s)		21.5			341.3			39.0			37.5	
Approach LOS		C			F			D			D	

Intersection Summary			
HCM Average Control Delay	230.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.42		
Actuated Cycle Length (s)	85.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	115.5%	ICU Level of Service	H
Analysis Period (min)	15		

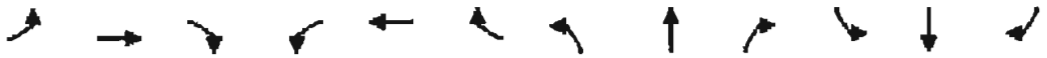
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	48	1189	0	11	1523	1217	2	1	22	1229	1	59
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1670	3223		1670	3223	1473		1218		3239	1392	
Flt Permitted	0.10	1.00		0.10	1.00	1.00		0.97		0.89	1.00	
Satd. Flow (perm)	183	3223		183	3223	1473		1181		3031	1392	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	1292	0	12	1655	1323	2	1	24	1336	1	64
RTOR Reduction (vph)	0	0	0	0	0	0	0	23	0	0	43	0
Lane Group Flow (vph)	52	1292	0	12	1655	1323	0	4	0	1336	22	0
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	41.6	38.4		41.6	38.4	86.3		4.5		28.7	28.7	
Effective Green, g (s)	41.6	38.4		41.6	38.4	86.3		4.5		28.7	28.7	
Actuated g/C Ratio	0.48	0.44		0.48	0.44	1.00		0.05		0.33	0.33	
Clearance Time (s)	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	
Lane Grp Cap (vph)	143	1434		143	1434	1473		62		1066	527	
v/s Ratio Prot	0.01	0.40		0.00	c0.51					c0.35	0.00	
v/s Ratio Perm	0.16			0.04		c0.90		0.00		0.07	0.01	
v/c Ratio	0.36	0.90		0.08	1.15	0.90		0.07		1.25	0.04	
Uniform Delay, d1	37.4	22.2		28.9	23.9	0.0		38.9		27.7	19.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.6	8.1		0.3	77.7	9.0		0.5		121.8	0.0	
Delay (s)	38.9	30.3		29.1	101.7	9.0		39.4		149.5	19.5	
Level of Service	D	C		C	F	A		D		F	B	
Approach Delay (s)		30.6			60.4			39.4			143.4	
Approach LOS		C			E			D			F	

Intersection Summary				
HCM Average Control Delay	73.5	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.13			
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	8.0	
Intersection Capacity Utilization	93.6%	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												
Volume (vph)	48	1592	0	11	2884	1465	2	1	22	1291	1	78
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1000	1550	1000	1775	1650	1000
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		1.00		0.97	1.00	
Frt	1.00	1.00		1.00	1.00	0.85		0.88		1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00		0.95	1.00	
Satd. Flow (prot)	1670	3223		1670	3223	1473		1218		3239	1391	
Flt Permitted	0.09	1.00		0.09	1.00	1.00		0.96		0.89	1.00	
Satd. Flow (perm)	166	3223		166	3223	1473		1178		3031	1391	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	1730	0	12	3135	1592	2	1	24	1403	1	85
RTOR Reduction (vph)	0	0	0	0	0	0	0	23	0	0	61	0
Lane Group Flow (vph)	52	1730	0	12	3135	1592	0	4	0	1403	25	0
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	Perm			pm+pt		
Protected Phases	1	2		1	2			3		4	3	
Permitted Phases	2		Free	2		Free	3			3	4	
Actuated Green, G (s)	45.6	42.4		45.6	42.4	86.3		4.5		24.7	24.7	
Effective Green, g (s)	45.6	42.4		45.6	42.4	86.3		4.5		24.7	24.7	
Actuated g/C Ratio	0.53	0.49		0.53	0.49	1.00		0.05		0.29	0.29	
Clearance Time (s)	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	
Lane Grp Cap (vph)	143	1583		143	1583	1473		61		916	463	
v/s Ratio Prot	0.01	0.54		0.00	c0.97					c0.36	0.00	
v/s Ratio Perm	0.18			0.04		c1.08		0.00		0.08	0.02	
v/c Ratio	0.36	1.09		0.08	1.98	1.08		0.07		1.53	0.05	
Uniform Delay, d1	37.4	21.9		36.5	21.9	43.1		38.9		29.6	22.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2	1.6	52.4		0.3	443.5	48.6		0.5		244.8	0.0	
Delay (s)	38.9	74.4		36.8	465.4	91.7		39.4		274.4	22.4	
Level of Service	D	E		D	F	F		D		F	C	
Approach Delay (s)		73.4			338.8			39.4			259.8	
Approach LOS		E			F			D			F	

Intersection Summary			
HCM Average Control Delay	264.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.68		
Actuated Cycle Length (s)	86.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	132.5%	ICU Level of Service	H
Analysis Period (min)	15		

