

# WESTPORTS MALAYSIA SDN. BHD.

## TRAFFIC IMPACT ASSESSMENT (TIA) STUDY FOR 'PROPOSED EXPANSION OF CONTAINER TERMINAL CT10-CT17 AND ITS ASSOCIATED WORKS AT WESTPORTS PULAU INDAH, SELANGOR DARUL EHSAN.'



Prepared by :

**MZK** **RUNDING TRAFIK MZK SDN. BHD.**  
(774116-A)  
Traffic and Transportation Planning Consultants

F-9-3A, Block F, Setia Walk,  
Persiaran Wawasan, Pusat Bandar Puchong,  
47160 Puchong, Selangor Darul Ehsan  
Tel : 03-5879 1611 / 1613 / 7210  
Fax :03-5879 1612  
email : mzkrunding@gmail.com  
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<b>CONTENT</b>	<b>PAGE</b>
<b>1.0 INTRODUCTION</b>	
1.1 Background	1
1.2 Study Objectives	1
1.3 Report Structures	2
<b>2.0 WESTPORT DEVELOPMENT</b>	
2.1 Site Location and Accessibility	3
2.2 Westport Containers and Cargo Movements	3
2.3 Proposed Access Point	3
<b>3.0 EXISTING TRAFFIC CONDITION</b>	
3.1 Introduction	5
3.2 Traffic Count Surveys	5
3.3 Analysis of Survey Data	6
3.4 Road and Junction Inventory	7
3.5 Performance of Existing Roads	8
3.6 Performance of Existing Junctions	10
<b>4.0 METHODOLOGY OF FUTURE TRAFFIC FORECAST</b>	
4.1 Introduction	12
4.2 Forecast of Non-Site (Base) Traffic	12
4.3 Westport Development Traffic Forecast	13
4.4 Trip Distribution and Assignment	15
<b>5.0 TRAFFIC IMPACT ASSESSMENT</b>	
5.1 Introduction	16
5.2 Future Year 2028 Traffic Analysis	16
5.3 Future Year 2038 Traffic Analysis	21
<b>6.0 SUMMARY AND RECOMMENDATIONS</b>	
6.1 Introduction	27
6.2 Site Location and Access Arrangement	27
6.3 Existing Traffic Condition	27
6.4 Forecast of Future Traffic	28
6.5 Traffic Impact Assessment	29

## LIST OF TABLES

---

Table	3.1	Passenger Car Unit (pcu) Factors by Vehicles Type
Table	3.2	Vehicle Composition on Existing Roads
Table	3.3	Type of Junction Control
Table	3.4	Level of Service (LOS) Definition
Table	3.5	Operational Performance of Existing Roads
Table	3.6	Level of Service Criteria (LOS) for Junction Performance
Table	3.7	Operational Performance of Existing Junctions
Table	4.1	Summarization of Growth Rates for Design Year 2028 and Year 2038
Table	4.2	Predicted Peak Hour Project Site Traffics
Table	4.3	Peak Hour Development Traffic Generated by Committed Developments
Table	5.1	Future Year 2028 Operational Performance of Roads
Table	5.2	Project Site Traffic Contribution at Roads in Year 2028
Table	5.3	Future Year 2028 Operational Performance of Junctions
Table	5.4	Project Site Traffic Contribution at Junctions in Year 2028
Table	5.5	Future Year 2038 Operational Performance of Roads
Table	5.6	Project Site Traffic Contribution at Roads in Year 2038
Table	5.7	Future Year 2038 Operational Performance of Junctions
Table	5.8	Project Site Traffic Contribution at Junctions in Year 2038

## LIST OF FIGURES

Figure 2.1	Location of the Project Site in Relation to Existing Road Network
Figure 2.2	Project Site Layout Plan
Figure 2.3	Proposed Access Point for Project Site
Figure 3.1	Location of Survey Stations
Figure 3.2	Existing Morning and Evening Peak Hour Traffic Volumes (pcu/hour)
Figure 3.3	Existing Morning and Evening Peak Hour Volumes Over Capacity (v/c) Ratio - 1
Figure 3.4	Existing Morning and Evening Peak Hour Volumes Over Capacity (v/c) Ratio - 2
Figure 3.5	Schematic Diagram of Existing Pulau Indah Highway / Jalan Orkid 1 Junction (J1) and Its Operational Performance
Figure 3.6	Schematic Diagram of Existing Pulau Indah Highway / Access FFM Sdn. Bhd. Junction (J2) and Its Operational Performance
Figure 3.7	Schematic Diagram of Existing Pulau Indah Highway / Jalan Perigi Nanas 7/1 Junction (J3) and Its Operational Performance
Figure 3.8	Schematic Diagram of Existing Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Junction (J5) and Its Operational Performance
Figure 3.9	Schematic Diagram of Existing Pulau Indah Highway / Persiaran Sungai Pinang Junction (J6) and Its Operational Performance
Figure 3.10	Schematic Diagram of Existing Pulau Indah Highway / Persiaran Pelabuhan Barat Junction (J8) and Its Operational Performance
Figure 3.11	Schematic Diagram of Existing Persiaran Pulau Lumut / SKVE Highway Junction (J10) and Its Operational Performance
Figure 4.1	Normal Traffic Growth Rate in Selangor
Figure 4.2	Location of Committed Development
Figure 4.3	Trip Distribution Pattern
Figure 5.1	Future Year 2028 Morning and Evening Peak Hours Traffic Volume (pcu/hour)
Figure 5.2	Future Year 2028 Recommended Traffic Improvement
Figure 5.3	Future Year 2028 Morning and Evening Peak Hours Volumes Over Capacity (v/c) Ratio – 1
Figure 5.4	Future Year 2028 Morning and Evening Peak Hours Volumes Over Capacity (v/c) Ratio – 2
Figure 5.5	Project Site Traffic Contribution on Roads in Year 2028
Figure 5.6	Future Year 2028 Operational Performance of Pulau Indah Highway / Jalan Orkid 1 Signalised Junction (J1)
Figure 5.7	Future Year 2028 Operational Performance of Existing Pulau Indah Highway / Access FFM Sdn. Bhd. Priority Junction (J2)
Figure 5.8	Future Year 2028 Operational Performance of Existing Pulau Indah Highway / Jalan Perigi Nanas 7/1 Signalised Junction (J3)
Figure 5.9	Future Year 2028 Operational Performance of Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction (J5)
Figure 5.10	Future Year 2028 Operational Performance of Existing Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction (J6)
Figure 5.11	Future Year 2028 Operational Performance of Existing Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction (J8)
Figure 5.12	Future Year 2028 Operational Performance of Persiaran Pulau Lumut / SKVE Highway Priority Junction (J10)
Figure 5.13	Future Year 2028 Operational Performance of Road A / Project Site Proposed Access Road Signalised Junction (AJ1)



- Figure 5.14 Project Site Traffic Contribution at Junctions in Year 2028
- Figure 5.15 Future Year 2038 Morning and Evening Peak Hours Traffic Volume (pcu/hour)
- Figure 5.16 Future Year 2038 Recommended Traffic Improvement
- Figure 5.17 Future Year 2038 Morning and Evening Peak Hours Volumes Over Capacity (v/c) Ratio – 1
- Figure 5.18 Future Year 2038 Morning and Evening Peak Hours Volumes Over Capacity (v/c) Ratio – 2
- Figure 5.19 Project Site Traffic Contribution on Roads in Year 2028
- Figure 5.20 Future Year 2038 Operational Performance of Pulau Indah Highway / Jalan Orkid 1 Signalised Junction (J1)
- Figure 5.21 Future Year 2038 Operational Performance of Existing Pulau Indah Highway / Access FFM Sdn. Bhd. Signalised Junction (J2)
- Figure 5.22 Future Year 2038 Operational Performance of Existing Pulau Indah Highway / Jalan Perigi Nanas 7/1 Signalised Junction (J3)
- Figure 5.23 Future Year 2038 Operational Performance of Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction (J5)
- Figure 5.24 Future Year 2038 Operational Performance of Existing Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction (J6)
- Figure 5.25 Future Year 2038 Operational Performance of Existing Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction (J8)
- Figure 5.26 Future Year 2038 Operational Performance of Road A / Project Site Proposed Access Road Signalised Junction (AJ1)
- Figure 5.27 Project Site Traffic Contribution at Junctions in Year 2038

# **INTRODUCTION**

## **1.0 INTRODUCTION**

### **1.1 Background**

1.1.1 Messrs. Westports Malaysia Sdn. Bhd., herein refer as WMSB the container terminal operator of Westport, Port Klang plans to build new container terminals CT10-CT 17 for container vessels at Pulau Indah, Selangor.

1.1.2 In an effort to ensure the provision of good traffic system and minimal impact on the existing surrounding roads, Westports Malaysia Sdn. Bhd. has appointed Runding Trafik MZK Sdn. Bhd. to undertake a Traffic Impact Assessment (TIA) for the project site. The TIA report is part of the supporting document for WMSB to fulfil the technical requirements for the conceptual master plan.

### **1.2 Study Objectives**

1.2.1 The main objective of this TIA study is to analyse the impact of the increase number of vehicles on the adjacent external roads and junctions in the immediate vicinity of the project site. The recommendations set out at the end of the study are intended to ensure a smooth traffic flow and efficient movement of traffic to and from the project site.

1.2.2 Hence, in order to achieve the study objectives, the following tasks have been performed:

- i. To carry out road and junctions' inventories to determine the present road and junction characteristics in the vicinity of the project site. This includes determining the number of lanes, junction control and layout as well as other existing traffic facilities near the project site.
- ii. To carry out traffic count survey during normal peak periods at existing roads and junctions in close proximity of the project site.
- iii. To analyse and evaluate traffic condition on the existing road to determine the present traffic flow, composition and the period of peak hours. Performance of the adjacent road will be analysed using volume to capacity (v/c) ratio as indicator of road performance.

- iv. To forecast the amount of traffic likely to be generated by and attracted to the project site and surrounding committed development taking into consideration the proposed project components.
- v. To distribute and assign the projected traffic to the adjacent road network based upon the present traffic pattern.
- vi. To investigate the impact of the development traffic on the external roads and junctions in terms of their capacities and performances and recommend mitigation measure to accommodate any possible impacts if necessary.
- vii. To assess the access arrangement serving the project site and advice traffic issues associated with the proposed access points.
- viii. To assist the Highway Engineer/Planner/Architect to comply or incorporate all traffic requirements and designs.
- ix. To prepare Traffic Impact Assessment (TIA) report and it will be in a form of suitable for submission to Authorities.

### **1.3 Report Structures**

1.3.1 Apart from this introductory chapter, this report has a further five chapters as described below:

- i. Chapter 2 describes the project site, outlines component of the project site and its access arrangement.
- ii. Chapter 3 detail the analysis of existing traffic condition in the vicinity of the project site.
- iii. Chapter 4 highlights the forecast of the future traffic involving traffic aspects such as traffic generation, directional distribution and traffic assignment.
- iv. Chapter 5 presents the traffic impact analysis on the existing roads and junctions in the vicinity of the project site and proposal to accommodate the future traffic demand.
- v. Chapter 6 summarises the findings and recommendations of the overall traffic impact study.

# **PROPOSED DEVELOPMENT**

## **2.0 WESTPORT DEVELOPMENT**

### **2.1 Site Location and Accessibility**

2.1.1 Westports is the leading port terminal for container and bulk cargo in Port Klang, Selangor. Strategically located along the Straits of Malacca, it serves as pit stop for container vessels plying the world's busiest shipping lanes. On the land side, it is connected to Pulau Indah Highway (Federal Route FT181) that connects Westports to KESAS Highway (E5) to the east. Persiaran Pulau Lumut provides the connection between the South Klang Valley Expressway, SKVE (E26) on the south and Pulau Indah Highway. The project site is located to the southern of Pulau Indah, Selangor. The location of the project site in relation to the existing road network is shown in **Figure 2.1**.

### **2.2 Westport Containers and Cargo Movements**

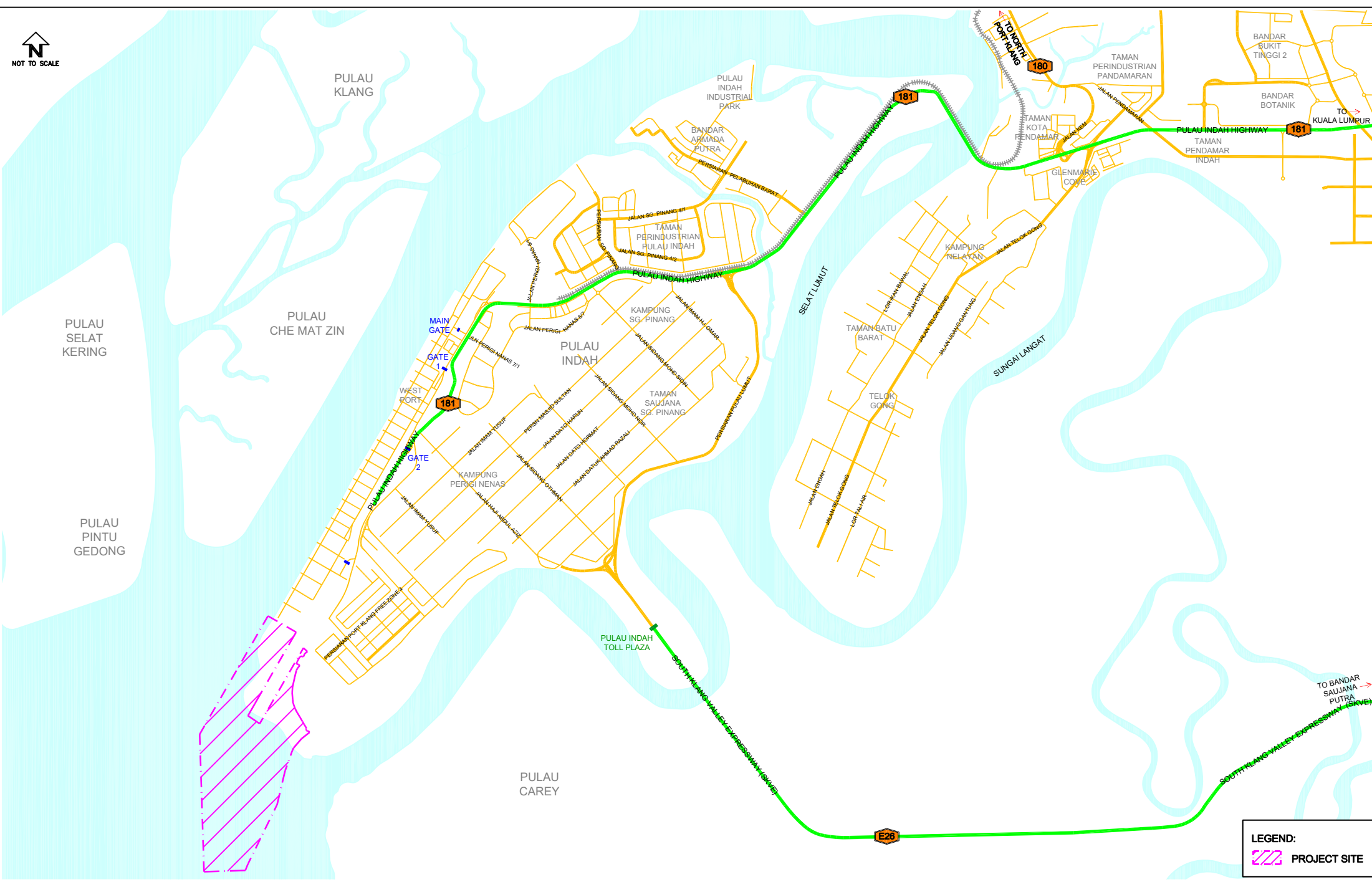
2.2.1 Westports is a mega hub for both local and transshipment containers. Presently, the port quay length measuring 5.8 kilometers houses 9 container terminals that would give Westports a capacity of 14 million TEUs.


2.2.2 Container throughput at Westports has increased from 2.6 million TEUs in 2004 to 9.02 million TEUs in 2017. Westports commands 75 per cent share of the container volume in Port Klang is poised to become a preferred port for local boxes within the next 5 years. In addition to being a transshipment mega hub, Westports container volume achieved a cumulative figure of over 90 million TEUs to date, since beginning operations in 1996. With the launch of Container Terminal 10 to Container Terminal 17 (CT 10-CT 17), Westports Malaysia Sdn. Bhd. is expecting to achieve its 26.8 million twenty-foot equivalent units (TEUs) by 2040.

2.2.3 The project site (CT 10-CT 17) which will consist of 8 nos of berth with 600meter berth length each total up 4,800meter quay length were anticipate to produce additional 12 million TEUs capacity.



NOT TO SCALE

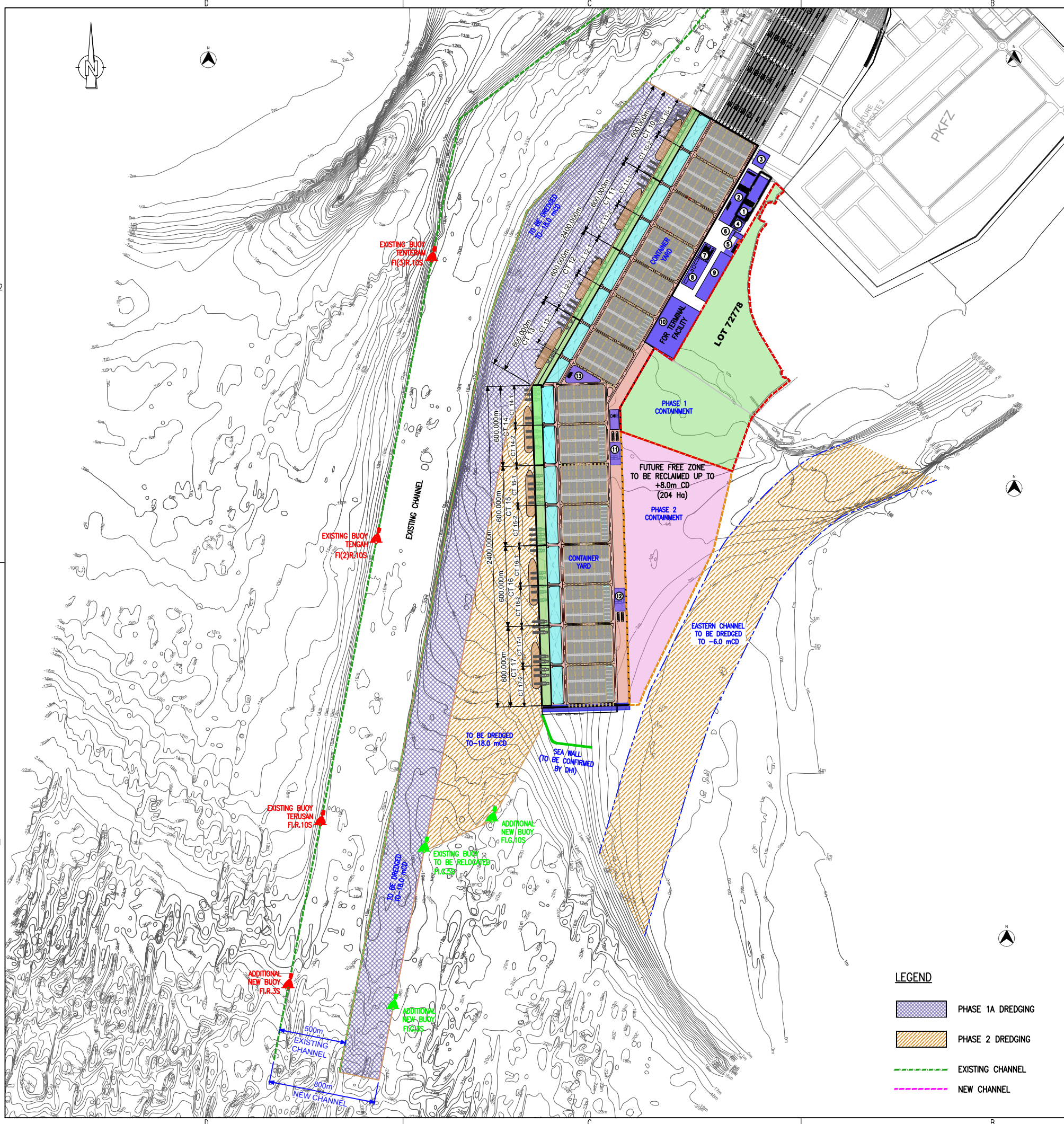


**LEGEND:**  
 PROJECT SITE

LOCATION OF THE PROJECT SITE IN RELATION TO EXISTING ROAD NETWORK

FIGURE 2.1





**NOTES :**

1. ALL DIMENSIONS ARE IN METRES (m), UNLESS OTHERWISE SPECIFIED.
2. ALL LEVELS ARE WITH REFERENCE TO CHART DATUM & ARE IN METERS.

TOTAL GROUND SLOTS = 44,112 TEUs

**LEGEND**

- ① ENTRANCE GATE
- ② OUT GATE
- ③ SUB STATION
- ④ CUSTOM BUILDING
- ⑤ OFFICE BUILDING AND CAR PARK
- ⑥ STP BUILDING
- ⑦ HAULAGE PARKING
- ⑧ MAIN WORKSHOP WITH EQUIPMENT PARKING
- ⑨ MARSHALLING
- ⑩ ODD AREA
- ⑪ MAINTENANCE WORKSHOP-1
- ⑫ MAINTENANCE WORKSHOP-2
- ⑬ FORWARD STATION

**LEGEND**

- PHASE 1A DREDGING
- PHASE 2 DREDGING
- EXISTING CHANNEL
- NEW CHANNEL

REVISION	DATE	DESCRIPTION	APPRO.
A	XX-05-19	FINAL	KKG

CLIENT:

CONSULTANT:

PROJECT  
**PROPOSED EXPANSION OF CONTAINER TERMINAL CT10-CT19 AND ITS ASSOCIATED WORKS AT WESTPORTS, PULAU INDAH, SELANGOR DARUL EHSAN**

TITLE  
**WESTPORTS EXPANSION OVERALL LAYOUT**

PROJECT No.	DRAWING No.	REVISION
7157A005G3	7157-MS-GE001	A
DRAWN BY	DESIGNED BY	CHECKED BY
MAY	-	KKG
SCALE	DATE	PAPER SIZE
AS SHOWN	MAY 2019	A1
		CAD REF.
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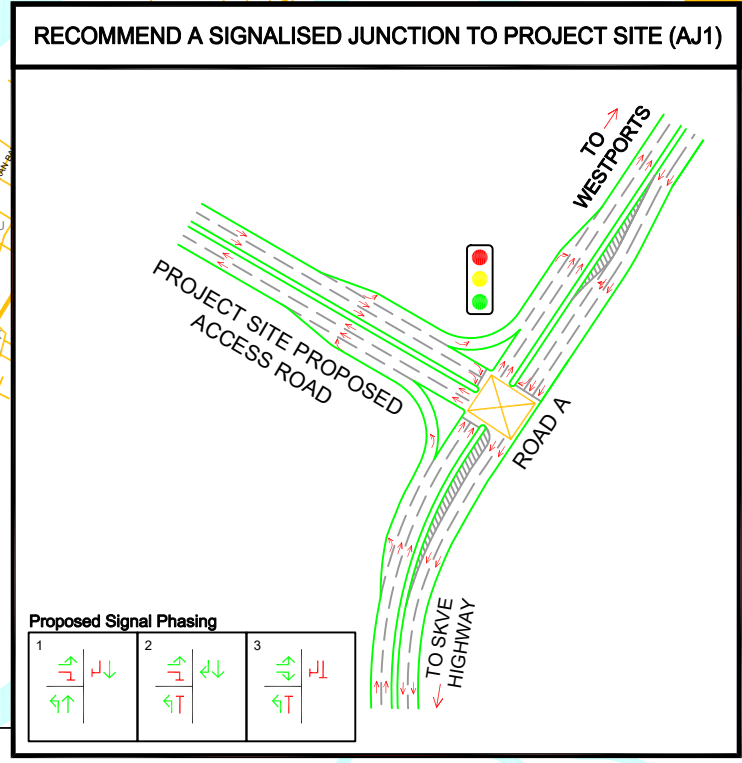
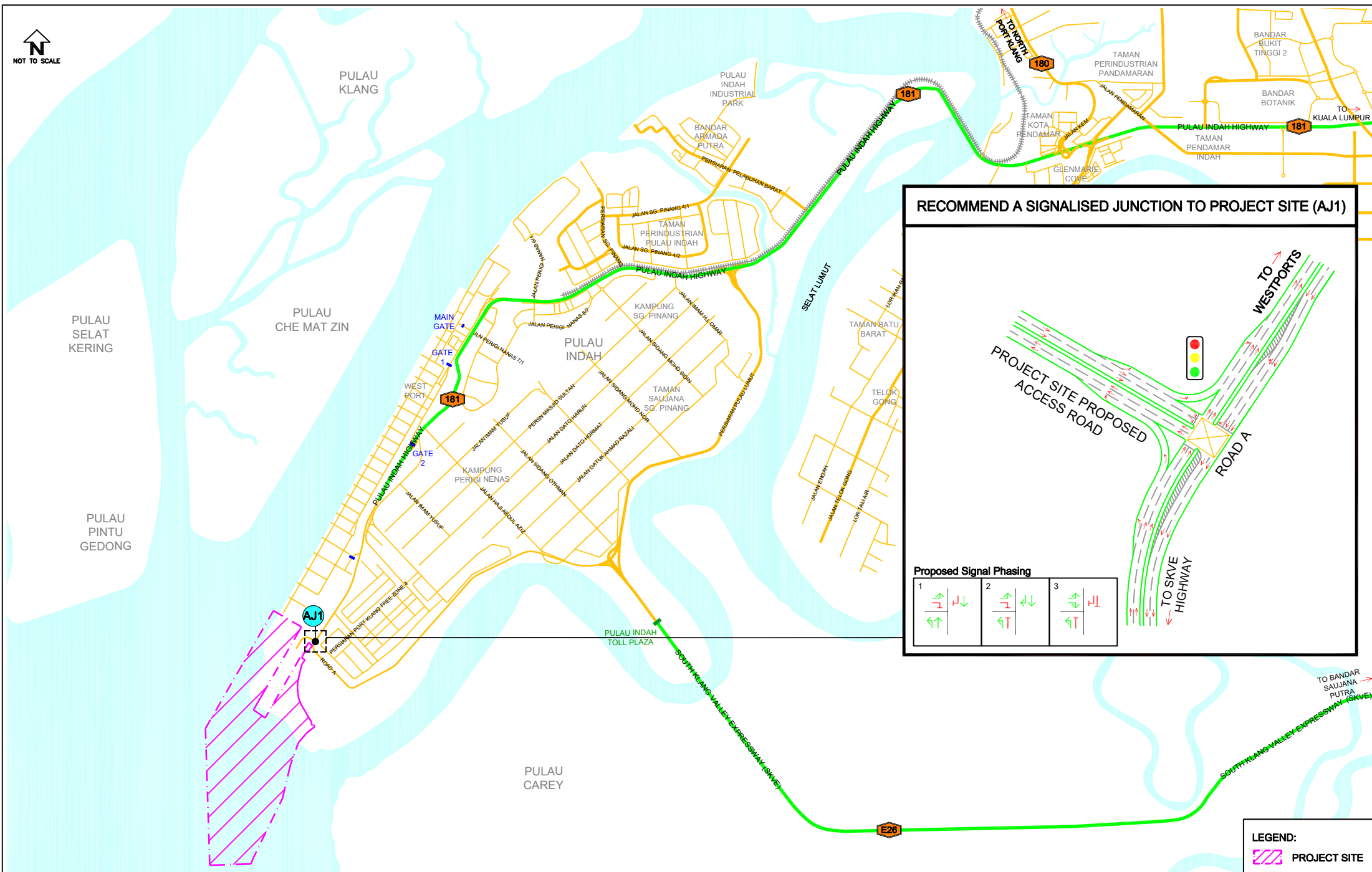


## 2.3 Proposed Access Point

- 2.3.1 The planning of access points is an integral part of the design of any developments as it forms the interface between the development and the transport network. A well planned access arrangement will reduced congestions and increase efficiency thus allowing larger capacity for vehicle movements, whilst poor access arrangement can result in traffic congestion and cause unnecessary delay not only to the traffic heading towards the port but also the traffic plying the adjacent roads.
- 2.3.2 Currently, Pulau Indah Highway serves as the main road to the Westport which ends at the roundabout of Persiaran Port Klang Free Zone 4 / Persiaran Port Klang Free Zone 7. It is has been assumed that Pulau Indah Ring Road (PIRR) will commence in the Year 2024 which connect Pulau Indah Highway with Persiaran Pulau Lumut (Referenced as Road A in all road network figures). The current plan for the Westport extension is to have an access point off Road A in the form of a signalised junction (AJ1). The project site access point is illustrated in **Figure 2.3**.



NOT TO SCALE



**LEGEND:**  
 PROJECT SITE

**PROPOSED ACCESS POINT FOR PROJECT SITE**

**FIGURE 2.3**

# **EXISTING TRAFFIC CONDITION**

### 3.0 EXISTING TRAFFIC CONDITION

#### 3.1 Introduction

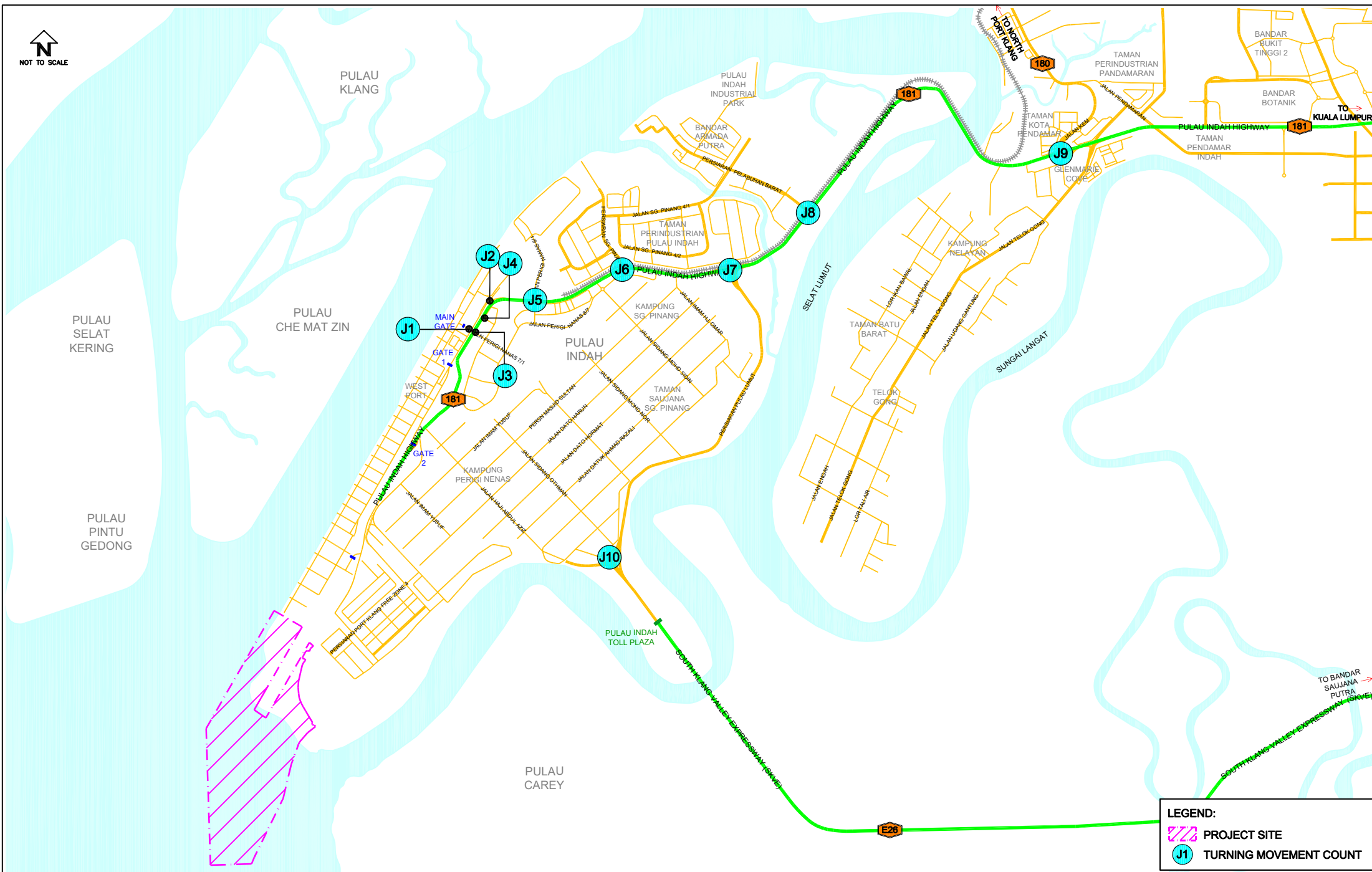
3.1.1 Existing traffic conditions on the surrounding road systems in the study area were ascertained through visual reconnaissance survey as well as conducting traffic count survey. These provide qualitative and quantitative measures of the existing site conditions.

#### 3.2 Traffic Count Surveys



3.2.1 Traffic count surveys were carried out to determine the existing traffic flow patterns and the period of peak hours on roads and junctions in the vicinity of the project site. These counts were conducted at the critical locations whereby the impact of the development traffic is considered the greatest.

3.2.2 Peak hour traffic count surveys were conducted on Wednesday and Thursday, 5<sup>th</sup> and 6<sup>th</sup> September 2018 between 7.00am to 10.00am for the morning peak and 4.30pm to 7.30pm for the evening peak. The peak hour traffic count was conducted at the following location and illustrated in **Figure 3.1**.

- i. Pulau Indah Highway / Jalan Orkid 1 Junction (J1),
- ii. Pulau Indah Highway / Access FFM Sdn. Bhd. Junction (J2),
- iii. Pulau Indah Highway / Jalan Perigi Nanas 7/1 Junction (J3),
- iv. Pulau Indah Highway / Jalan Perigi Nanas 8/2 Junction (J4),
- v. Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Junction (J5),
- vi. Pulau Indah Highway / Persiaran Sungai Pinang Junction (J6),
- vii. Pulau Indah Highway / Persiaran Pulau Lumut Junction (J7),
- viii. Pulau Indah Highway / Persiaran Pelabuhan Barat Junction (J8),
- ix. Pulau Indah Highway / Jalan Kem Junction (J9), and
- x. Persiaran Pulau Lumut / SKVE Highway Junction (J10).



**LEGEND:**

-  PROJECT SITE
-  TURNING MOVEMENT COUNT

**LOCATION OF SURVEY STATIONS**

**FIGURE 3.1**

3.2.3 The counts were conducted manually at a 15 minute interval and classified into the following five vehicle categories:

- i. Car, Taxi and Private Van
- ii. Motorcycle
- iii. Light Truck (2 axles)
- iv. Heavy Truck (3+axles); and
- v. Bus

### 3.3 Analysis of Survey Data

3.3.1 Prior to evaluating the existing traffic characteristics all counted vehicles were converted into passenger car unit (pcu) to account for the varying traffic composition. Pcu factors based on JKR Arahan Teknik (Jalan) 8/86 guidelines were used as shown in **Table 3.1**.

