



**TRAFFIC IMPACT ASSESSMENT FOR  
1501 DOUGLAS STREET  
DEVELOPMENT, VICTORIA BC**

*October 7, 2013*

*File: 1606*

*TRAFFIC IMPACT ASSESSMENT FOR 1501 DOUGLAS STREET  
DEVELOPMENT, VICTORIA, BC*

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# TRAFFIC IMPACT ASSESSMENT FOR 1501 DOUGLAS STREET DEVELOPMENT, VICTORIA, BC

## 1 INTRODUCTION

Boulevard Transportation Group Ltd was retained by *Jawl Properties Ltd.* to undertake a traffic impact assessment for the proposed development at 1501 Douglas Street in the City of Victoria. An analysis of post-development conditions was undertaken in order to provide a clear view of the impacts on the surrounding road network after full build-out and occupancy. The study considers two operational schemes on Cormorant Street (one-way eastbound and two-way operation), and identifies off-site improvements required. Study recommendations and conclusions are intended to provide safe and efficient movement of pedestrians, bicycles and vehicular traffic for the proposed development while minimizing the impact to non-site trips.

### 1.1 Study Area

The study area for this project is Douglas Street, Blanshard Street, Fisgard Street, Pandora Avenue and Cormorant Street. The proposed development is located between Douglas Street and Blanshard Street from Pandora Avenue to Cormorant Street. There are six intersections to be reviewed within the study area: four signalized intersections and two unsignalized. See **Figure 1** for study area and proposed development site.

## 2 EXISTING CONDITIONS

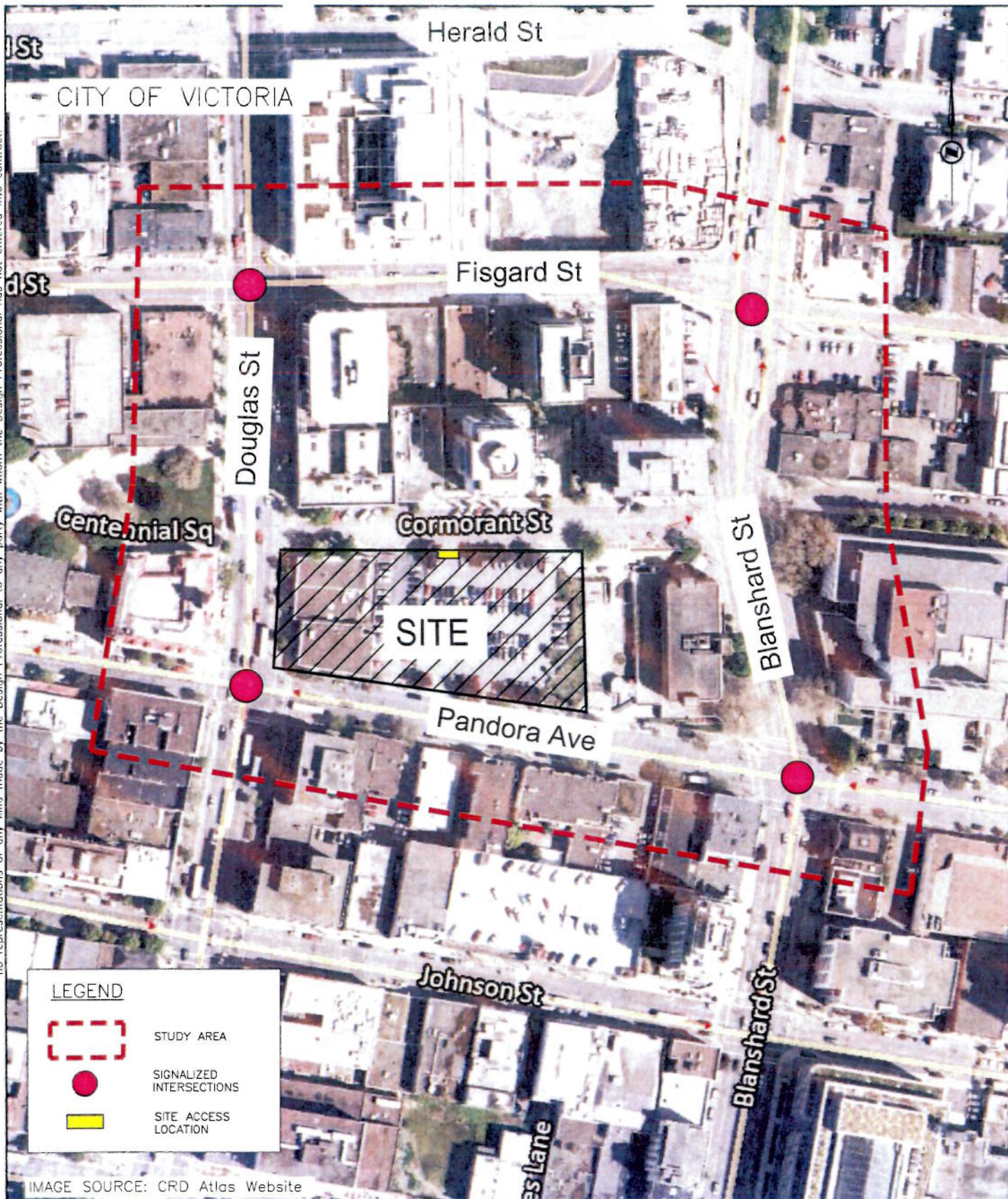
### 2.1 Road Network

Douglas Street is a four lane arterial road running north/south along the west frontage of the site and Blanshard Street is a six lane north/south arterial road to the east of the site. Fisgard Street runs west-east and forms two intersections with Douglas Street and Blanshard Street. Pandora Avenue is a westbound one-way three lane road (plus on-street parking on both sides of the street). The posted speed limit on these roads is 50km/h. The intersections of Fisgard Street/Blanshard Street, Pandora Avenue/Blanshard Street, Fisgard Street/Douglas Street and Pandora Avenue/Douglas Street are all signalized with co-ordinated signals.

Cormorant Street is one-way (eastbound) connecting Douglas Street to Blanshard Street and is the access road to the development. From Douglas Street onto Cormorant Street, there are no turn restrictions, and no turning lanes. At Cormorant Street/Blanshard Street, the eastbound movement is right-out only, with stop-controlled.



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**LEGEND**

- STUDY AREA
- SIGNALIZED INTERSECTIONS
- SITE ACCESS LOCATION

IMAGE SOURCE: CRD Atlas Website



TITLE: <b>FIGURE 1</b> STUDY AREA AND SITE LOCATION 1501 DOUGLAS STREET DEVELOPMENT		
DESIGNED:	DRAWN: MJ Oh	SCALE: NTS
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## 2.2 Traffic Data

Traffic data, signal timing, and Synchro models were obtained from the City of Victoria for the four signalized intersections in the study area, for the am and pm peak hours. The am and pm peak hours represent typical worst case recurring conditions of a weekday.

Manual traffic counts were undertaken at the intersections of Cormorant Street/Blanshard Street and Cormorant Street/Douglas Street on August 27th and 28th, 2013 (Tuesday and Wednesday), during the am and pm peak hours. The measured volumes were similar to the City's data; existing traffic volumes in the model were balanced based on the measured through volumes on Blanshard Street and Douglas Street. In discussions with the City of Victoria staff, it was confirmed that traffic volumes on the study area streets have been flat; therefore, no future background growth scenario was reviewed.

There is a high percentage of heavy vehicles on Douglas Street, with 13% during the am peak hour and 9% during the pm peak hour. Most (greater than 75% of total) of the heavy vehicles on Douglas Street were transit buses.

## 2.3 Traffic Analysis

Analysis of the current traffic conditions at the study area intersections was undertaken using Synchro software for the am and pm peak hours. Existing conditions provide a baseline with which to compare future post-development conditions. The am and pm peak hours were investigated as these time periods represent the typical recurring worst-case traffic conditions. The existing geometry and traffic control were used for the Synchro analysis. The Synchro results were also reviewed using the microsimulation portion of the software (SimTraffic).

Synchro software (Synchro 8) is used because of its ability to provide analysis using the Highway Capacity Manual methodology and a microsimulation of the traffic conditions. The software analysis uses measures of effectiveness to return the results of the analysis. These measures of effectiveness include level of service (LOS), delay and 95<sup>th</sup> percentile queue length. The delays and type of traffic control (signalized versus unsignalized) are used to determine the level of service. The level of services are broken down into six letter grades with LOS A being excellent operations and LOS F being unstable/failure operations. Level of service C is considered to be an acceptable LOS by most municipalities. In most urban areas, level of service D is also considered acceptable for signalized intersections in peak hours. See *Appendix A* for additional details.

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Existing traffic conditions were reviewed for the four signalized intersections and the two Cormorant Street intersections in the study area.

### 2.3.1 Existing AM Peak Hour Conditions

The collected data was used to determine the existing traffic conditions during the existing 2013 am peak hour. The four signalized intersections within the study area are currently operating at LOS C or better for all movements during the am peak hour. Cormorant Street (one-way) is operating at LOS A / LOS B for entering/exiting movements respectively during the am peak hour.

Tables 1 to 4 summarize a breakdown of each movement at the four signalized intersections in the am peak hour. See Figure 2 for existing 2013 am peak hour traffic conditions. See Appendix B for the Synchro reports.