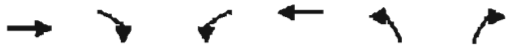
c Critical Lane Group

APPENDIX F

SYNCHRO TRAFFIC FORECASTS
PTH 1W (PTH 1) / CAMP MANITOU ROAD INTERSECTION

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	530	38	123	675	33	122
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2981		1506	3223	1506	1328
Flt Permitted	1.00		0.40	1.00	0.95	1.00
Satd. Flow (perm)	2981		629	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	576	41	134	734	36	133
RTOR Reduction (vph)	6	0	0	0	0	116
Lane Group Flow (vph)	611	0	134	734	36	17
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	17.7		22.9	22.9	5.1	5.1
Effective Green, g (s)	17.7		22.9	22.9	5.1	5.1
Actuated g/C Ratio	0.44		0.57	0.57	0.13	0.13
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)	1319		474	2167	192	169
v/s Ratio Prot			0.04	c0.15	c0.02	
v/s Ratio Perm	c0.21		0.13	0.08		0.01
v/c Ratio	0.46		0.28	0.34	0.19	0.10
Uniform Delay, d1	7.8		4.0	4.5	15.6	15.4
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3		0.3	0.1	0.5	0.3
Delay (s)	8.1		4.4	4.6	16.1	15.7
Level of Service	A		A	A	B	B
Approach Delay (s)	8.1			4.6	15.8	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	812	42	108	880	23	108
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2989		1506	3223	1506	1328
Flt Permitted	1.00		0.26	1.00	0.95	1.00
Satd. Flow (perm)	2989		404	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	883	46	117	957	25	117
RTOR Reduction (vph)	4	0	0	0	0	104
Lane Group Flow (vph)	925	0	117	957	25	13
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	24.4		29.3	29.3	5.0	5.0
Effective Green, g (s)	24.4		29.3	29.3	5.0	5.0
Actuated g/C Ratio	0.53		0.63	0.63	0.11	0.11
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)	1575		372	2318	163	143
v/s Ratio Prot			0.03	c0.22	c0.02	
v/s Ratio Perm	c0.31		0.17	0.08		0.01
v/c Ratio	0.59		0.31	0.41	0.15	0.09
Uniform Delay, d1	7.5		3.6	4.2	18.7	18.6
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6		0.5	0.1	0.4	0.3
Delay (s)	8.1		4.1	4.3	19.2	18.9
Level of Service	A		A	A	B	B
Approach Delay (s)	8.1			4.3	18.9	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	46.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	609	32	81	660	17	81
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2988		1506	3223	1506	1328
Flt Permitted	1.00		0.37	1.00	0.95	1.00
Satd. Flow (perm)	2988		592	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	662	35	88	717	18	88
RTOR Reduction (vph)	4	0	0	0	0	81
Lane Group Flow (vph)	693	0	88	717	18	7
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	18.5		21.5	21.5	3.1	3.1
Effective Green, g (s)	18.5		21.5	21.5	3.1	3.1
Actuated g/C Ratio	0.51		0.59	0.59	0.08	0.08
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)	1510		423	2246	128	112
v/s Ratio Prot			0.02	c0.16	c0.01	
v/s Ratio Perm	c0.23		0.11	0.06		0.01
v/c Ratio	0.46		0.21	0.32	0.14	0.07
Uniform Delay, d1	5.8		3.3	3.8	15.5	15.4
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2		0.2	0.1	0.5	0.3
Delay (s)	6.0		3.6	3.9	16.0	15.7
Level of Service	A		A	A	B	B
Approach Delay (s)	6.0			3.9	15.7	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	5.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	36.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	590	42	137	751	37	136
Ideal Flow (vphpl)	1775	1775	1000	1775	1900	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2981		848	3011	1612	1328
Flt Permitted	1.00		0.35	1.00	0.95	1.00
Satd. Flow (perm)	2981		312	3011	1612	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	641	46	149	816	40	148
RTOR Reduction (vph)	5	0	0	0	0	130
Lane Group Flow (vph)	682	0	149	816	40	18
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	21.4		28.7	28.7	5.5	5.5
Effective Green, g (s)	21.4		28.7	28.7	5.5	5.5
Actuated g/C Ratio	0.46		0.62	0.62	0.12	0.12
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)	1381		279	2131	192	158
v/s Ratio Prot			c0.08	0.18	c0.02	
v/s Ratio Perm	0.23		c0.25	0.09		0.01
v/c Ratio	0.49		0.53	0.38	0.21	0.11
Uniform Delay, d1	8.6		4.1	4.3	18.4	18.2
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3		2.0	0.1	0.5	0.3
Delay (s)	8.9		6.1	4.5	18.9	18.5
Level of Service	A		A	A	B	B
Approach Delay (s)	8.9			4.7	18.6	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	46.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	904	47	120	980	26	120
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2989		1506	3223	1506	1328
Flt Permitted	1.00		0.22	1.00	0.95	1.00
Satd. Flow (perm)	2989		354	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	983	51	130	1065	28	130
RTOR Reduction (vph)	4	0	0	0	0	117
Lane Group Flow (vph)	1030	0	130	1065	28	13
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	29.9		35.1	35.1	5.4	5.4
Effective Green, g (s)	29.9		35.1	35.1	5.4	5.4
Actuated g/C Ratio	0.57		0.67	0.67	0.10	0.10
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)	1702		351	2400	155	137
v/s Ratio Prot			0.04	c0.25	c0.02	
v/s Ratio Perm	c0.34		0.21	0.08		0.01
v/c Ratio	0.61		0.37	0.44	0.18	0.10
Uniform Delay, d1	7.4		3.6	4.1	21.5	21.3
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6		0.7	0.1	0.6	0.3
Delay (s)	8.0		4.3	4.2	22.1	21.7
Level of Service	A		A	A	C	C
Approach Delay (s)	8.0			4.2	21.7	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	52.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