**Table 3.1: Passenger Car Unit (pcu) Factors by Vehicles Type**

Vehicle Type	Pcu Factor
Car, Taxi and Private Van	1.00
Motorcycle	0.22
Medium Lorries	1.19
Heavy Lorries	2.27
Buses	2.08

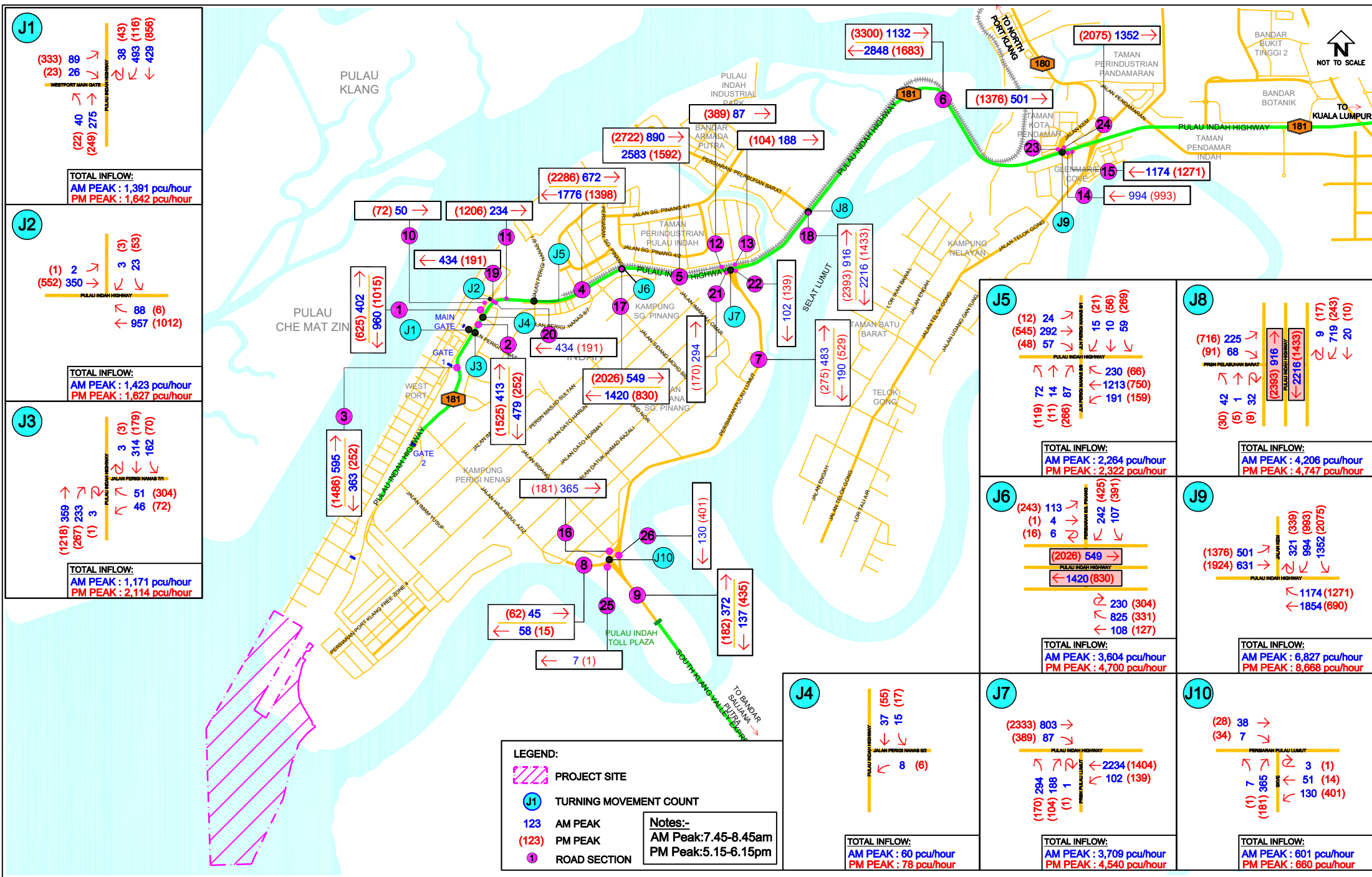
Source: Highway Capacity Manual (HCM) by HPU Malaysia, 2006

3.3.2 The peak hour periods were identified by taking the maximum hourly pcu flows at the survey location. The peak hours were found to be:

- i. Morning (AM) peak hours - 7.45am – 8.45am
- ii. Evening (PM) peak hours - 5.15pm – 6.15pm

3.3.3 **Figure 3.2** illustrates the existing morning and evening peak hour traffic volumes on the existing roads and junctions in vicinity to the project site in pcu to account for the impact of vehicular types and sizes.

3.3.4 Traffic count survey indicated that on average car constitutes the highest percentage of vehicle type followed by motorcycles, heavy truck, light trucks and bus. Heavy vehicles compositions are sometimes higher than motorcycles at certain traffic count survey



EXISTING MORNING AND EVENING PEAK HOUR TRAFFIC VOLUME (pcu/hour)

FIGURE 3.2

location. **Table 3.2** shows the vehicle composition on the existing roads in the vicinity of the project site.

**Table 3.2: Vehicle Composition on Existing Roads**

Road Name	Car / Van	Motorcycle	Light Truck	Heavy Truck	Bus	Total
Pulau Indah Highway	53.1%	26.1%	3.7%	17.0%	0.1%	100%
Persiaran Pulau Highway	49.6%	19.4%	2.8%	28.1%	0.1%	100%
SKVE Highway	43.0%	15.2%	5.7%	36.0%	0.0%	100%
Westport Conventional Main Gate	50.2%	31.1%	4.8%	13.8%	0.1%	100%
Jalan Perigi Nanas 7/1	47.1%	16.9%	2.8%	33.2%	0.0%	100%
Jalan Perigi Nanas 6/1	55.3%	21.8%	7.0%	15.5%	0.5%	100%
Jalan Perigi Nanas 8/9	42.2%	23.3%	6.1%	28.4%	0.0%	100%
Persiaran Sungai Pinang	48.0%	29.3%	3.7%	18.7%	0.2%	100%
Persiaran Pelabuhan Barat	63.6%	26.9%	4.0%	5.3%	0.2%	100%
Jalan Kem	58.0%	22.3%	5.4%	14.2%	0.1%	100%

### 3.4 Road and Junction Inventory

- 3.4.1 Road inventories such as carriageway width, number of lanes and site constrains of the existing road in the vicinity of the project site were made. These road characteristics are used in estimating the carrying capacity of the road.
- 3.4.2 Presently, there are two linking bridge from the main land to Pulau Indah; the northern side; Pulau Indah Highway (Federal Route 181) and the southern side; South Klang Valley Expressway (E26).
- 3.4.3 Pulau Indah Highway (FT181) is a 2-lane dual carriageway road traversing east-west connecting Westports, Pulau Indah from west to KESAS Highway (E5) to the east. This road is categorised as the main arterial road for Pulau Indah to the main land especially to West Port and Port Klang Free Zone (PKFZ). This road also mainly serves Pulau Indah Industrial Park and other kampong residential.
- 3.4.4 South Klang Valley Expressway, SKVE Highway (E26) is the second main road Pulau Indah to the main land. This highway is a 2-lane dual carriageway road between Persiaran Pulau Lumut and Pulau Indah Toll Plaza, whilst single carriageway road from the Pulau Indah Toll Plaza to the Telok Panglima Garang Interchange. It continues 2-lane carriageway road to Ayer Hitam Toll Plaza East Bound and 3-lane dual carriageway road from Ayer Hitam Toll Plaza East Bound to SILK Highway (E18).



3.4.5 Currently, Persiaran Pulau Lumut is the only 2-lane dual carriageway road connecting to SKVE Highway from Pulau Indah Highway.

3.4.6 In addition to road inventories, junction inventories were also undertaken. **Table 3.3** summarised the type of junction control in vicinity of project site.

**Table 3.3: Type of Junction Control**

Junction Id	Junction Name	Type of Junction Control
J1	Pulau Indah Highway / Jalan Orkid 1 Junction	Priority Junction
J2	Pulau Indah Highway / Access FFM Sdn. Bhd. Junction	Priority Junction
J3	Pulau Indah Highway / Jalan Perigi Nanas 7/1 Junction	Priority Junction
J4	Pulau Indah Highway / Jalan Perigi Nanas 8/2 Junction	Left-in/left-out Junction
J5	Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Junction	Signalised Junction
J6	Pulau Indah Highway / Persiaran Sungai Pinang Junction	Interchange with At-grade Signalised Junction
J7	Pulau Indah Highway / Persiaran Pulau Lumut Junction	Free-flow Interchange
J8	Pulau Indah Highway / Persiaran Pelabuhan Barat Junction	Interchange with At-grade Signalised Junction
J9	Pulau Indah Highway / Jalan Kem Junction	Free-flow Interchange
J10	Persiaran Pulau Lumut / SKVE Highway Junction	Priority Junction

### 3.5 Performance of Existing Roads

3.5.1 Performance of the existing roads is measure based upon the volume to capacity (V/C) ratio and level of service (LOS). **Table 3.4** indicates the traffic condition under urban condition for various ranges of V/C ratio and its associated level of service. LOS A and F represent the best and worst operating conditions respectively. LOS D is considered the acceptable traffic conditions for design criteria in an urban area.

**Table 3.4: Level of Service (LOS) Definition**

LOS	V/C Ratio	Definition
A	< 0.60	Free flow with volume densities and high speeds. Drivers can maintain their desired speeds with little or no delay.
B	0.60-0.69	Stable flow. Operating speeds beginning to be restricted somewhat by traffic conditions. Some slight delay.
C	0.70-0.79	Stable flow. Speed and manoeuvrability are more closely controlled by higher volume. Acceptable delay.
D	0.80-0.89	Approaching unstable flow. Tolerable operating speeds, which are considerably affected by operating conditions. Tolerable delay.
E	0.90-1.00	Unstable flow. Yet lower operating speeds and perhaps stoppages of momentary duration. Volumes are at or near capacity. Congestion and intolerable delay.
F	>1.00	Forced flow. Speeds and volume can drop to zero. Stoppages can occur for long periods. Queues of vehicles backing up from a restriction downstream.

Source: JKR Arahan Teknik (Jalan) 8/86 – A Guide on Geometric Design of Roads.

3.5.2 The existing roadway volume over capacity analysis is conducted for the morning and evening peak hour periods. It is assumed that if the road network can accommodate the demand during these peak periods, it would then adequately cater for the non-peak period. **Table 3.5** and **Figure 3.3** show the existing morning and evening volume/capacity (v/c) ratios on the existing roads in the vicinity of the project site.

**Table 3.5: Operational Performance of Existing Roads**

Road Name	Road Section	Dir.	Capacity (pcu/hr)	Hourly Traffic Flow (pcu/hour)		Volume/Capacity (V/C)		Level of Service (LOS)	
				AM	PM	AM	PM	AM	PM
Pulau Indah Highway (FT181)	1	NB	3,600	402	625	0.11	0.17	A	A
		SB	3,600	960	1,015	0.27	0.28	A	A
	2	NB	3,600	413	1,525	0.11	0.42	A	A
		SB	3,600	479	252	0.13	0.07	A	A
	3	NB	3,600	595	1,486	0.17	0.41	A	A
		SB	3,600	363	252	0.10	0.07	A	A
	4	EB	3,600	672	2,286	0.19	0.64	A	B
		WB	3,600	1,776	1,398	0.49	0.39	A	A
	5	EB	3,600	890	2,722	0.25	0.76	A	C
		WB	3,600	2,583	1,592	0.72	0.44	C	A
	6	EB	3,600	1,132	3,300	0.31	0.92	A	E
		WB	3,600	2,848	1,683	0.79	0.47	C	A
Persiaran Pulau Lumut	7	NB	3,600	483	275	0.13	0.08	A	A
		SB	3,600	190	529	0.05	0.15	A	A
	8	EB	3,600	45	62	0.01	0.02	A	A
		WB	3,600	58	15	0.02	0.00	A	A
SKVE Highway (E26)	9	NB	3,600	372	182	0.10	0.05	A	A
		SB	3,600	137	435	0.04	0.12	A	A
Elevated Ramp 1	10	1-Way	3,600	50	72	0.01	0.02	A	A
Elevated Ramp 2	11	1-Way	3,600	234	1,206	0.07	0.34	A	A
Elevated Ramp 3	12	1-Way	3,600	87	389	0.02	0.11	A	A
Elevated Ramp 4	13	1-Way	3,600	188	104	0.05	0.03	A	A
Elevated Ramp 5	14	1-Way	3,600	994	993	0.28	0.28	A	A
Elevated Ramp 6	15	1-Way	3,600	1,174	127	0.33	0.04	A	A
Elevated Ramp 7	16	1-Way	1,800	365	181	0.20	0.10	A	A
Flyover 1	17	EB	3,600	549	2,026	0.15	0.56	A	A
		WB	3,600	1,420	830	0.39	0.23	A	A
Flyover 2	18	EB	3,600	916	2,393	0.25	0.66	A	B
		WB	3,600	2,216	1,433	0.62	0.40	B	A
Slip road 1	19	1-Way	3,600	179	319	0.05	0.09	A	A
Slip road 2	20	1-Way	3,600	434	191	0.12	0.05	A	A
Slip road 3	21	1-Way	3,600	294	170	0.08	0.05	A	A
Slip road 4	22	1-Way	3,600	102	139	0.03	0.04	A	A
Slip road 1	23	1-Way	3,600	501	1,376	0.14	0.38	A	A
Slip road 2	24	1-Way	3,600	1,352	2,075	0.38	0.58	A	A
Slip road 3	25	1-Way	1,800	7	1	0.01	0.01	A	A
Slip road 4	26	1-Way	1,800	130	401	0.07	0.22	A	A

Note: Dir. = Direction, NB = Northbound, SB = Southbound, EB = Eastbound, WB = Westbound.



SECTION 11 : ELEVATED RAMP 2				
DIRECTION	V/C RATIO		LOS	
1-WAY	0.07	0.34	A	A

SECTION 4 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.19	0.64	A	B
WESTBOUND	0.49	0.39	A	A

SECTION 5 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.25	0.76	A	C
WESTBOUND	0.72	0.44	C	A

SECTION 10 : ELEVATED RAMP 1				
DIRECTION	V/C RATIO		LOS	
1-WAY	0.01	0.02	A	A

SECTION 1 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.11	0.17	A	A
SOUTHBOUND	0.27	0.28	A </td <td>A</td>	A

SECTION 2 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.11	0.42	A	A
SOUTHBOUND	0.13	0.07	A	A

SECTION 3 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.17	0.41	A	A
SOUTHBOUND	0.10	0.07	A	A

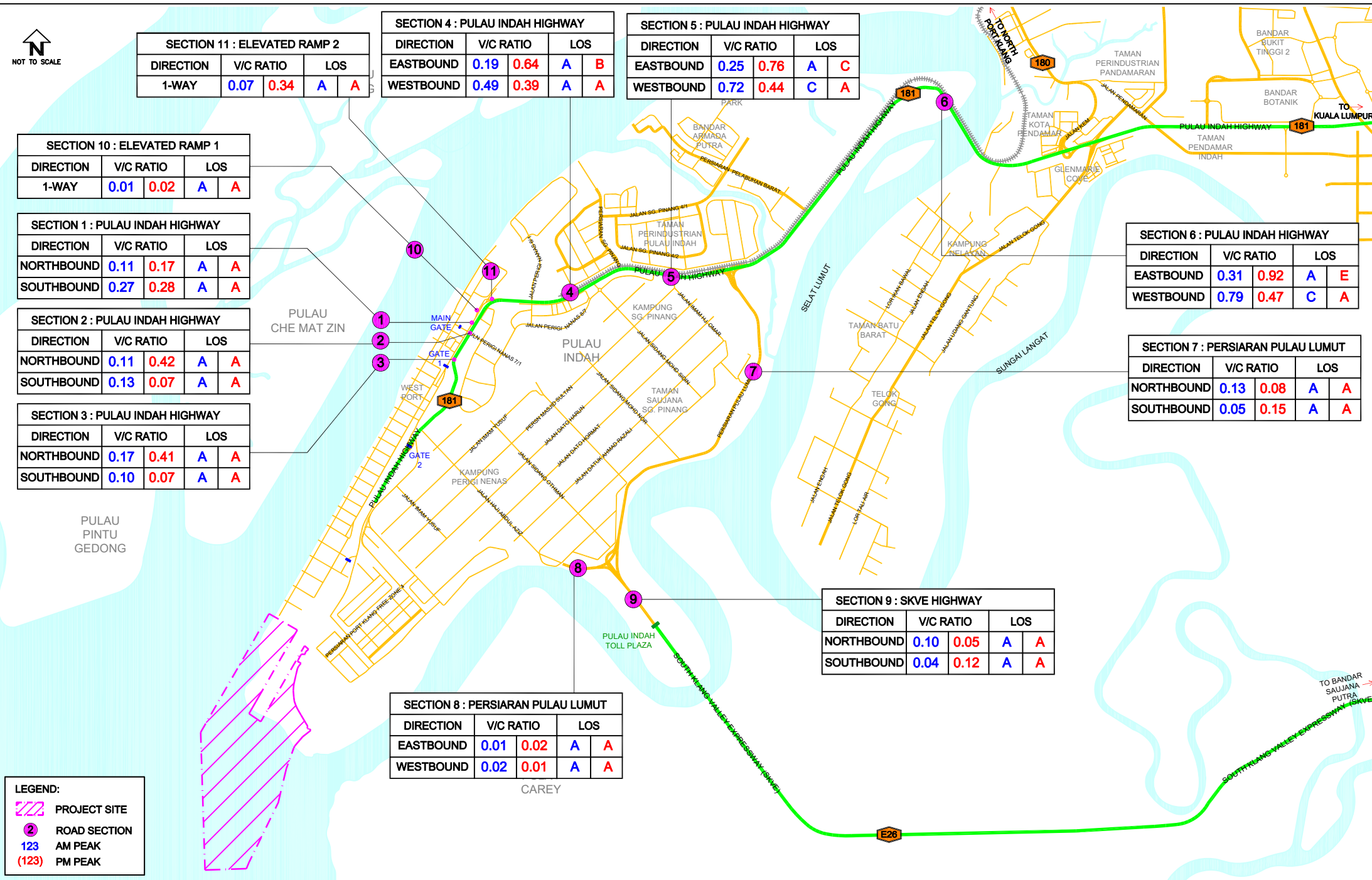
SECTION 6 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.31	0.92	A	E
WESTBOUND	0.79	0.47	C	A

SECTION 7 : PERSIARAN PULAU LUMUT				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.13	0.08	A	A
SOUTHBOUND	0.05	0.15	A	A

SECTION 9 : SKVE HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.10	0.05	A	A
SOUTHBOUND	0.04	0.12	A	A

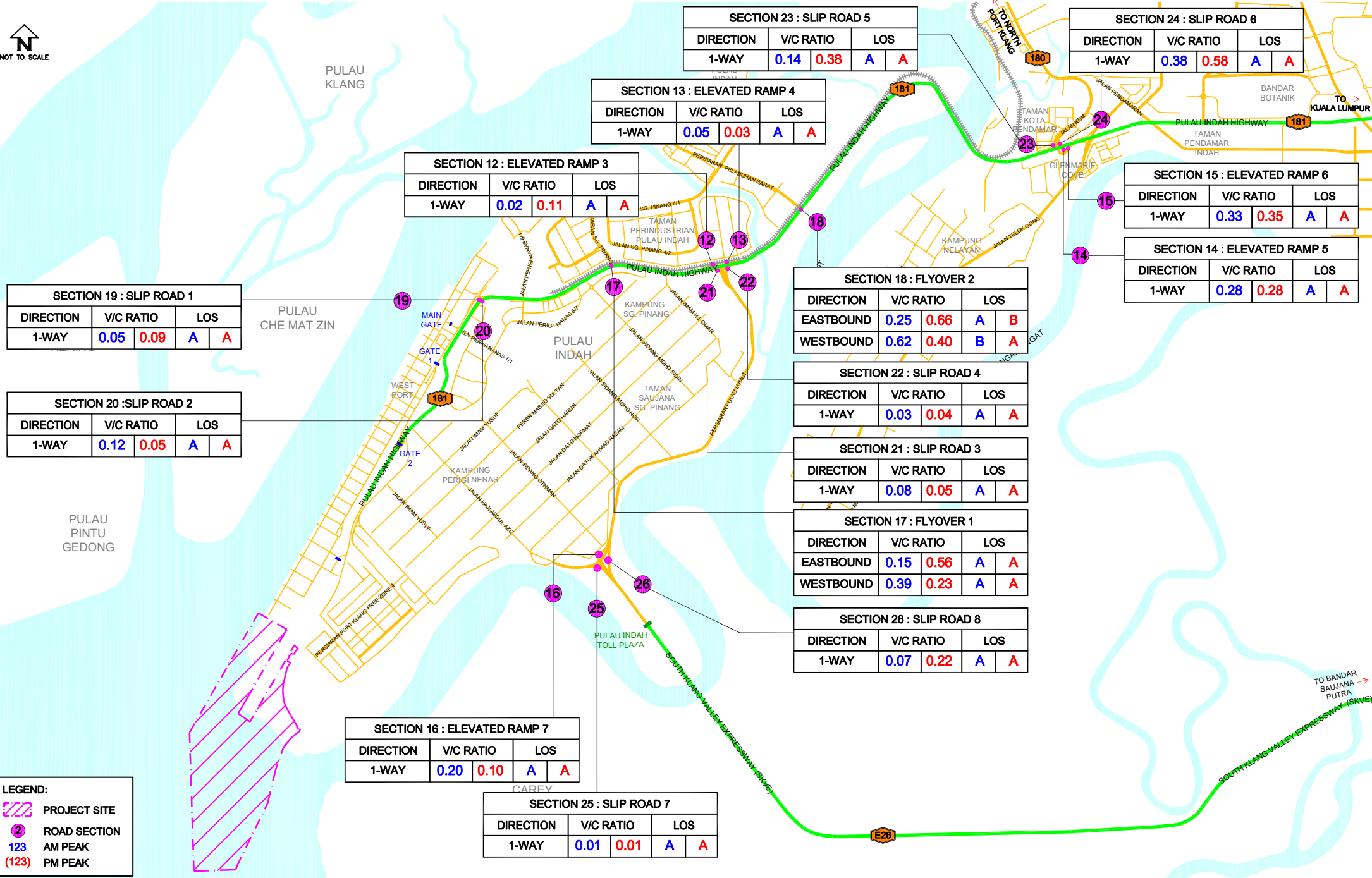
SECTION 8 : PERSIARAN PULAU LUMUT				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.01	0.02	A	A
WESTBOUND	0.02	0.01	A	A

LEGEND:	
	PROJECT SITE
	ROAD SECTION
	AM PEAK
	PM PEAK



EXISTING MORNING AND EVENING PEAK HOUR VOLUME OVER CAPACITY (v/c) RATIO - 1

FIGURE 3.3



EXISTING MORNING AND EVENING PEAK HOUR VOLUME OVER CAPACITY (v/c) RATIO - 2

FIGURE 3.4

3.5.3 The results of the roadway volume over capacity analysis indicated that the existing roads within the study area/Pulau Indah are currently operating at acceptable level of service ranging from LOS A to LOS C during morning and evening peak hour periods except Pulau Indah Highway (FT181) road section 6 eastbound direction which currently is operating at near capacity; LOS E during evening peak hour.

### 3.6 Analysis of Existing Junctions

3.6.1 Evaluation of existing junction operational performance is carried out using the SIDRA (Signalized and Unsignalised Intersection Design and Research Aid) program. This program was developed by the Australian Road Research Board for the design and evaluation of junction. The operational performance of junction is measures based on degree of saturation as shown in **Table 3.6**.

**Table 3.6: Level of Service Criteria (LOS) for Junction Performance**

Level of Service (LOS)	Controlled Delay, x (second)		
	Stop Control Junction	Roundabout	Signalised Junction
A	$x \leq 10$	$x \leq 10$	$x \leq 10$
B	$10 < x \leq 15$	$10 < x \leq 20$	$10 < x \leq 20$
C	$15 < x \leq 25$	$20 < x \leq 35$	$20 < x \leq 35$
D	$25 < x \leq 35$	$35 < x \leq 50$	$35 < x \leq 55$
E	$35 < x \leq 50$	$50 < x \leq 70$	$55 < x \leq 80$
F	$x > 50$	$x > 70$	$x > 80$

3.6.2 Based on the existing traffic volume at the junctions, junction analysis were undertaken for each of the junctions and the results are summarised in **Table 3.7** and are illustrated in **Figure 3.5** to **Figure 3.11**, respectively.

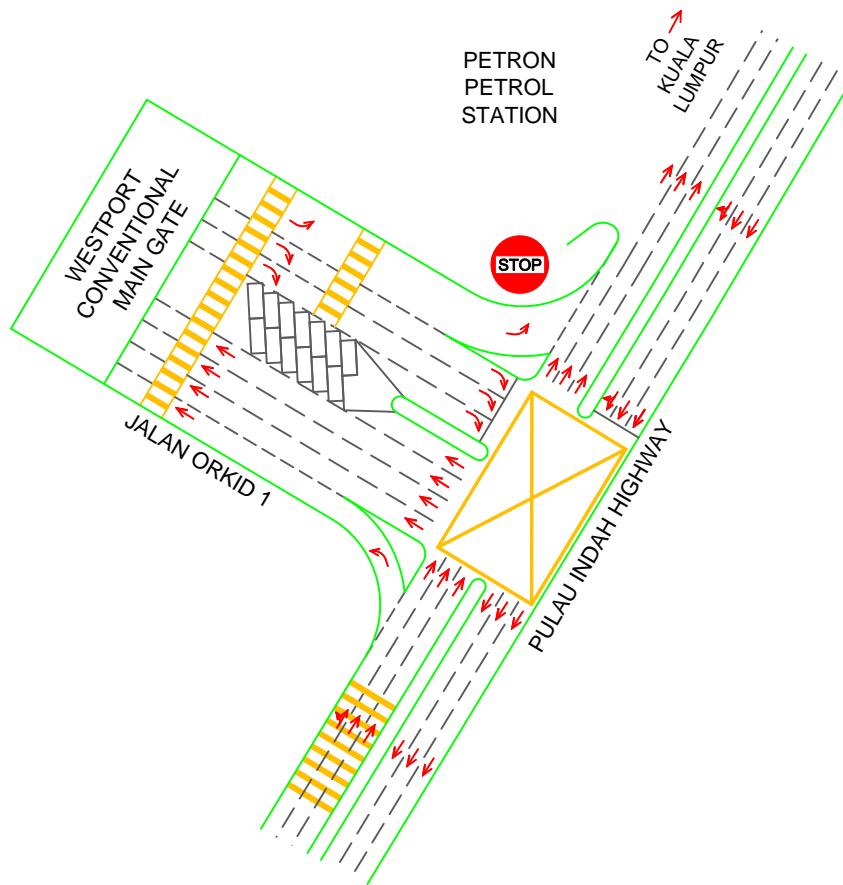
**Table 3.7: Operational Performance of Existing Junctions**

Junction Name	Junction Id	Peak Hour Traffic Flow (pcu/hr)		Maximum Degree of Saturation		Average Controlled Delay (second)		Maximum Level of Service (LOS)	
		AM	PM	AM	PM	AM	PM	AM	PM
Pulau Indah Highway / Jalan Orkid 1 Priority Junction	J1	1,390	1,642	0.72	0.26	56	55	F	F
Pulau Indah Highway / Access FFM Sdn. Bhd. Priority Junction	J2	1,423	1,627	0.23	0.25	11	14	B	B
Pulau Indah Highway / Jalan Perigi Nanas 7/1 Priority Junction	J3	1,171	2,114	0.33	0.42	19	57	C	F
Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction	J5	2,264	2,322	0.78	0.73	24	21	C	C

**Table 3.7: Operational Performance of Existing Junctions (Continued)**

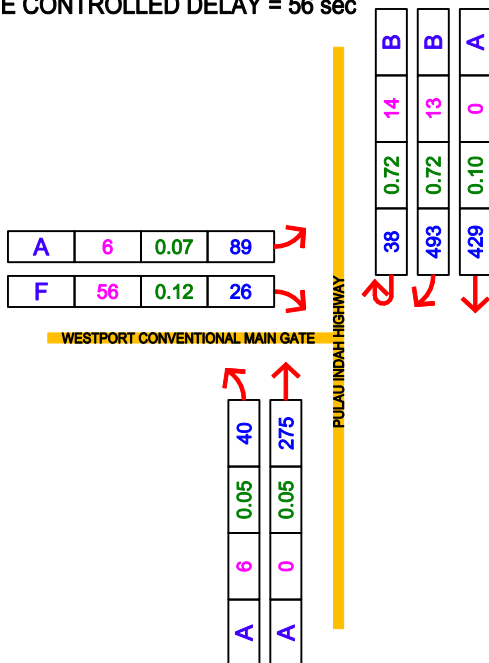
Junction Name	Junction Id	Peak Hour Traffic Flow (pcu/hr)		Maximum Degree of Saturation		Average Controlled Delay (second)		Maximum Level of Service (LOS)	
		AM	PM	AM	PM	AM	PM	AM	PM
Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction	J6	3,604	4,694	0.80	0.94	21	29	C	C
Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction	J8	4,248	4,947	0.68	0.62	18	12	B	B
Persiaran Pulau Lumut / SKVE Highway Priority Junction	J10	236	247	0.06	0.06	7	7	A	A

3.6.3 The junction performance analysis indicated that the existing junctions within the study area are currently operating at acceptable level of service; ranging from LOS A to LOS C except Pulau Indah Highway / Jalan Orkid 1 Priority Junction (J1) and Pulau Indah Highway / Jalan Perigi Nanas 7/1 Priority Junction (J3) during morning and evening peak hour period. These junctions were already required to upgrade to a signalised junction based on the existing condition and traffic count survey.



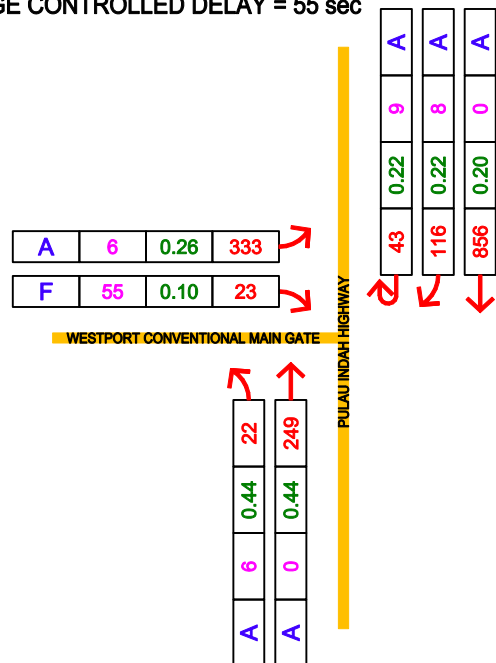
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS F  
 DEGREE OF SATURATION = 0.72  
 TOTAL INFLOW = 1,390 pcu/hour  
 AVERAGE CONTROLLED DELAY = 56 sec



### PM PEAK HOUR

OVERALL PERFORMANCE = LOS F  
 DEGREE OF SATURATION = 0.26  
 TOTAL INFLOW = 1,642 pcu/hour  
 AVERAGE CONTROLLED DELAY = 55 sec

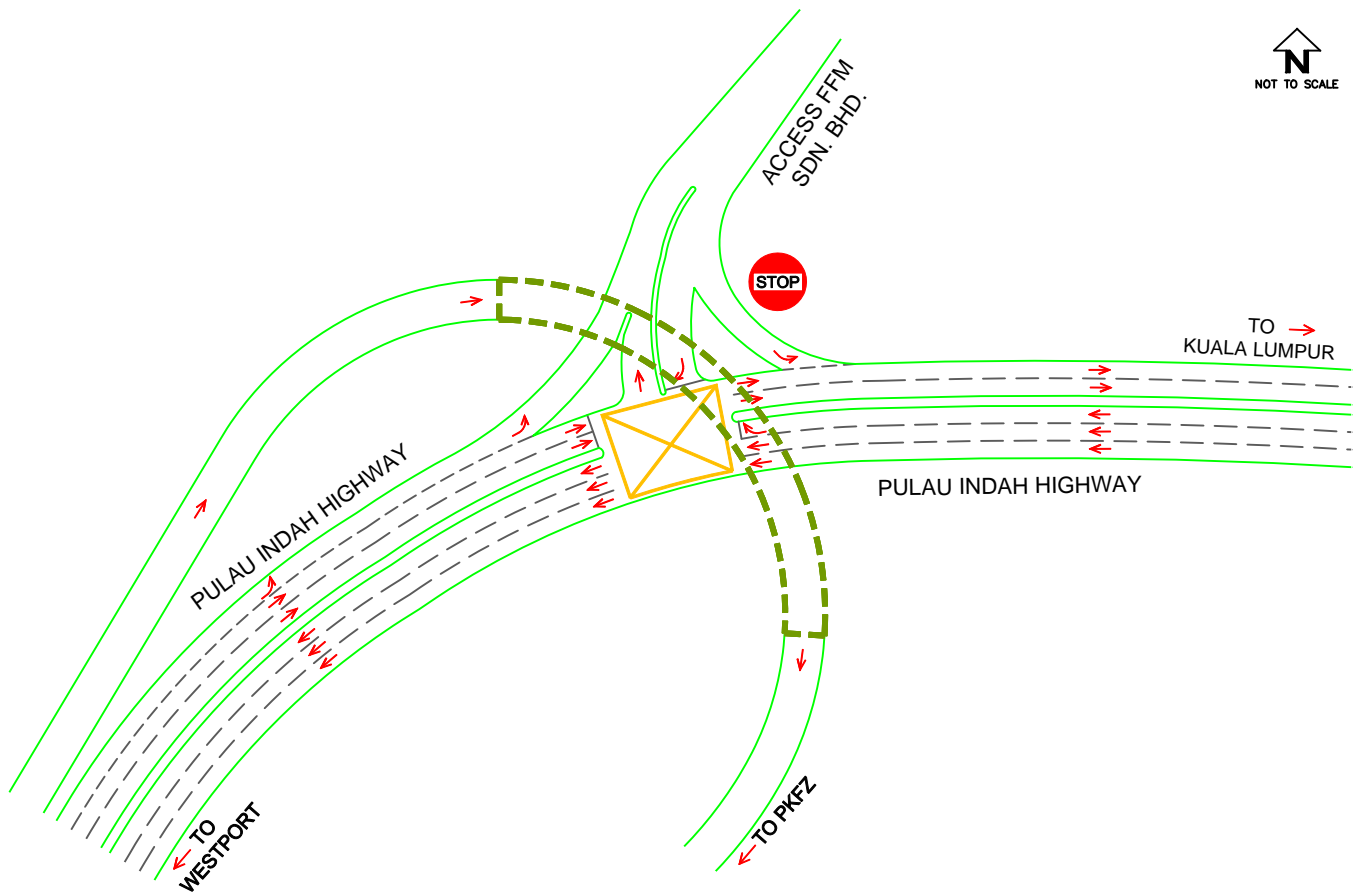


LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

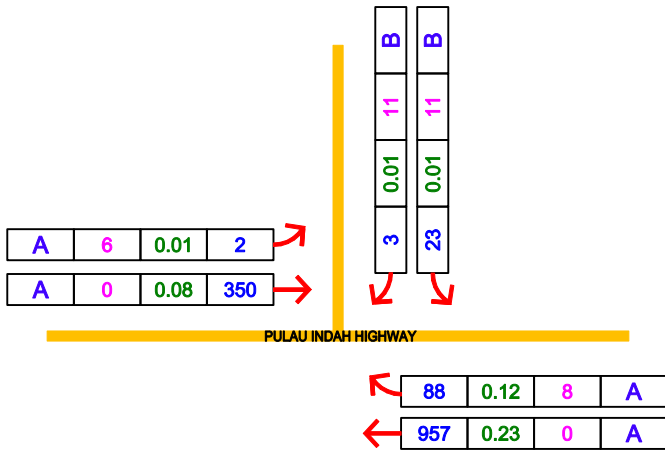
SCHEMATIC DIAGRAM OF EXISTING PULAU INDAH HIGHWAY / JALAN ORKID 1 PRIORITY JUNCTION (J1) AND ITS OPERATIONAL PERFORMANCE