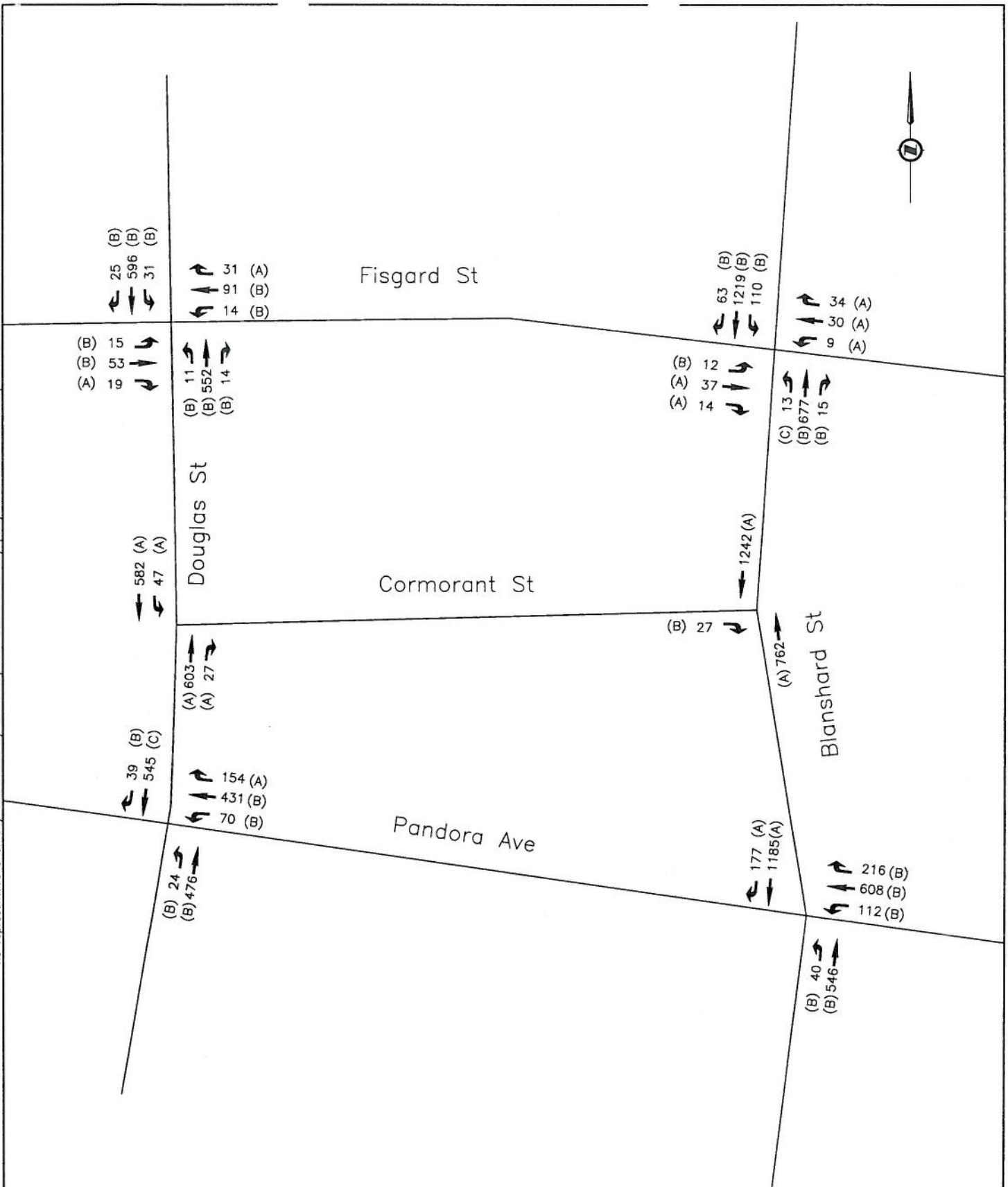
**Table 1: Existing AM Peak Hour Conditions at Fisgard St/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	B	10.2	50.4
Southbound	B	12.1	41.7
Eastbound left	B	14.4	4.8
thru	B	14.8	11.5
right	A	4.5	3.1
Westbound left	B	14.1	3.2
thru	B	14.0	14.9
right	A	5.9	1.7

**Table 2: Existing AM Peak Hour Conditions at Pandora Ave/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	B	17.1	39.3
Southbound thru	C	26.2	60.0
right	B	15.5	9.1
Westbound thru	B	11.0	31.0
right	A	3.6	8.5

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TITLE: <b>FIGURE 2</b>		
EXISTING 2013 AM TRAFFIC CONDITIONS 1501 DOUGLAS STREET DEVELOPMENT		
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**Table 3: Existing AM Peak Hour Conditions at Fisgard St/Blanshard St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left	C	25.5	5.3
thru/right	B	18.7	36.5
Southbound left	B	16.4	20.8
thru/right	B	13.6	54.7
Eastbound left	B	11.5	3.5
thru/right	A	9.5	9.5
Westbound	A	8.6	9.6

**Table 4: Existing AM Peak Hr Conditions at Pandora Ave/Blanshard St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left/thru	B	13.6	27.6
Southbound thru	A	4.8	10.5
right	A	3.6	3.9
Westbound left	B	12.8	18.8
Westbound thru/right	B	11.3	30.6

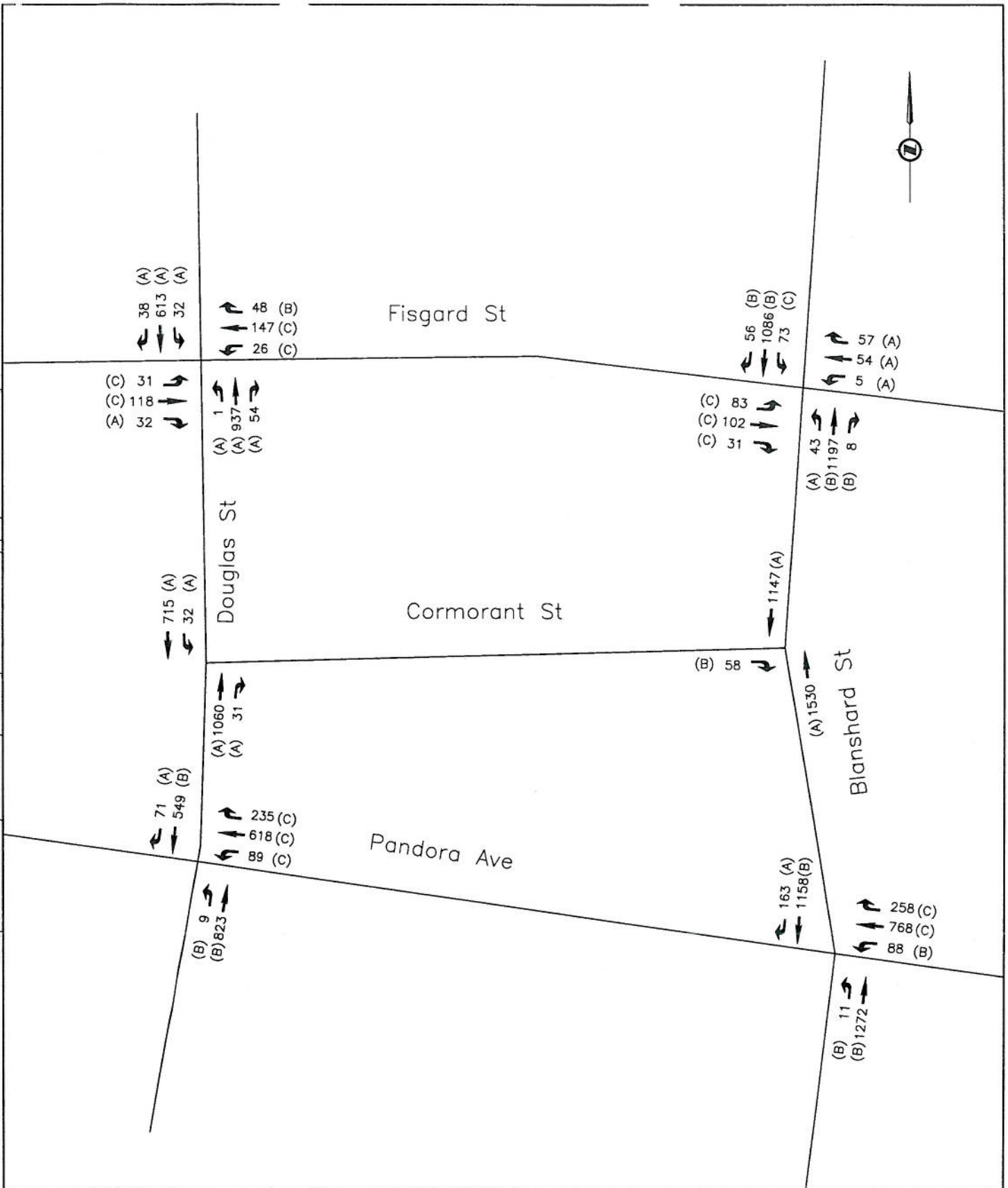
### 2.3.2 Existing PM Peak Hour Conditions

The four signalized intersections are currently operating at LOS C or better for all movements during the existing 2013 pm peak hour. Cormorant Street (one-way) is operating at LOS A / LOS B for entering/exiting movements respectively during the pm peak hour.