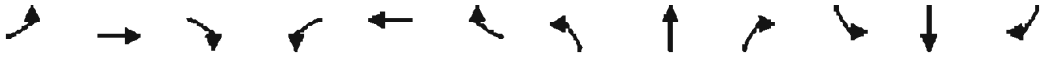
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	678	36	90	735	19	90
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2988		1506	3223	1506	1328
Flt Permitted	1.00		0.32	1.00	0.95	1.00
Satd. Flow (perm)	2988		500	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	737	39	98	799	21	98
RTOR Reduction (vph)	4	0	0	0	0	87
Lane Group Flow (vph)	772	0	98	799	21	11
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	19.4		24.1	24.1	4.7	4.7
Effective Green, g (s)	19.4		24.1	24.1	4.7	4.7
Actuated g/C Ratio	0.48		0.59	0.59	0.12	0.12
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)	1421		411	2220	173	153
v/s Ratio Prot			0.03	c0.17	c0.01	
v/s Ratio Perm	c0.26		0.11	0.08		0.01
v/c Ratio	0.54		0.24	0.36	0.12	0.07
Uniform Delay, d1	7.6		3.7	4.3	16.2	16.1
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4		0.3	0.1	0.3	0.2
Delay (s)	8.0		4.0	4.4	16.5	16.3
Level of Service	A		A	A	B	B
Approach Delay (s)	8.0			4.4	16.3	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	40.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.0%	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												
Volume (vph)	50	531	38	123	676	25	33	5	122	40	5	16
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.96	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1265		1586	1493	1473
Flt Permitted	0.22	1.00	1.00	0.31	1.00	1.00	0.74	1.00		0.71	0.76	1.00
Satd. Flow (perm)	395	3223	1473	538	3223	1473	1174	1265		1193	1179	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	577	41	134	735	27	36	5	133	43	5	17
RTOR Reduction (vph)	0	0	0	0	0	0	0	121	0	0	0	0
Lane Group Flow (vph)	54	577	41	134	735	27	36	17	0	24	24	17
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	D.P+P		Free	pm+pt			pm+pt		Free
Protected Phases	2!	1		2	2!		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	39.2	17.8	63.5	39.2	21.4	63.5	8.3	5.6		8.3	8.3	63.5
Effective Green, g (s)	39.2	17.8	63.5	39.2	21.4	63.5	8.3	5.6		8.3	8.3	63.5
Actuated g/C Ratio	0.62	0.28	1.00	0.62	0.34	1.00	0.13	0.09		0.13	0.13	1.00
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)	739	903	1473	714	1086	1473	168	112		173	167	1473
v/s Ratio Prot	0.02	c0.18		0.06	c0.23		c0.01	0.01		0.01	0.01	
v/s Ratio Perm	0.02		0.03	0.05		0.02	c0.02			0.01	0.01	0.01
v/c Ratio	0.07	0.64	0.03	0.19	0.68	0.02	0.21	0.15		0.14	0.14	0.01
Uniform Delay, d1	11.8	20.0	0.0	8.4	18.1	0.0	24.8	26.7		25.1	24.5	0.0
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	0.0	1.5	0.0	0.1	1.7	0.0	0.6	0.6		0.4	0.4	0.0
Delay (s)	11.8	21.5	0.0	8.5	19.8	0.0	25.4	27.4		25.5	24.8	0.0
Level of Service	B	C	A	A	B	A	C	C		C	C	A
Approach Delay (s)		19.4			17.5			27.0			18.6	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	63.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	46	814	42	108	881	662	23	5	108	75	5	28
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.96	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1266		1586	1486	1473
Flt Permitted	0.24	1.00	1.00	0.27	1.00	1.00	0.73	1.00		0.68	0.67	1.00
Satd. Flow (perm)	422	3223	1473	474	3223	1473	1152	1266		1133	1034	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	885	46	117	958	720	25	5	117	82	5	30
RTOR Reduction (vph)	0	0	10	0	0	0	0	102	0	0	0	0
Lane Group Flow (vph)	50	885	36	117	958	720	25	20	0	43	44	30
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Perm	pm+pt		Free	Perm			Perm		Free
Protected Phases	1	2		1	2			3			3	
Permitted Phases	2		2	2		Free	3			3		Free
Actuated Green, G (s)	29.6	24.7	24.7	29.6	24.7	47.5	5.9	5.9		5.9	5.9	47.5
Effective Green, g (s)	29.6	24.7	24.7	29.6	24.7	47.5	5.9	5.9		5.9	5.9	47.5
Actuated g/C Ratio	0.62	0.52	0.52	0.62	0.52	1.00	0.12	0.12		0.12	0.12	1.00
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)	412	1676	766	419	1676	1473	143	157		141	128	1473
v/s Ratio Prot	0.01	0.27		0.03	c0.30			0.02				