FIGURE 3.5



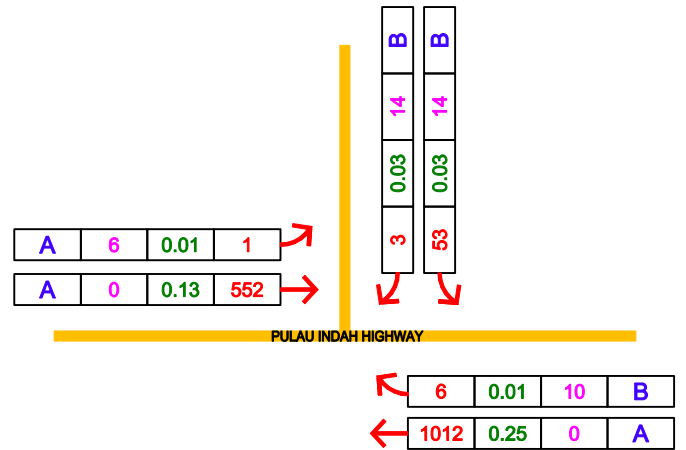
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.23  
 TOTAL INFLOW = 1,423 pcu/hour  
 AVERAGE CONTROLLED DELAY = 11 sec



### PM PEAK HOUR

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.25  
 TOTAL INFLOW = 1,627 pcu/hour  
 AVERAGE CONTROLLED DELAY = 14 sec



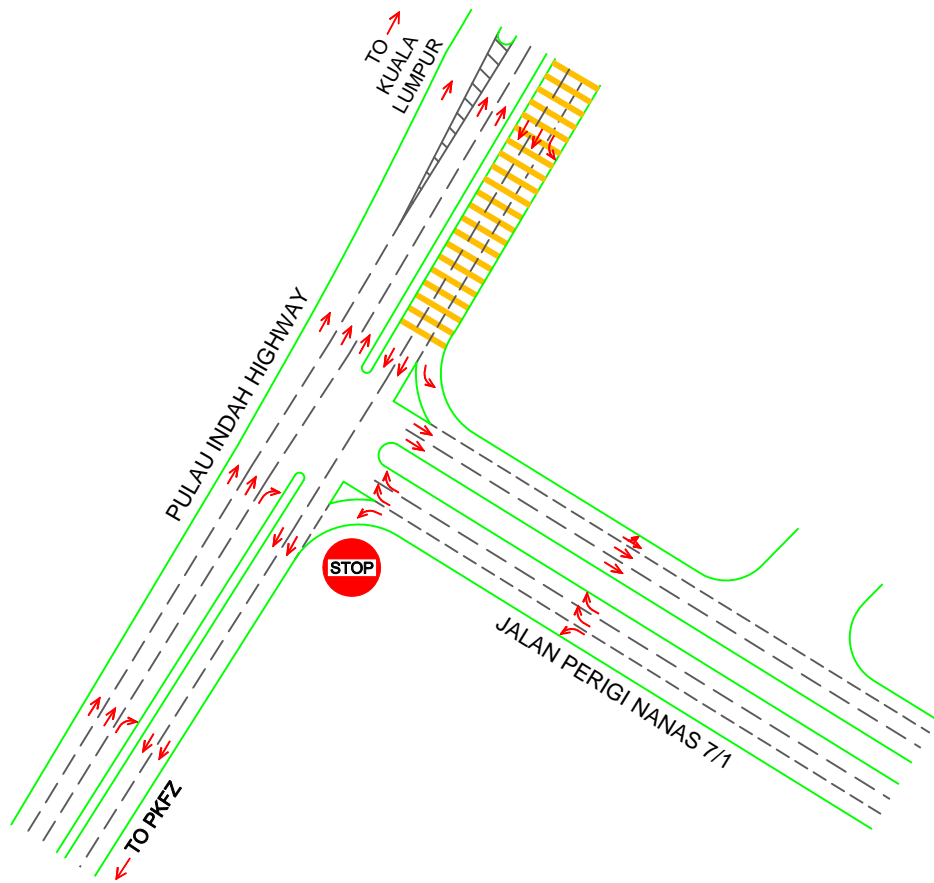
LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

SCHMATIC DIAGRAM OF EXISTING PULAU INDAH HIGHWAY / ACCESS FFM SDN. BHD. PRIORITY JUNCTION (J2) AND ITS OPERATIONAL PERFORMANCE

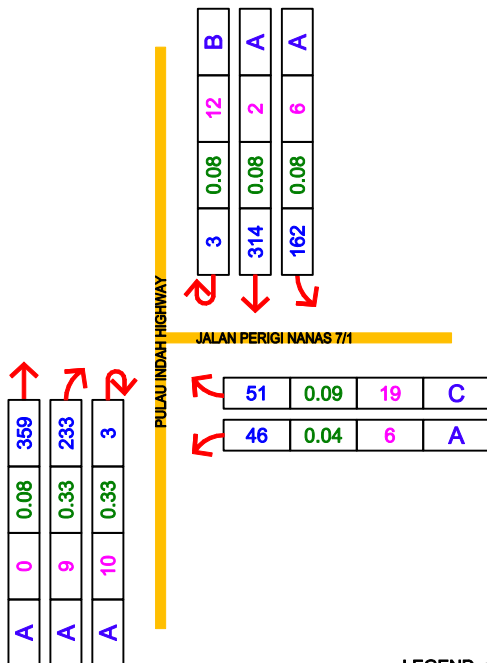
FIGURE 3.6





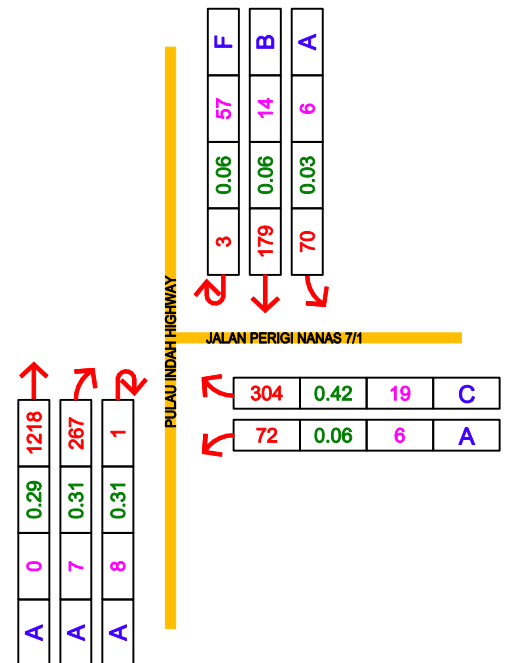
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.33  
 TOTAL INFLOW = 1,171 pcu/hour  
 AVERAGE CONTROLLED DELAY = 19 sec



### PM PEAK HOUR

OVERALL PERFORMANCE = LOS F  
 DEGREE OF SATURATION = 0.42  
 TOTAL INFLOW = 2,114 pcu/hour  
 AVERAGE CONTROLLED DELAY = 57 sec

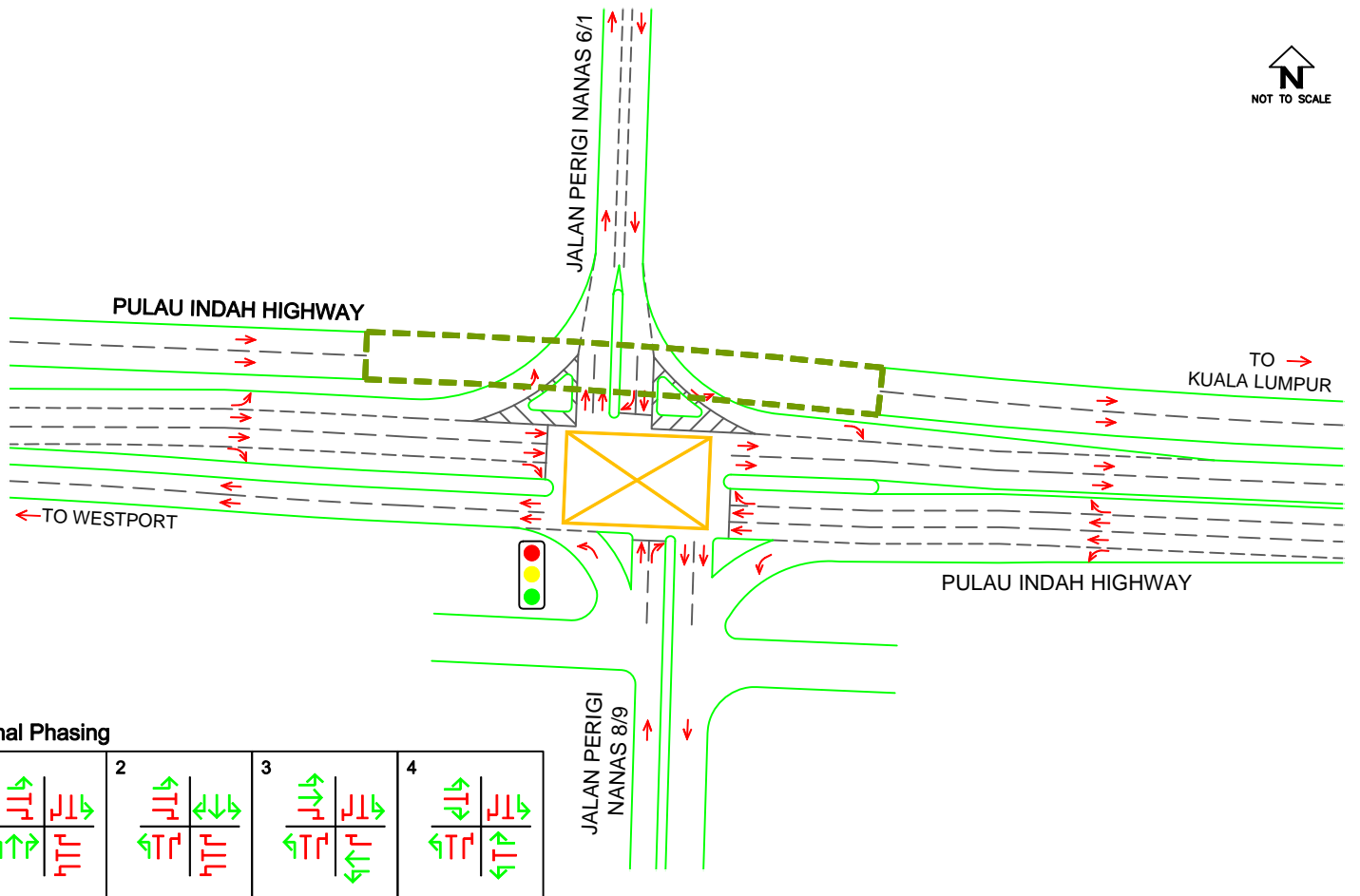


LEGEND :

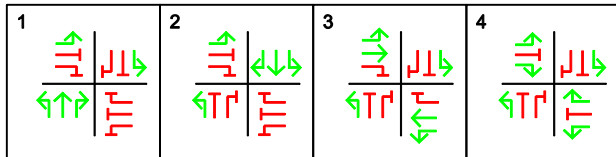
- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

SCHMATIC DIAGRAM OF EXISTING PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 7/1 PRIORITY JUNCTION (J3) AND ITS OPERATIONAL PERFORMANCE

FIGURE 3.7



**Signal Phasing**

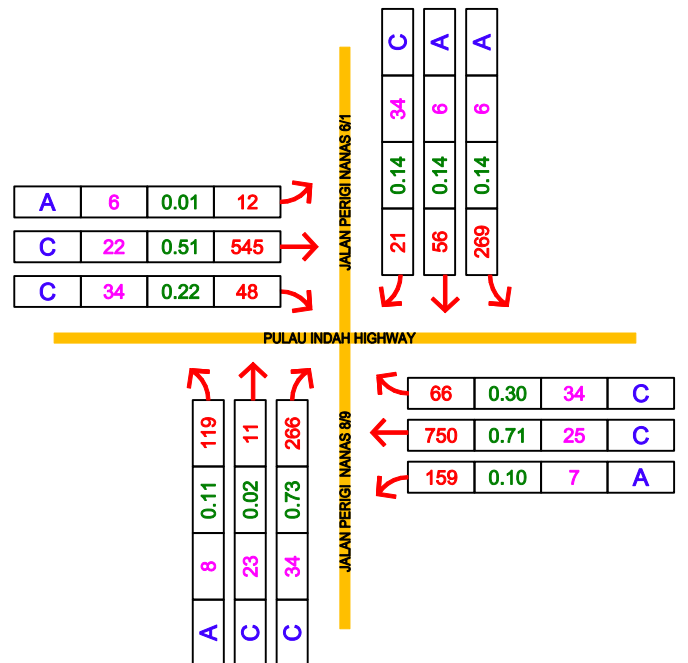
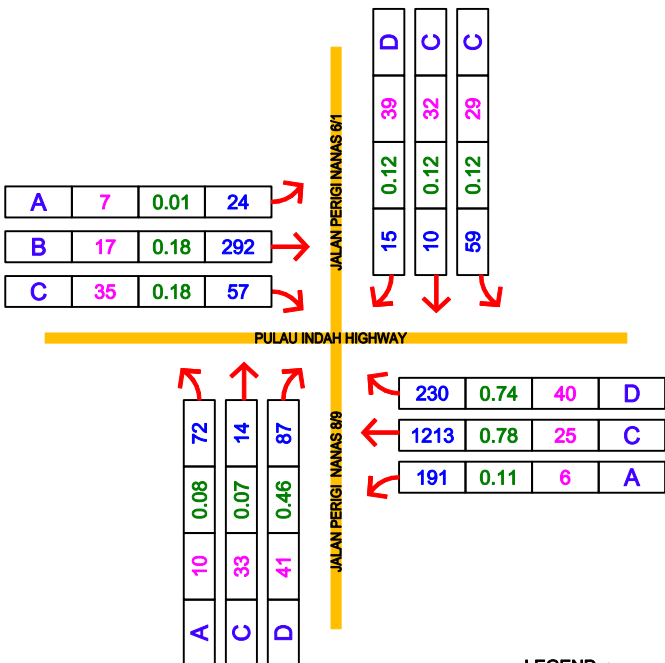


**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.78  
 TOTAL INFLOW = 2,264 pcu/hour  
 AVERAGE CONTROLLED DELAY = 24 sec

**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.73  
 TOTAL INFLOW = 2,322 pcu/hour  
 AVERAGE CONTROLLED DELAY = 21 sec

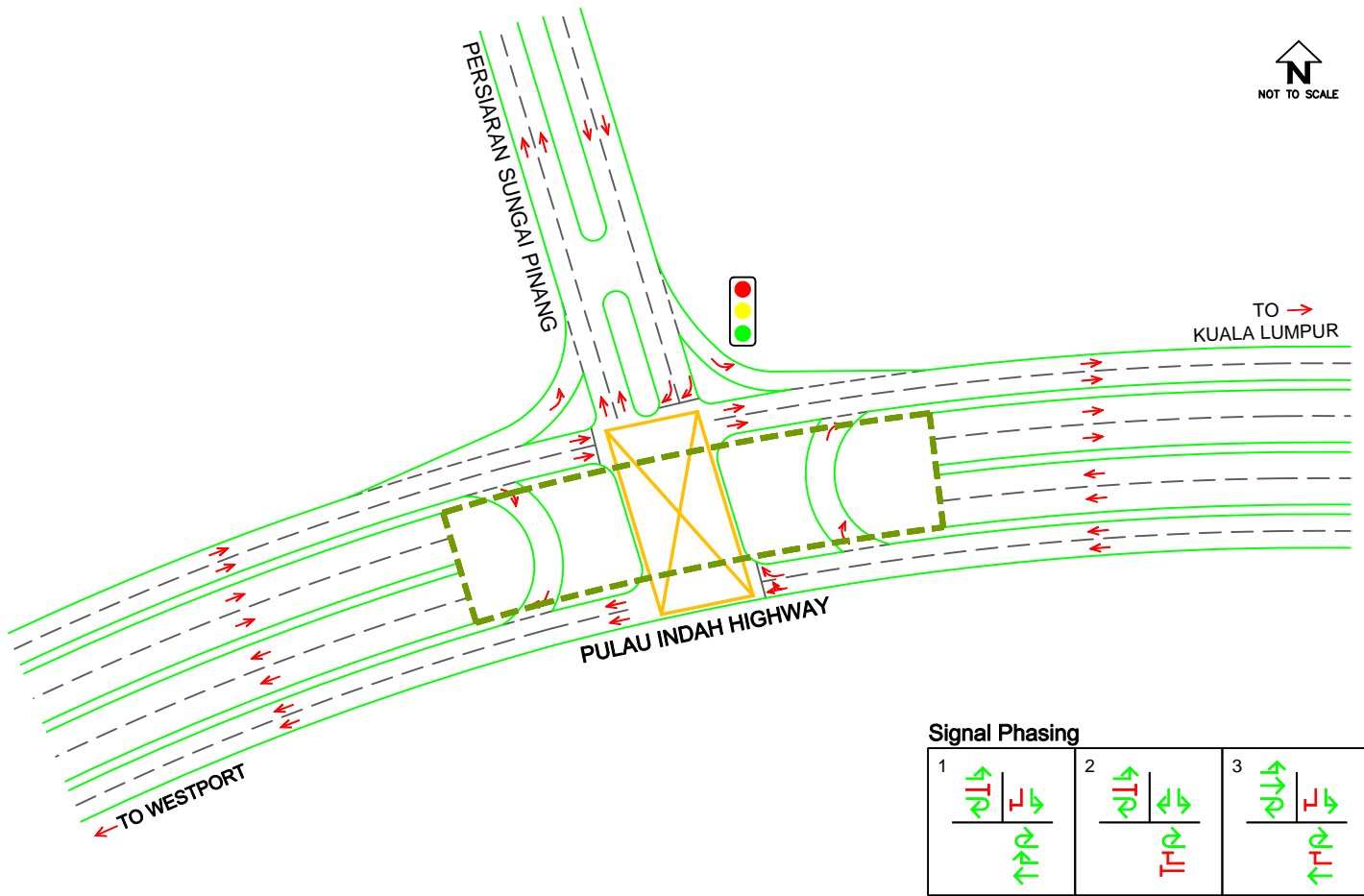


**LEGEND :**

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

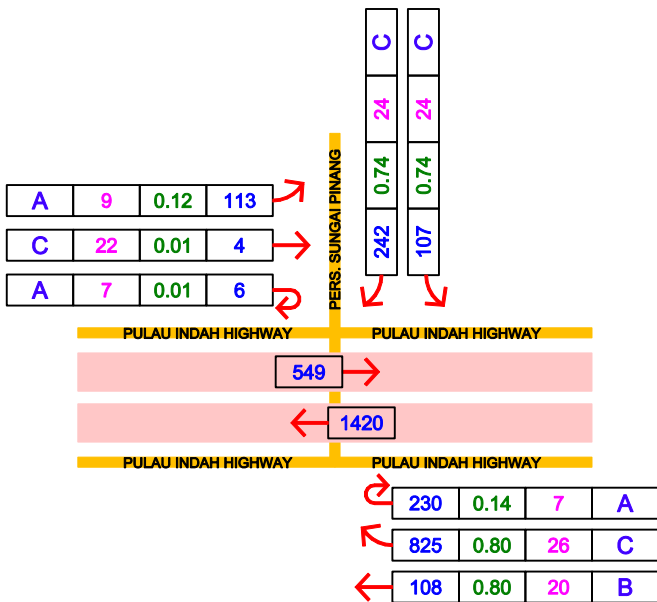
SCHEMATIC DIAGRAM OF EXISTING PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 6/1 / JALAN PERIGI NANAS 8/9 SIGNALISED JUNCTION (J5) AND ITS OPERATIONAL PERFORMANCE

FIGURE 3.8



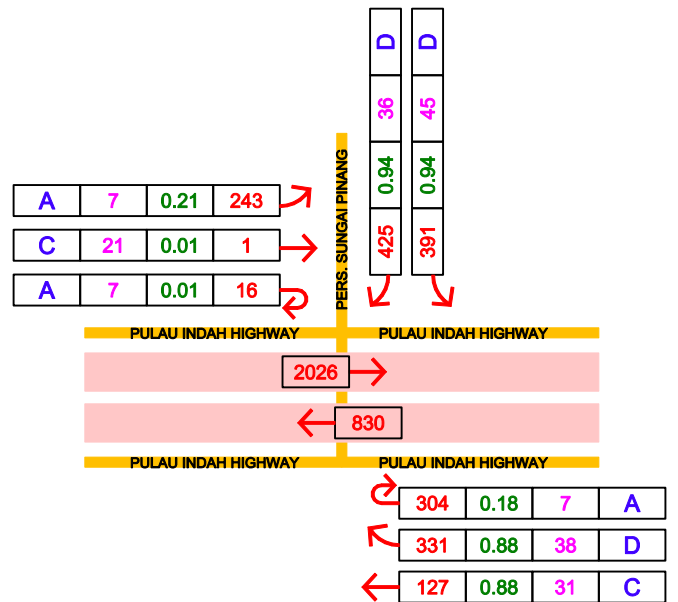
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.80  
 TOTAL INFLOW = 3,604 pcu/hour  
 AVERAGE CONTROLLED DELAY = 21 sec



### PM PEAK HOUR

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.94  
 TOTAL INFLOW = 4,694 pcu/hour  
 AVERAGE CONTROLLED DELAY = 29 sec

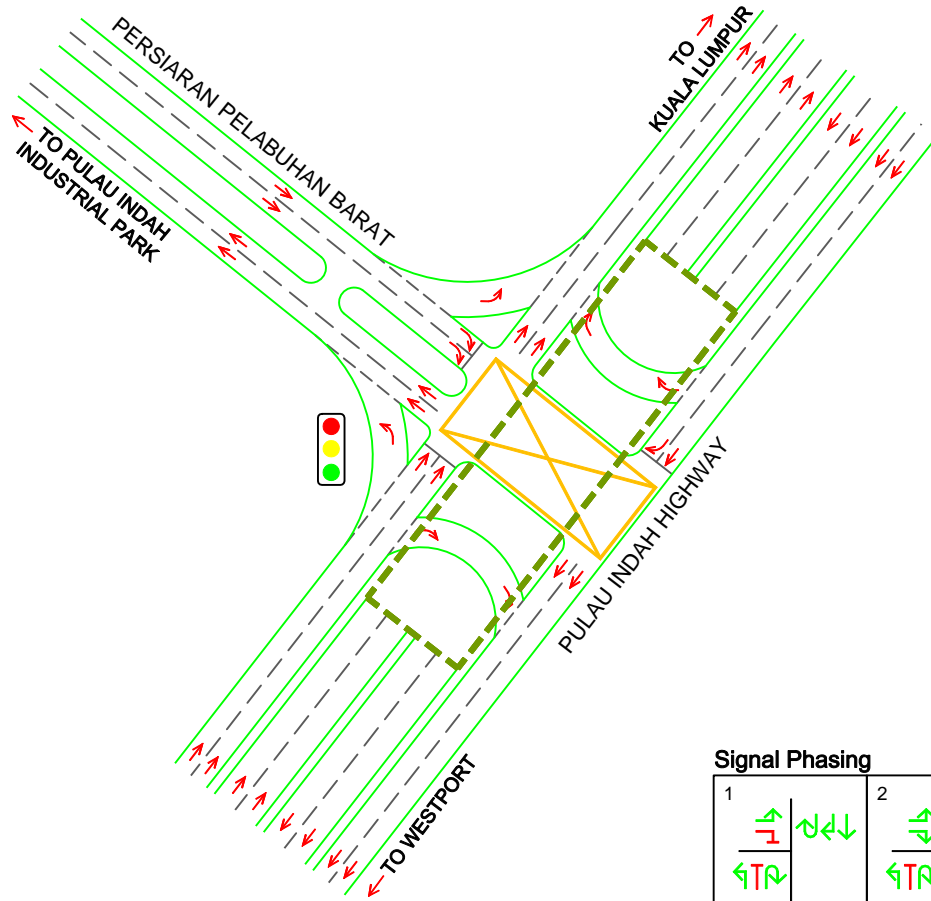


**LEGEND :**

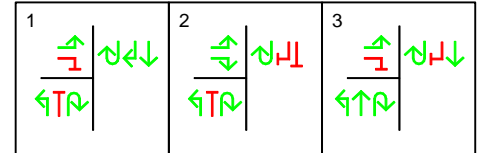
- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

SCHMATIC DIAGRAM OF EXISTING PULAU INDAH HIGHWAY / PERSIARAN SUNGAI PINANG SIGNALISED JUNCTION (J6) AND ITS OPERATIONAL PERFORMANCE

FIGURE 3.9

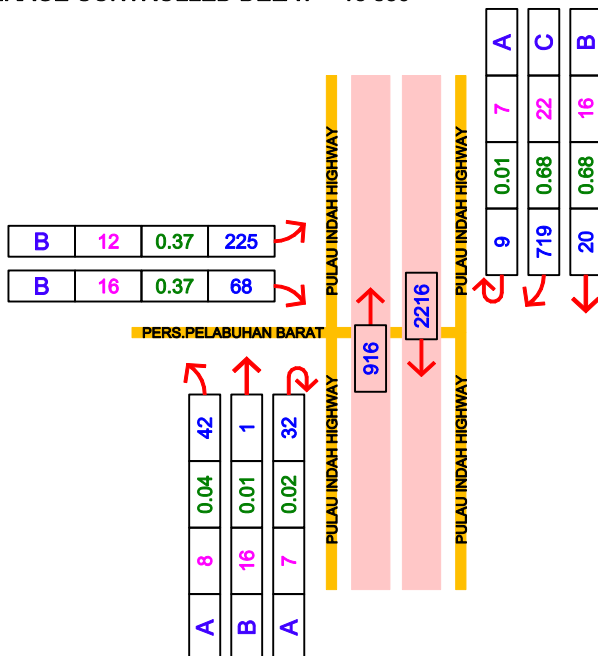


**Signal Phasing**



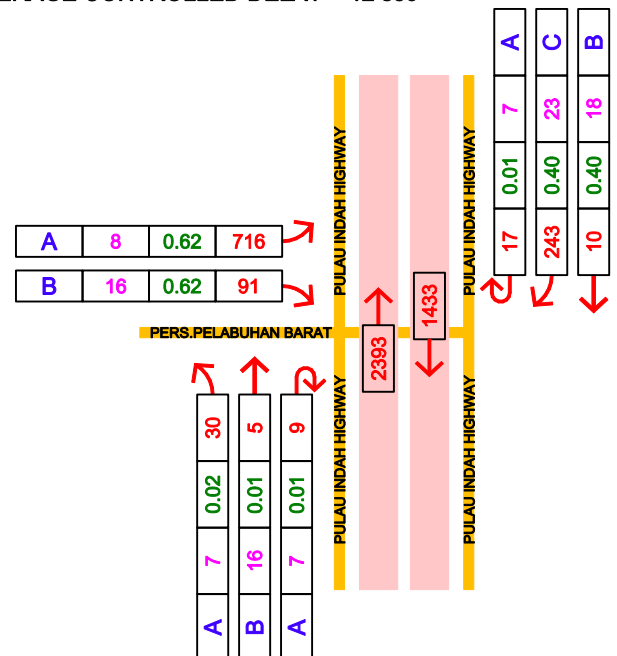
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.68  
 TOTAL INFLOW = 4,248 pcu/hour  
 AVERAGE CONTROLLED DELAY = 18 sec



**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.62  
 TOTAL INFLOW = 4,947 pcu/hour  
 AVERAGE CONTROLLED DELAY = 12 sec

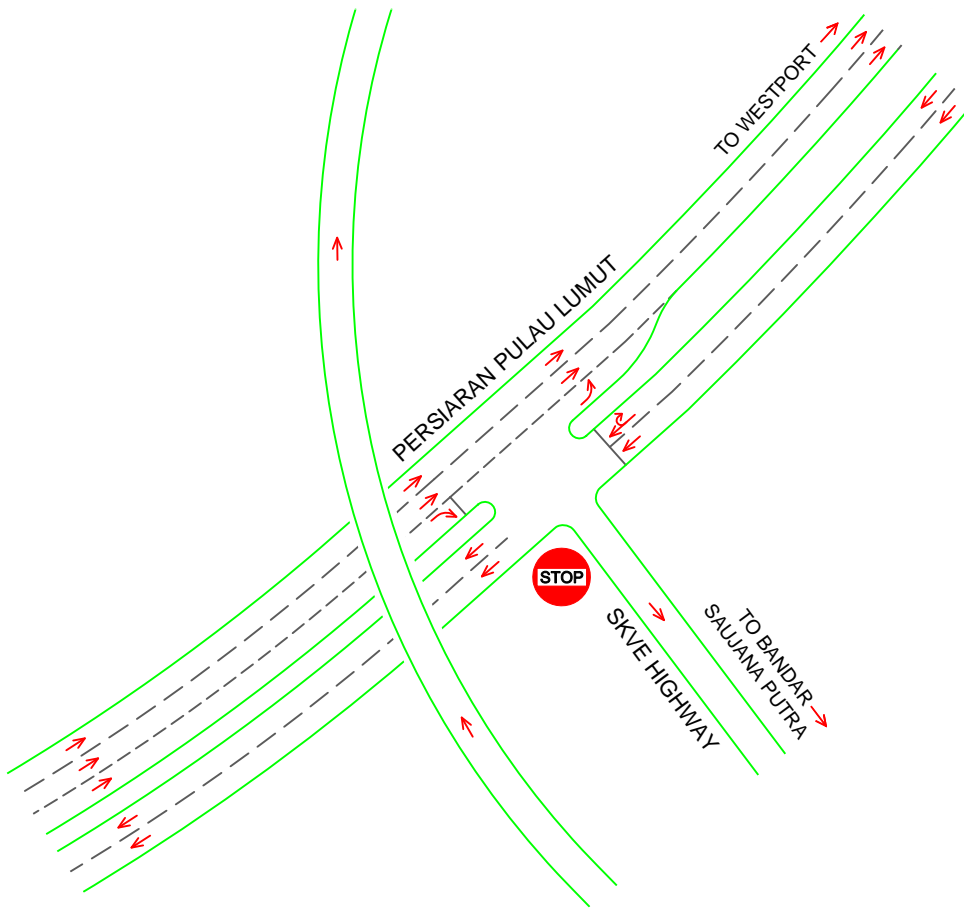


**LEGEND :**

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

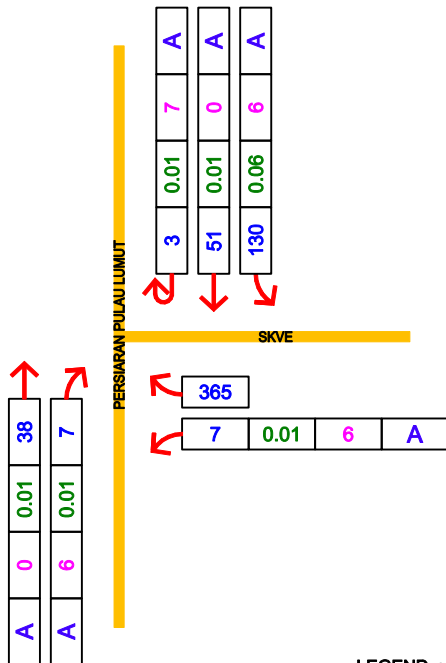
**SCHEMATIC DIAGRAM OF EXISTING PULAU INDAH HIGHWAY / PERSIARAN PELABUHAN BARAT SIGNALISED JUNCTION (J8) AND ITS OPERATIONAL PERFORMANCE**

**FIGURE 3.10**



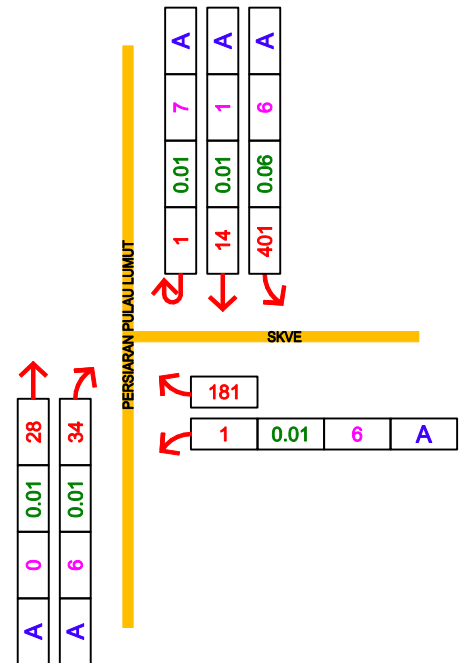
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS A  
 DEGREE OF SATURATION = 0.06  
 TOTAL INFLOW = 236 pcu/hour  
 AVERAGE CONTROLLED DELAY = 7 sec



### PM PEAK HOUR

OVERALL PERFORMANCE = LOS A  
 DEGREE OF SATURATION = 0.06  
 TOTAL INFLOW = 247 pcu/hour  
 AVERAGE CONTROLLED DELAY = 7 sec



LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

SCHMATIC DIAGRAM OF EXISTING PERSIARAN PULAU LUMUT / SKVE HIGHWAY PRIORITY JUNCTION (J10) AND ITS OPERATIONAL PERFORMANCE

FIGURE 3.11

# **METHODOLOGY OF FUTURE TRAFFIC FORECAST**

## **4.0 METHODOLOGY OF FUTURE TRAFFIC FORECAST**

### **4.1 Introduction**

4.1.1 Forecast of total future traffic is divided into two traffic components, which are the non-site and site traffic. The details of each traffic components are described below:

- i. Non-site traffic comprises through traffic in the vicinity of the project site. This traffic is normally referred as base traffic.
- ii. Site traffic comprises traffic generated and attracted by the project site and is normally referred to as 'project site traffic'.

4.1.2 Future traffic forecast focuses on two critical hours of the day i.e. morning and evening peak hours. It was assumed that if the road network and junction are able to cater for the morning and evening peak periods, they would adequately meet the traffic demand during others periods of the day.

4.1.3 In forecasting the future traffic demand, it is necessary to determine the design year for which the analysis of future traffic is to be undertaken. The design year used in the study are Year 2028 and Year 2038 which represents ten (10) and twenty (20) years traffic projection, respectively.

### **4.2 Forecast of Non-Site (Base) Traffic**

4.2.1 Traffic on the road in the vicinity of the project site will continue to increase and it is normally referred to as base traffic or background traffic. The future base traffic is normally calculated by applying a traffic growth rate onto the existing traffic flows up to the design year. Traffic growth is related to growth in population and motor vehicles as well as economic activities trends of traffic on the surrounding roads.

4.2.2 It is reported in the RTVM 2018 the normal growth rate of Selangor is -0.60% per annum. Thus, this study has adopt an annual traffic growth of 0.5% percent per annum for the non-site base traffic to reflect the current natural growth of the locality. The adoption of these growth rates over the future years is expected to provide a realistic

forecast for future traffic demand. **Figure 4.1** illustrates the average traffic growth for the state of Selangor.

### 4.3 Westport Development Traffic Forecast

4.3.1 Development traffic forecast focuses on two critical hours of the day i.e. morning and evening peak hours. It is expected that during these hours the traffic volumes are at the highest and thus provide the greatest test on the road network capacity.