Tables 5 to 8 summarize a breakdown of each movement at the four signalized intersections in the pm peak hour. See **Figure 3** for existing 2013 pm peak hour traffic conditions. See *Appendix B* for the Synchro reports.



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TITLE: <b>FIGURE 3</b>		
EXISTING 2013 PM TRAFFIC CONDITIONS 1501 DOUGLAS STREET DEVELOPMENT		
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**Table 5: Existing PM Peak Hour Conditions at Fisgard St/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	A	5.0	23.3
Southbound	A	8.4	37.1
Eastbound left	C	23.4	10.6
thru	C	24.2	28.5
right	A	8.6	6.3
Westbound left	C	27.9	9.2
thru	C	30.4	40.7
right	B	12.7	6.8

**Table 6: Existing PM Peak Hour Conditions at Pandora Ave/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	B	17.4	68.3
Southbound thru	B	10.9	24.8
right	A	7.1	7.1
Westbound thru	C	22.7	76.0
right	C	20.6	54.2

**Table 7: Existing PM Peak Hour Conditions at Fisgard St/Blanshard St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left	A	9.4	7.3
thru/right	B	13.1	69.0
Southbound left	C	29.4	21.9
thru/right	B	19.4	63.2
Eastbound left	C	29.1	23.9
thru/right	C	26.4	30.1
Westbound	B	16.7	21.7



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**Table 8: Existing PM Peak Hr Conditions at Pandora Ave/Blanshard St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left/thru	B	12.8	65.4
Southbound thru	B	18.3	82.4
right	B	14.8	42.9
Westbound left	B	19.0	19.6
Westbound thru/right	C	24.2	60.0

### **3 POST DEVELOPMENT CONDITIONS**

#### **3.1 Land Use**

The proposed development is a mix of commercial and office land uses. The total gross floor area is 30,970 sq.ft for commercial and 255,630 sq.ft for office. The existing buildings and parking facility on the site will be completely replaced by the new development. The development will be two-phased, but the analysis is based on full build-out. For surrounding area of the site, land uses are commercial, multi-family residential (condominium) and institutional (government office buildings).

#### **3.2 Site Access**

There is one access proposed for the entire site, on Cormorant Street, so as to comply with Victoria's Access bylaw No. 91-38, provision #12. Cormorant Street (at Douglas St) is located 60m north of Pandora Avenue and 90m south of Fisgard Street. As Cormorant Street is currently one-way eastbound, the site traffic would be accessed from Douglas Street only and exit (right-out only) onto Blanshard Street from Cormorant Street. Traffic volumes on Cormorant Street are currently low with 40 to 60 vehicles during the peak hours. However, the proposed development will add a lot of new trips (in comparison to current volumes) on Cormorant Street in the future, which may result in a large amount of extra circulating traffic due to the one-way constraints. Therefore, a two-way option was also reviewed as an alternative operation, to assess operations and circulation conditions.

#### **3.3 Trip Generation**

The proposed development will be a significant trip generator, with a mix of commercial and office land uses. The Institute of Transportation Engineers (ITE) *Trip Generation Manual (8<sup>th</sup> Edition)* was used to estimate vehicle trips for the proposed land uses. For the ITE's trip rates shopping centre (ITE Code: 820) and general office building (ITE Code: 710) were used as a worst case estimate. The actual site trips would be influenced by the on-site parking capacity (230 stalls) and fee or permit structure (which

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would likely limit the number of vehicle based trips and instead encourage alternative modes); however, as a worst-case analysis the ITE trip generation approach was used. Based on the ITE rates, the proposed development will generate 295 new trips during am peak hour and 496 new trips during the pm. Tables 9 and 10 summarize trip generation for the development.

**Table 9: Weekday AM Trip Generation**

Code	Land Use	GFA	Trip Rate*	Total	Trips In	Trips Out
ITE 820	Shopping Centre	30,970 sq. ft	0.96/unit	29	18	11
ITE 710	General Office Building	255,630 sq. ft	1.56/unit	266	234	32
Total				295	252	43

\*Trip rates based on vehicle trips per unit: 1,000 sq. ft Gross Floor Area

**Table 10: Weekday PM Trip Generation**

Code	Land Use	GFA	Trip Rate*	Total	Trips In	Trips Out
ITE 820	Shopping Centre	30,970 sq. ft	3.71/unit	115	55	60
ITE 710	General Office Building	255,630 sq. ft	1.49/unit	381	65	316
Total				496	120	376

\*Trip rates based on vehicle trips per unit: 1,000 sq. ft Gross Floor Area

### 3.3.1 Existing Parking Lot Trips

There are three existing parking lots on-site, which are generally commuter-trip based stalls (i.e., commuters parking all day). In the future (post-development), the existing trips from these parking lots will be shifted (redistributed) to other parking lots (e.g. the Figgard Street Parkade). These trips were factored into the analysis. It was assumed that, in the peak hours (both am and pm), that the existing parking lots fill up (am) and empty out (pm) at a rate of one-third of all stalls per peak hour. (This represents the am from approximately 6-9am, and pm from 3-6pm.) There are 136 existing stalls, and therefore, the existing parking lot trips are estimated at 45 trips during the peak hours. These estimated existing parking lot trips (45 vehicles per hour) were be deducted from entering / exiting the lots via Cormorant Street and Pandora Avenue (assuming 50 percent using Cormorant St, and 50 percent using Pandora Avenue, as both streets have accesses to the lots). These existing parking lot trips were redistributed, with an assumption of 50 percent using the Figgard Parkade (using the intersection of Figgard Street and Douglas St) and 50 percent using other parking lots outside of the immediate boundary roadways.



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## **3.4 Trip Modifications**

Trip modification factors were applied to account for the effects of pass-by trips (for commercial trips) and internal trips (on-site, between the office and commercial land uses). There are two types of commercial trips: primary and pass by trips. Primary trips are new trips to the road network due to the new land use. Pass by trips are existing trips on the road network which divert into the site due to the new land use. For example, a motorist driving home from work will stop for groceries on their way home. Pass by trips are not added to the surrounding road network, but do enter and exit the site. Pass-by trips, for the proposed development, were determined using the ITE "Trip Generation Manual (9th Edition, Volume 1: User's Guide and Handbook)" which identified the pass-by trip rate for shopping centre at 34% on average during the pm peak hour. A 25% pass-by trip rate was applied for the analysis as a conservative estimation; overall pass-by trip rates for downtown areas are likely to be lower than in suburban areas. It is assumed that all pass-by trips occur along Douglas Street due to the access location.

There will also be internal trips, on-site, between the office building and commercial land uses. These internal trips can be made by walking on-site without using external streets. As a result, the total generation of vehicle trips entering and exiting the multi-use site will be reduced from a sum of the individual trips generated by each land use. The ITE manual contains methodology for estimating internal capture rates at multi-use sites. For the proposed development, the internal capture rate is estimated to be 14.5% of the total trip generation. Internal capture rates may vary by day of the week, but the internal capture rate (14.5%) was applied to only pm peak hour analysis. See *Appendix F* for the internal trips calculation chart. Internal trips are subtracted out before pass-by reductions are applied. There will be an estimated 20 pass-by trips (10 vehicles entering, 10 exiting) during the pm peak hour.

The number of external trips was estimated to be **424 vehicles during the pm peak hour** after the internal trip deduction (72 vehicles). The external trips are used for the ultimate development traffic. **Table 11** outlines internal trips and external trips for the pm peak hour trip generation.

**Table 11: Internal & External Trips during PM Peak Hour**

	Commercial			Office			Total		
	IN	OUT	Total	IN	OUT	Total	IN	OUT	Total
Trips Generated	55	60	115	65	316	381	120	376	496
Internal Trips	17	19	36	19	17	36	36	36	72
External Trips	38	41	79	46	299	345	84	340	424

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### **3.5 Trip Assignment**

Trip assignment was based on the existing population distribution of the Greater Victoria area and the directional percentage split of vehicles at adjacent intersections. It was assumed that, with respect to the larger CRD area, 80% of the office trips are to/from the north and east via either Blanshard Street, Douglas Street, or Pandora Avenue, and 20% of the trips are to/from the west (Vic West / Esquimalt / West Shore) and south (Downtown Victoria / James Bay / Oak Bay).

Trip assignment for commercial trips would be slightly different from the office trips, due to differences in time-of-day demand as well as because office / commuter trips typically attract from a larger catchment area than do ground level commercial land uses. The directional percentage split for commercial trips is as follows: 50% of the trips are to/from the north and east, 30% of the trips are to/from the south, and 20% of the trips are to/from the west.

Trips were then assigned to the surrounding roadway network. Due to left turns being prohibited to/from Cormorant Street at Blanshard Street, trips out to the east (from the site) were assigned to the north first using Douglas Street (same as trips out to the north) while trips-in from the east were assigned to arrive via Pandora Avenue. See Figures 4 and 5 for the development trip assignment.