v/s Ratio Perm	0.06		0.02	0.15		c0.49	0.02			0.04	0.04	0.02
v/c Ratio	0.12	0.53	0.05	0.28	0.57	0.49	0.17	0.12		0.30	0.34	0.02
Uniform Delay, d1	3.7	7.5	5.6	3.8	7.8	0.0	18.6	18.5		18.9	19.0	0.0
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	0.1	0.3	0.0	0.4	0.5	1.2	0.6	0.4		1.2	1.6	0.0
Delay (s)	3.9	7.8	5.6	4.2	8.3	1.2	19.2	18.9		20.2	20.6	0.0
Level of Service	A	A	A	A	A	A	B	B		C	C	A
Approach Delay (s)		7.5			5.1			18.9			15.2	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	47.5	Sum of lost time (s)	4.0
Intersection Capacity Utilization	48.1%	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												
Volume (vph)	60	612	32	81	662	34	17	4	81	735	4	29
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1267		1586	1479	1473
Flt Permitted	0.21	1.00	1.00	0.25	1.00	1.00	0.30	1.00		0.70	0.66	1.00
Satd. Flow (perm)	369	3223	1473	431	3223	1473	480	1267		1164	1027	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	665	35	88	720	37	18	4	88	799	4	32
RTOR Reduction (vph)	0	0	0	0	0	0	0	62	0	0	0	0
Lane Group Flow (vph)	65	665	35	88	720	37	18	30	0	399	404	32
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	2	1		2	1		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	26.6	22.2	74.2	26.6	22.2	74.2	31.6	22.3		31.6	31.6	74.2
Effective Green, g (s)	26.6	22.2	74.2	26.6	22.2	74.2	31.6	22.3		31.6	31.6	74.2
Actuated g/C Ratio	0.36	0.30	1.00	0.36	0.30	1.00	0.43	0.30		0.43	0.43	1.00
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)	221	964	1473	228	964	1473	333	381		549	494	1473
v/s Ratio Prot	0.02	0.21		c0.02	c0.22		0.01	0.02		0.09	c0.10	
v/s Ratio Perm	0.09		0.02	0.12		0.03	0.02			0.22	c0.25	0.02
v/c Ratio	0.29	0.69	0.02	0.39	0.75	0.03	0.05	0.08		0.73	0.82	0.02
Uniform Delay, d1	24.7	23.0	0.0	24.3	23.5	0.0	18.5	18.6		18.6	18.8	0.0
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	0.7	2.1	0.0	1.1	3.2	0.0	0.1	0.1		4.8	10.1	0.0
Delay (s)	25.4	25.0	0.0	25.4	26.7	0.0	18.5	18.7		23.4	28.9	0.0
Level of Service	C	C	A	C	C	A	B	B		C	C	A
Approach Delay (s)		23.9			25.4			18.7			25.2	
Approach LOS		C			C			B			C	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	74.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.1%	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												
Volume (vph)	113	595	42	137	753	61	37	5	136	68	5	29
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	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		0.95	0.96	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1264		1586	1487	1473
Flt Permitted	0.25	1.00	1.00	0.34	1.00	1.00	0.73	1.00		0.69	0.70	1.00
Satd. Flow (perm)	441	3223	1473	605	3223	1473	1156	1264		1151	1089	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	123	647	46	149	818	66	40	5	148	74	5	32
RTOR Reduction (vph)	0	0	0	0	0	0	0	132	0	0	0	0
Lane Group Flow (vph)	123	647	46	149	818	66	40	21	0	39	40	32
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	2	1		2	1		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	28.9	22.0	53.5	28.9	22.0	53.5	8.6	5.8		8.6	8.6	53.5
Effective Green, g (s)	28.9	22.0	53.5	28.9	22.0	53.5	8.6	5.8		8.6	8.6	53.5
Actuated g/C Ratio	0.54	0.41	1.00	0.54	0.41	1.00	0.16	0.11		0.16	0.16	1.00
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)	422	1325	1473	464	1325	1473	204	137		208	196	1473
v/s Ratio Prot	0.04	0.20		c0.04	c0.25		0.01	0.02		0.01	c0.01	
v/s Ratio Perm	0.12		0.03	0.13		0.04	0.02			0.02	c0.02	0.02
v/c Ratio	0.29	0.49	0.03	0.32	0.62	0.04	0.20	0.15		0.19	0.20	0.02
Uniform Delay, d1	10.9	11.6	0.0	9.2	12.4	0.0	19.5	21.6		19.8	19.5	0.0
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	0.4	0.3	0.0	0.4	0.9	0.1	0.5	0.5		0.4	0.5	0.0
Delay (s)	11.3	11.9	0.0	9.6	13.3	0.1	20.0	22.1		20.3	20.0	0.0
Level of Service	B	B	A	A	B	A	B	C		C	B	A
Approach Delay (s)		11.1			11.9			21.7			14.3	
Approach LOS		B			B			C			B	