4.3.2 The estimation of the trips generation and attraction by the Westport development is undertaken for all vehicular modes and therefore walk trips are excluded from the analysis. The forecast of the development traffic is usually undertaken by using trip generation rates, which are observed relationship between traffic and development land use mix and size. Traffic generated by and attracted to the project site based on the trip rates produces by the latest Trip Generation for Malaysia 2010.

4.3.3 However, the estimation of the trips generation and attraction by the project site is based on the growth rate calculated from the forecast of total trucking traffic, twenty-foot equivalent unit (TEU) for design year 2028 and year 2038. The growth rates for the total trucking traffic forecast for project site are summarised in **Table 4.1**.

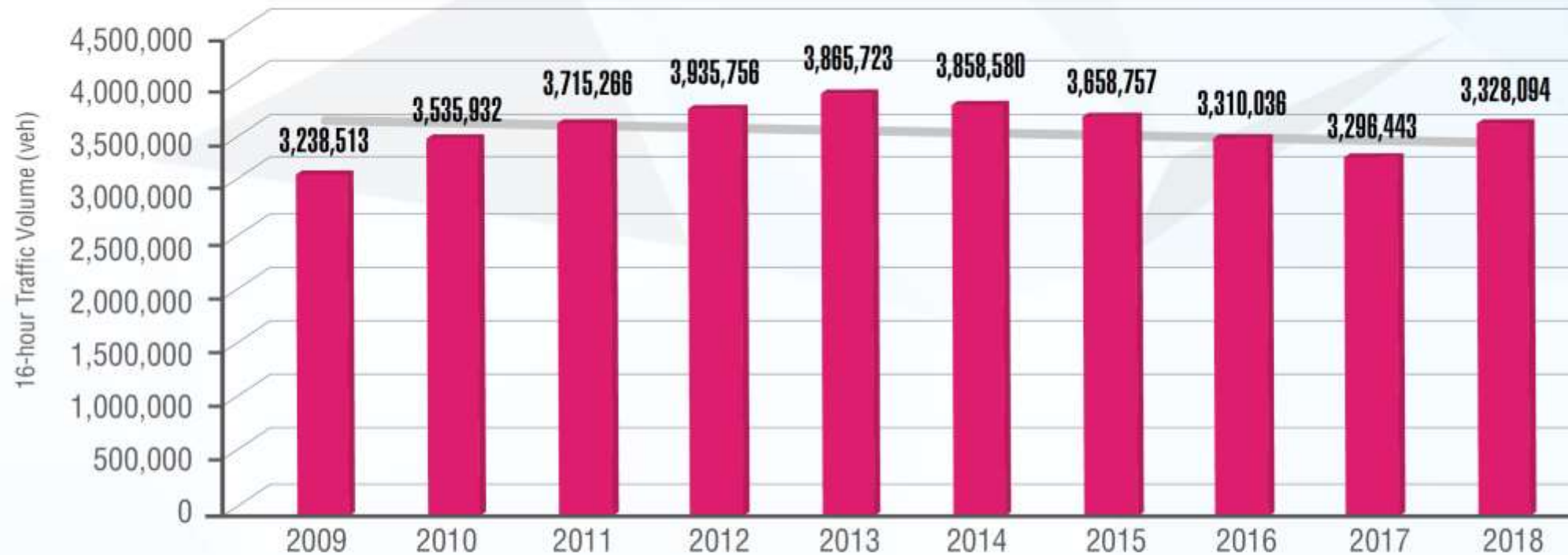
**Table 4.1: Summarization of Growth Rates for Design Year 2028 and Year 2038**

Year	Total Trucking Traffic Forecast of Project Site (In/Out)(Units/year)	Truck Traffic Growth
2018	2,559,425	-
2028	4,241,714	4.7%
2038	5,827,682	3.2%

4.3.4 Based on the truck traffic growth, it is estimated the project site will generate 389pcu/hour and attract 1,066pcu/hour during morning peak whilst in the evening peak it is expected to generate 1,199pcu/hour and attract 833pcu/hour for design year 2028, whilst for design year 2038 it is forecasted to generate 583pcu/hour and attract 1,746pcu/hour during morning peak whilst in the evening peak it is expected to generate 1,679pcu/hour and attract 1,042pcu/hour. In addition to the port traffic, a free zone development which consisting industrial plots have also been considered 50% by year 2028 and 100% by year 2038.



## YEARLY 16-HOUR TRAFFIC VOLUME (2009 - 2018)



$$y = 1E+12e^{-0.006x} \mid R^2 = 0.06516$$

**NORMAL GROWTH = -0.60%**

*Yearly 16-hour Traffic Volume (2009- 2018)  
& Normal Traffic Growth with Exponential Trendline for the Year 2018 in Selangor*

4.3.5 The detailed breakdown of trips generated by and attracted to the Westport and Free Zone development during morning and evening peak hour is shown in **Table 4.2**.

**Table 4.2: Predicted Peak Hour Project Site Traffics**

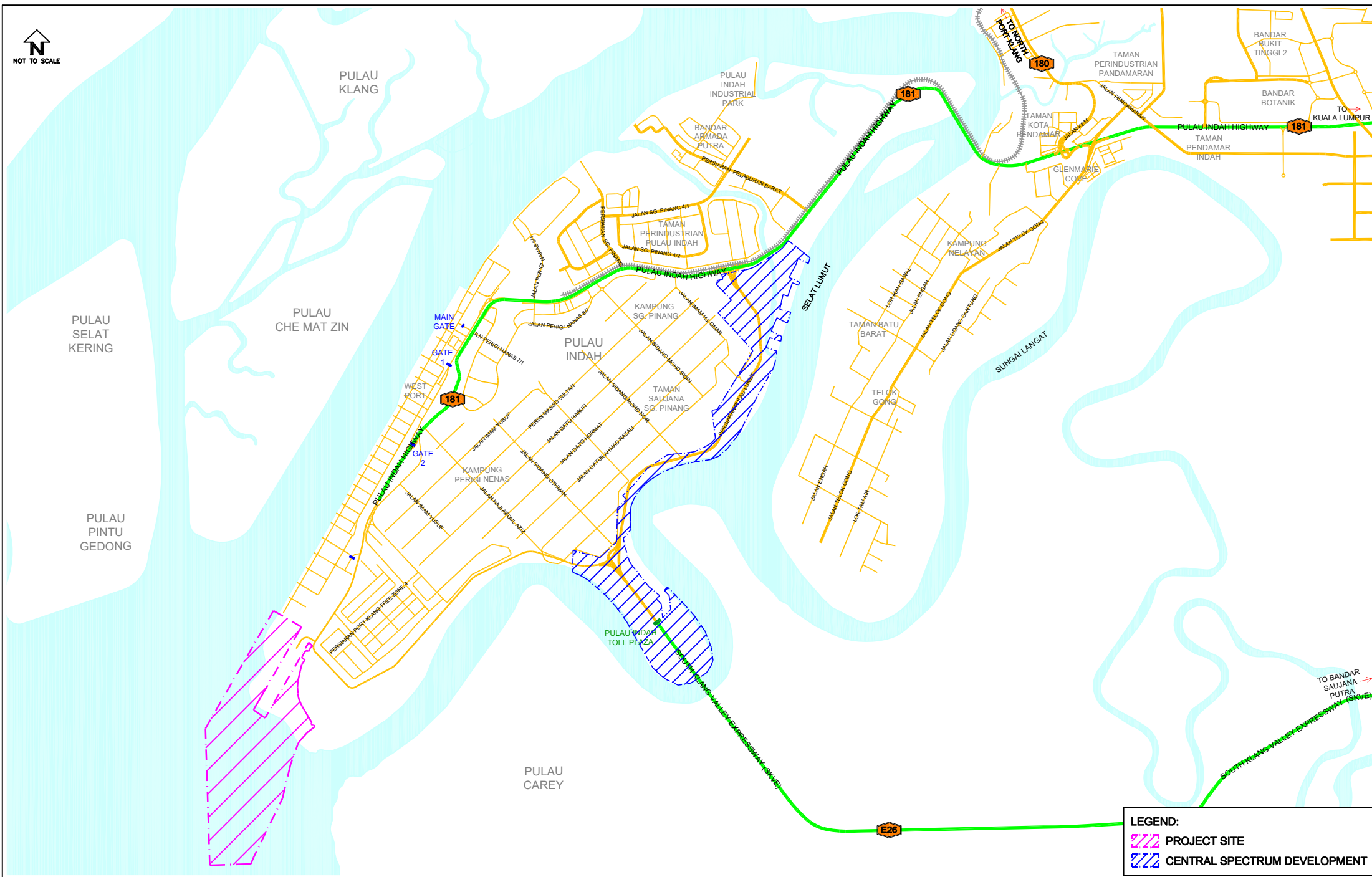
Land Use	Design Year	AM Peak Hour (Pcu/Hr)			PM Peak Hour (Pcu/Hr)		
		In	Out	Total	In	Out	Total
Westport Development	2028	391	199	590	630	726	1,356
	2038	396	203	599	637	734	1,371
Free Zone Development	2028	675	190	865	203	473	676
	2038	1,350	380	1,730	405	945	1,350
<b>Total</b>	<b>2028</b>	<b>1,066</b>	<b>389</b>	<b>1,455</b>	<b>833</b>	<b>1,199</b>	<b>2,032</b>
	<b>2038</b>	<b>1,746</b>	<b>583</b>	<b>2,329</b>	<b>1,042</b>	<b>1,679</b>	<b>2,721</b>

4.3.6 Traffic generated by the committed development in vicinity of the project site are also considered and included as part of other development traffic forecast. The location of committed development are illustrated in **Figure 4.2**. The detailed breakdown of trips generated by and attracted to committed development during peak hours are shown in **Table 4.4**.

**Table 4.4: Peak Hour Development Traffic Generated by Committed Development**

Committed Development	Phase Year	Land Use	Commuter Peak Hour (pcu/hour)					
			AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Central Spectrum Development	2022	<u>Precinct 1:</u> Commercial Plot, Bio Bay, Industrial	1,870	684	2,554	1,361	2,047	3,408
	2030	<u>Precinct 3:</u> Bio Bay	673	214	887	232	515	747
	2033	<u>Precinct 3:</u> Commercial Plot, Service Apartment, Royal Club	2476	1085	3,561	2118	2981	5,099
	2037	<u>Precinct 2A, 2B, 2C:</u> Commercial Plot, Shop Offices, Library, Worker's Quarters,	2472	1119	3,591	2135	2929	5,064
	2040	<u>Precinct 3:</u> Condominium	175	474	649	371	218	589
	2042	<u>Precinct 2A, 2B, 2C:</u> Apartment, Terrace House	333	895	1,228	701	415	1,116
<b>Total</b>			<b>7,999</b>	<b>4,471</b>	<b>12,470</b>	<b>6,918</b>	<b>9,105</b>	<b>16,023</b>

4.3.7 The central spectrum development is estimated to generate 4,471pcu/hour and attract 7,999pcu/hour during morning peak and is expected to generate 9,105pcu/hour and attract 6,918pcu/hour during the evening peak.



LOCATION OF COMMITTED DEVELOPMENT

FIGURE 4.2

4.3.8 This committed development; central spectrum development has been considered according to its phase year development. Phase year 2022 development has been considered for forecast year 2028, whilst the phase year of 2022, 2030, 2033 and 2037 development were considered for forecast year 2038.

#### **4.4 Trip Distribution and Assignment**

4.4.1 The development traffic was then distribute and assigned to the road network. Directional splits of the distribution are derived from the existing travel pattern of the study area.

4.4.2 The travel pattern was determined from the turning movement count conducted at the existing junctions in the vicinity of the project site. It is assumed that the current travel pattern will be reflective of the future travel pattern unless there is a major change in the road network of the study area.

4.4.3 Trip assignment involves the determination of the amount of traffic that will use certain routes of the road network. By taking into account the proposed entry and exit point for the project site and future planned road network; Pulau Indah Ring Road (PIRR) which is assumed to be completed by the Year 2028, the trips were assigned accordingly. The Pulau Indah Ring Road will be completed with road connection from Pulau Indah Highway at Westports to the Persiaran Pulau Lumut and thus, it is assumed the SKVE Highway is anticipated to be the major road for the development traffics from Pulau Indah to the external areas instead of Pulau Indah Highway. Trip distribution pattern is illustrated in **Figure 4.3**.



PULAU SELAT KERING  
PULAU CHE MAT ZIN  
PULAU PINTU GEDONG

PULAU KLANG

42% (40%)  
41% (41%)

14% (12%)  
6% (28%)

15% (17%)  
22% (2%)

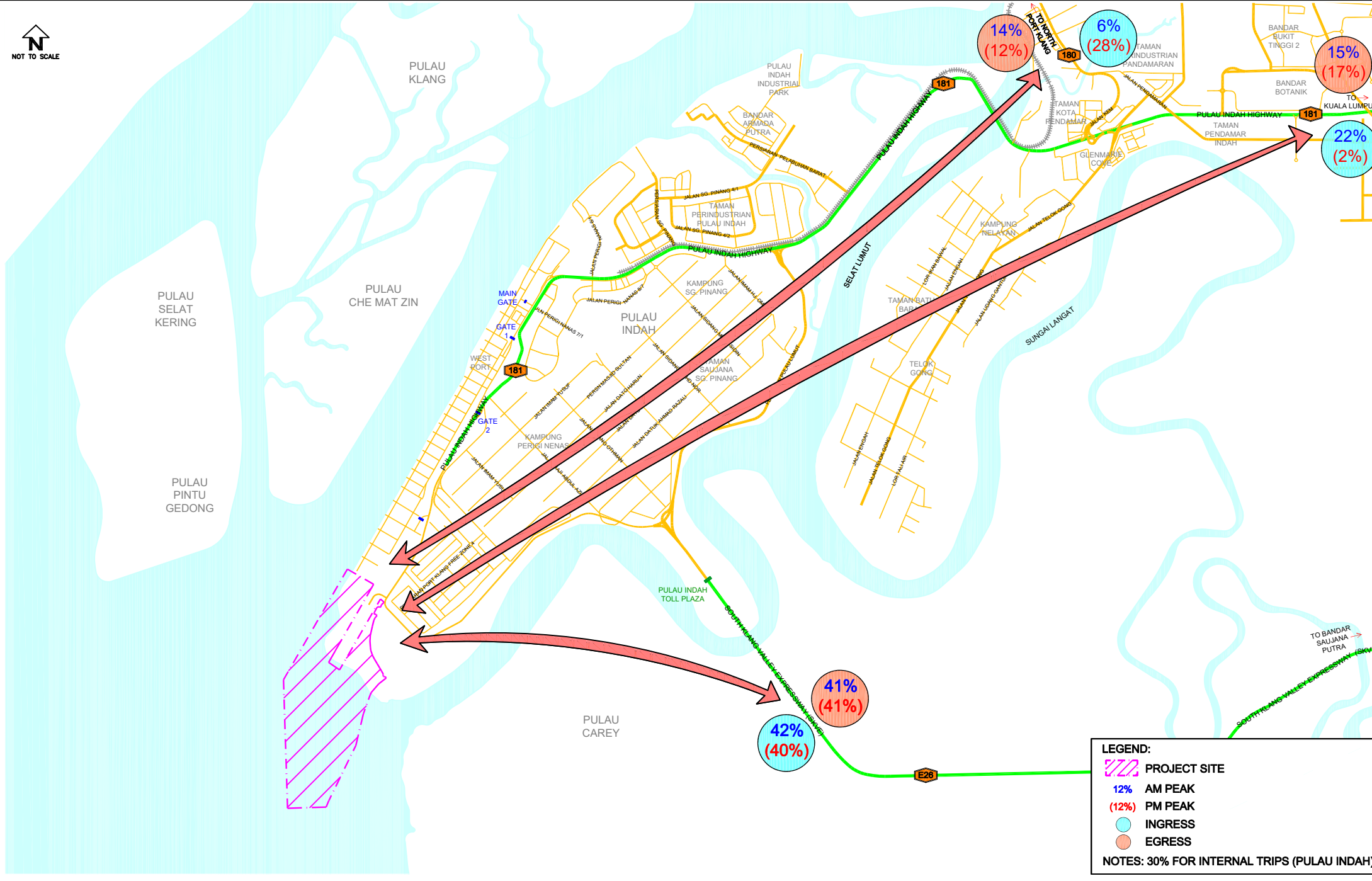
**LEGEND:**

- PROJECT SITE
- 12% AM PEAK
- (12%) PM PEAK
- INGRESS
- EGRESS

**NOTES:** 30% FOR INTERNAL TRIPS (PULAU INDAH)

TRIP DISTRIBUTION PATTERN

FIGURE 4.3



# **TRAFFIC IMPACT ASSESSMENT**

## 5.0 TRAFFIC IMPACT ASSESSMENT

### 5.1 Introduction

5.1.1 The chapter examine the impact of the project sites on the adjacent roads and junctions based on the forecast of the future traffic volumes, predicted distribution of the development traffic as well as the proposed access point for the project site.

5.1.2 Analysis of the future traffic on the studied road is undertaken based on two future years traffic projection which are as follows:-

- i. Future Year 2028 (Ten years traffic projection); and
- ii. Future Year 2038 (Twenty years traffic projection)

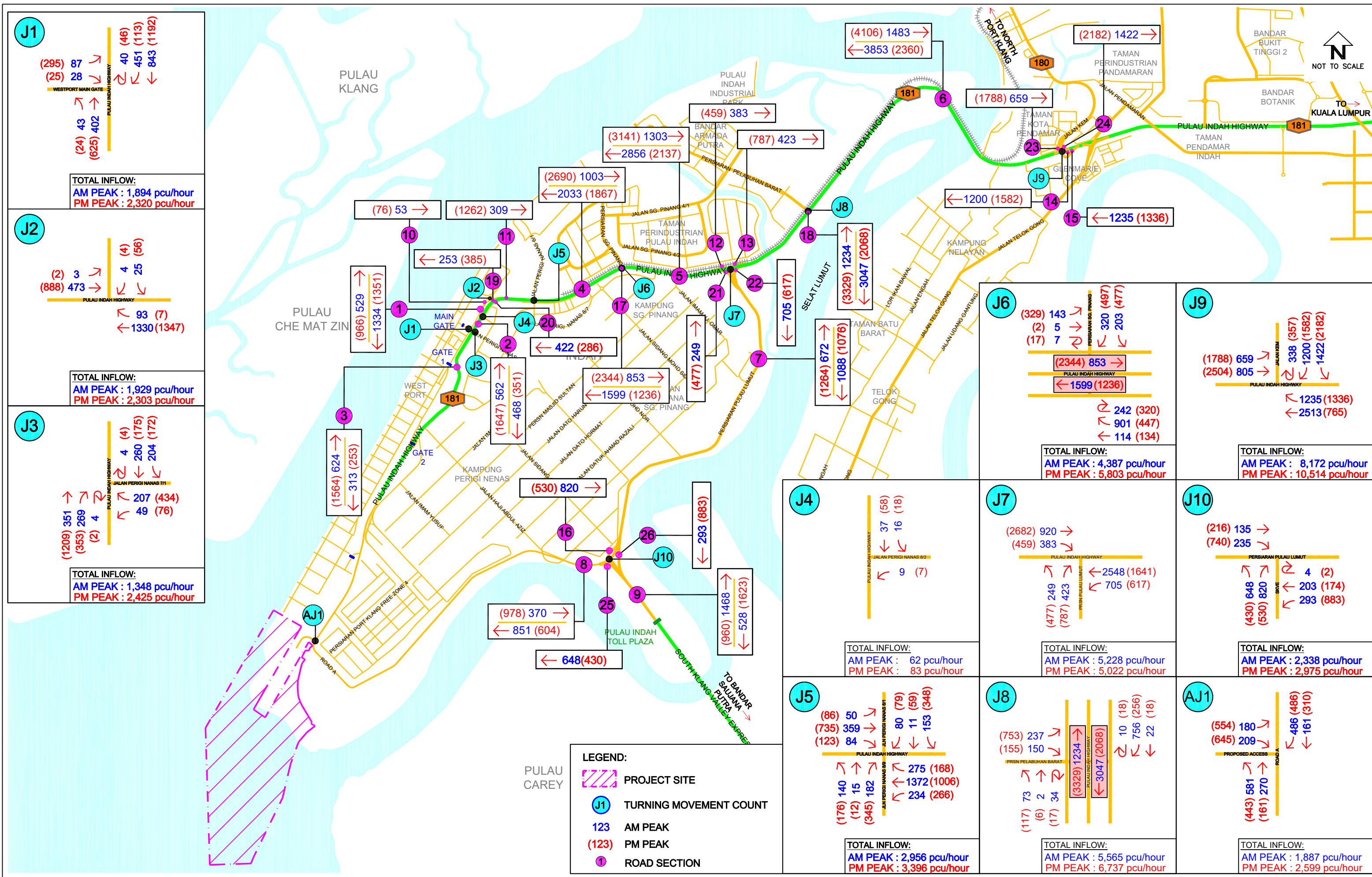
5.1.2 Traffic impact analysis was carried out during morning and evening peak hours for Year 2028 and Year 2038. It was assumed that if the road network and junction are able to cater for the morning and evening peak periods, they would adequately meet the traffic demand during others periods of the day.

### 5.2 Future Year 2028 Traffic Analysis

5.2.1 The predicted future traffic Year 2028 with the project site is shown in **Figure 5.1**. Based on the predicted future year 2028 traffic flows, the recommended traffic proposal for the studied road and junctions at Pulau Indah are as following and is illustrated in **Figure 5.2**.

- i. Road upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at Jalan Kem and Pulau Indah Highway stretching from Persiaran Pulau Lumut (J7) to KESAS Highway by others. The Pulau Indah Highway road upgrading had been originally proposed by Ministry of Work; KKR),
- ii. Committed Pulau Indah Ring Road (PIRR) 2-lane dual carriageway road connection from Westports to Persiaran Pulau Lumut by others (originally proposed by KKR),





FUTURE YEAR 2028 MORNING AND EVENING PEAK HOUR TRAFFIC VOLUME (pcu/hour)

FIGURE 5.1



- iii. Flyover upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at Pulau Indah Highway / Persiaran Pelabuhan Barat Junction (J8) by others,
- iv. Junction upgrading from priority junction to signalised junction at Pulau Indah Highway / Jalan Orkid 1 Junction (J1) and Pulau Indah Highway / Jalan Perigi Nanas 7/1 Junction (J3),
- v. Junction improvement at Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction (J6) which includes additional lane at north approach for left turn movement and signal phasing modification by others and
- vi. Junction improvement at Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction (J8) which includes lane marking and signal phasing modification by others.

### **Future Year 2028 Mid-Block Capacity Analysis**

5.2.2 Future year 2028 mid-block capacity analysis of the roads in vicinity of the project site is based on the future Year 2028 peak hour traffic volumes and the carrying capacity of the existing and upgraded road sections. Result of the future mid-block capacity analysis at roads is shown in **Table 5.1** and illustrated in **Figure 5.3** and **Figure 5.4**.

**Table 5.1: Future Year 2028 Operational Performance of Roads**

Road Name	Road Section	Dir.	Capacity (pcu/hr)	Hourly Traffic Flow (pcu/hour)		Volume/ Capacity (V/C)		Level of Service (LOS)	
				AM	PM	AM	PM	AM	PM
Pulau Indah Highway (FT181)	1	NB	3,600	529	966	0.15	0.27	A	A
		SB	3,600	1,334	1,351	0.37	0.38	A	A
	2	NB	3,600	562	1,647	0.16	0.46	A	A
		SB	3,600	468	351	0.13	0.10	A	A
	3	NB	3,600	624	1,564	0.17	0.43	A	A
		SB	3,600	313	253	0.09	0.07	A	A
	4	EB	3,600	1,003	2,690	0.28	0.75	A	C
		WB	3,600	2,040	1,884	0.57	0.52	A	A
	5	EB	3,600	1,303	3,143	0.36	0.87	A	D
		WB	3,600	2,856	2,137	0.79	0.59	C	A
6	EB	5,400	1,483	4,106	0.27	0.76	A	C	
	WB	5,400	3,835	2,356	0.71	0.44	C	A	
Persiaran Pulau Lumut	7	NB	3,600	672	1,264	0.19	0.35	A	A
		SB	3,600	1,088	1,076	0.30	0.30	A	A
	8	EB	3,600	370	956	0.10	0.27	A	A
		WB	3,600	851	604	0.24	0.17	A	A



NOT TO SCALE

PULAU  
KLANG

PULAU  
INDAH  
INDUSTRIAL  
PARK

**RECOMMEND ROAD UPGRADING  
TO 3-LANE DUAL CARRIAGEWAY  
ROAD BY OTHERS**

**RECOMMEND JUNCTION IMPROVEMENT  
BY OTHERS**  
- ADDITIONAL LANE AT NORTH APPROACH  
- SIGNAL PHASING MODIFICATION

**RECOMMEND JUNCTION  
UPGRADING FROM PRIORITY TO  
SIGNALISED JUNCTION**

**RECOMMEND ROAD UPGRADING TO 3-LANE  
DUAL CARRIAGEWAY ROAD BY OTHERS  
(ORIGINALLY PROPOSED BY KKR)**

**RECOMMEND FLYOVER  
UPGRADING TO 3-LANE DUAL  
CARRIAGEWAY ROAD BY OTHERS**

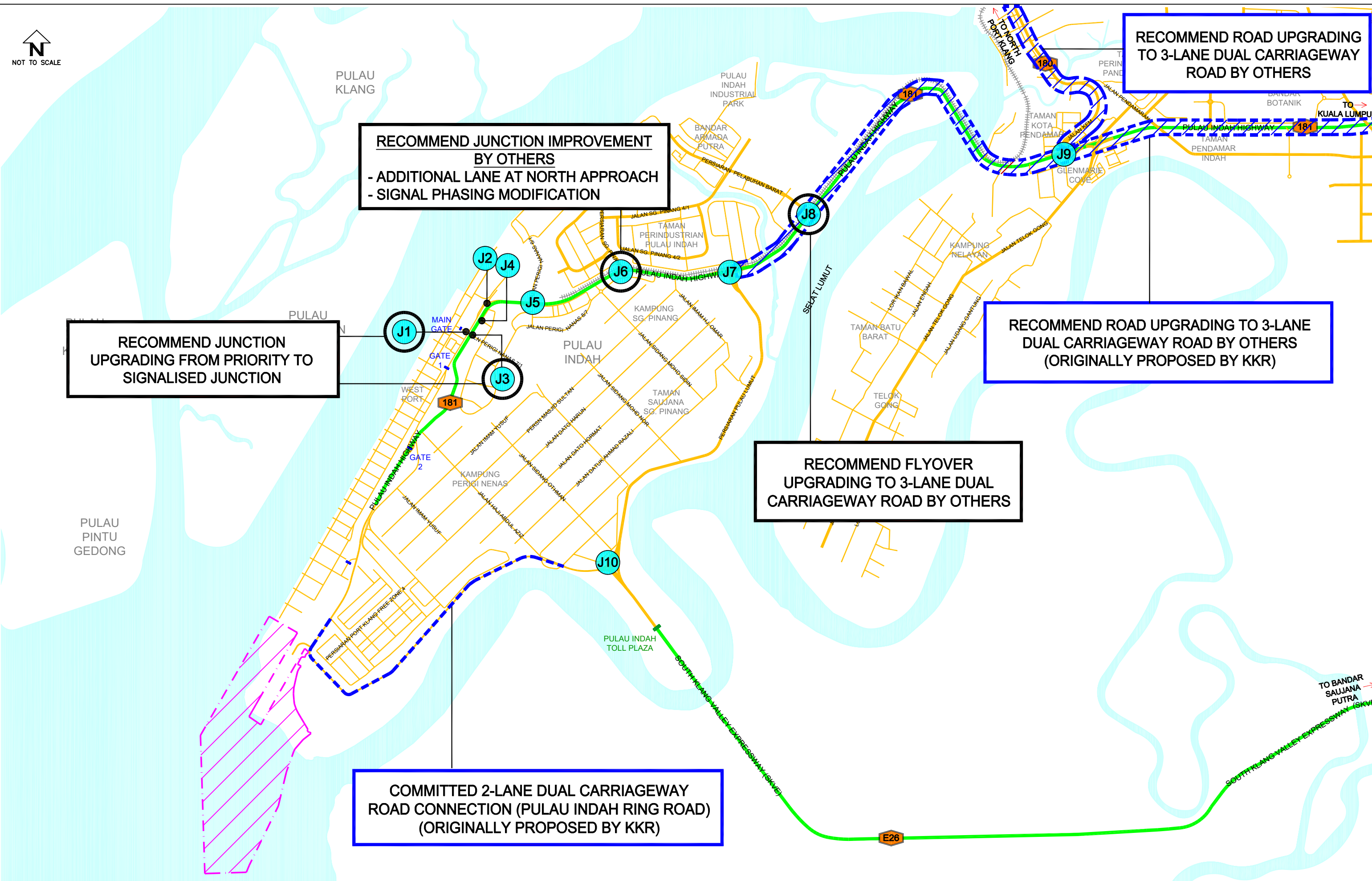
**COMMITTED 2-LANE DUAL CARRIAGEWAY  
ROAD CONNECTION (PULAU INDAH RING ROAD)  
(ORIGINALLY PROPOSED BY KKR)**

PULAU  
PINTU  
GEDONG

TO BANDAR  
SAUJANA  
PUTRA

**FUTURE YEAR 2028 RECOMMENDED TRAFFIC IMPROVEMENT**

**FIGURE 5.2**



**Table 5.1: Future Year 2028 Operational Performance of Roads (Continued)**

Road Name	Road Section	Dir.	Capacity (pcu/hr)	Hourly Traffic Flow (pcu/hour)		Volume/Capacity (V/C)		Level of Service (LOS)	
				AM	PM	AM	PM	AM	PM
SKVE Highway	9	NB	3,600	1,468	960	0.41	0.27	A	A
		SB	3,600	528	1,623	0.15	0.45	A	A
Elevated Ramp 1	10	1-Way	3,600	53	76	0.01	0.02	A	A
Elevated Ramp 2	11	1-Way	3,600	309	1,262	0.09	0.35	A	A
Elevated Ramp 3	12	1-Way	3,600	383	459	0.11	0.13	A	A
Elevated Ramp 4	13	1-Way	3,600	423	787	0.12	0.22	A	A
Elevated Ramp 5	14	1-Way	3,600	1,200	1,582	0.33	0.44	A	A
Elevated Ramp 6	15	1-Way	3,600	1,235	1,336	0.34	0.37	A	A
Elevated Ramp 7	16	1-Way	1,800	820	530	0.46	0.29	A	A
Flyover 1	17	EB	3,600	853	2,344	0.24	0.65	A	B
		WB	3,600	1,599	1,236	0.44	0.34	A	A
Flyover 2	18	EB	5,400	1,234	3,329	0.23	0.62	A	B
		WB	5,400	3,047	2,064	0.56	0.38	A	A
Slip road 1	19	1-Way	3,600	253	385	0.07	0.11	A	A
Slip road 2	20	1-Way	3,600	422	286	0.12	0.08	A	A
Slip road 3	21	1-Way	3,600	249	477	0.07	0.13	A	A
Slip road 4	22	1-Way	3,600	705	617	0.20	0.17	A	A
Slip road 5	23	1-Way	3,600	659	1,788	0.18	0.50	A	A
Slip road 6	24	1-Way	3,600	1,422	2,182	0.40	0.61	A	B
Slip road 7	25	1-Way	1,800	648	430	0.36	0.24	A	A
Proposed Elevated Ramp 1	26	1-Way	1,800	293	883	0.16	0.49	A	A

Note: Dir. = Direction, NB = Northbound, SB = Southbound, WB = Westbound, EB = Eastbound

5.2.3 The results of future mid-block capacity analysis indicated that with road upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at Jalan Kem and Pulau Indah Highway stretching from Persiaran Pulau Lumut (J7) to KESAS Highway and J8 Flyover; Flyover 2, all studied road sections are expected to operate at acceptable level of service; ranging from LOS A to LOS D during morning and evening peak hours in the Year 2028.

5.2.4 In addition to the mid-block capacity analysis, project site traffic contributions on major roads at Pulau Indah were also evaluated to identify the percentage of project site traffic on the roads in Year 2028 as shown in **Table 5.2** and is illustrated in **Figure 5.5**. The analysis is based on knowledge of current committed surrounding development.