### **3.6 Post Development: Cormorant Street One-way Option**

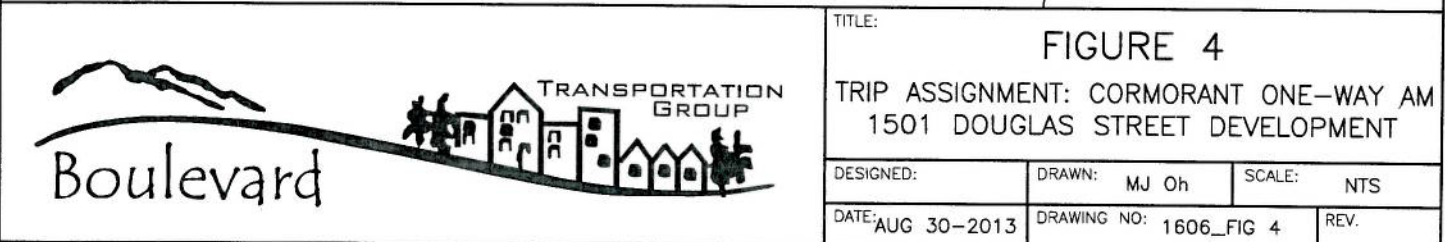
New trips were added to existing traffic volumes and analyzed using Synchro software for the post development 2013 am/pm peak hour traffic conditions. The analysis is based on the current one-way travel for Cormorant Street.

#### **3.6.1 Post Development AM Peak Hour Conditions – One-way**

With the development, the four signalized intersections will continue to operate at a LOS C or better during the am peak hour. The development will not impact the intersections operation during the am peak hour. The additional delays will be minor with less than a couple of seconds for all left and through movements at the four signalized intersections during the am peak hour. Cormorant Street (entering/exiting movements from Douglas/to Blanshard) will continue to operate at a LOS A/B respectively during the am peak hour. See Figure 6 for the post development am peak hour traffic conditions at the six intersections studied. Tables 12 to 15 summarize the post development am peak hour traffic conditions at the four signalized intersections.



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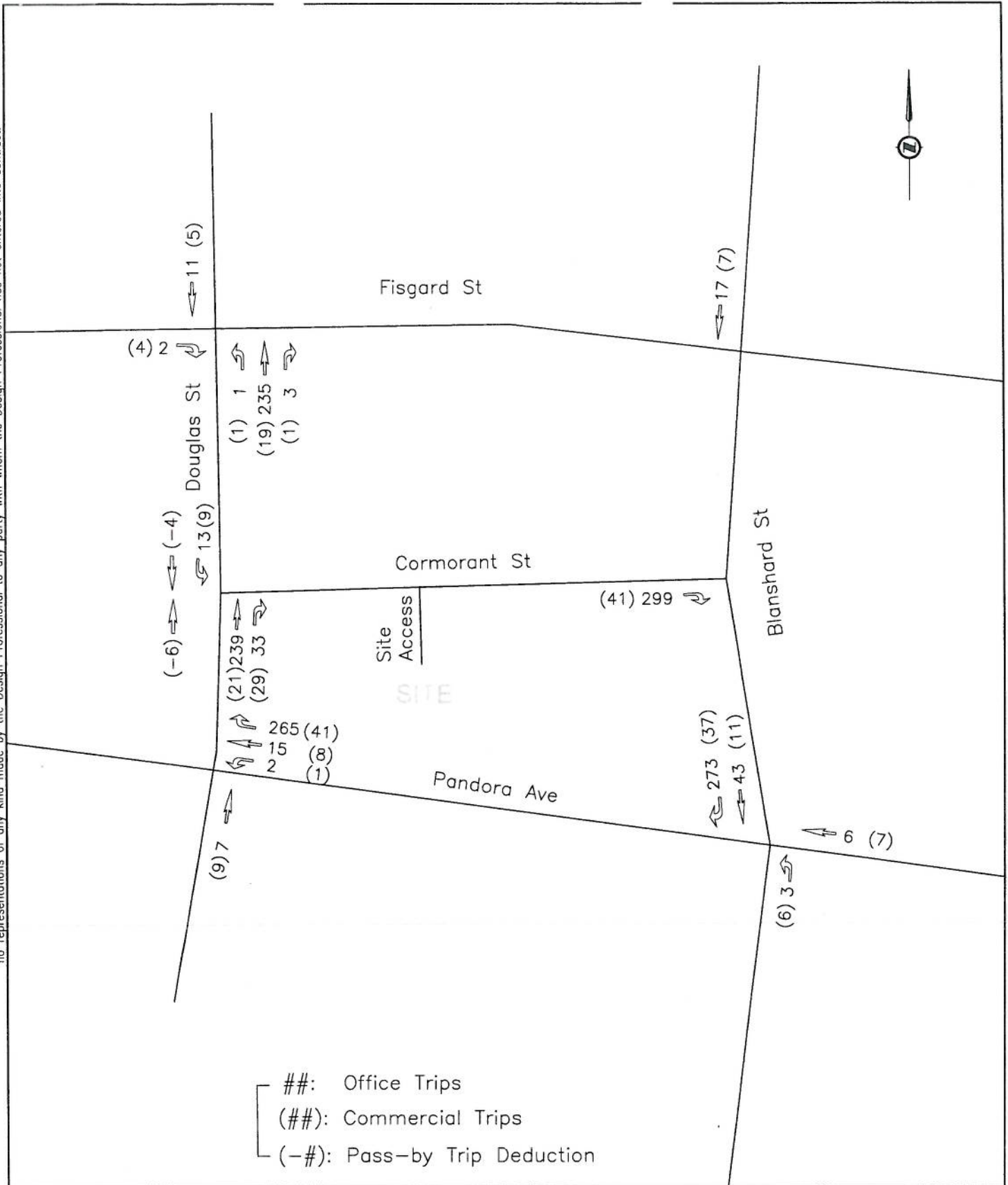


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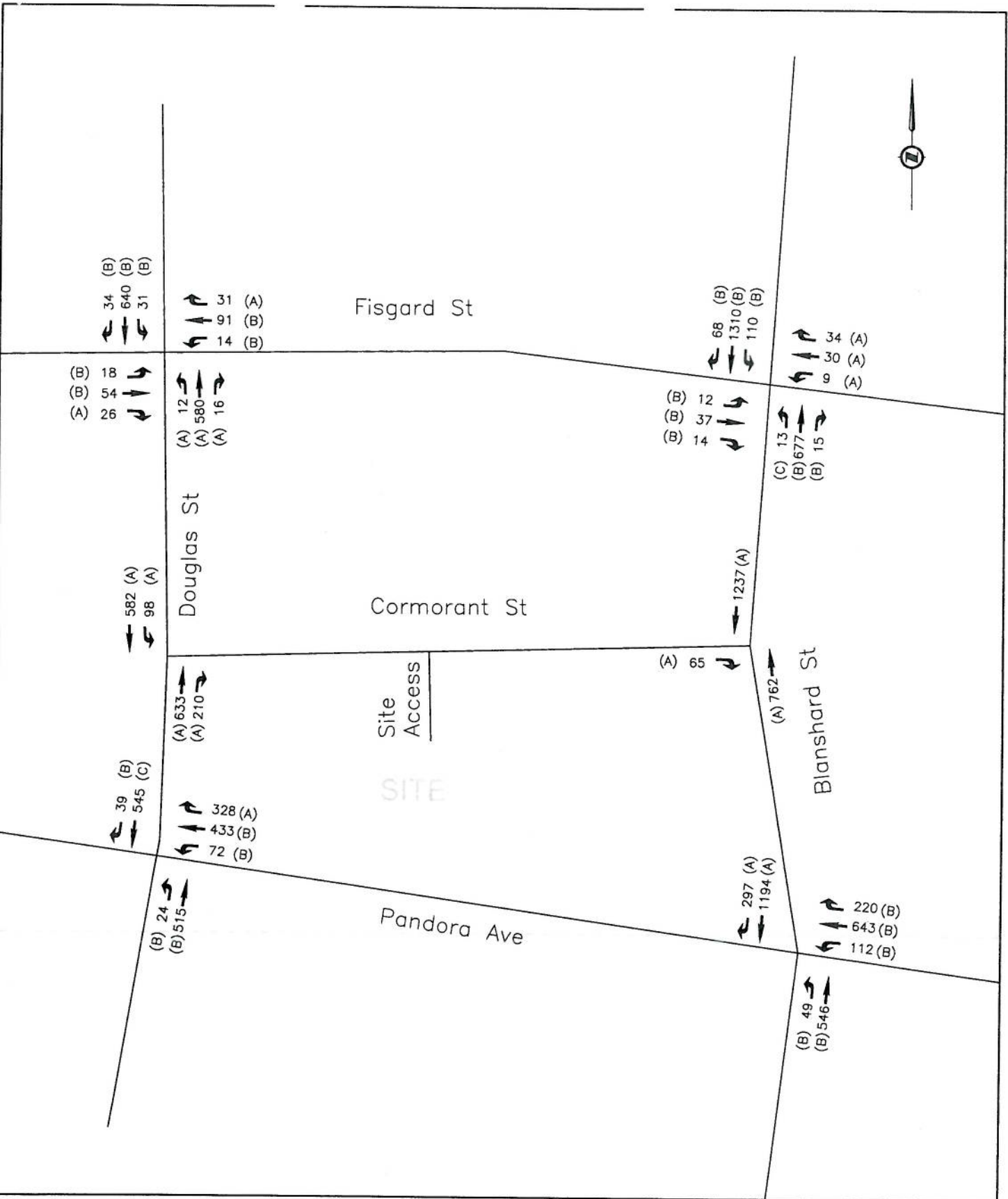
- ##: Office Trips
- (##): Commercial Trips
- (-#): Pass-by Trip Deduction