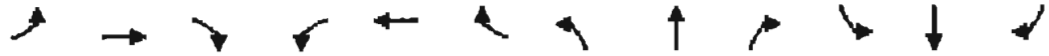
Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	53.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	169	913	47	120	990	97	26	5	120	254	5	112
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1265		1586	1481	1473
Flt Permitted	0.13	1.00	1.00	0.17	1.00	1.00	0.60	1.00		0.60	0.57	1.00
Satd. Flow (perm)	237	3223	1473	292	3223	1473	947	1265		993	879	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	184	992	51	130	1076	105	28	5	130	276	5	122
RTOR Reduction (vph)	0	0	0	0	0	0	0	112	0	0	0	0
Lane Group Flow (vph)	184	992	51	130	1076	105	28	23	0	141	140	122
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	2	1		2	1		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	40.4	31.6	74.2	40.4	31.6	74.2	17.8	10.4		17.8	17.8	74.2
Effective Green, g (s)	40.4	31.6	74.2	40.4	31.6	74.2	17.8	10.4		17.8	17.8	74.2
Actuated g/C Ratio	0.54	0.43	1.00	0.54	0.43	1.00	0.24	0.14		0.24	0.24	1.00
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)	322	1373	1473	322	1373	1473	283	177		297	271	1473
v/s Ratio Prot	c0.07	0.31		0.05	c0.33		0.01	0.02		0.05	c0.05	
v/s Ratio Perm	0.24		0.03	0.17		0.07	0.01			0.07	c0.07	0.08
v/c Ratio	0.57	0.72	0.03	0.40	0.78	0.07	0.10	0.13		0.47	0.52	0.08
Uniform Delay, d1	22.3	17.7	0.0	20.2	18.4	0.0	22.8	27.9		25.6	24.5	0.0
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	2.4	1.9	0.0	0.8	3.0	0.1	0.2	0.3		1.2	1.7	0.1
Delay (s)	24.8	19.6	0.0	21.0	21.4	0.1	23.0	28.3		26.8	26.1	0.1
Level of Service	C	B	A	C	C	A	C	C		C	C	A
Approach Delay (s)		19.5			19.6			27.4			18.5	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	74.2	Sum of lost time (s)	16.0
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												
Volume (vph)	272	693	36	90	749	158	19	4	90	307	4	139
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1266		1586	1480	1473
Flt Permitted	0.20	1.00	1.00	0.23	1.00	1.00	0.53	1.00		0.69	0.66	1.00
Satd. Flow (perm)	344	3223	1473	402	3223	1473	837	1266		1154	1021	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	296	753	39	98	814	172	21	4	98	334	4	151
RTOR Reduction (vph)	0	0	0	0	0	0	0	84	0	0	0	0
Lane Group Flow (vph)	296	753	39	98	814	172	21	18	0	170	168	151
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	2	1		2	1		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	37.1	24.4	70.9	37.1	24.4	70.9	17.8	9.8		17.8	17.8	70.9
Effective Green, g (s)	37.1	24.4	70.9	37.1	24.4	70.9	17.8	9.8		17.8	17.8	70.9
Actuated g/C Ratio	0.52	0.34	1.00	0.52	0.34	1.00	0.25	0.14		0.25	0.25	1.00
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)	452	1109	1473	437	1109	1473	286	175		338	308	1473
v/s Ratio Prot	c0.12	0.23		0.04	c0.25		0.01	0.01		0.06	c0.06	
v/s Ratio Perm	0.23		0.03	0.08		0.12	0.01			0.07	c0.08	0.10
v/c Ratio	0.65	0.68	0.03	0.22	0.73	0.12	0.07	0.10		0.50	0.55	0.10
Uniform Delay, d1	19.5	19.9	0.0	15.3	20.4	0.0	21.7	26.7		23.3	23.0	0.0
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	3.4	1.7	0.0	0.3	2.6	0.2	0.1	0.3		1.2	2.0	0.1
Delay (s)	22.9	21.6	0.0	15.6	23.0	0.2	21.8	26.9		24.5	25.0	0.1
Level of Service	C	C	A	B	C	A	C	C		C	C	A
Approach Delay (s)		21.2			18.7			26.1			17.2	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	19.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	70.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	825	32	81	684	17	81
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	0.99		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	2994		1506	3223	1506	1328
Flt Permitted	1.00		0.25	1.00	0.95	1.00
Satd. Flow (perm)	2994		401	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	897	35	88	743	18	88
RTOR Reduction (vph)	3	0	0	0	0	79
Lane Group Flow (vph)	929	0	88	743	18	9
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	23.1		27.7	27.7	4.8	4.8
Effective Green, g (s)	23.1		27.7	27.7	4.8	4.8
Actuated g/C Ratio	0.52		0.62	0.62	0.11	0.11
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)	1554		364	2296	162	143
v/s Ratio Prot			0.03	c0.17	c0.01	
v/s Ratio Perm	c0.31		0.13	0.06		0.01
v/c Ratio	0.60		0.24	0.32	0.11	0.07
Uniform Delay, d1	7.5		3.6	4.0	17.9	17.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6		0.3	0.1	0.3	0.2
Delay (s)	8.1		3.9	4.1	18.2	18.0
Level of Service	A		A	A	B	B
Approach Delay (s)	8.1			4.0	18.1	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1271	32	81	734	17	81
Ideal Flow (vphpl)	1775	1000	1775	1900	1775	1750
Total Lost time (s)	4.0		4.0	4.0	4.0	4.0
Lane Util. Factor	*0.95		1.00	*0.95	1.00	1.00
Frt	1.00		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3000		1506	3223	1506	1328
Flt Permitted	1.00		0.13	1.00	0.95	1.00
Satd. Flow (perm)	3000		208	3223	1506	1328
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1382	35	88	798	18	88
RTOR Reduction (vph)	1	0	0	0	0	81
Lane Group Flow (vph)	1416	0	88	798	18	7
Turn Type			pm+pt			Perm
Protected Phases			1	2	3	
Permitted Phases	2		2	1		3
Actuated Green, G (s)	37.6		42.4	42.4	5.0	5.0
Effective Green, g (s)	37.6		42.4	42.4	5.0	5.0
Actuated g/C Ratio	0.63		0.71	0.71	0.08	0.08
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)	1899		253	2518	127	112
v/s Ratio Prot			0.03	c0.20	c0.01	
v/s Ratio Perm	c0.47		0.22	0.05		0.01
v/c Ratio	0.75		0.35	0.32	0.14	0.07
Uniform Delay, d1	7.6		4.1	3.1	25.2	25.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6		0.8	0.1	0.5	0.3
Delay (s)	9.2		5.0	3.2	25.7	25.3
Level of Service	A		A	A	C	C
Approach Delay (s)	9.2			3.4	25.4	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	59.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.8%	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												
Volume (vph)	276	612	32	81	671	814	17	4	81	298	4	44
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1267		1586	1480	1473
Flt Permitted	0.24	1.00	1.00	0.28	1.00	1.00	0.57	1.00		0.70	0.66	1.00
Satd. Flow (perm)	415	3223	1473	484	3223	1473	897	1267		1164	1032	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	300	665	35	88	729	885	18	4	88	324	4	48
RTOR Reduction (vph)	0	0	0	0	0	0	0	75	0	0	0	0
Lane Group Flow (vph)	300	665	35	88	729	885	18	17	0	165	163	48
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	1	2		1	2		4	3		4	3	
Permitted Phases	2		Free	2		Free	3			3		Free
Actuated Green, G (s)	34.6	22.6	68.2	34.6	22.6	68.2	17.6	10.4		17.6	17.6	68.2
Effective Green, g (s)	34.6	22.6	68.2	34.6	22.6	68.2	17.6	10.4		17.6	17.6	68.2
Actuated g/C Ratio	0.51	0.33	1.00	0.51	0.33	1.00	0.26	0.15		0.26	0.26	1.00
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)	465	1068	1473	454	1068	1473	296	193		345	314	1473
v/s Ratio Prot	0.11	0.21		0.03	0.23		0.01	0.01		0.05	0.05	
v/s Ratio Perm	0.21		0.02	0.06		c0.60	0.01			0.07	0.08	0.03
v/c Ratio	0.65	0.62	0.02	0.19	0.68	0.60	0.06	0.09		0.48	0.52	0.03
Uniform Delay, d1	10.8	19.2	0.0	9.1	19.7	0.0	20.1	24.8		21.9	21.7	0.0
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	3.1	1.1	0.0	0.2	1.8	1.8	0.1	0.2		1.0	1.5	0.0
Delay (s)	13.9	20.3	0.0	9.4	21.5	1.8	20.2	25.0		22.9	23.1	0.0
Level of Service	B	C	A	A	C	A	C	C		C	C	A
Approach Delay (s)		17.7			10.6			24.2			20.1	
Approach LOS		B			B			C			C	