**Table 5.2: Project Site Traffic Contribution at Roads in Year 2028**

Road Name	Road Section	Dir.	Future Year 2028 Traffic Volume (pcu/hour)				Percentage of Project Site Traffic Contribution	
			Future Year 2028 (pcu/hr)		Project Site Traffic (pcu/hr)		AM	PM
			AM	PM	AM	PM		
Pulau Indah Highway	1	EB	1,003	2,690	99	303	10%	11%
		WB	2,040	1,884	264	215	13%	11%

SECTION 11 : ELEVATED RAMP 2				
DIRECTION	V/C RATIO		LOS	
1-WAY	0.09	0.35	A	A

SECTION 4 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.28	0.75	A	C
WESTBOUND	0.57	0.52	A	A

SECTION 5 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.36	0.87	A	D
WESTBOUND	0.79	0.59	C	A

SECTION 10 : ELEVATED RAMP 1				
DIRECTION	V/C RATIO		LOS	
1-WAY	0.01	0.02	A	A

SECTION 1 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.15	0.27	A	A
SOUTHBOUND	0.37	0.38	A	A

SECTION 2 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.16	0.46	A	A
SOUTHBOUND	0.13	0.10	A	A

SECTION 3 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.17	0.43	A	A
SOUTHBOUND	0.09	0.07	A	A

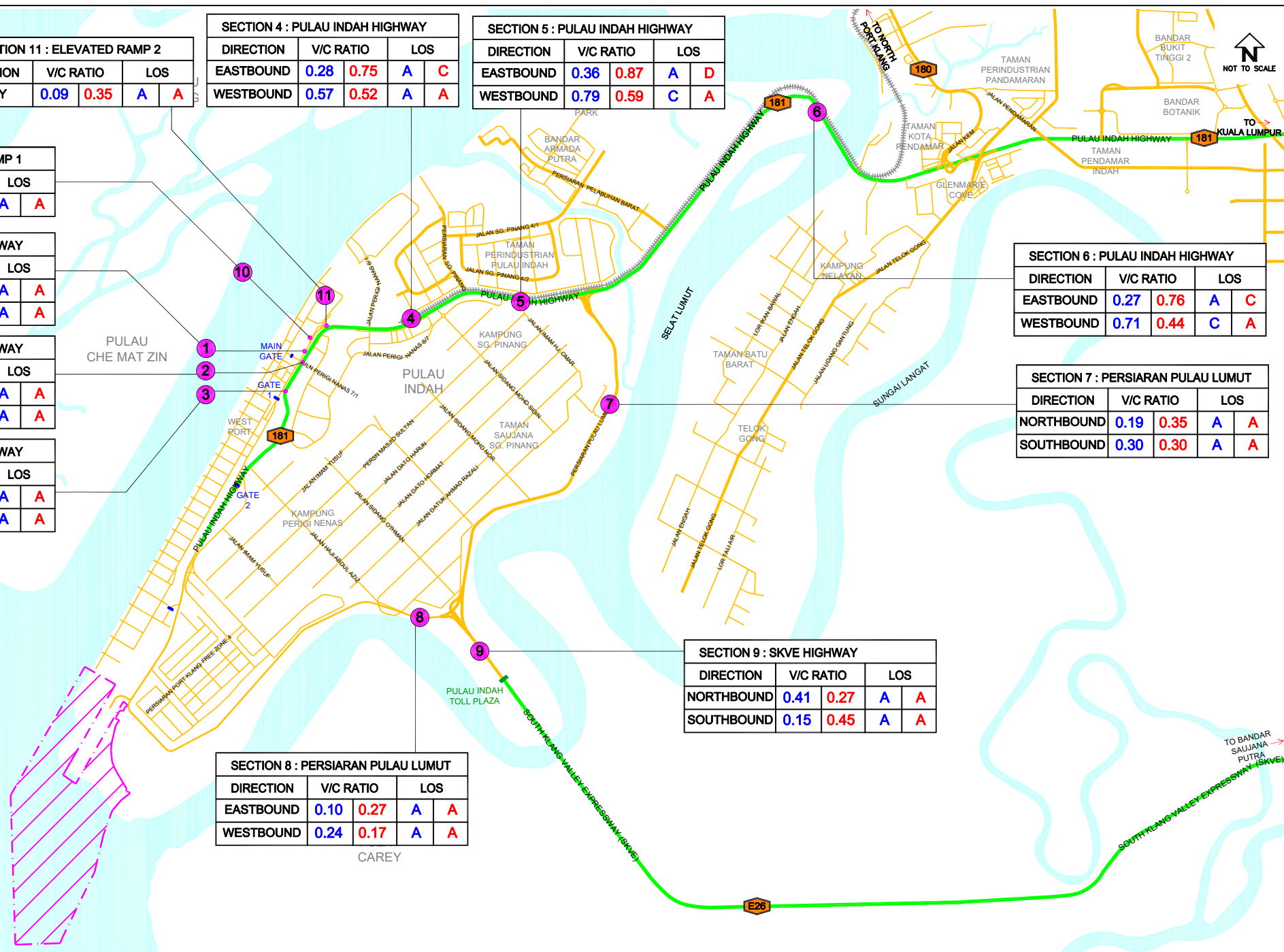
SECTION 6 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.27	0.76	A	C
WESTBOUND	0.71	0.44	C	A

SECTION 7 : PERSIARAN PULAU LUMUT				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.19	0.35	A	A
SOUTHBOUND	0.30	0.30	A	A

SECTION 9 : SKVE HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.41	0.27	A	A
SOUTHBOUND	0.15	0.45	A	A

SECTION 8 : PERSIARAN PULAU LUMUT				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.10	0.27	A	A
WESTBOUND	0.24	0.17	A	A

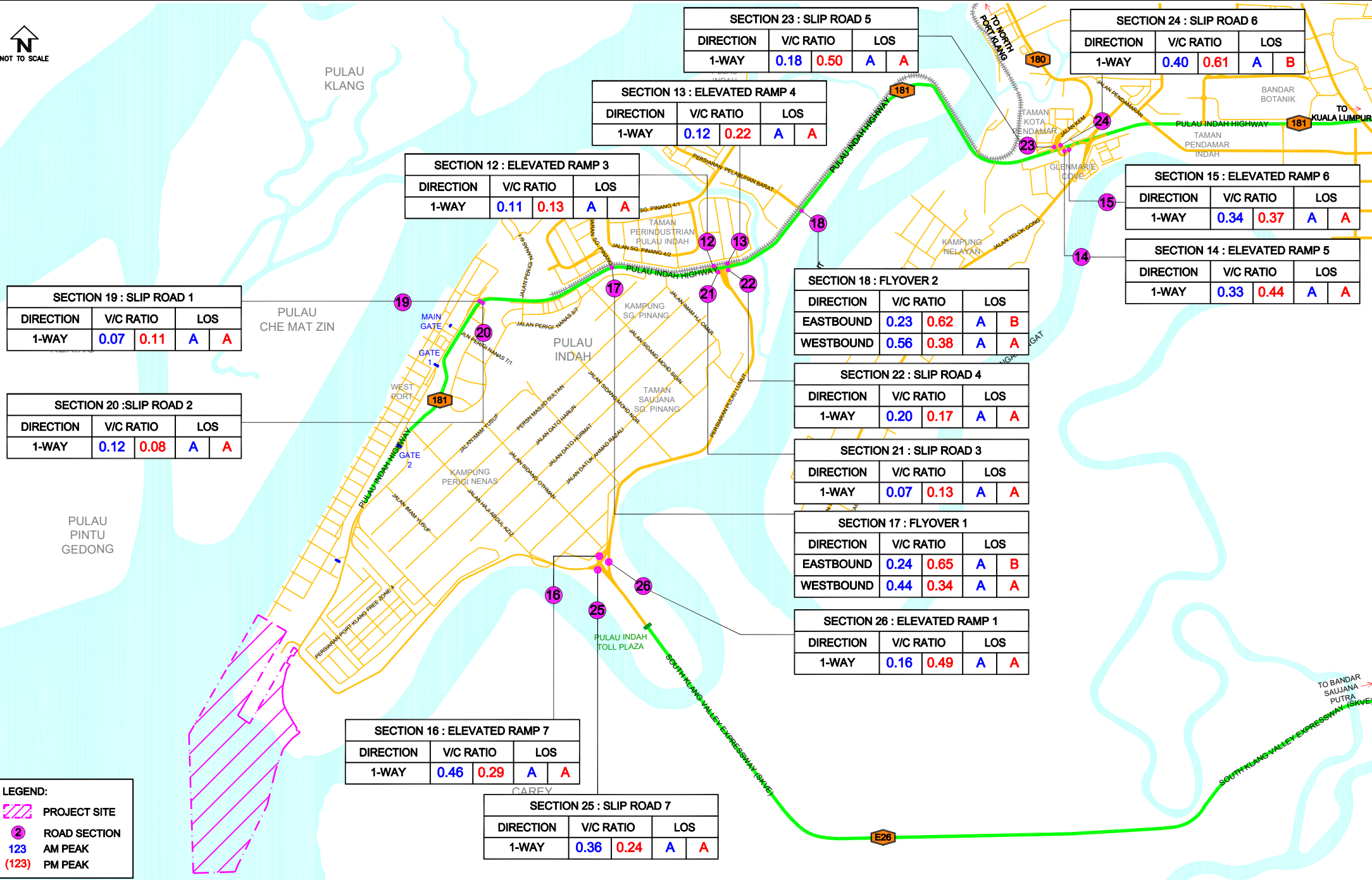
- LEGEND:
- PROJECT SITE
  - ROAD SECTION
  - AM PEAK
  - PM PEAK



FUTURE YEAR 2028 MORNING AND EVENING PEAK HOUR VOLUME OVER CAPACITY (v/c) RATIO - 1

FIGURE 5.3





FUTURE YEAR 2028 MORNING AND EVENING PEAK HOUR VOLUME OVER CAPACITY (v/c) RATIO - 2

FIGURE 5.4

**Table 5.2: Project Site Traffic Contribution at Roads in Year 2028 (Continued)**

Road Name	Road Section	Dir.	Future Year 2028 Traffic Volume (pcu/hour)				Percentage of Project Site Traffic Contribution	
			Future Year 2028 (pcu/hr)		Project Site Traffic (pcu/hr)		AM	PM
			AM	PM	AM	PM		
Pulau Indah Highway	2	EB	1,483	4,106	113	347	8%	8%
		WB	3,835	2,356	299	250	8%	11%
Persiaran Pulau Lumut	3	NB	672	1,264	50	153	7%	12%
		SB	1,088	1,076	133	110	12%	10%
SKVE Highway	4	NB	1,468	960	448	333	31%	35%
		SB	528	1,623	159	492	30%	30%

Note: Dir. = Direction, NB = Northbound, SB = Southbound, WB = Westbound, EB = Eastbound

5.2.5 The contribution of the project site traffic along Pulau Indah Highway and Persiaran Pulau Lumut is ranging from 7% to 35%. Project site is expected to contribute high traffics at SKVE Highway due to SKVE Highway’s low current traffic flow and approximately 40% trip distribution assumption as shown in **Figure 4.3**.

**Future Year 2028 Junction Performance Analysis**

5.2.6 Apart from analyzing the future road performance, analysis will also undertake at the junctions where majority of the project site traffic is expected to utilize. The future junction capacity analysis is carried out to evaluate the future performance of the immediate junctions at Pulau Indah in Year 2028 and is summarised in **Table 5.3** and illustrated in **Figure 5.6** to **Figure 5.13**.

**Table 5.3: Future Year 2028 Operational Performance of Junctions**

Junction Name	Junction Id	Peak Hour Traffic Flow (pcu/hr)		Maximum Degree of Saturation		Average Controlled Delay (second)		Maximum Level of Service (LOS)	
		AM	PM	AM	PM	AM	PM	AM	PM
Pulau Indah Highway / Jalan Orkid 1 Signalised Junction	J1	1,894	2,320	0.58	0.48	13	10	B	A
Pulau Indah Highway / Access FFM Sdn. Bhd. Priority Junction	J2	1,929	2,303	0.32	0.33	14	28	B	D
Pulau Indah Highway / Jalan Perigi Nanas 7/1 Signalised Junction	J3	1,348	2,425	0.50	0.74	16	18	B	B
Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction	J5	2,956	3,396	0.83	0.82	29	28	C	C
Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction	J6	4,387	5,803	0.82	0.78	21	16	C	B

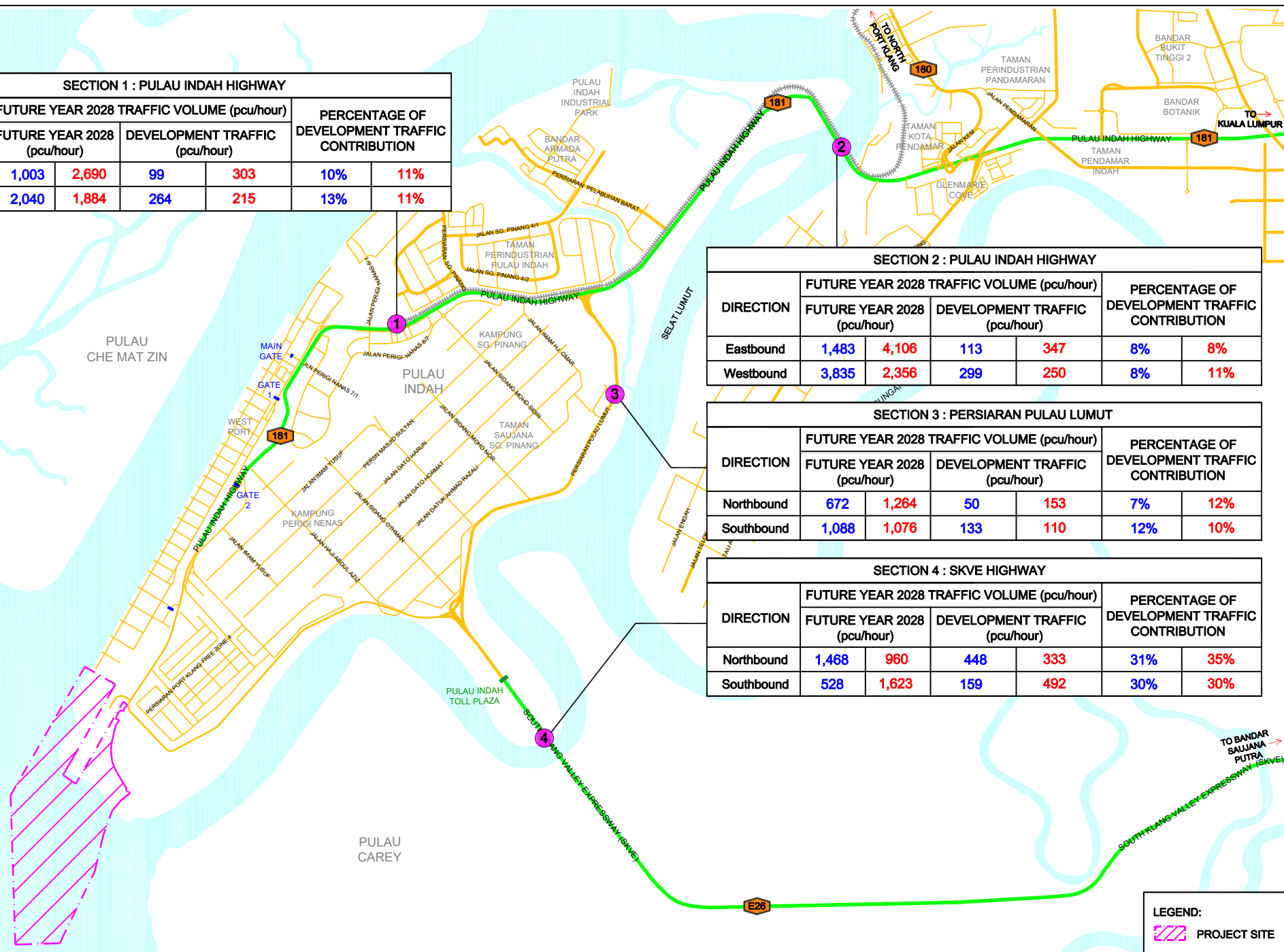


SECTION 1 : PULAU INDAH HIGHWAY						
DIRECTION	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Eastbound	1,003	2,690	99	303	10%	11%
Westbound	2,040	1,884	264	215	13%	11%

SECTION 2 : PULAU INDAH HIGHWAY						
DIRECTION	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Eastbound	1,483	4,106	113	347	8%	8%
Westbound	3,835	2,356	299	250	8%	11%

SECTION 3 : PERSIARAN PULAU LUMUT						
DIRECTION	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Northbound	672	1,264	50	153	7%	12%
Southbound	1,088	1,076	133	110	12%	10%

SECTION 4 : SKVE HIGHWAY						
DIRECTION	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Northbound	1,468	960	448	333	31%	35%
Southbound	528	1,623	159	492	30%	30%



LEGEND:  
 PROJECT SITE

PROJECT SITE TRAFFIC CONTRIBUTION ON ROADS IN YEAR 2028

FIGURE 5.5

**Table 5.3: Future Year 2028 Operational Performance of Junctions (Continued)**

Junction Name	Junction Id	Peak Hour Traffic Flow (pcu/hr)		Maximum Degree of Saturation		Average Controlled Delay (second)		Maximum Level of Service (LOS)	
		AM	PM	AM	PM	AM	PM	AM	PM
Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction	J8	5,565	6,737	0.78	0.71	24	14	C	B
Persiaran Pulau Lumut / SKVE Highway Priority Junction	J10	2,338	2,975	0.34	0.87	8	16	A	C
Pulau Indah Highway / Project Site Proposed Access Road Signalised Junction	AJ1	1,887	2,503	0.57	0.87	14	16	B	C

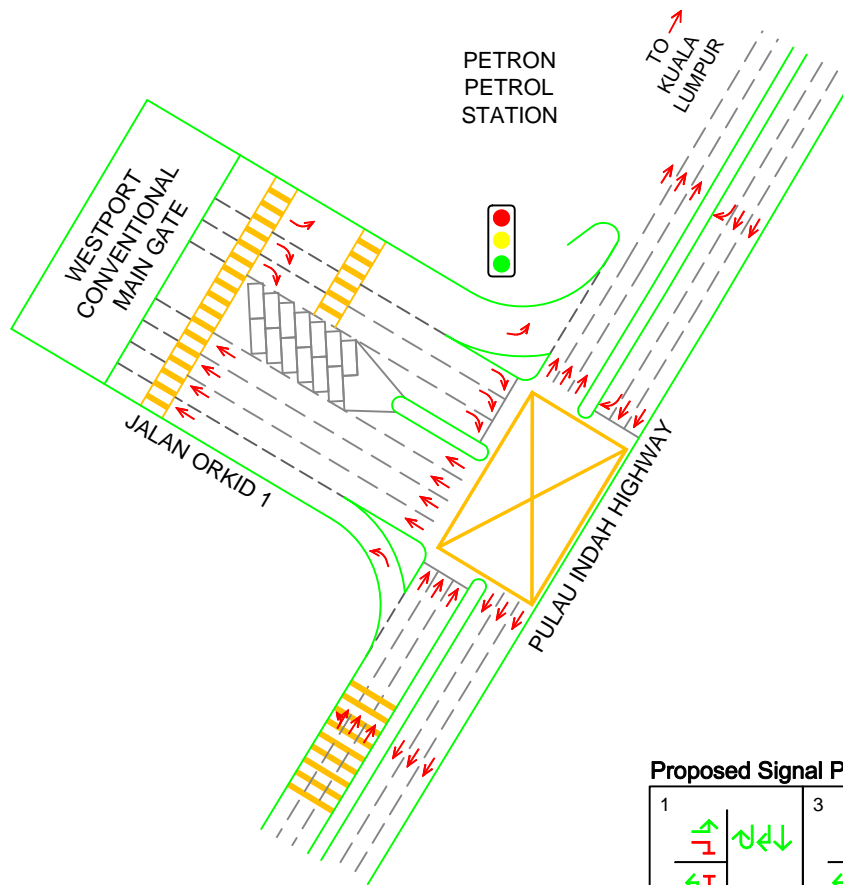
5.2.7 Future junction capacity analysis indicated that with recommend upgrading from priority to signalised junction at J1 and J3 and certain junction improvements at J6, all studied junctions at Pulau Indah includes the project site proposed access junction (AJ1) are expected to operate at acceptable level of service; ranging from LOS A to LOS D during both morning and evening peak hours in Year 2028.

5.2.8 Similarly to road analysis, project site traffic contributions on the junctions at Pulau Indah were also evaluated to identify the percentage of project traffic at the junctions as shown in **Table 5.4** and illustrated in **Figure 5.14**.

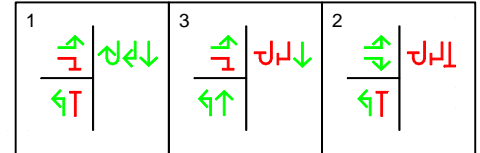
**Table 5.4: Project Site Traffic Contribution at Junctions in Year 2028**

Junction Name	Junction Id	Year 2028 Traffic Volume (pcu/hour)				Percentage of Project Site Traffic Contribution	
		Future Year 2028 (pcu/hr)		Project Site Traffic (pcu/hr)			
		AM	PM	AM	PM	AM	PM
Pulau Indah Highway / Jalan Orkid 1 Signalised Junction	J1	1,894	2,320	566	727	30%	31%
Pulau Indah Highway / Access FFM Sdn. Bhd. Priority Junction	J2	1,929	2,303	566	727	29%	32%
Pulau Indah Highway / Jalan Perigi Nanas 7/1 Signalised Junction	J3	1,348	2,425	122	205	9%	8%
Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction	J5	2,956	3,396	504	679	17%	20%
Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction	J6	4,387	5,803	363	518	8%	9%
Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction	J8	5,565	6,737	457	659	8%	10%
Persiaran Pulau Lumut / SKVE Highway Priority Junction	J10	2,338	2,975	790	1,088	34%	37%



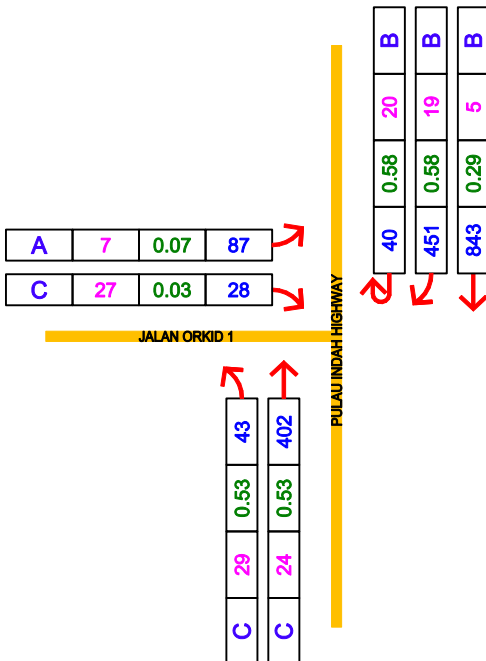


Proposed Signal Phasing



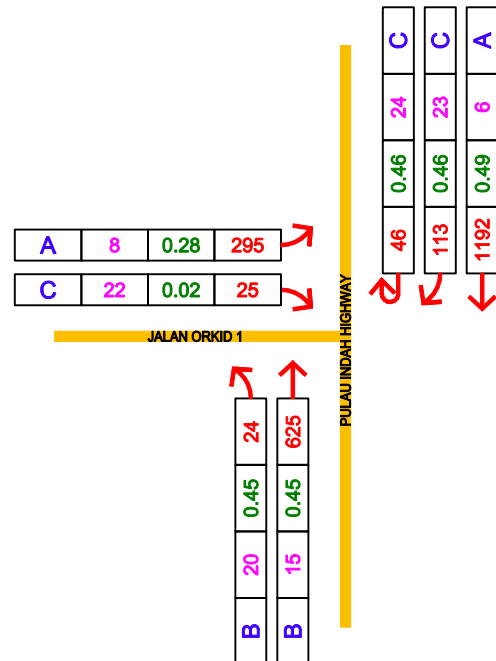
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.58  
 TOTAL INFLOW = 1,894 pcu/hour  
 AVERAGE CONTROLLED DELAY = 13 sec



**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS A  
 DEGREE OF SATURATION = 0.48  
 TOTAL INFLOW = 2,320 pcu/hour  
 AVERAGE CONTROLLED DELAY = 10 sec

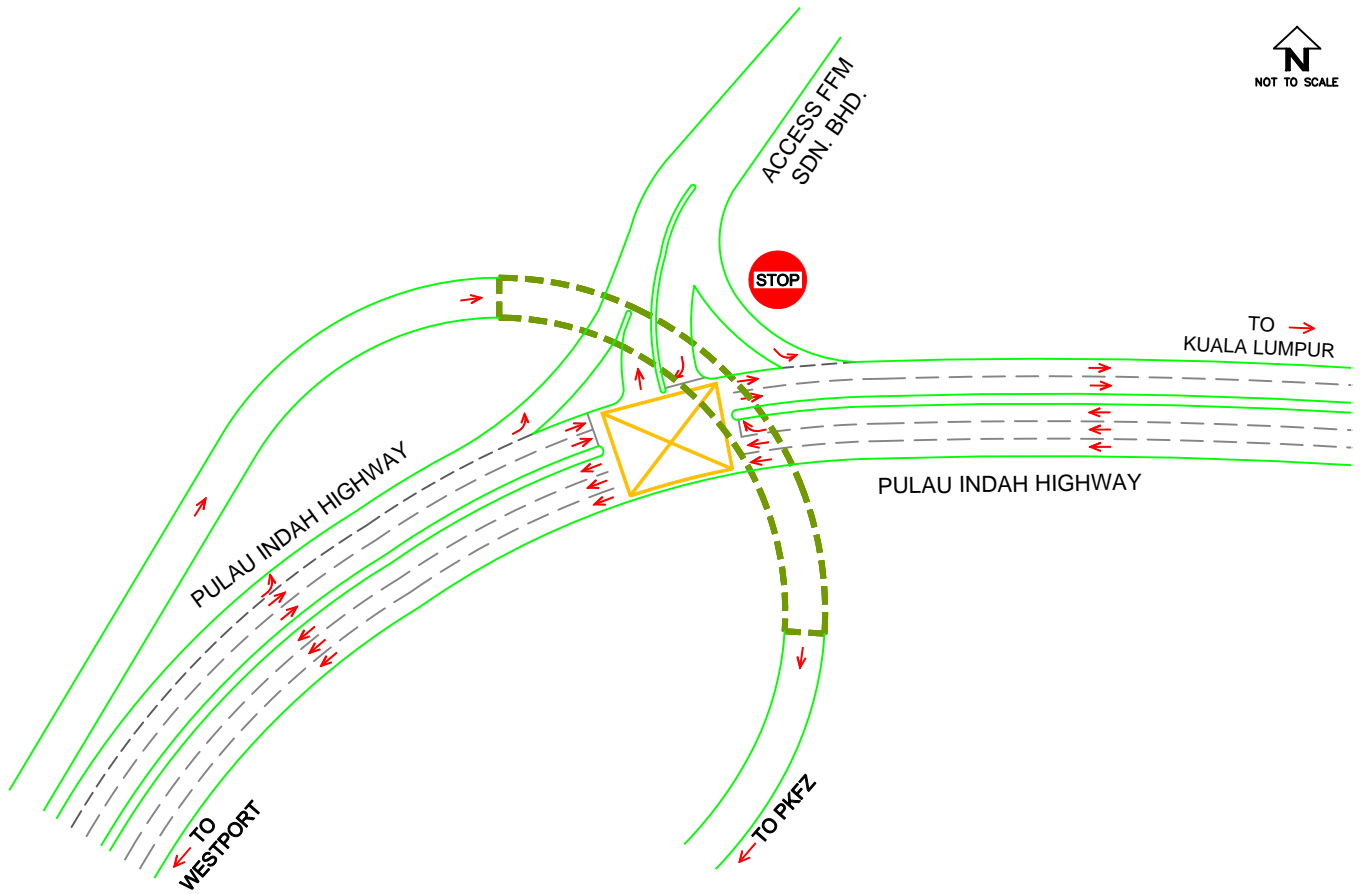


LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

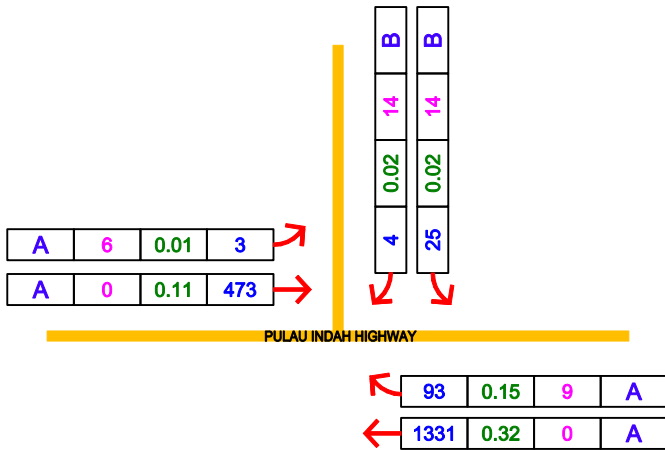
FUTURE YEAR 2028 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY /  
 JALAN ORKID 1 SIGNALISED JUNCTION (J1)

FIGURE 5.6



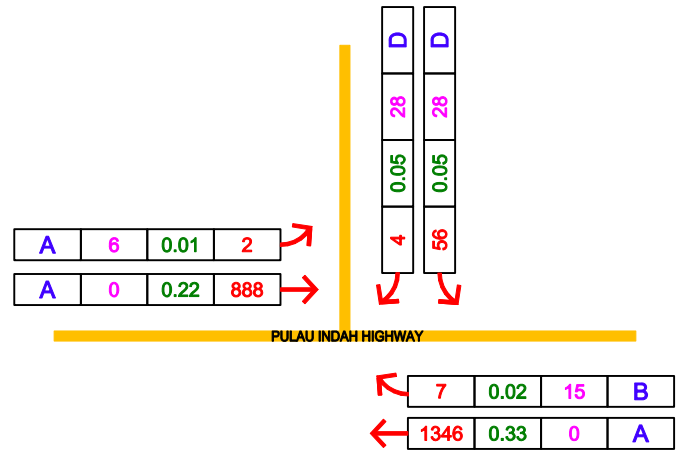
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.32  
 TOTAL INFLOW = 1,929 pcu/hour  
 AVERAGE CONTROLLED DELAY = 14 sec



### PM PEAK HOUR

OVERALL PERFORMANCE = LOS D  
 DEGREE OF SATURATION = 0.33  
 TOTAL INFLOW = 2,303 pcu/hour  
 AVERAGE CONTROLLED DELAY = 28 sec

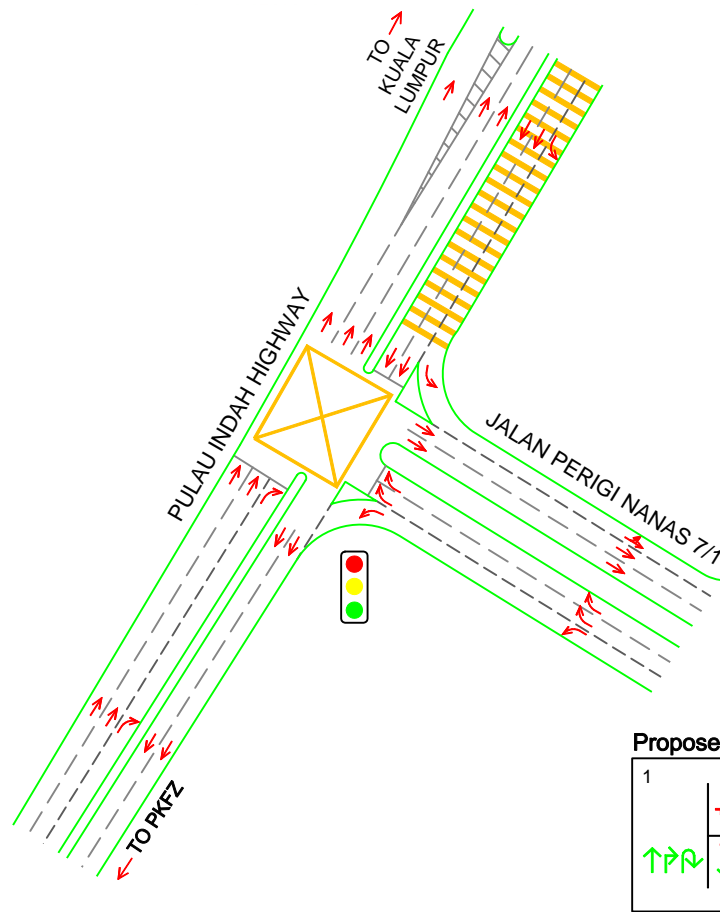


LEGEND :

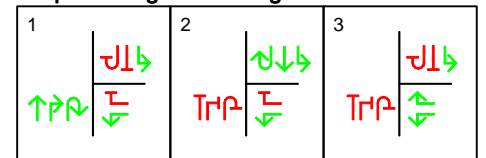
- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

FUTURE YEAR 2028 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY /  
 ACCESS FFM SDN. BHD. PRIORITY JUNCTION (J2)

FIGURE 5.7

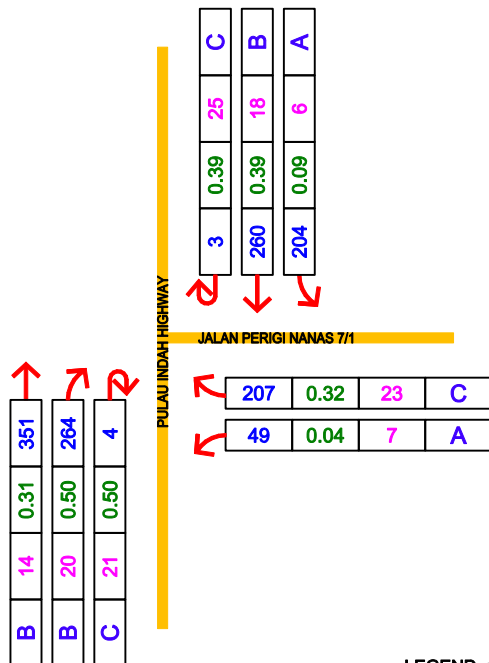


**Proposed Signal Phasing**



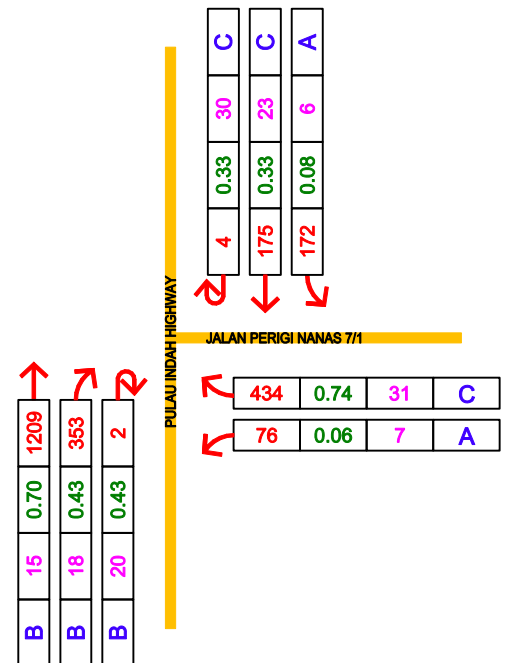
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.50  
 TOTAL INFLOW = 1,343 pcu/hour  
 AVERAGE CONTROLLED DELAY = 16 sec



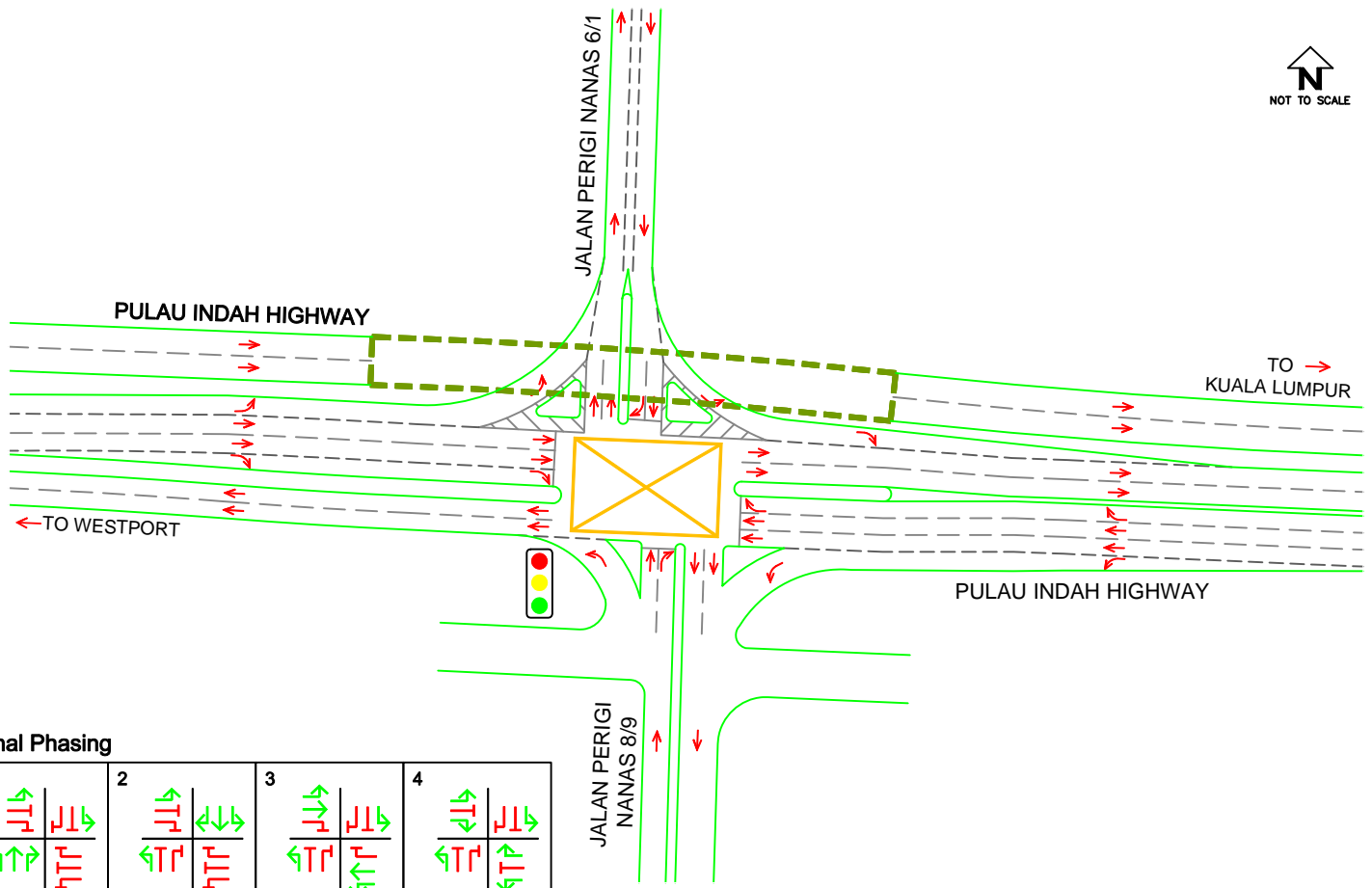
**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.74  
 TOTAL INFLOW = 2,425 pcu/hour  
 AVERAGE CONTROLLED DELAY = 18 sec