TITLE: <b>FIGURE 5</b>		
TRIP ASSIGNMENT: CORMORANT ONE-WAY PM 1501 DOUGLAS STREET DEVELOPMENT		
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**TITLE:** **FIGURE 6**  
**POST DEVELOPMENT AM CONDITIONS**  
**ONE-WAY CORMORANT OPTION**

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**Table 12: Post Development AM Conditions at Fisgard St/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	A	9.9	47.2
Southbound	B	12.6	45.9
Eastbound left	B	14.5	5.6
thru	B	14.8	11.7
right	A	5.8	4.2
Westbound left	B	14.6	3.0
thru	B	14.6	14.4
right	A	6.2	1.8

**Table 13: Post Development AM Conditions at Pandora Ave/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	B	17.5	42.7
Southbound thru	C	26.0	60.2
right	B	15.3	8.4
Westbound thru	B	10.5	29.6
right	A	7.9	30.8

**Table 14: Post Development AM Conditions at Fisgard St/Blanshard St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left	C	23.8	4.9
thru/right	B	18.7	36.3
Southbound left	B	16.4	20.8
thru/right	B	14.2	60.3
Eastbound left	B	11.8	3.4
thru/right	B	10.5	10.2
Westbound	A	8.6	9.6



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**Table 15: Post Development AM Conditions at Pandora/Blanshard**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left/thru	B	13.8	28.3
Southbound thru	A	5.1	11.5
right	A	7.4	7.8
Westbound left	B	12.8	18.8
Westbound thru/right	B	11.7	32.8

**3.6.2 Post Development PM Peak Hour Conditions – One-way**

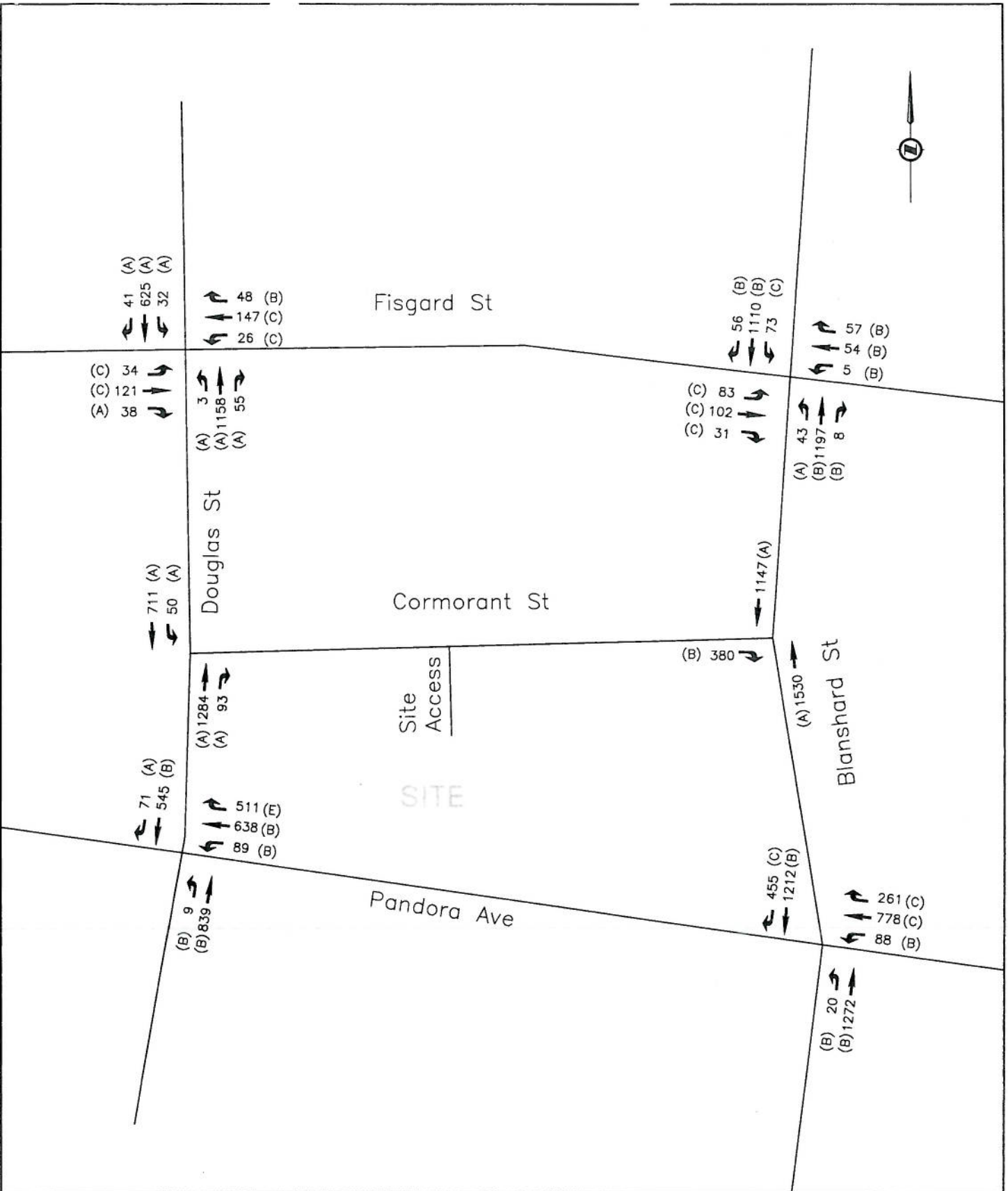
With the development, the four signalized intersections will continue to operate at a LOS C or better for all movements except the westbound right movement at Pandora Avenue/Douglas Street, where the westbound right movement will drop to a LOS E with a long 95<sup>th</sup> percentile queue length (154m) due to the increased turning volumes. Also, queuing may be an issue at the intersection of Pandora Avenue/Blanshard Street; the southbound right queue length may exceed (block) Cormorant Street although the movement itself will remain at a LOS C.

On Cormorant Street the eastbound exiting movement (right-out) onto Blanshard Street will operate at a LOS B during the pm peak hour with the development and the entering movement (from Douglas Street) will continue to operate at a LOS A. See Figure 7 for the post development pm peak hour traffic conditions at the six intersections studied. Tables 16 to 19 summarize the post development pm peak hour traffic conditions at the four signalized intersections.

**Table 16: Post Development PM Conditions at Fisgard St/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	A	9.1	49.8
Southbound	A	8.6	38.6
Eastbound left	C	23.4	11.4
thru	C	24.3	29.2
right	A	8.2	6.9
Westbound left	C	27.9	9.2
thru	C	30.4	40.7
right	B	15.1	7.6

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TITLE: <b>FIGURE 7</b>		
POST DEVELOPMENT PM CONDITIONS ONE-WAY CORMORANT OPTION		
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**Table 17: Post Development PM Conditions at Pandora Ave/Douglas St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound	B	17.6	70.0
Southbound thru	B	10.9	24.7
right	A	7.0	7.1
Westbound thru	B	19.2	69.0
right	E	78.9	153.8

**Table 18: Post Development PM Conditions at Fisgard St/Blanshard St**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left	A	8.9	6.8
thru/right	B	12.9	69.1
Southbound left	C	29.4	21.9
thru/right	B	19.6	65.0
Eastbound left	C	29.5	23.5
thru/right	C	27.0	30.6
Westbound	B	16.7	21.7

**Table 19: Post Development PM Conditions at Pandora/Blanshard**

Movement	LOS	Delay (Sec)	95 <sup>th</sup> Queue (m)
Northbound left/thru	B	13.2	66.8
Southbound thru	B	17.2	81.0
right	C	27.1	108.1
Westbound left	B	18.9	19.6
Westbound thru/right	C	24.3	60.9

### **3.7 Post Development Conditions: Cormorant Street Two-way**

This option is based on a two-way operation for Cormorant Street (between Douglas Street and Blanshard St). With this option, the traffic heading to the north from the site can make right turns directly from Cormorant Street onto Douglas Street north instead of detouring via Blanshard Street and Pandora Avenue. Therefore, the two signalized intersections of Pandora Avenue/Blanshard Street and Pandora Avenue/Douglas Street will be impacted less by the development traffic with this option than the Cormorant one-way option.

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To obtain 2013 background traffic volumes for the Cormorant two-way option, 2013 traffic volumes on Cormorant Street were reassigned based on the trip distribution of Fisgard Street. The intersection of Cormorant Street/Douglas Street was taken to be full movement, while the intersection of Cormorant Street/Blanshard Street as right-in / right-out. Based on this configuration, the site trips were assigned to the surrounding roadway network with the same directional percentage splits of vehicles (see Section 3.5). See **Figures 8 and 9** for the trip assignment Cormorant two-way option.