Intersection Summary				
HCM Average Control Delay	14.4	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.60			
Actuated Cycle Length (s)	68.2	Sum of lost time (s)	0.0	
Intersection Capacity Utilization	61.2%	ICU Level of Service	B	
Analysis Period (min)	15			

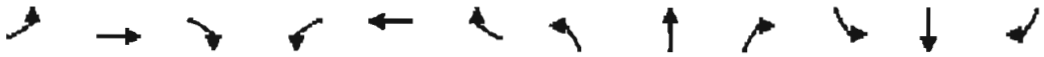
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	722	612	32	81	690	2423	17	4	81	763	4	75
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1000
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1267		1586	1479	842
Flt Permitted	0.17	1.00	1.00	0.17	1.00	1.00	0.36	1.00		0.66	0.63	1.00
Satd. Flow (perm)	306	3223	1473	306	3223	1473	576	1267		1109	977	842
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	785	665	35	88	750	2634	18	4	88	829	4	82
RTOR Reduction (vph)	0	0	0	0	0	0	0	78	0	0	0	0
Lane Group Flow (vph)	785	665	35	88	750	2634	18	14	0	414	419	82
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	1	2		1	2		4	3		4	3	
Permitted Phases	2		Free	2		Free	3			3		Free
Actuated Green, G (s)	52.0	23.0	95.0	52.0	23.0	95.0	27.0	11.0		27.0	27.0	95.0
Effective Green, g (s)	52.0	23.0	95.0	52.0	23.0	95.0	27.0	11.0		27.0	27.0	95.0
Actuated g/C Ratio	0.55	0.24	1.00	0.55	0.24	1.00	0.28	0.12		0.28	0.28	1.00
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)	643	780	1473	584	780	1473	320	147		396	362	842
v/s Ratio Prot	0.37	0.21		0.05	0.23		0.01	0.01		0.18	0.19	
v/s Ratio Perm	0.30		0.02	0.04		c1.79	0.01			0.12	0.13	0.10
v/c Ratio	1.22	0.85	0.02	0.15	0.96	1.79	0.06	0.10		1.05	1.16	0.10
Uniform Delay, d1	26.0	34.4	0.0	11.3	35.6	47.5	29.9	37.6		32.6	34.0	0.0
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	113.0	8.9	0.0	0.1	23.1	357.4	0.1	0.3		57.6	97.4	0.2
Delay (s)	139.0	43.3	0.0	11.5	58.7	404.9	30.0	37.8		90.2	131.4	0.2
Level of Service	F	D	A	B	E	F	C	D		F	F	A
Approach Delay (s)		92.9			320.2			36.6			101.0	
Approach LOS		F			F			D			F	