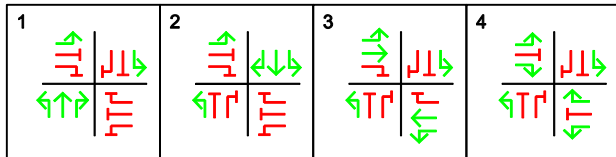


**LEGEND :**

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)



**Signal Phasing**

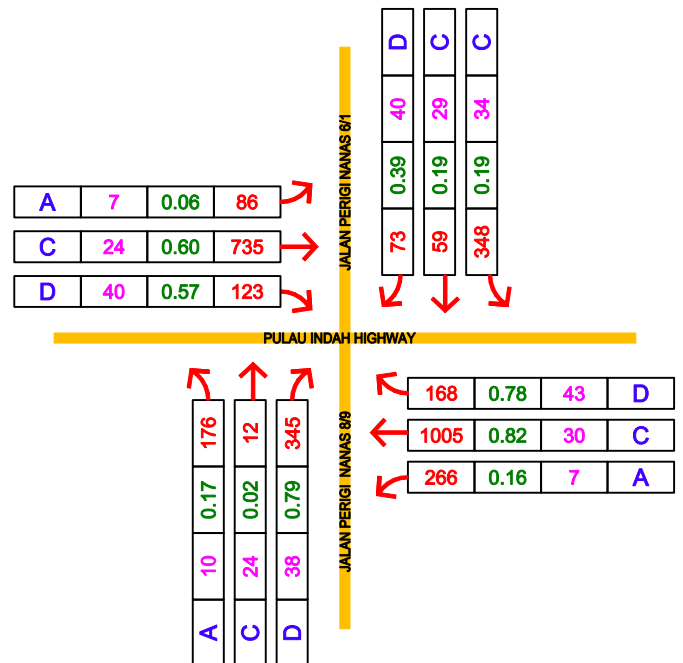
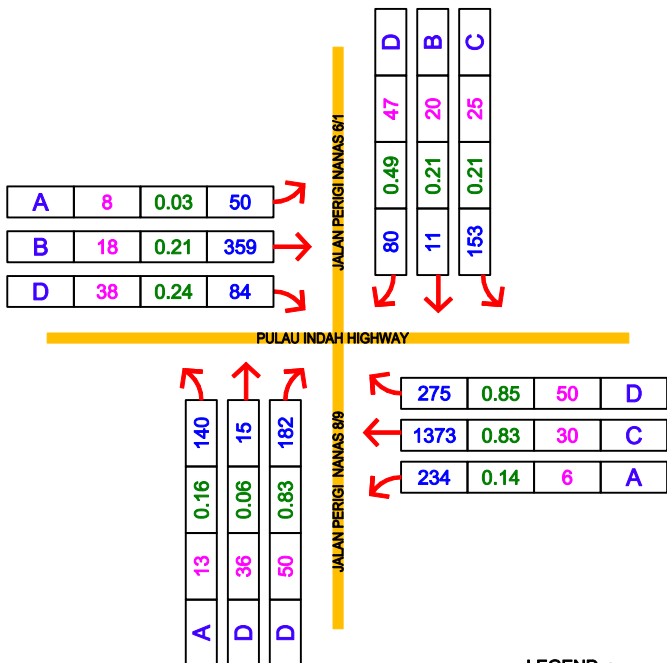


**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.83  
 TOTAL INFLOW = 2,956 pcu/hour  
 AVERAGE CONTROLLED DELAY = 29 sec

**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.82  
 TOTAL INFLOW = 3,396 pcu/hour  
 AVERAGE CONTROLLED DELAY = 28 sec

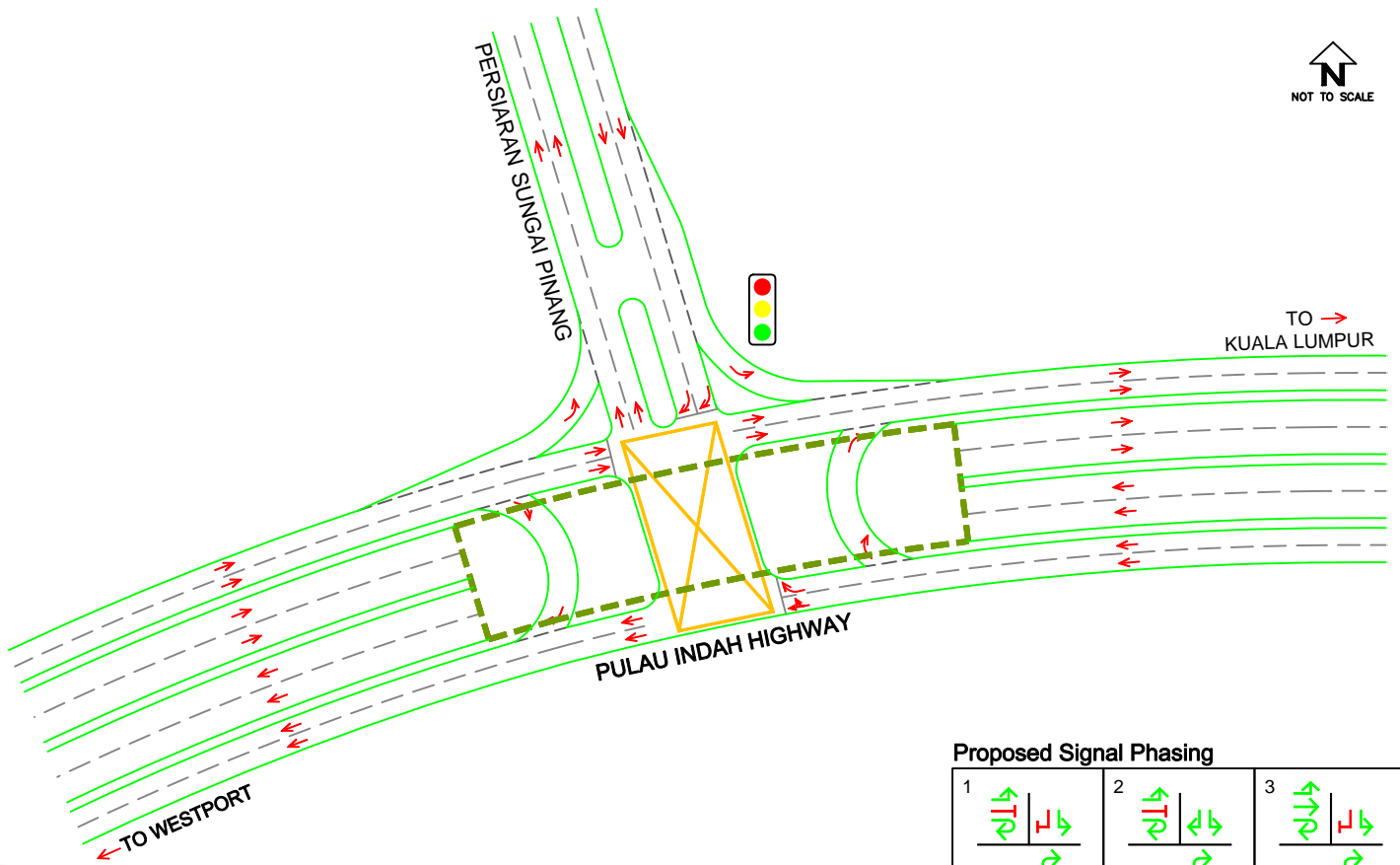


**LEGEND :**

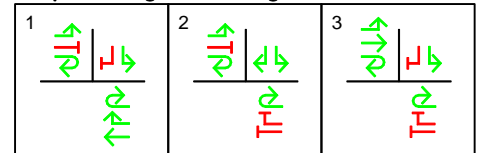
- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

FUTURE YEAR 2028 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 6/1 / JALAN PERIGI NANAS 8/9 SIGNALISED JUNCTION (J5)

FIGURE 5.9

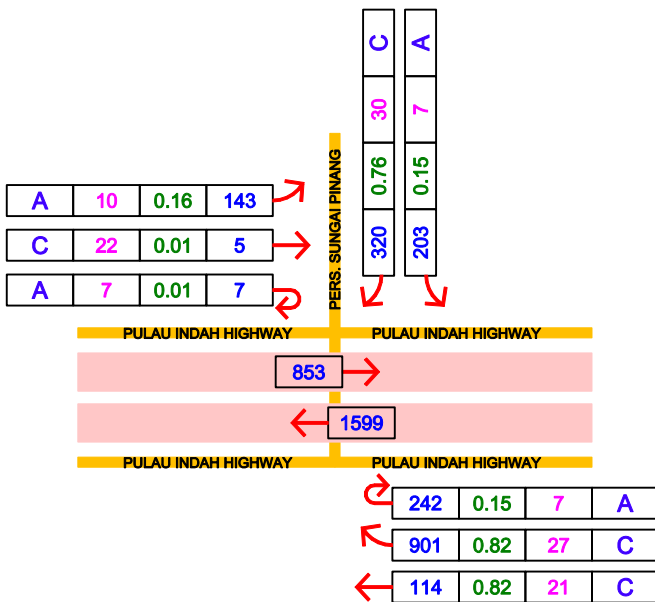


**Proposed Signal Phasing**



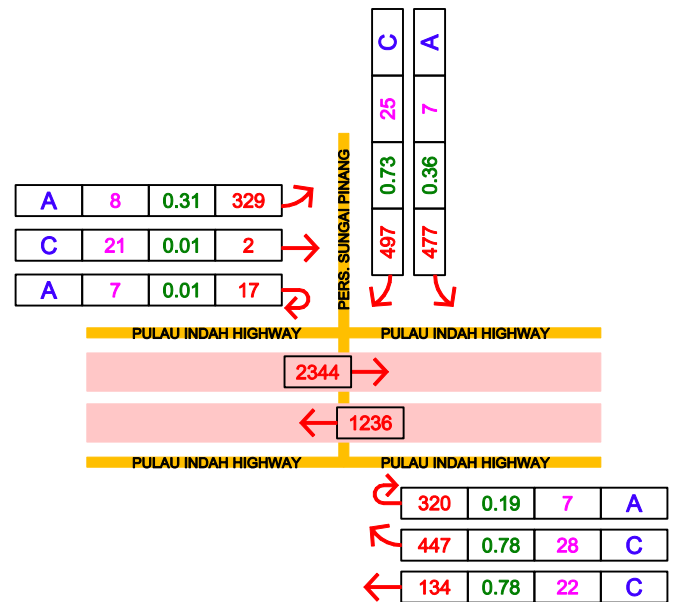
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.82  
 TOTAL INFLOW = 4,387 pcu/hour  
 AVERAGE CONTROLLED DELAY = 21 sec



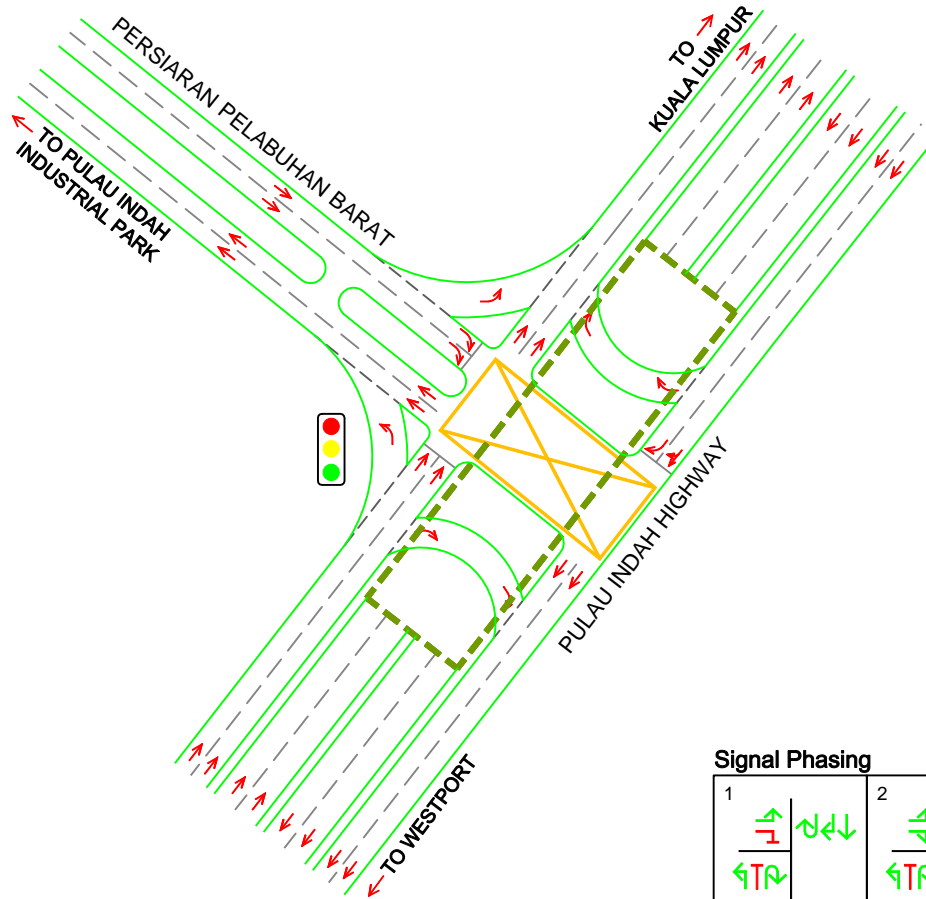
**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.78  
 TOTAL INFLOW = 5,803 pcu/hour  
 AVERAGE CONTROLLED DELAY = 16 sec

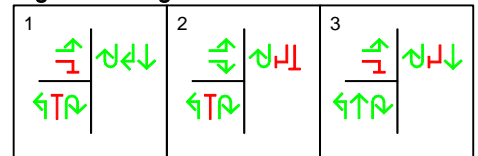


**LEGEND :**

123	AM TRAFFIC VOLUME (pcu/hour)
123	PM TRAFFIC VOLUME (pcu/hour)
0.12	DEGREE OF SATURATION
1	AVERAGE CONTROLLED DELAY (second)
A	LEVEL OF SERVICE (LOS)

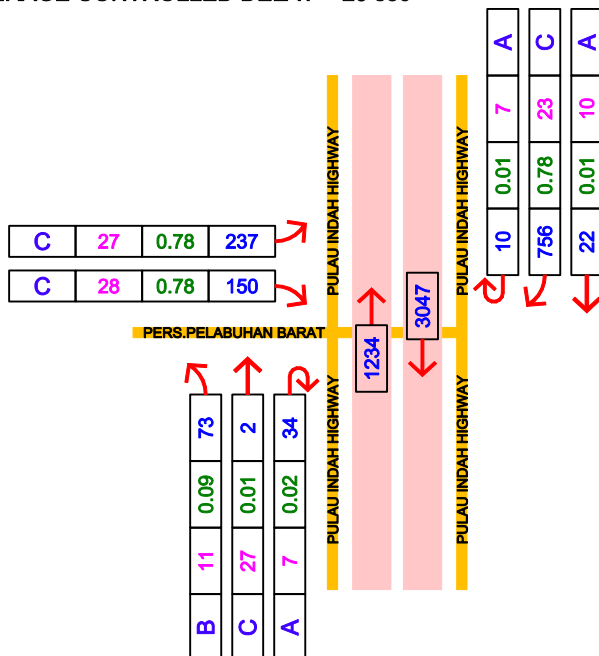


**Signal Phasing**



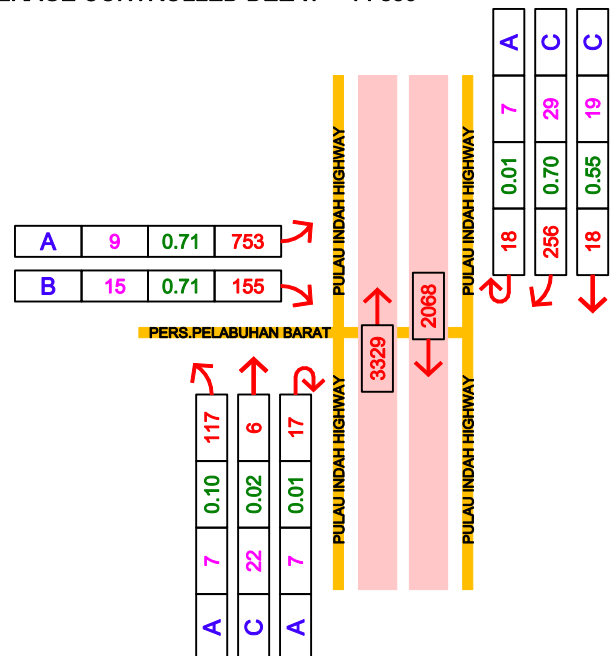
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.78  
 TOTAL INFLOW = 5,565 pcu/hour  
 AVERAGE CONTROLLED DELAY = 23 sec



**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.71  
 TOTAL INFLOW = 6,737 pcu/hour  
 AVERAGE CONTROLLED DELAY = 14 sec

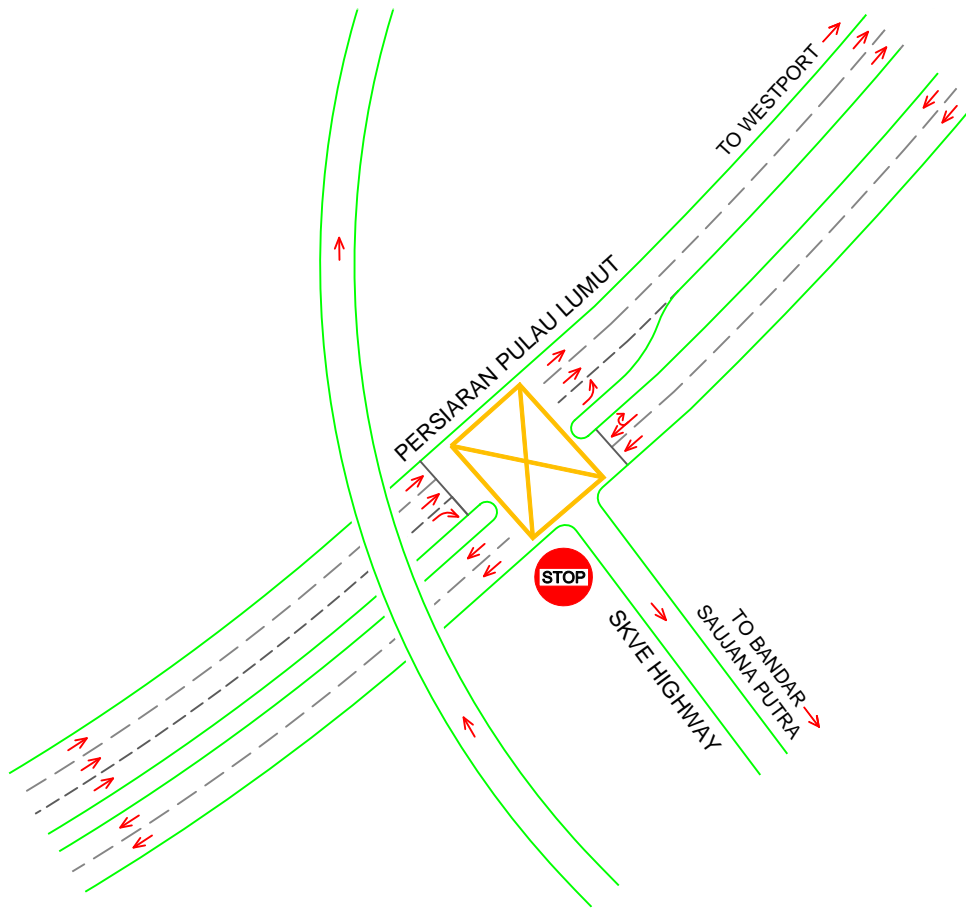


**LEGEND :**

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

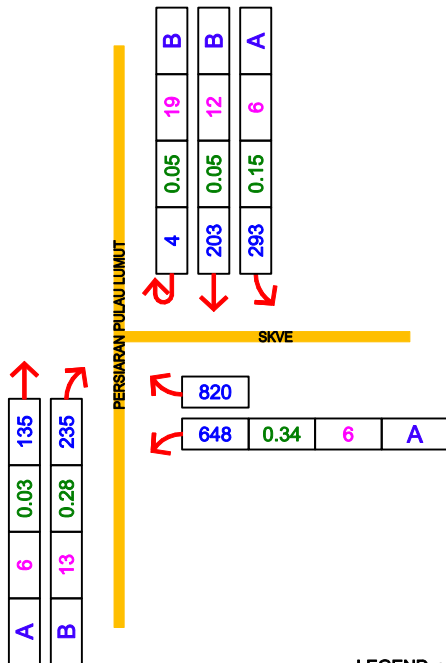
FUTURE YEAR 2028 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY / PERSIARAN PELABUHAN BARAT SIGNALISED JUNCTION (J8)

FIGURE 5.11



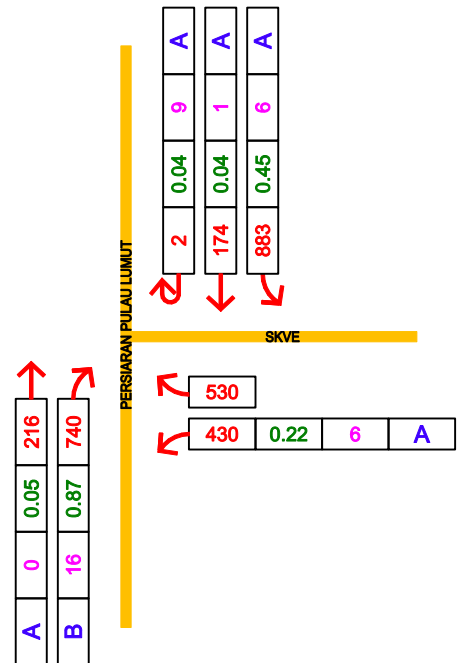
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS A  
 DEGREE OF SATURATION = 0.34  
 TOTAL INFLOW = 1,518 pcu/hour  
 AVERAGE CONTROLLED DELAY = 5 sec



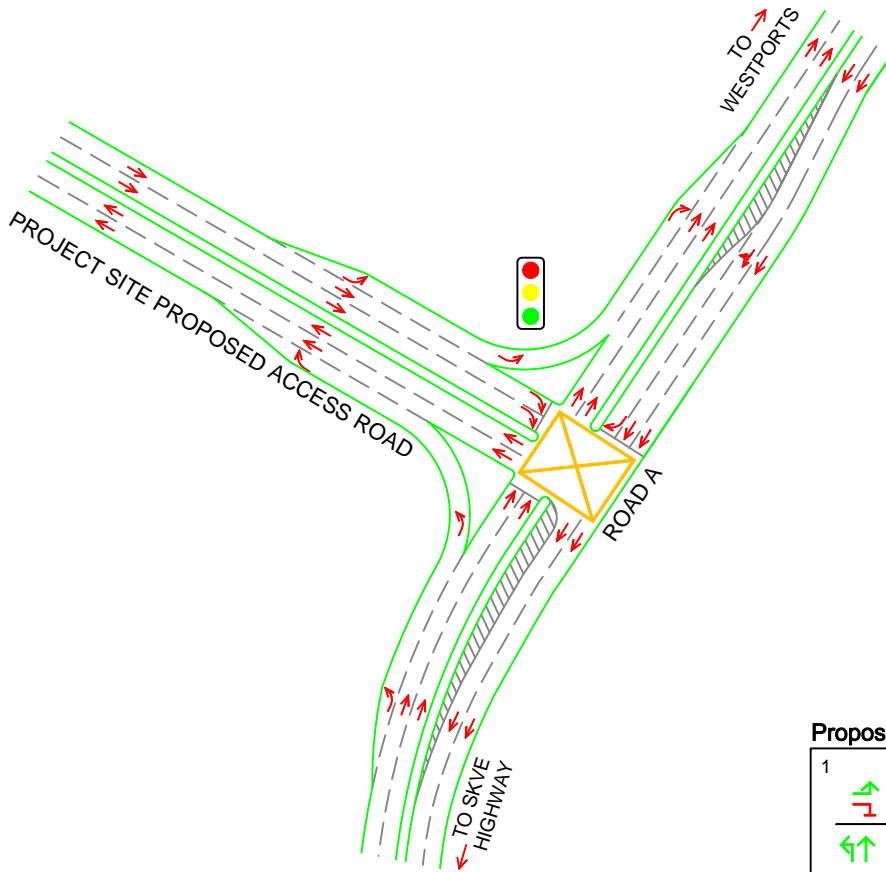
### PM PEAK HOUR

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.87  
 TOTAL INFLOW = 2,445 pcu/hour  
 AVERAGE CONTROLLED DELAY = 16 sec

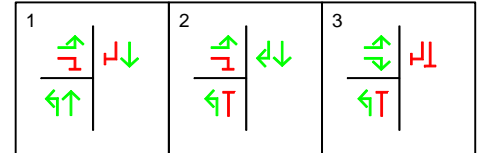


LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

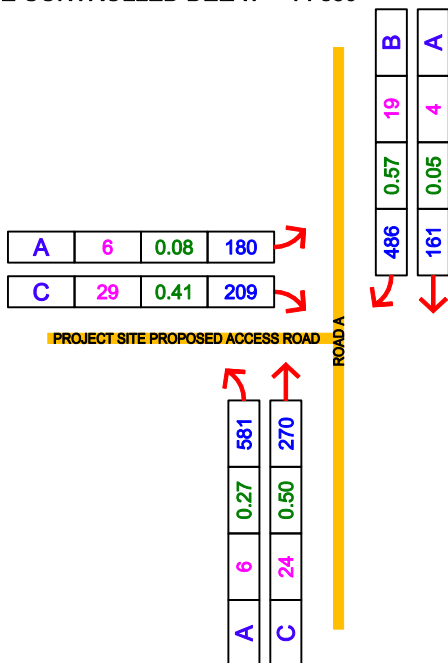


**Proposed Signal Phasing**



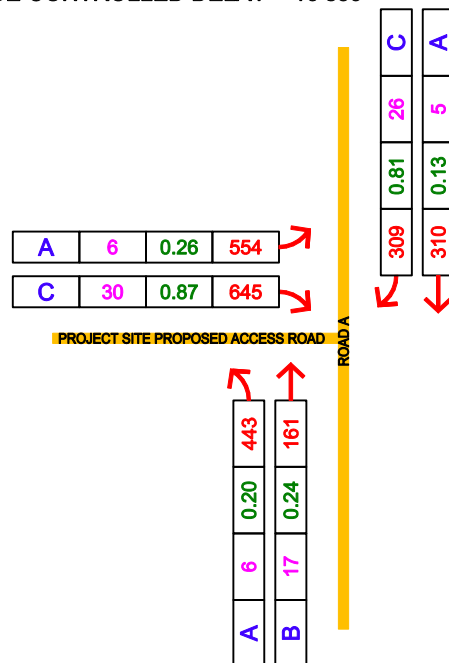
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.57  
 TOTAL INFLOW = 1,887 pcu/hour  
 AVERAGE CONTROLLED DELAY = 14 sec



**PM PEAK HOUR**

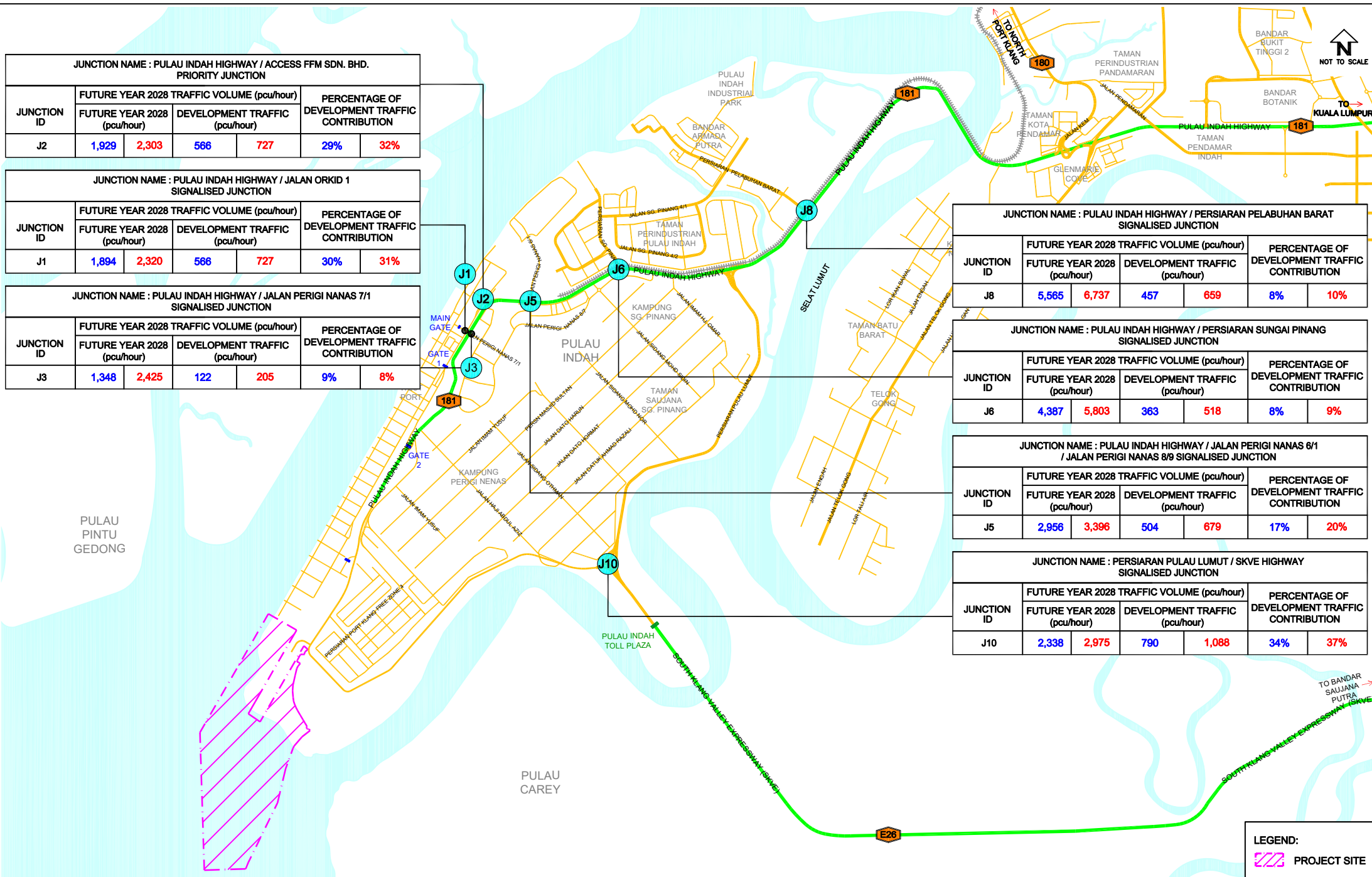
OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.87  
 TOTAL INFLOW = 2,503 pcu/hour  
 AVERAGE CONTROLLED DELAY = 16 sec



**LEGEND :**

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)





JUNCTION NAME : PULAU INDAH HIGHWAY / ACCESS FFM SDN. BHD. PRIORITY JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J2	1,929	2,303	566	727	29%	32%

JUNCTION NAME : PULAU INDAH HIGHWAY / JALAN ORKID 1 SIGNALISED JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J1	1,894	2,320	566	727	30%	31%

JUNCTION NAME : PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 7/1 SIGNALISED JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J3	1,348	2,425	122	205	9%	8%

JUNCTION NAME : PULAU INDAH HIGHWAY / PERSIARAN PELABUHAN BARAT SIGNALISED JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J8	5,565	6,737	457	659	8%	10%

JUNCTION NAME : PULAU INDAH HIGHWAY / PERSIARAN SUNGAI PINANG SIGNALISED JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J6	4,387	5,803	363	518	8%	9%

JUNCTION NAME : PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 6/1 / JALAN PERIGI NANAS 8/9 SIGNALISED JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J5	2,956	3,396	504	679	17%	20%

JUNCTION NAME : PERSIARAN PULAU LUMUT / SKVE HIGHWAY SIGNALISED JUNCTION						
JUNCTION ID	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)		DEVELOPMENT TRAFFIC (pcu/hour)			
J10	2,338	2,975	790	1,088	34%	37%

PROJECT SITE TRAFFIC CONTRIBUTION AT JUNCTIONS IN YEAR 2028

FIGURE 5.14

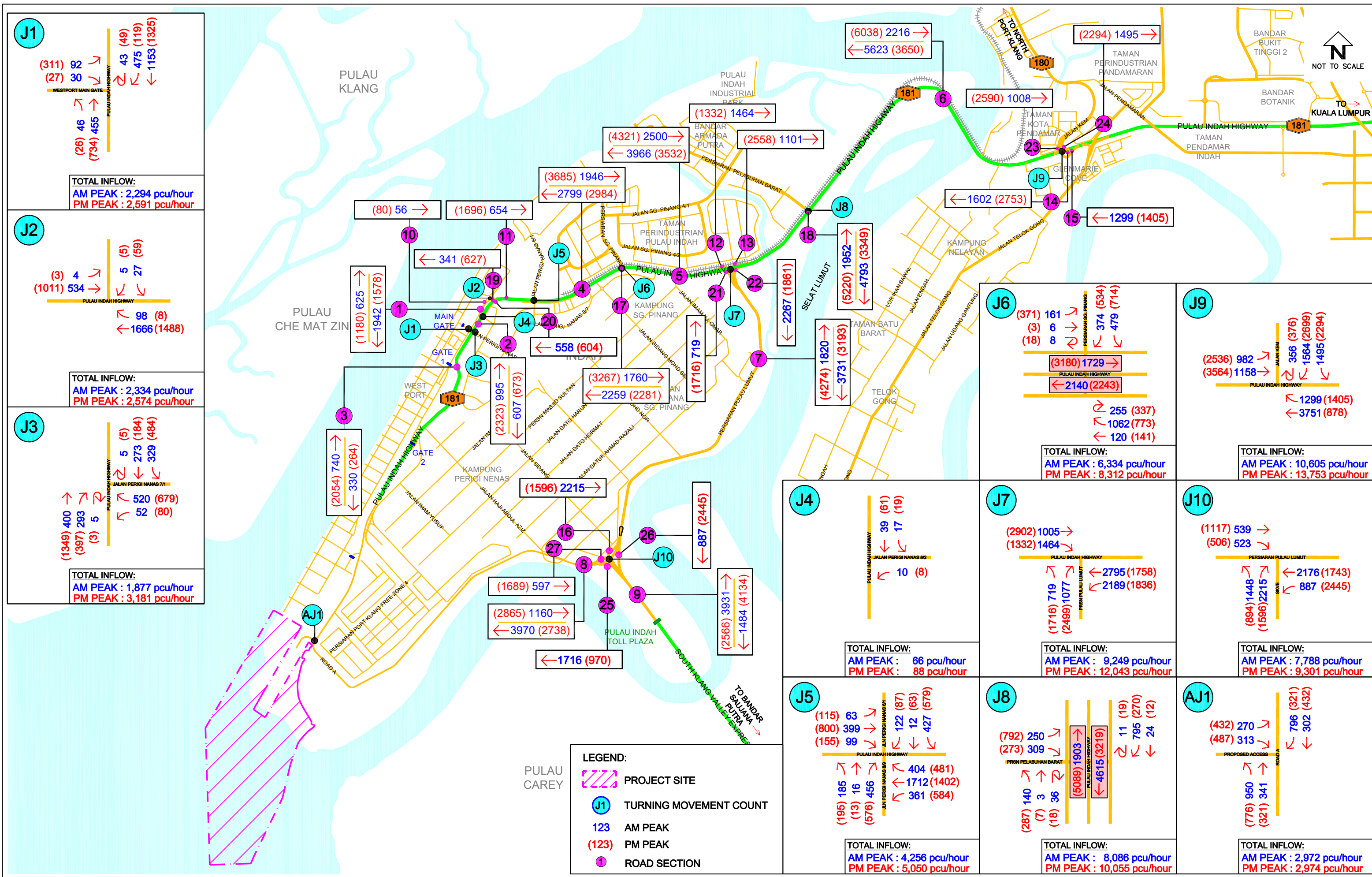
5.2.9 The contribution of the project site traffic to the junctions at Pulau Indah ranges from 8% to 37% of the total future forecasted Year 2028 peak hour traffic volume with maximum traffic contribution at Persiaran Pulau Lumut / SKVE Highway Priority Junction (J10). This is due to current low traffic inflow and fully developed Phase 1 committed development; Central Spectrum Development.