### **3.7.1 Post Development AM Peak Hour Conditions – Two-way**

The background 2013 am and pm peak hour traffic volumes were entered into Synchro to determine future traffic conditions with the development. During the am peak hour, the Cormorant two-way option will have better operations than the one-way option; all intersections (four signalized and two unsignalized intersections) will be at a LOS C or better with the development. At the intersection of Cormorant Street/Douglas Street with a full movement, the westbound right turn movement will operate at LOS B and at Cormorant Street/Blanshard Street, the eastbound right turn movement will operate at LOS A. No mitigation would be required for post development am peak hour conditions. See **Figure 10** for the post development am peak hour conditions with the Cormorant two-way option.

### **3.7.2 Post Development PM Peak Hour Conditions – Two-way**

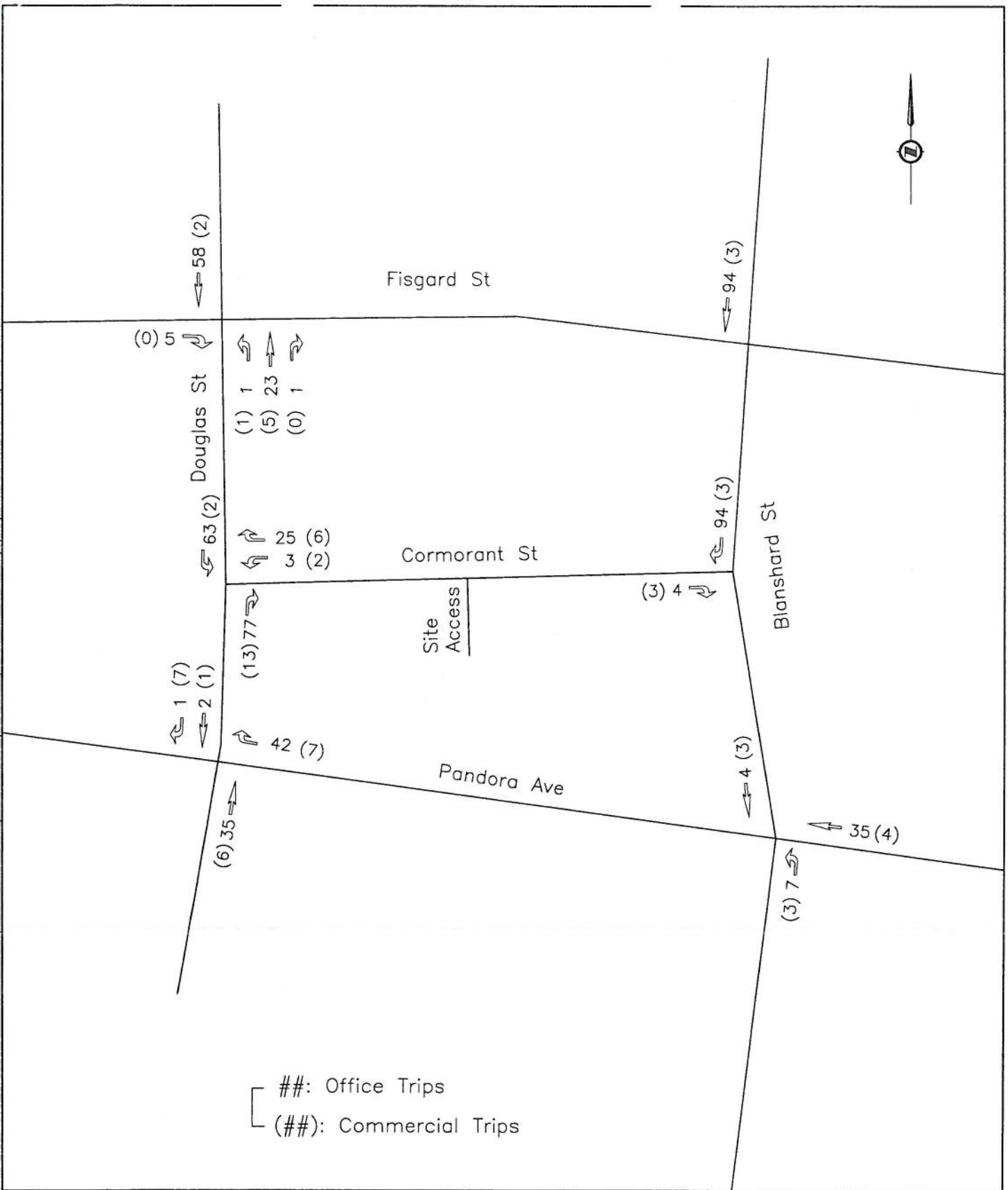
During the pm peak hour, the Cormorant two-way option will improve traffic conditions at the four signalized intersections; all movements will be at a LOS C or better without queuing issues. At Pandora Avenue/Douglas Street, the westbound right 95<sup>th</sup> queue length will reduce to 55.4m compared with the Cormorant one-way option (154m). However, at the intersection of Cormorant Street/Douglas Street with a full movement (stop control), the westbound movement will be operating at a LOS F during the pm peak hour, due to westbound left turning vehicles that have difficulty finding acceptable gaps (and blocking right-turning vehicles). See **Figure 11** for the post development pm peak hour conditions with the Cormorant two-way option.

To improve the conditions at Cormorant Street/Douglas Street, the intersection could either be right-out only or signalized.

At Cormorant Street/Douglas Street with stop control, the westbound movement (exiting) will operate at a LOS C with a right-out only during the pm peak hour. The left turn trips (from Cormorant to Douglas) would be shifted to Blanshard Street and Pandora Avenue. The two signalized intersections of Pandora Avenue/Blanshard Street and Pandora Avenue/Douglas Street will continue to operate at a LOS C or