Intersection Summary				
HCM Average Control Delay	225.0	HCM Level of Service	F	
HCM Volume to Capacity ratio	1.79			
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	0.0	
Intersection Capacity Utilization	103.0%	ICU Level of Service	G	
Analysis Period (min)	15			

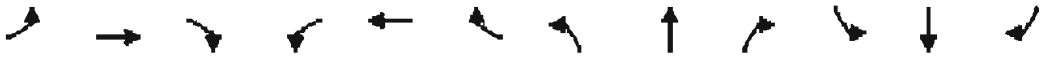
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	488	693	36	90	758	818	19	4	90	502	4	154
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1266		1586	1479	1473
Flt Permitted	0.17	1.00	1.00	0.17	1.00	1.00	0.44	1.00		0.65	0.62	1.00
Satd. Flow (perm)	290	3223	1473	295	3223	1473	697	1266		1085	957	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	530	753	39	98	824	889	21	4	98	546	4	167
RTOR Reduction (vph)	0	0	0	0	0	0	0	87	0	0	0	0
Lane Group Flow (vph)	530	753	39	98	824	889	21	15	0	273	277	167
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	2	1		2	1		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	47.1	24.2	84.7	47.1	24.2	84.7	21.6	9.1		21.6	21.6	84.7
Effective Green, g (s)	47.1	24.2	84.7	47.1	24.2	84.7	21.6	9.1		21.6	21.6	84.7
Actuated g/C Ratio	0.56	0.29	1.00	0.56	0.29	1.00	0.26	0.11		0.26	0.26	1.00
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)	587	921	1473	536	921	1473	297	136		351	321	1473
v/s Ratio Prot	c0.24	0.23		0.05	0.26		0.01	0.01		0.11	c0.13	
v/s Ratio Perm	c0.26		0.03	0.05		c0.60	0.01			0.08	0.09	0.11
v/c Ratio	0.90	0.82	0.03	0.18	0.89	0.60	0.07	0.11		0.78	0.86	0.11
Uniform Delay, d1	24.8	28.2	0.0	17.9	29.0	0.0	27.8	34.1		28.8	30.1	0.0
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	17.2	5.7	0.0	0.2	11.1	1.8	0.1	0.3		10.4	20.5	0.2
Delay (s)	42.0	33.9	0.0	18.1	40.1	1.8	27.9	34.5		39.1	50.7	0.2
Level of Service	D	C	A	B	D	A	C	C		D	D	A
Approach Delay (s)		36.2			20.1			33.4			34.5	
Approach LOS		D			C			C			C	