### 5.3 Future Year 2038 Traffic Analysis

5.3.1 The predicted future traffic Year 2038 traffic volume is shown in **Figure 5.15**. The future traffic Year 2038 traffic volume were firstly been analysed with the Year 2028 proposed traffic improvement before come out with further traffic recommendations. Future Year 2038 traffic analysis can be considered as the ultimate future year analysis for Pulau Indah as most of the development are expected to be completed during that year.

5.3.2 Based on the predicted forecasted Year 2038 and with assumption year 2028 traffic improvement have been complied, the further traffic recommendations for Pulau Indah's roads and junctions are as following. These traffic is shown in **Figure 5.16**.

- i. Road upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at SKVE Highway Pulau Indah Highway stretching from Persiaran Sungai Pinang (J6) to Persiaran Pulau Lumut (J7),
- ii. Road upgrading from 3-lane dual carriageway road to 4-lane dual carriageway road at Pulau Indah Highway stretching from Persiaran Pulau Lumut (J7) to Jalan Kem (J9) by others,
- iii. Road widening of Pulau Indah Highway eastbound direction between Jalan Perigi Nanas 6/1 at (J5) and Persiaran Sungai Pinang at (J6) from 2-lane to 3-lane by others,
- iv. Road widening of Pulau Indah Highway eastbound direction between Jalan Kem and KESAS Highway from 3-lane to 4-lane by others,



FUTURE YEAR 2038 MORNING AND EVENING PEAK HOUR TRAFFIC VOLUME (pcu/hour)

FIGURE 5.15

- v. Road widening of Jalan Kem southbound direction from 3-lane to 4-lane by others,
- vi. Committed road upgrading of Persiaran Pulau Lumut from 2-lane dual carriageway road to 3-lane dual carriageway road by others,
- vii. Junction upgrading of Pulau Indah Highway / Access FFM Sdn. Bhd. Junction (J2) from priority junction to signalised junction,
- viii. Junction improvement at Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction (J5) which includes additional lane at north approach for left turn movement, signal phasing and lane marking modification by others, and
- ix. Committed junction upgrading to a free-flow interchange at Persiaran Pulau Lumut / SKVE Highway Junction (J10) by others.

### **Future Year 2038 Mid-Block Capacity Analysis**

5.3.3 Similarly to future year 2028 mid-block capacity analysis, future year 2038 mid-block capacity analysis of the roads at Pulau Indah site is based on the future year 2038 peak hour traffic volumes and the carrying capacity of existing and upgraded road sections. Result of the future year 2038 mid-block capacity analysis at Pulau Indah is shown in **Table 5.5** and illustrated in **Figure 5.17** and **Figure 5.18**.

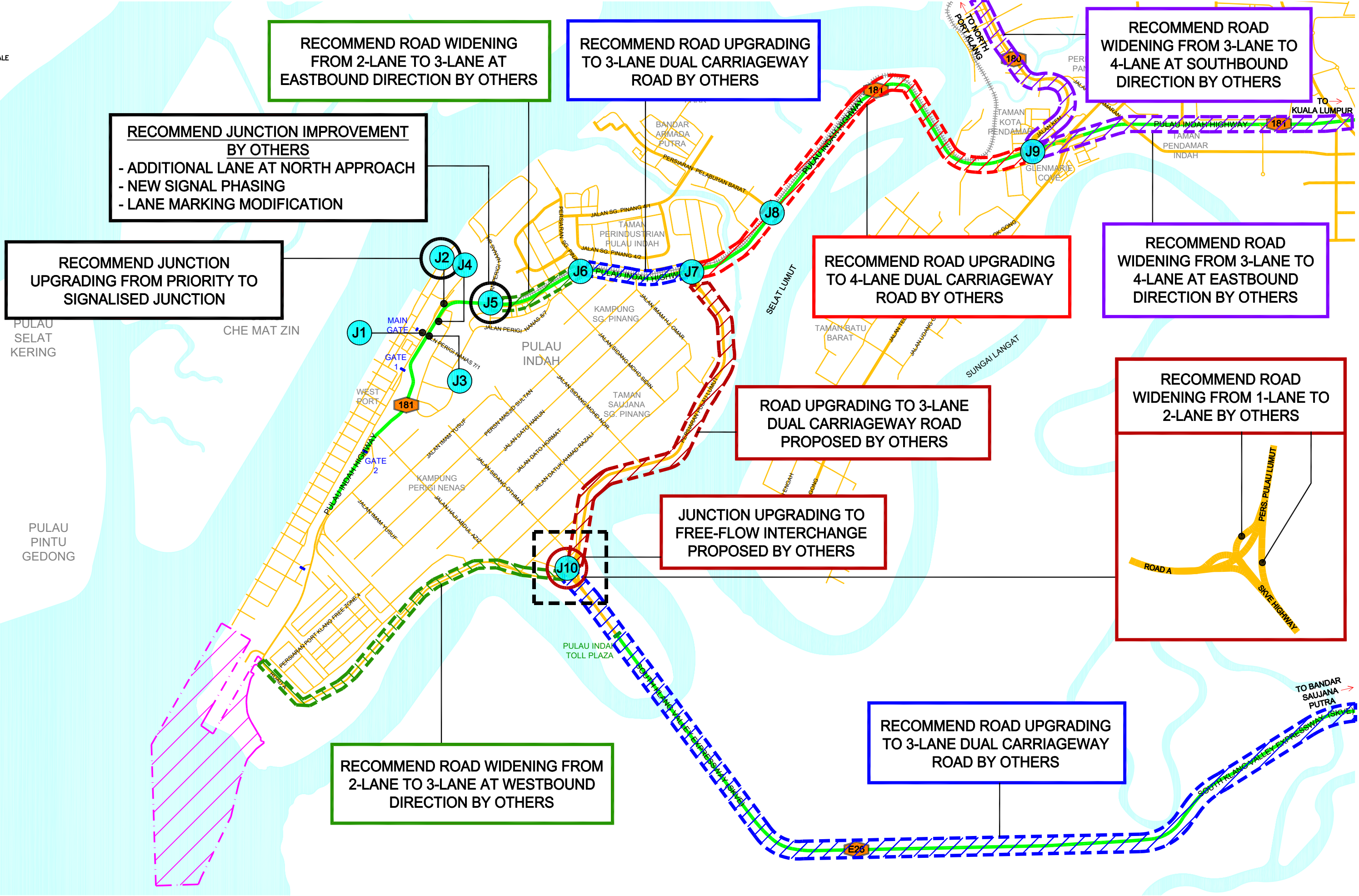
**Table 5.5: Future Year 2038 Operational Performance of Roads**

Road Name	Road Section	Dir.	Capacity (pcu/hr)	Hourly Traffic Flow (pcu/hour)		Volume/ Capacity (V/C)		Level of Service (LOS)	
				AM	PM	AM	PM	AM	PM
Pulau Indah Highway (FT181)	1	NB	3,600	590	1,094	0.16	0.30	A	A
		SB	3,600	1,671	1,493	0.46	0.41	A	A
	2	NB	3,600	925	2,033	0.26	0.56	A	A
		SB	3,600	607	673	0.17	0.19	A	A
	3	NB	3,600	698	1,749	0.19	0.49	A	A
		SB	3,600	330	267	0.09	0.07	A	A
	4	EB	5,400	1,904	3,572	0.35	0.66	A	B
		WB	3,600	2,642	2,934	0.73	0.82	C	D
	5	EB	5,400	2,469	4,234	0.46	0.78	A	C
		WB	5,400	3,577	3,494	0.66	0.65	B	B
	6	EB	7,200	2,167	5,907	0.30	0.82	A	D
		WB	7,200	5,445	3,592	0.76	0.50	C	A





NOT TO SCALE



FUTURE YEAR 2038 RECOMMENDED TRAFFIC IMPROVEMENT

FIGURE 5.16

**Table 5.5: Future Year 2038 Operational Performance of Roads (Continued)**

Road Name	Road Section	Dir.	Capacity (pcu/hr)	Hourly Traffic Flow (pcu/hour)		Volume/Capacity (V/C)		Level of Service (LOS)	
				AM	PM	AM	PM	AM	PM
Persiaran Pulau Lumut	7	NB	5,400	1,796	4,215	0.33	0.78	A	C
		SB	5,400	3,653	3,168	0.68	0.59	B	A
	8	EB	3,600	1,062	2,623	0.30	0.73	A	C
		WB	5,400	3,624	2,637	0.67	0.49	B	A
SKVE Highway	9	NB	5,400	3,663	2,490	0.68	0.46	B	A
		SB	5,400	1,410	3,951	0.26	0.73	A	C
Elevated Ramp 1	10	1-Way	3,600	56	80	0.02	0.02	A	A
Elevated Ramp 2	11	1-Way	3,600	622	1,617	0.17	0.45	A	A
Elevated Ramp 3	12	1-Way	3,600	1,464	1,332	0.41	0.37	A	A
Elevated Ramp 4	13	1-Way	3,600	1,077	2,499	0.30	0.69	A	B
Elevated Ramp 5	14	1-Way	3,600	1,564	2,699	0.43	0.75	A	C
Elevated Ramp 6	15	1-Way	3,600	1,299	1,405	0.36	0.39	A	A
Elevated Ramp 7	16	1-Way	3,600	2,215	1,596	0.62	0.44	B	A
Flyover 1	17	EB	3,600	1,729	3,180	0.48	0.88	A	D
		WB	3,600	2,140	2,243	0.59	0.62	A	B
Flyover 2	18	EB	5,400	1,903	5,089	0.35	0.94	A	E
		WB	5,400	4,615	3,291	0.85	0.61	D	B
Slip road 1	19	1-Way	3,600	303	416	0.08	0.12	A	A
Slip road 2	20	1-Way	3,600	558	604	0.16	0.17	A	A
Slip road 3	21	1-Way	3,600	719	1,716	0.20	0.48	A	A
Slip road 4	22	1-Way	3,600	2,189	1,836	0.61	0.51	B	A
Slip road 5	23	1-Way	3,600	982	2,536	0.27	0.70	A	C
Slip road 6	24	1-Way	3,600	1,495	2,294	0.42	0.64	A	B
Slip road 7	25	1-Way	1,800	1,448	894	0.80	0.50	D	A
Proposed Elevated Ramp 1	26	1-Way	3,600	887	2,445	0.25	0.68	A	B
Proposed Elevated Ramp 2	27	1-Way	1,800	523	1,506	0.29	0.84	A	D

Note: Dir. = Direction, NB = Northbound, SB = Southbound, WB = Westbound, EB = Eastbound

5.3.4 The results of future year 2038 mid-block capacity analysis indicated that with road widening and upgrading, all studied road sections are expected to operate at acceptable level of service; ranging from LOS A to LOS D during morning and evening peak hours except Flyover 2 eastbound direction is expected to operate at near capacity level of service; LOS E during evening peak hour. It is assumed the flyover at interchange to have a maximum upgrading of 3-lane dual carriageway road due to availability space and road reserve.

5.3.5 Project site traffic contributions on major roads at Pulau Indah were also evaluated to identify the percentage of project site traffic on the roads in Year 2038. The contribution of project traffic is shown in **Table 5.6** and illustrated in **Figure 5.19**.



SECTION 11 : ELEVATED RAMP 2				
DIRECTION	V/C RATIO		LOS	
1-WAY	0.17	0.45	A	A

SECTION 4 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.35	0.66	A	B
WESTBOUND	0.73	0.82	C	D

SECTION 5 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.46	0.78	A	C
WESTBOUND	0.66	0.65	B	B

SECTION 10 : ELEVATED RAMP 1				
DIRECTION	V/C RATIO		LOS	
1-WAY	0.02	0.02	A	A

SECTION 1 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.16	0.30	A	A
SOUTHBOUND	0.46	0.41	A	A

SECTION 2 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.26	0.56	A	A
SOUTHBOUND	0.17	0.19	A	A

SECTION 3 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.19	0.49	A	A
SOUTHBOUND	0.09	0.07	A </td <td>A</td>	A

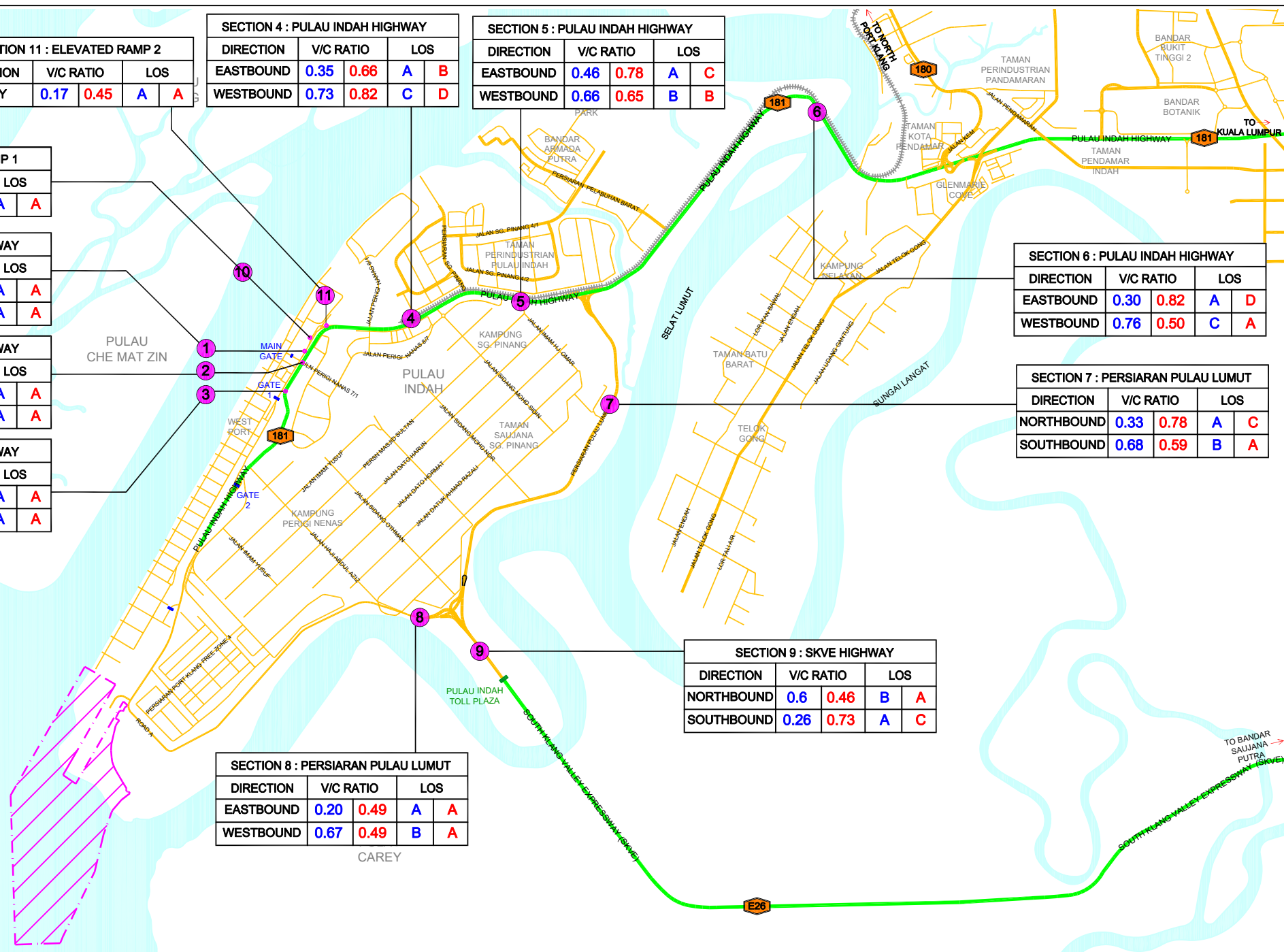
SECTION 6 : PULAU INDAH HIGHWAY				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.30	0.82	A	D
WESTBOUND	0.76	0.50	C	A

SECTION 7 : PERSIARAN PULAU LUMUT				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.33	0.78	A	C
SOUTHBOUND	0.68	0.59	B	A

SECTION 9 : SKVE HIGHWAY				
DIRECTION	V/C RATIO		LOS	
NORTHBOUND	0.6	0.46	B	A
SOUTHBOUND	0.26	0.73	A	C

SECTION 8 : PERSIARAN PULAU LUMUT				
DIRECTION	V/C RATIO		LOS	
EASTBOUND	0.20	0.49	A	A
WESTBOUND	0.67	0.49	B	A

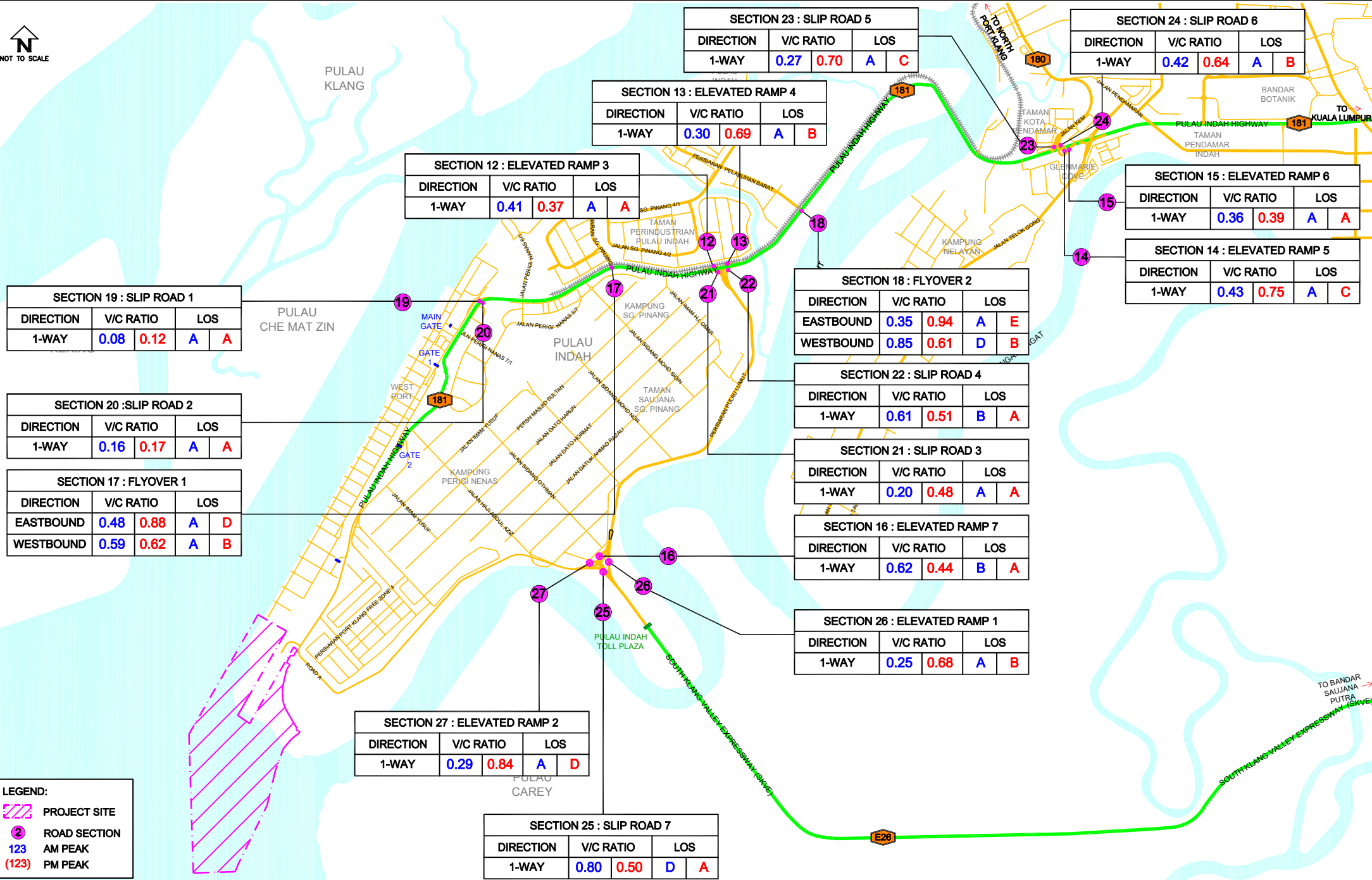
LEGEND:	
	PROJECT SITE
	ROAD SECTION
	AM PEAK
	PM PEAK



FUTURE YEAR 2038 MORNING AND EVENING PEAK HOUR VOLUME OVER CAPACITY (v/c) RATIO - 1

FIGURE 5.17





FUTURE YEAR 2038 MORNING AND EVENING PEAK HOUR VOLUME OVER CAPACITY (v/c) RATIO - 2

FIGURE 5.18



**Table 5.6: Project Site Traffic Contribution at Roads in Year 2038**

Road Name	Road Section	Dir.	Future Year 2038 Traffic Volume (pcu/hour)				Percentage of Project Site Traffic Contribution	
			Future Year 2038 (pcu/hr)		Project Site Traffic (pcu/hr)		AM	PM
			AM	PM	AM	PM		
Pulau Indah Highway	1	EB	1,904	3,572	147	423	8%	12%
		WB	2,642	2,934	430	268	16%	9%
	2	EB	2,167	5,907	169	486	8%	8%
		WB	5,445	3,592	489	312	9%	9%
Persiaran Pulau Lumut	3	NB	1,796	4,215	74	214	4%	5%
		SB	3,653	3,168	217	138	6%	4%
SKVE Highway	4	NB	3,663	2,490	733	417	20%	17%
		SB	1,410	3,951	239	689	17%	17%

Note: Dir. = Direction, NB = Northbound, SB = Southbound, WB = Westbound, EB = Eastbound

5.3.6 The contribution of the project site traffic along Pulau Indah Highway, Persiaran Pulau Lumut and SKVE Highway is ranging from 4% to 20%. The maximum project site traffic contribution is located at SKVE Highway.

**Future Year 2038 Junction Performance Analysis**

5.3.7 The future junction capacity analysis is also carried out to evaluate the future performance of the immediate junctions at Pulau Indah in Year 2038 and is summarised in **Table 5.7** and illustrated in **Figure 5.20** to **Figure 5.26**.

**Table 5.7: Future Year 2038 Operational Performance of Junctions**

Junction Name	Junction Id	Peak Hour Traffic Flow (pcu/hr)		Maximum Degree of Saturation		Average Controlled Delay (second)		Maximum Level of Service (LOS)	
		AM	PM	AM	PM	AM	PM	AM	PM
Pulau Indah Highway / Jalan Orkid 1 Signalised Junction	J1	2,294	2,591	0.63	0.66	17	17	B	B
Pulau Indah Highway / Access FFM Sdn. Bhd. Signalised Junction	J2	2,334	2,574	0.68	0.56	10	9	A	A
Pulau Indah Highway / Jalan Perigi Nanas 7/1 Signalised Junction	J3	1,877	3,181	0.69	0.90	17	24	B	C
Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction	J5	4,256	5,050	0.90	0.92	35	49	C	D
Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction	J6	6,334	8,312	0.82	0.83	21	20	C	B
Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction	J8	8,086	10,055	0.91	0.85	36	20	D	B

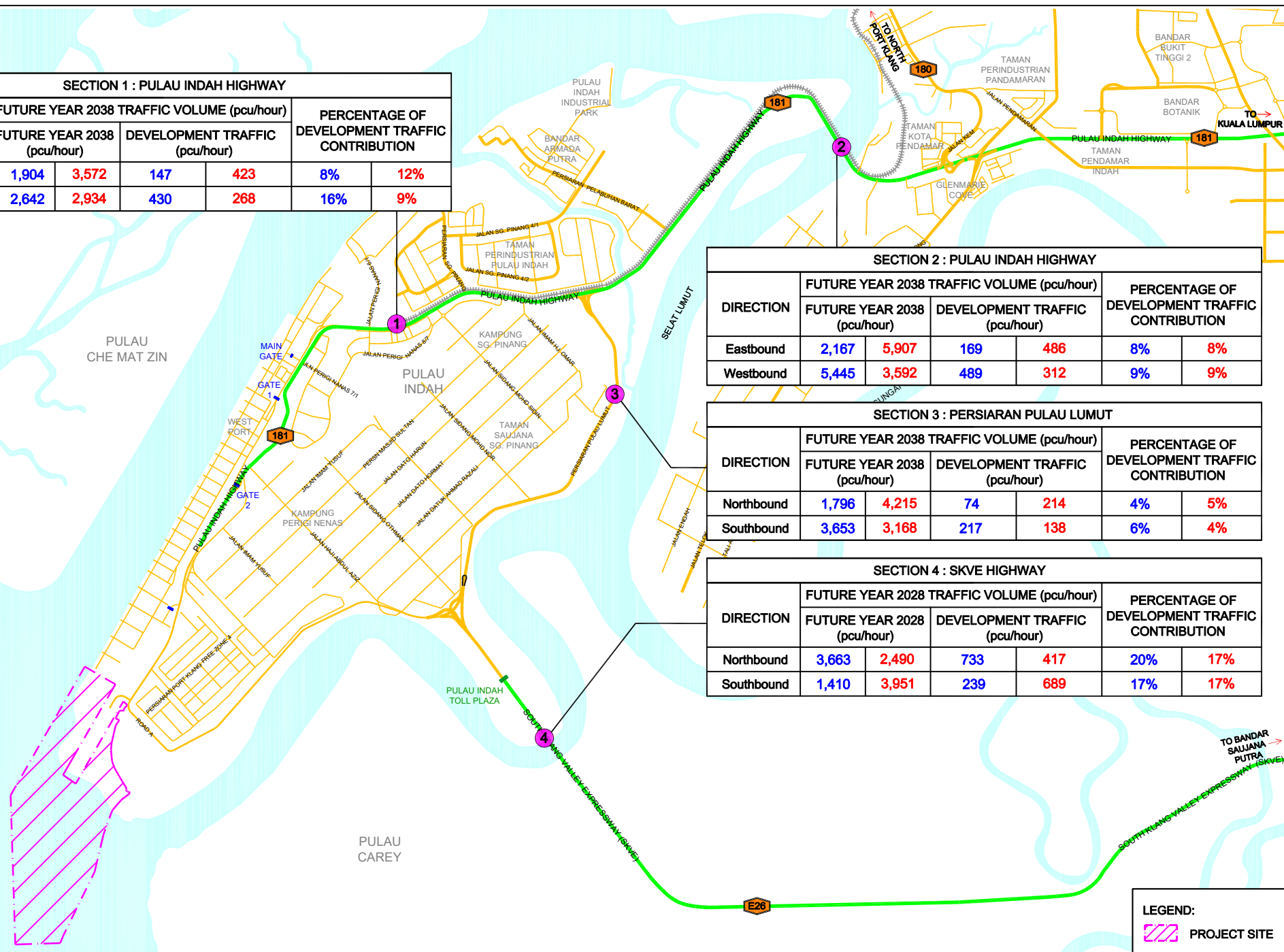


SECTION 1 : PULAU INDAH HIGHWAY						
DIRECTION	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Eastbound	1,904	3,572	147	423	8%	12%
Westbound	2,642	2,934	430	268	16%	9%

SECTION 2 : PULAU INDAH HIGHWAY						
DIRECTION	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Eastbound	2,167	5,907	169	486	8%	8%
Westbound	5,445	3,592	489	312	9%	9%

SECTION 3 : PERSIARAN PULAU LUMUT						
DIRECTION	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Northbound	1,796	4,215	74	214	4%	5%
Southbound	3,653	3,168	217	138	6%	4%

SECTION 4 : SKVE HIGHWAY						
DIRECTION	FUTURE YEAR 2028 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2028 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
Northbound	3,663	2,490	733	417	20%	17%
Southbound	1,410	3,951	239	689	17%	17%



**LEGEND:**  
 PROJECT SITE

**PROJECT SITE TRAFFIC CONTRIBUTION ON ROADS IN YEAR 2038**

**FIGURE 5.19**

**Table 5.7: Future Year 2038 Operational Performance of Junctions (Continued)**

Junction Name	Junction Id	Peak Hour Traffic Flow (pcu/hr)		Maximum Degree of Saturation		Average Controlled Delay (second)		Maximum Level of Service (LOS)	
		AM	PM	AM	PM	AM	PM	AM	PM
Persiaran Pulau Lumut / SKVE Highway Junction	J10	7,788	9,301	Committed Junction Upgrading to a Free-Flow Interchange by Others					
Pulau Indah Highway / Project Site Proposed Access Road Signalised Junction	AJ1	2,972	3,473	0.80	0.75	16	15	C	B

5.3.8 Future junction capacity analysis indicated that with upgrading from priority to signalised junction at J2 and junction improvement at J5, the studied junctions are expected to operate at acceptable level of service; ranging LOS A to LOS D during both morning and evening peak hours in Year 2038. The maximum degree of saturation is 0.92 at J5 with 49 second average controlled delay.

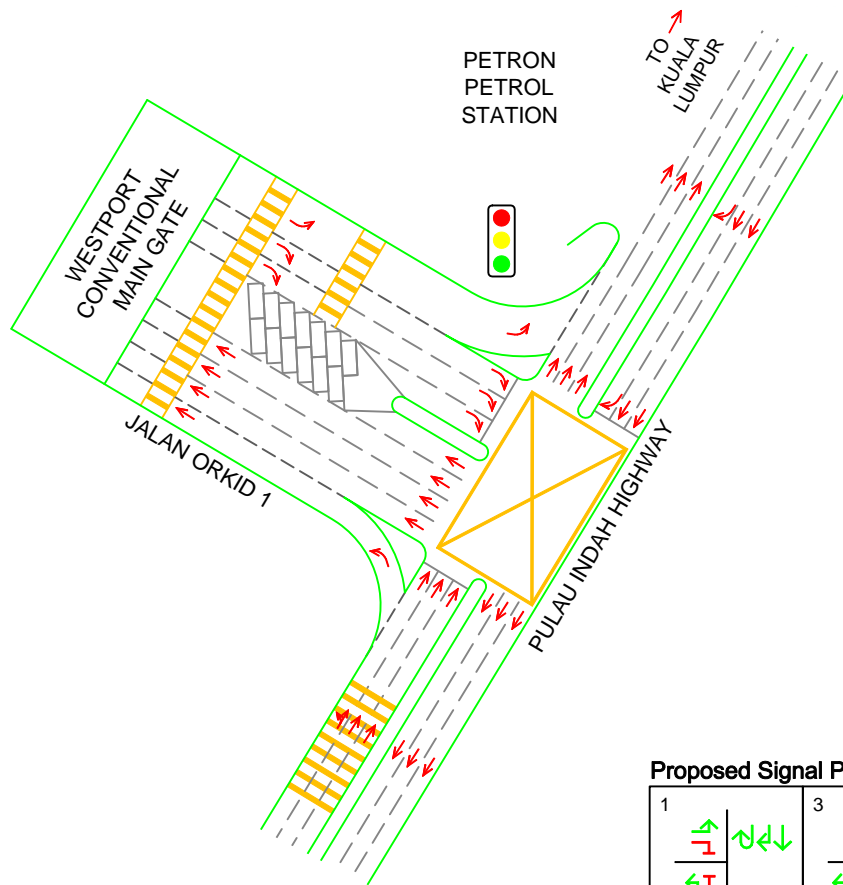
5.3.9 Project site traffic contributions on the junctions at Pulau Indah were also evaluated to identify the percentage of project traffic at the junctions as shown in **Table 5.8** and illustrated in **Figure 5.27**.

**Table 5.8: Project Site Traffic Contribution at Junctions in Year 2038**

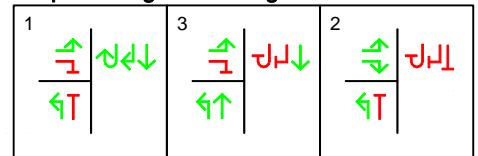
Junction Name	Junction Id	Year 2038 Traffic Volume (pcu/hour)				Percentage of Project Site Traffic Contribution	
		Future Year 2038 (pcu/hr)		Project Site Traffic (pcu/hr)		AM	PM
		AM	PM	AM	PM		
Pulau Indah Highway / Jalan Orkid 1 Signalised Junction	J1	2,294	2,591	894	912	39%	35%
Pulau Indah Highway / Access FFM Sdn. Bhd. Signalised Junction	J2	2,334	2,574	894	912	38%	35%
Pulau Indah Highway / Jalan Perigi Nanas 7/1 Signalised Junction	J3	1,877	3,181	206	330	11%	10%
Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction	J5	4,256	5,050	790	850	19%	17%
Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction	J6	6,334	8,312	577	691	9%	8%
Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction	J8	8,086	10,055	728	880	9%	9%
Persiaran Pulau Lumut / SKVE Highway Junction	J10	7,788	9,301	1,263	1,458	16%	16%

5.3.10 The contribution of the project site traffic to the junctions at Pulau Indah ranges from 8% to 39% of the total future forecasted Year 2038 peak hour traffic volume. The project site traffic contribution is high at Pulau Indah Highway / Jalan Orkid 1 Signalised Junction (J1) and Pulau Indah Highway / Access FFM Sdn. Bhd. Signalised Junction (J2). The

contribution of project site traffic at Persiaran Pulau Lumut / SKVE Highway Junction (J10) has become low as the junction have been contributed more by the committed developments.