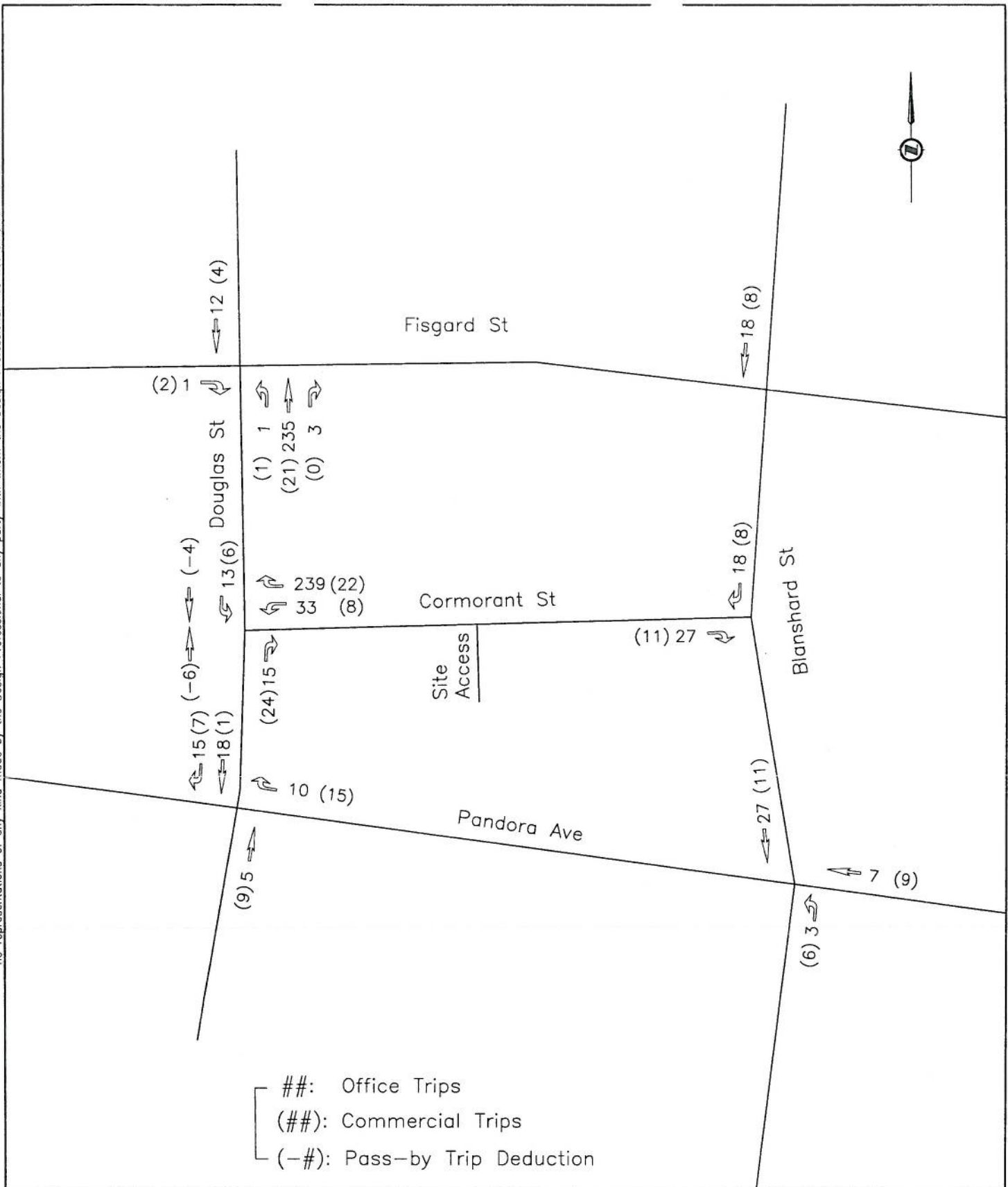


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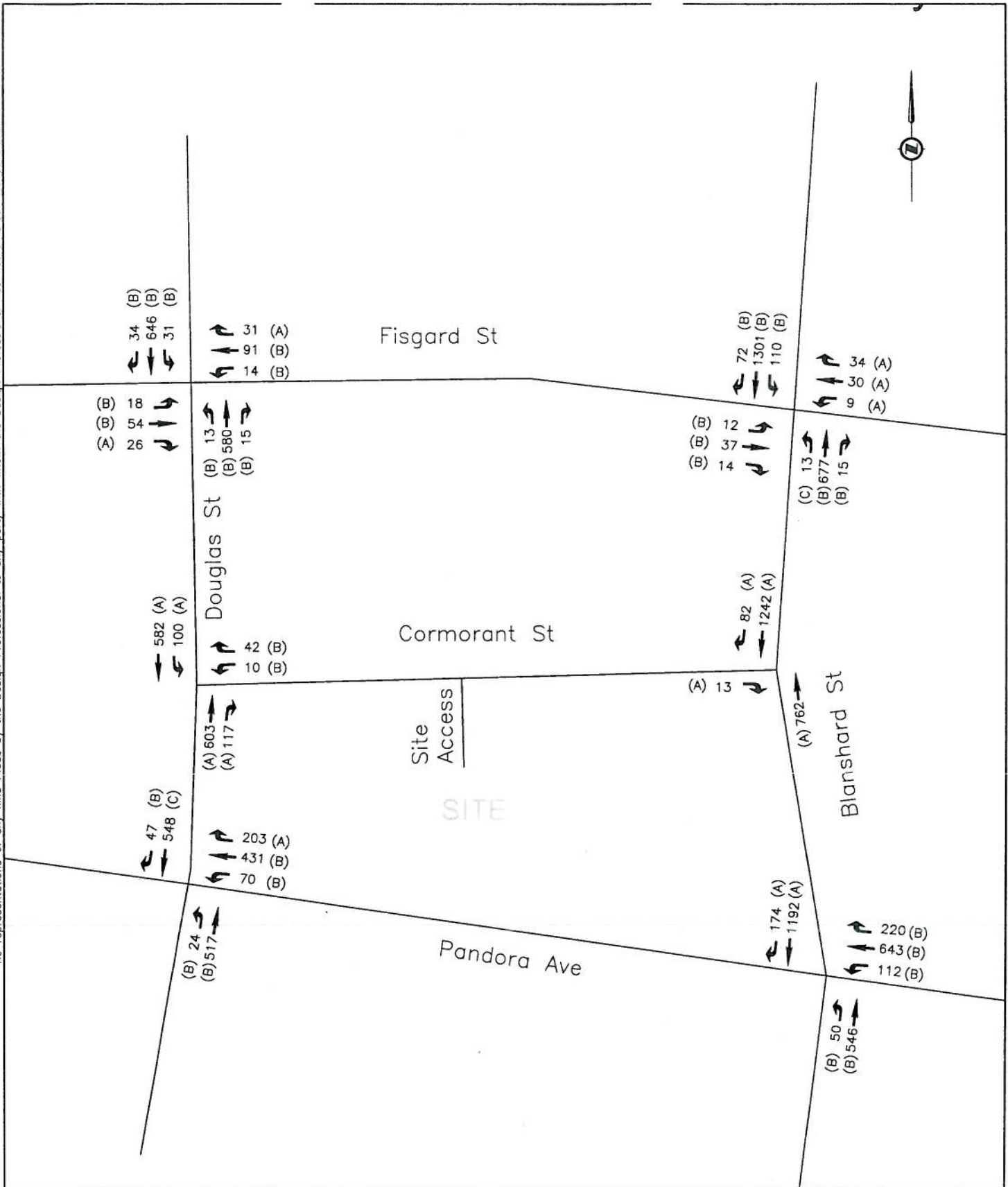
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DESIGNED:	DRAWN: MJ Oh	SCALE: NTS
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TITLE: <b>FIGURE 9</b>		
TRIP ASSIGNMENT: CORMORANT TWO-WAY PM 1501 DOUGLAS STREET DEVELOPMENT		
DESIGNED:	DRAWN: MJ Oh	SCALE: NTS
DATE: AUG 30-2013	DRAWING NO: 1606_FIG 9	REV.

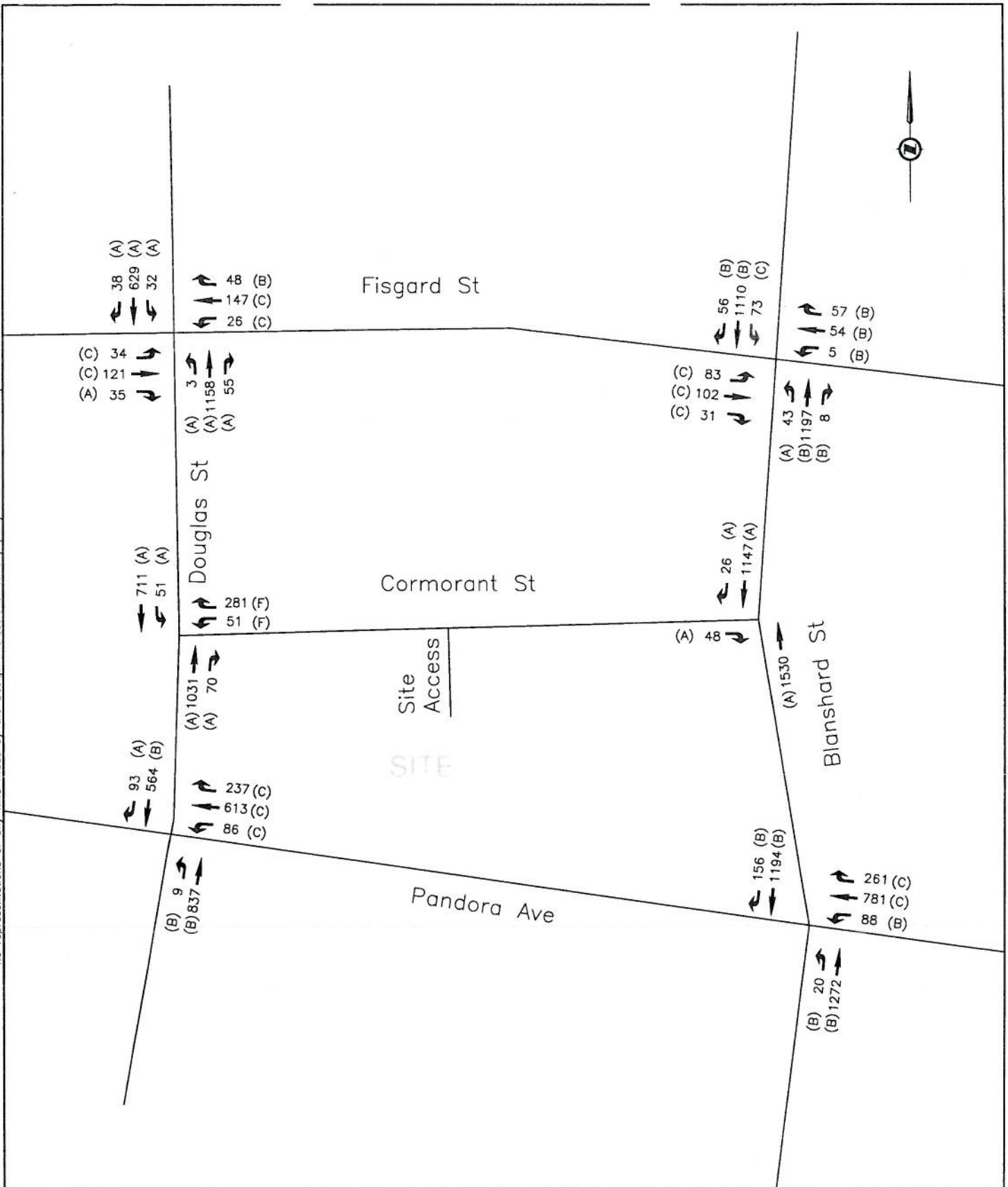
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TITLE: <b>FIGURE 10</b>		
POST DEVELOPMENT AM CONDITIONS CORMORANT STREET TWO-WAY OPTION		
DESIGNED:	DRAWN: MJ Oh	SCALE: NTS
DATE: OCT 2-2013	DRAWING NO: 1606_FIG 10	REV.



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TITLE: <b>FIGURE 11</b> POST DEVELOPMENT PM CONDITIONS CORMORANT STREET TWO-WAY OPTION		
DESIGNED:	DRAWN: MJ Oh	SCALE: NTS
DATE: OCT 2-2013	DRAWING NO: 1606_FIG 11	REV.

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better with the shifted trips during the pm peak hour and all other intersections in the study area will operate at a LOS C or better with this option (stop control with a right-out only). Therefore, signalization would not be required for the intersection of Cormorant Street/Douglas Street with a right-out only for the exiting to Douglas Street. With a signal, the intersection will be operating at a LOS C or better for all movements during the post development am and pm peak hour with co-ordinated signal phasing. Note also that signalization would require relocating the bus stops on the west side of Douglas St at Cormorant St.