Intersection Summary				
HCM Average Control Delay	28.5	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.84			
Actuated Cycle Length (s)	84.7	Sum of lost time (s)	12.0	
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												
Volume (vph)	934	693	36	90	758	2179	19	4	90	905	4	185
Ideal Flow (vphpl)	1775	1900	1750	1775	1900	1750	1775	1650	1000	1775	1650	1750
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		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		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	0.95	1.00
Satd. Flow (prot)	1863	3223	1473	1670	3223	1473	1506	1266		1586	1479	1473
Flt Permitted	0.21	1.00	1.00	0.21	1.00	1.00	0.44	1.00		0.62	0.59	1.00
Satd. Flow (perm)	370	3223	1473	370	3223	1473	704	1266		1043	918	1473
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1015	753	39	98	824	2368	21	4	98	984	4	201
RTOR Reduction (vph)	0	0	0	0	0	0	0	88	0	0	0	0
Lane Group Flow (vph)	1015	753	39	98	824	2368	21	14	0	492	496	201
Heavy Vehicles (%)	1%	12%	1%	1%	12%	1%	12%	1%	12%	1%	1%	1%
Turn Type	pm+pt		Free	pm+pt		Free	pm+pt			pm+pt		Free
Protected Phases	2	1		2	1		4	3		4	3	
Permitted Phases	1		Free	1		Free	3			3		Free
Actuated Green, G (s)	49.0	19.0	90.0	49.0	19.0	90.0	25.0	9.0		25.0	25.0	90.0
Effective Green, g (s)	49.0	19.0	90.0	49.0	19.0	90.0	25.0	9.0		25.0	25.0	90.0
Actuated g/C Ratio	0.54	0.21	1.00	0.54	0.21	1.00	0.28	0.10		0.28	0.28	1.00
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)	699	680	1473	635	680	1473	338	127		386	355	1473
v/s Ratio Prot	0.48	0.23		0.05	0.26		0.01	0.01		0.23	0.25	
v/s Ratio Perm	0.31		0.03	0.03		c1.61	0.01			0.13	0.14	0.14
v/c Ratio	1.45	1.11	0.03	0.15	1.21	1.61	0.06	0.11		1.27	1.40	0.14
Uniform Delay, d1	27.0	35.5	0.0	18.5	35.5	45.0	27.6	36.9		31.5	32.5	0.0
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	211.4	67.8	0.0	0.1	108.6	276.6	0.1	0.4		142.4	195.1	0.2
Delay (s)	238.4	103.3	0.0	18.6	144.1	321.6	27.7	37.2		173.9	227.6	0.2
Level of Service	F	F	A	B	F	F	C	D		F	F	A
Approach Delay (s)		176.9			268.1			35.6			166.9	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM Average Control Delay	219.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	122.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX G

SYNCHRO TRAFFIC FORECASTS
PR 425 / CAMP MANITOU ROAD INTERSECTION



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	4	1	91	6	1	42
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	1	99	7	1	46
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						6
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			5		209	5
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			5		209	5
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			94		100	96
cM capacity (veh/h)			1553		709	1050

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	5	105	47
Volume Left	0	99	1
Volume Right	1	0	46
cSH	1700	1553	1075
Volume to Capacity	0.00	0.06	0.04
Queue Length 95th (m)	0.0	1.6	1.1
Control Delay (s)	0.0	7.0	8.6
Lane LOS		A	A
Approach Delay (s)	0.0	7.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	7.3		
Intersection Capacity Utilization	21.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	6	1	114	6	1	149
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	1	124	7	1	162
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						6
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			8		261	7
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			8		261	7
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			92		100	85
cM capacity (veh/h)			1550		650	1047

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	8	130	163
Volume Left	0	124	1
Volume Right	1	0	162
cSH	1700	1550	1054
Volume to Capacity	0.00	0.08	0.15
Queue Length 95th (m)	0.0	2.1	4.4
Control Delay (s)	0.0	7.2	9.1
Lane LOS		A	A
Approach Delay (s)	0.0	7.2	9.1
Approach LOS			A

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	6	1	171	4	1	173
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	1	186	4	1	188
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						6
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			8		383	7
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			8		383	7
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			88		100	82
cM capacity (veh/h)			1550		528	1047

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	8	190	189
Volume Left	0	186	1
Volume Right	1	0	188
cSH	1700	1550	1053
Volume to Capacity	0.00	0.12	0.18
Queue Length 95th (m)	0.0	3.3	5.2
Control Delay (s)	0.0	7.5	9.2
Lane LOS		A	A
Approach Delay (s)	0.0	7.5	9.2
Approach LOS			A

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	25.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	6	1	291	4	1	203
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	1	316	4	1	221
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						6
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			8		644	7
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			8		644	7
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			80		100	79
cM capacity (veh/h)			1550		336	1047

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	8	321	222
Volume Left	0	316	1
Volume Right	1	0	221
cSH	1700	1550	1052
Volume to Capacity	0.00	0.20	0.21
Queue Length 95th (m)	0.0	6.1	6.4
Control Delay (s)	0.0	7.8	9.4
Lane LOS		A	A
Approach Delay (s)	0.0	7.8	9.4
Approach LOS			A

Intersection Summary			
Average Delay	8.4		
Intersection Capacity Utilization	32.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	6	1	539	4	1	265
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	1	586	4	1	288
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						6
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			8		1183	7
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			8		1183	7
tC, single (s)			4.2		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			62		99	72
cM capacity (veh/h)			1550		124	1047

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	8	590	289
Volume Left	0	586	1
Volume Right	1	0	288
cSH	1700	1550	1051
Volume to Capacity	0.00	0.38	0.28
Queue Length 95th (m)	0.0	14.4	9.0
Control Delay (s)	0.0	8.7	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	8.7	9.8
Approach LOS			A

Intersection Summary			
Average Delay	9.0		
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		