### 4 NETWORK COMPARISON OF OPTIONS

The previous analysis of one-way and two-way operations investigated traffic capacity at each intersection. It is also important to examine the total impacts on the area roadway network, to assess circulation impacts in terms of travel distance, travel time, and emissions.

#### 4.1 Network Performance Assessment

Four options were reviewed for the network performance assessment: (1) Cormorant one-way, (2) two-way with stop control and a full movement at Douglas, (3) two-way with a full movement in and a right out only at Douglas, (4) two-way with signalization of Cormorant Street/Douglas Street.

The network performance simulations were undertaken for the pm peak hour, since this is the worst case / busiest time of day. **Table 20** summarizes SimTraffic results (travel distance, travel time and CO2 emissions) of network performance for each option during the pm peak hour.

**Table 20: Network Performance Summary – Post Development PM Peak**

	Cormorant One-way	Two-way (full movement, stop control)	Two-way (full movement in/right-out only)	Two-way (signal)
Travel Distance (km)	2317	2631	2620	2624
Travel Time (hr)	424.5	149.5	150.6	146.6
CO2 Emissions (kg/hr)	1284	792	792	785

Based on the SimTraffic analysis, the one-way option has the greatest travel time and emissions, resulting from the extra circulation required but also due to the added delay at certain intersections (e.g. at Pandora Avenue at Douglas Street). All of the two-way options are similar to each other in terms of

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travel distance, time, and emissions. Note, however, that the two-way full-movement stop-controlled option would not work from an operational perspective due to a failing level of service (LOS F) for the left turn exiting movement, and that the signal option would have impacts on transit and generally be a greater level of traffic control than is necessary to accommodate expected conditions. The full movement in and right-out only option is therefore preferable from an operations and overall convenience and emissions perspective.

### 5 GEOMETRY AND SAFETY

#### 5.1 Turn Lanes

The consideration for turn lanes is typically based on interference to trailing through-movement vehicles or safety considerations (e.g. collision prevention or severity reduction, conflicts with pedestrians), as opposed to level of service alone. In relation to this site, the location where a turn lane could be of greatest benefit is for southbound left turns on Douglas St, as turning vehicles may impede trailing southbound Douglas St vehicles, which must wait to turn from both northbound vehicles as well as pedestrians crossing Cormorant St at Douglas St. However, it is difficult to implement a dedicated left turn lane due to the current right of way limits, and there are no left turn lanes along the section of Douglas Street at other nearby intersections. The intersection will likely function without a left turn lane in a similar manner to other nearby intersections (e.g. Fisgard St, Caledonia Ave). Nonetheless, monitoring of the southbound left turn movement could be considered by the City to ensure adequate safety and operational performance is maintained, and if issues do occur consideration of prohibiting southbound left turn movements could be given (although this would increase area vehicle circulation).

Turn lanes would not be required at the site access (either on Cormorant St or on the site access itself).

#### 5.2 Sight Distances

At the proposed site access on Cormorant Street, there is visibility from the proposed site accesses up to Douglas Street (looking west) and to Blanshard Street (looking east), which is in excess of 100m in each direction. Any approaching vehicles will be turning (either from Douglas Street or Blanshard Street), at speeds less than 40km/h. The required turning sight distance for a stopped vehicle (i.e. from an access) is 90m where side-street traffic approaches at 40km/h. Therefore turning sight distance requirements are met at the site access location.

#### 5.3 Access Spacing

The proposed site access on Cormorant Street is located 70m east of Douglas Street and 95m west of Blanshard Street. The TAC *Geometric Design Guide for Canadian Roads* identifies the preferred



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minimum corner clearance for an access from an arterial stop-controlled intersection as 35m. There are therefore no access spacing concerns for the site.

#### **5.4 Cross Section of Cormorant Street**

There is on-street angled parking on both sides of Cormorant Street. If Cormorant Street is changed to two-way from one-way operation, the existing angled parking layout may need to be adjusted to secure the required width for two travel lanes.

### **6 OTHER MODES**

#### **6.1 Pedestrian Facilities**

Sidewalks are well established on Douglas Street, Blanshard Street, and Pandora Avenue. Sidewalk and frontage improvements along Cormorant St will be included as part of the project.

It was observed that there were several pedestrians crossing Douglas Street near or at Cormorant Street, particularly in the pm peak hour. It was not a large volume, however, and due to the close proximity of signalized intersections at Pandora Ave and Fisgard St it is not recommended to provide a marked and signed crosswalk (nor is it likely feasible due to BC Transit bus stops along the west side of Douglas St).

Although a marked and signed midblock crosswalk on Cormorant Street (between Douglas Street and Blanshard Street) is not likely to be warranted due to pedestrian volumes, one could nonetheless be considered as part of a north-south pedestrian corridor from Cormorant Street to Pandora Avenue. Any such midblock crosswalk on Cormorant Street should be located at the site access, as it is the preferred spacing away from Douglas Street and Blanshard Street, and will best position pedestrians within the area most visible to, and expected by, drivers. There is an existing pedestrian midblock crosswalk on Pandora Avenue, which would ideally be relocated slightly west so as to align with the proposed centre walkway of the site plan.

#### **6.2 Bicycle Facilities**

There are bicycle lanes on the Douglas Street frontage, and no bicycle lanes on Blanshard Street near the site. During the pm peak hour, significant cyclist volumes (approx. 70 cyclists) were observed along Douglas Street. Bicycle facilities are required on-site including bike racks for cyclist commuters as well as for the commercial land uses.

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### **6.3 Transit Facilities**

Douglas Street and Pandora Avenue are major transit bus routes in Downtown, and there are several bus stops along these roads near the development site. The comprehensive transit coverage can serve to limit site vehicle trips and promote sustainable models of travel.

### **7 CONCLUSIONS**

The following conclusions are made regarding the traffic impact assessment for the proposed development adjacent to Cormorant Street. At the four signalized intersections on Douglas Street and Blanshard Street near the development site, all movements currently operate at LOS C or better during the am and pm peak hours. Cormorant Street is also operating at good levels of service under one-way eastbound operation between Douglas Street and Blanshard Street (LOS A or B).

The proposed development is a mix of commercial and office buildings. It was estimated that the development will add 295 new trips during the am peak hour and 424 new trips during the pm peak hour based on ITE rates. This trip estimate was used as a conservative (high-end) value; the downtown location is conducive to alternative modes (bus, cycling, and walking) and this number of trips exceeds the proposed on-site parking capacity, which, along with pricing structure, will further the goal of reducing private vehicle trips to/from the site.

There is one access proposed for the site, on Cormorant Street. Post-development traffic conditions were investigated under two operation scenarios: 1) existing one-way eastbound Cormorant Street, and 2) two-way Cormorant Street between Douglas Street and Blanshard Street. For one-way operations, traffic operations are generally acceptable (LOS C or better) with the exception of the westbound right-turn movement from Pandora Avenue onto Douglas St, which will drop to LOS E with significant queues. For two-way operation, all intersections and movements will operate at LOS C or better with the exception of westbound Cormorant St at Douglas St, which will drop to LOS F (owing to the difficulty of westbound left turning vehicles to make a left turn). If, however, the westbound left turn from Cormorant St onto Douglas St was prohibited, or if the intersection were signalized, all movements would operate at LOS C or better.

In addition to a capacity review, the study assessed network performance for four options: (1) Cormorant one-way; (2) two-way with stop control and a full movement at Douglas; (3) two-way with a full movement in and a right out only at Douglas; and (4) two-way with signalization of Cormorant Street / Douglas Street, in terms of travel distance, travel time, and emissions. The two-way options performed similarly to each other, and had lower travel time and emissions (CO2) as compared to the one-way

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option. Of all the options, the full movement in and right-out only at Douglas option best balances network performance with capacity / delay results and safety.

While a southbound left-turn lane on Douglas Street at Cormorant Street would be beneficial, it is not an essential component as the intersection will operate in a manner similar to other nearby Douglas Street intersections (and would be difficult if not prohibitive to install due to land and land use constraints). No other turn lanes would be required as a result of this development.

No new pedestrian facilities would be necessary, and in particular a special crosswalk (marked/signed or signalized) across Douglas St at Cormorant St is not needed. Consideration could, however, be given to a midblock crosswalk on Cormorant St at the site access, and to relocating the existing midblock crosswalk on Pandora Ave to align with the site's proposed walkway. Bicycle parking should be provided for site commuters and for the commercial land uses. The area is well served by numerous transit routes and frequent service.

### **8 RECOMMENDATIONS**

The following mitigation measures are recommended:

- Cormorant Street be changed to two-way operation from the current one-way eastbound operation, with full movement in and right-out only at Douglas Street, and right-in / right-out only at Blanshard Street.
  - As part of this conversion, the current angle parking layout on the south side of Cormorant Street should be reviewed for geometric feasibility, as it may require conversion to parallel parking.
- To monitor the southbound left turn movement on Douglas Street at Cormorant Street for operation (queues / LOS) and safety issues, and if required consider prohibition of the southbound left movement at this location.