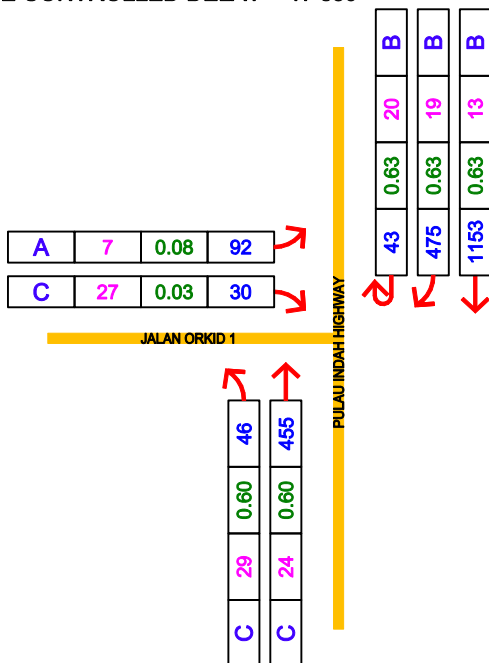


Proposed Signal Phasing



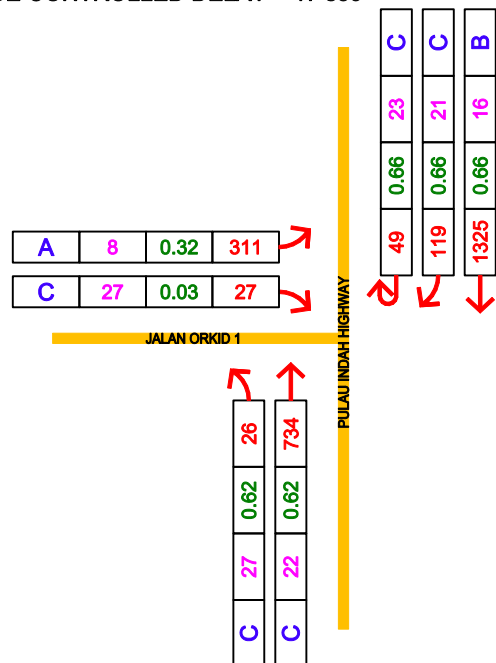
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.63  
 TOTAL INFLOW = 2,294 pcu/hour  
 AVERAGE CONTROLLED DELAY = 17 sec



**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.66  
 TOTAL INFLOW = 2,591 pcu/hour  
 AVERAGE CONTROLLED DELAY = 17 sec

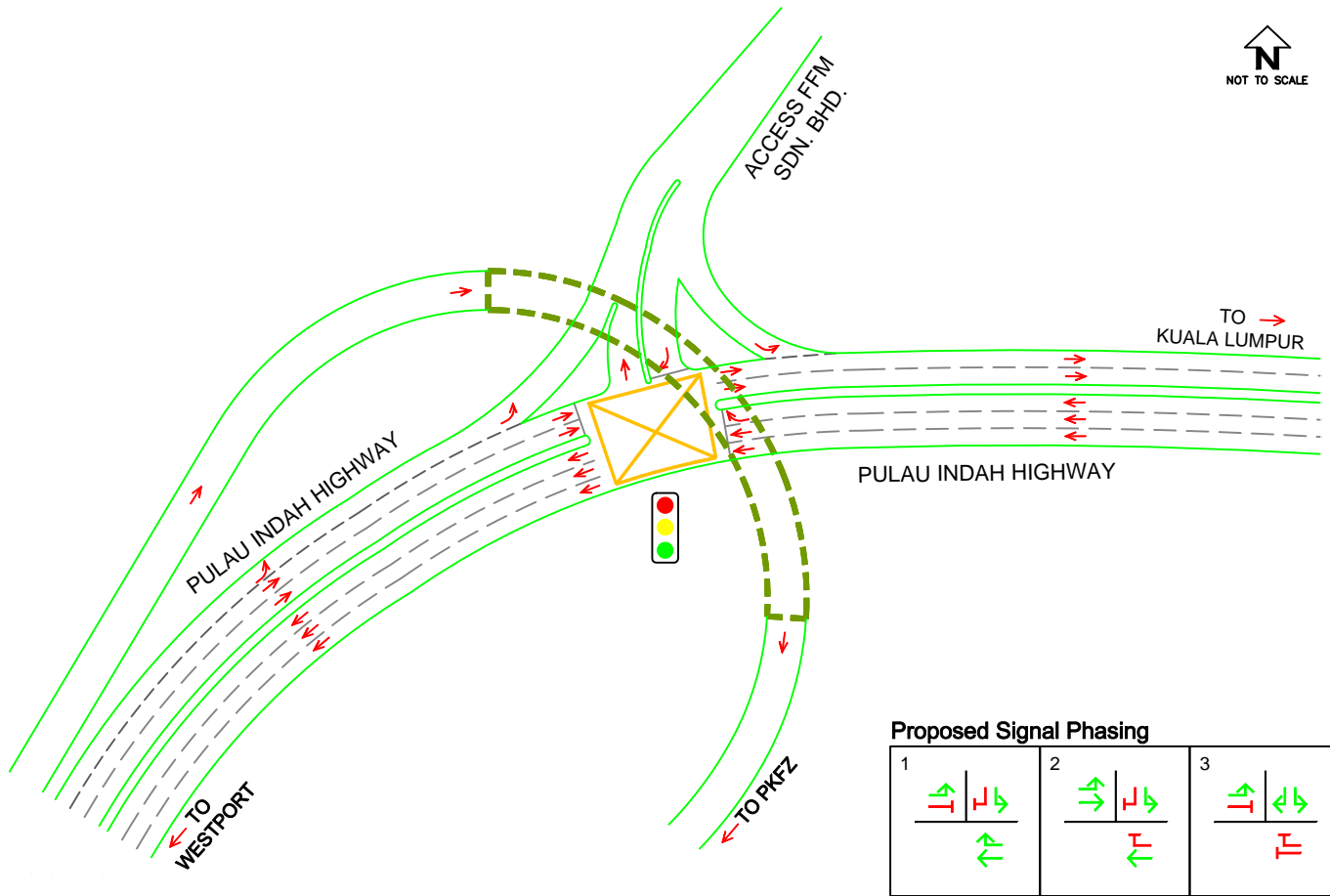


LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

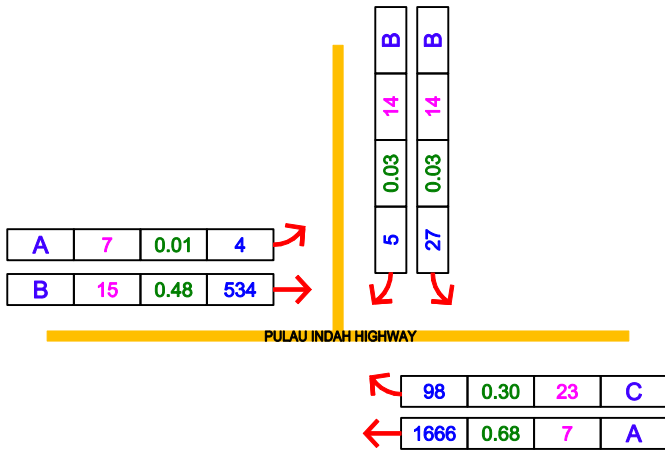
FUTURE YEAR 2038 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY /  
 JALAN ORKID 1 SIGNALISED JUNCTION (J1)

FIGURE 5.20



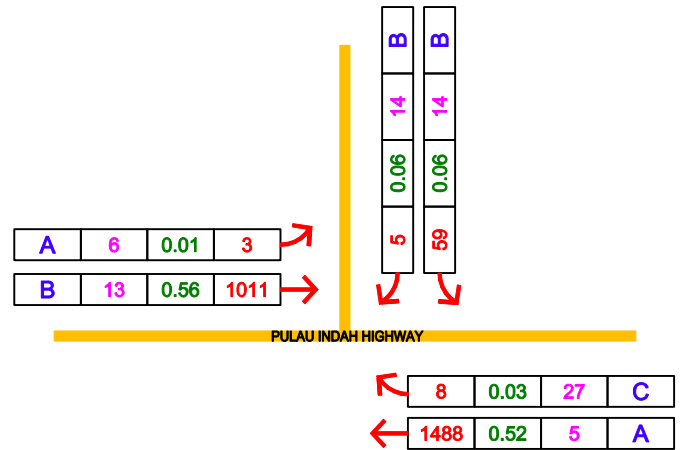
### AM PEAK HOUR

OVERALL PERFORMANCE = LOS A  
 DEGREE OF SATURATION = 0.68  
 TOTAL INFLOW = 2,334 pcu/hour  
 AVERAGE CONTROLLED DELAY = 10 sec



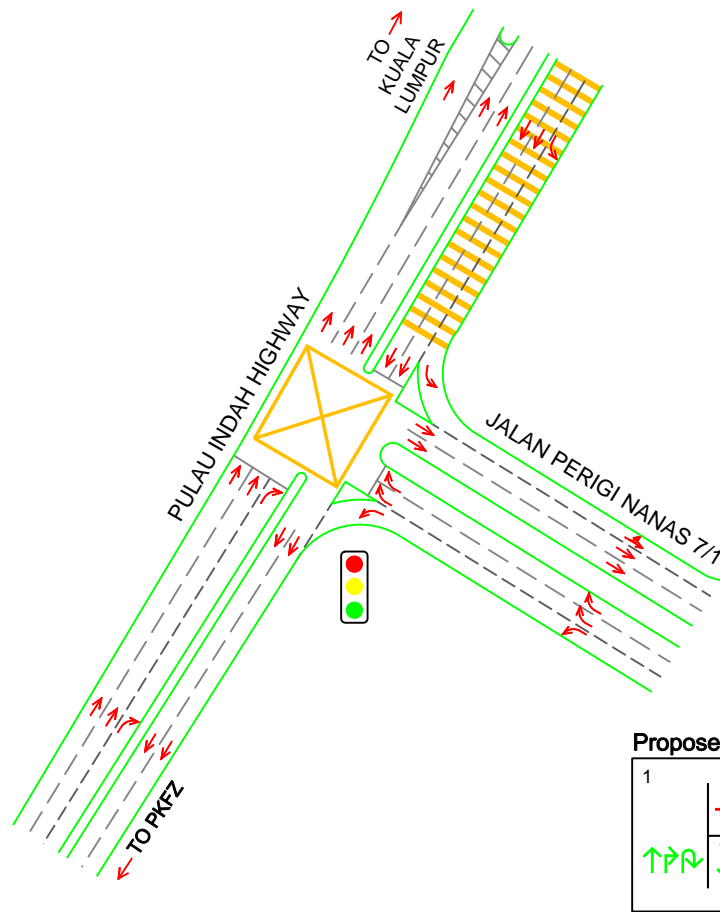
### PM PEAK HOUR

OVERALL PERFORMANCE = LOS A  
 DEGREE OF SATURATION = 0.56  
 TOTAL INFLOW = 2,574 pcu/hour  
 AVERAGE CONTROLLED DELAY = 9 sec

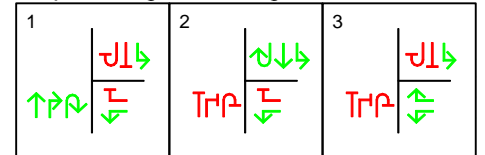


LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

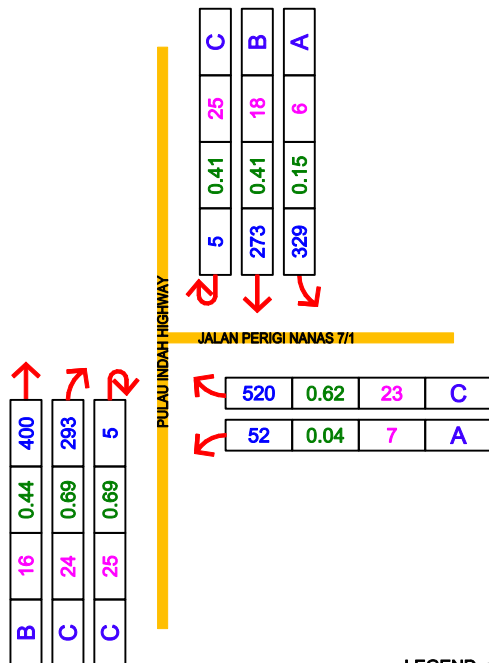


Proposed Signal Phasing



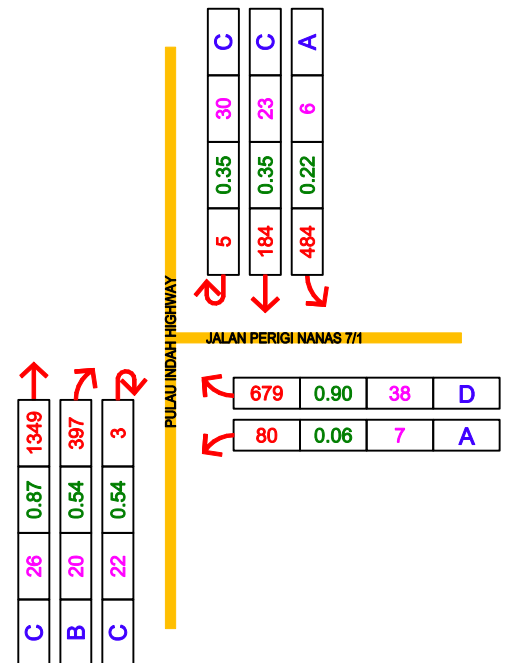
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.69  
 TOTAL INFLOW = 1,877 pcu/hour  
 AVERAGE CONTROLLED DELAY = 17 sec



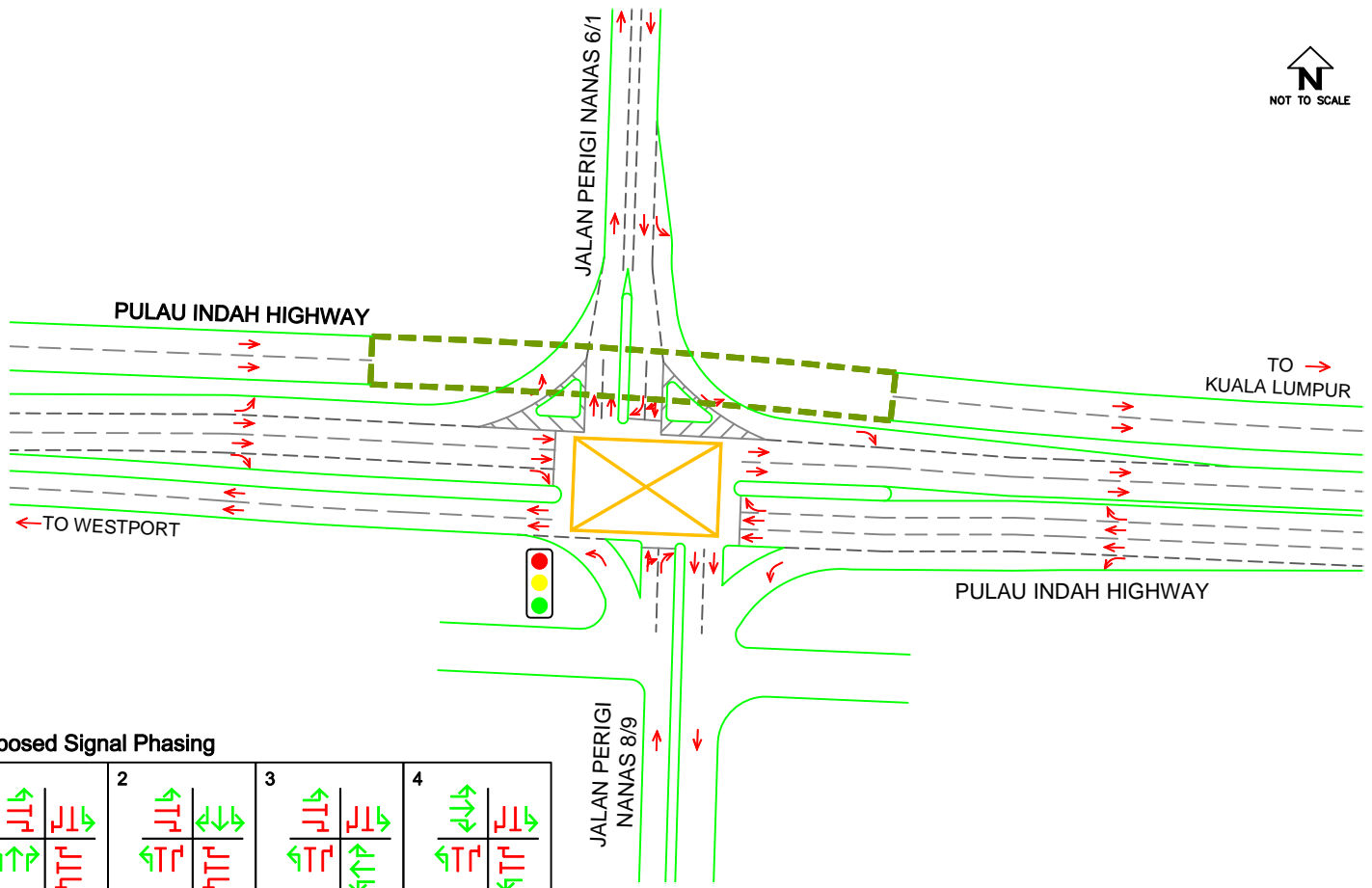
**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.90  
 TOTAL INFLOW = 3,181 pcu/hour  
 AVERAGE CONTROLLED DELAY = 24 sec

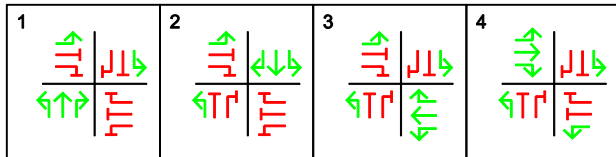


LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)



**Proposed Signal Phasing**

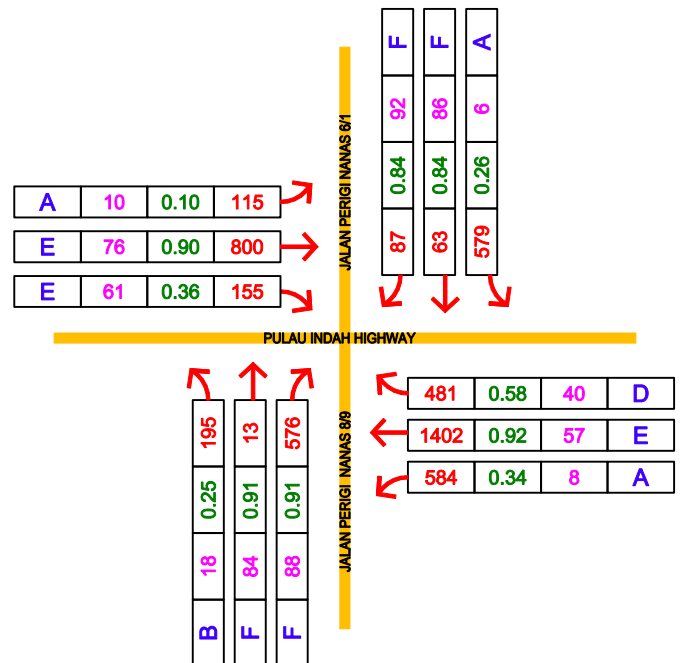
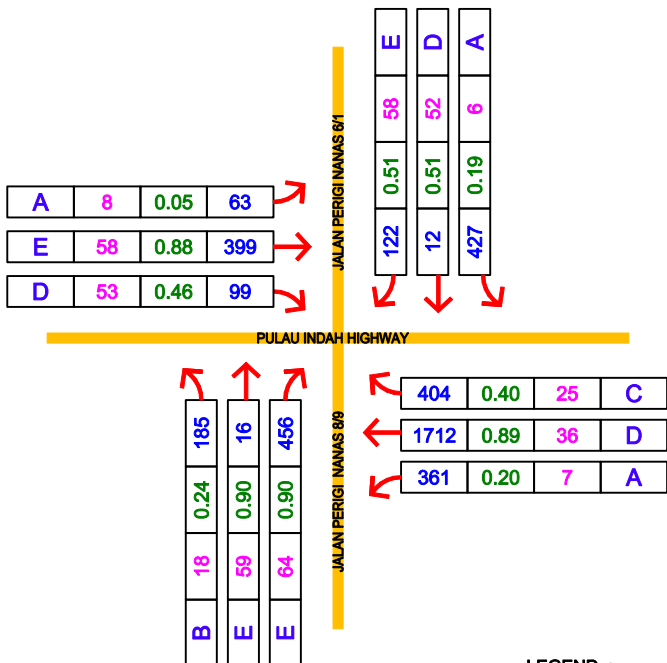


**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.90  
 TOTAL INFLOW = 4,256 pcu/hour  
 AVERAGE CONTROLLED DELAY = 35 sec

**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS D  
 DEGREE OF SATURATION = 0.92  
 TOTAL INFLOW = 5,050 pcu/hour  
 AVERAGE CONTROLLED DELAY = 50 sec



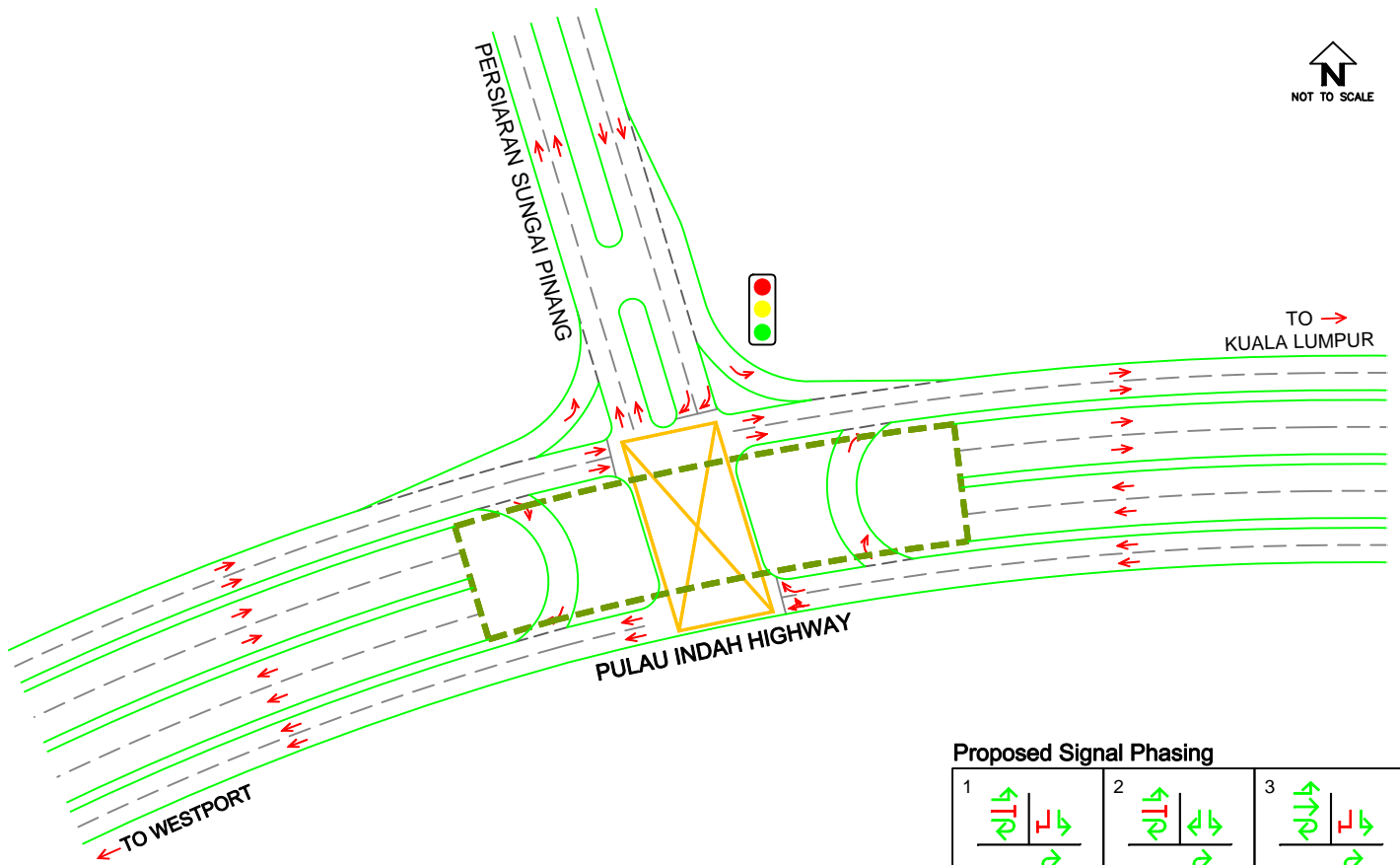
**LEGEND :**

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

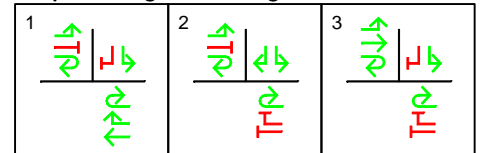
FUTURE YEAR 2038 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 6/1 / JALAN PERIGI NANAS 8/9 SIGNALISED JUNCTION (J5)

FIGURE 5.23



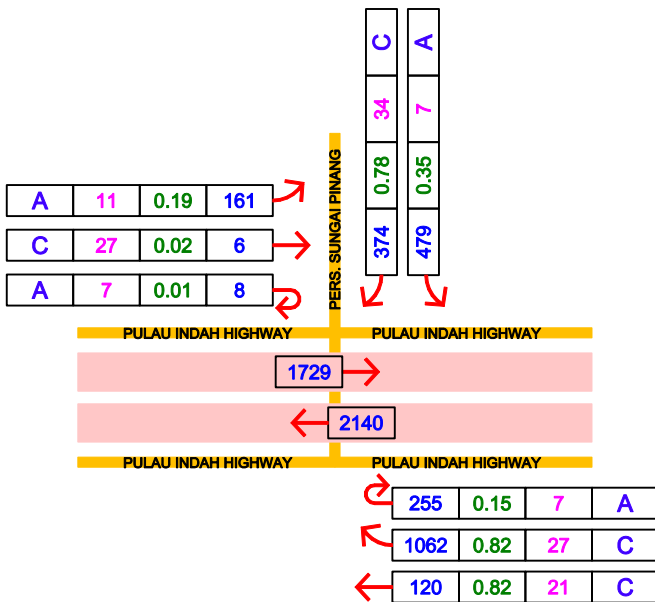


**Proposed Signal Phasing**



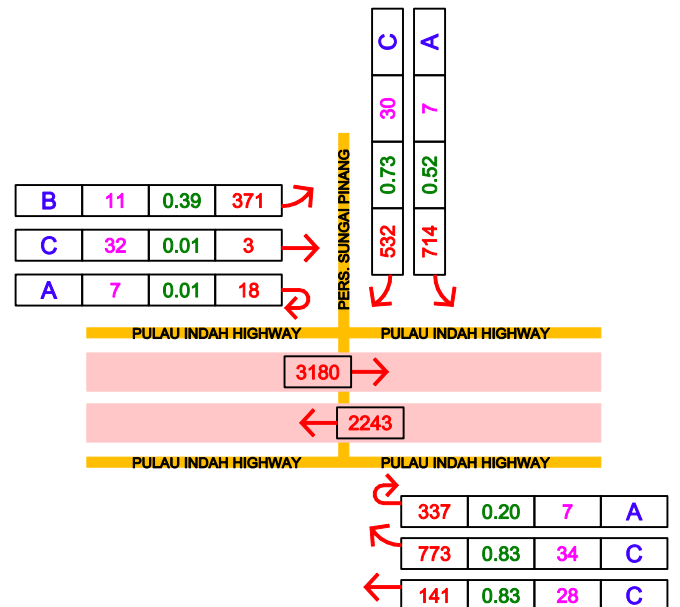
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS C  
 DEGREE OF SATURATION = 0.82  
 TOTAL INFLOW = 6,334 pcu/hour  
 AVERAGE CONTROLLED DELAY = 21 sec



**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.83  
 TOTAL INFLOW = 8,312 pcu/hour  
 AVERAGE CONTROLLED DELAY = 20 sec

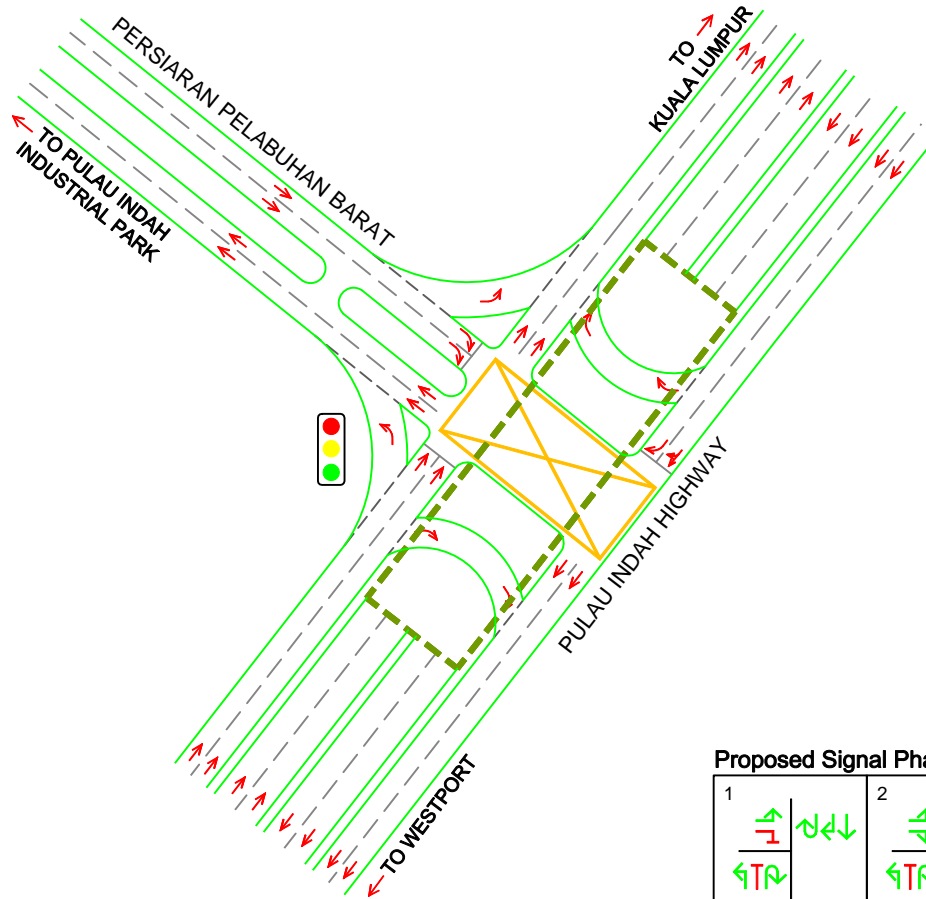


**LEGEND :**

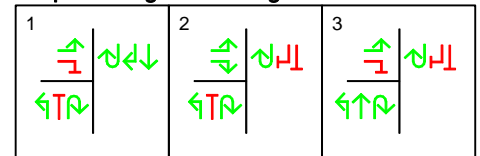
- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

FUTURE YEAR 2038 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY / PERSIARAN SUNGAI PINANG SIGNALISED JUNCTION (J6)

FIGURE 5.24

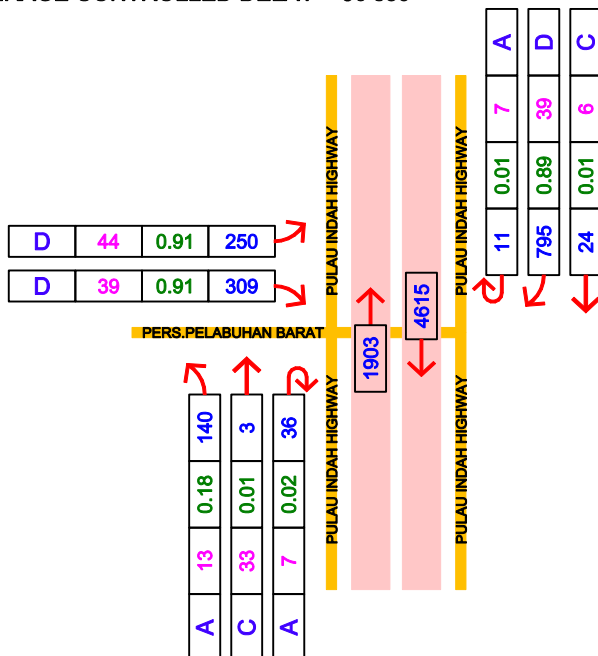


**Proposed Signal Phasing**



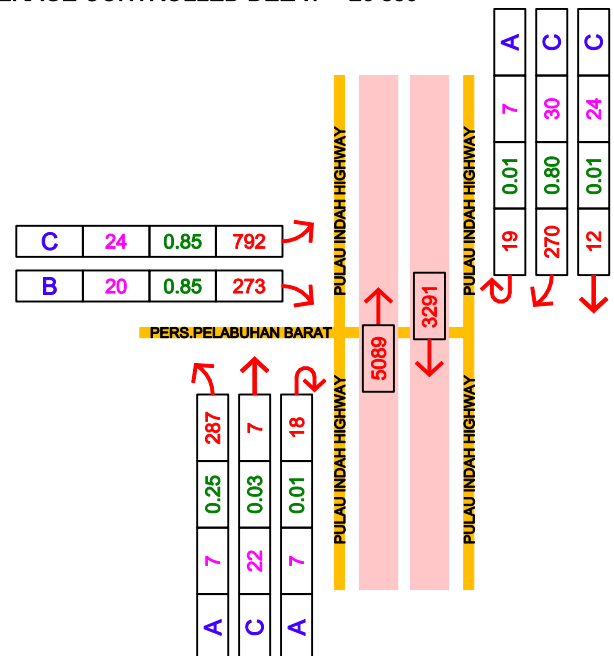
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS D  
 DEGREE OF SATURATION = 0.91  
 TOTAL INFLOW = 8,086 pcu/hour  
 AVERAGE CONTROLLED DELAY = 36 sec



**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.85  
 TOTAL INFLOW = 10,055 pcu/hour  
 AVERAGE CONTROLLED DELAY = 20 sec

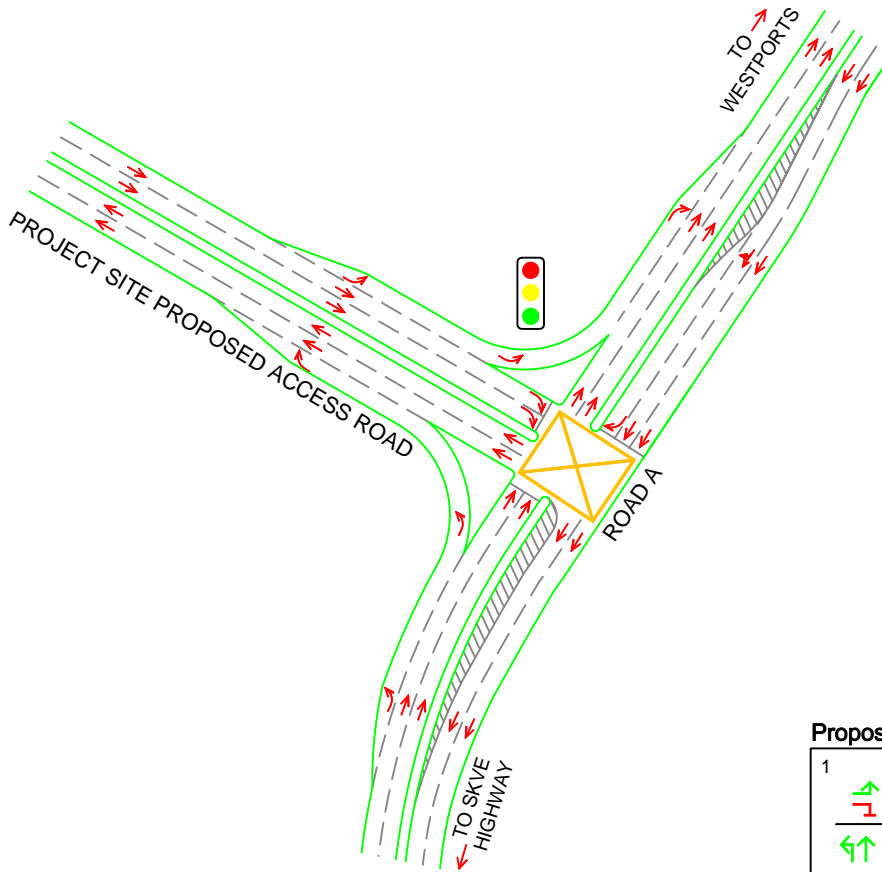


**LEGEND :**

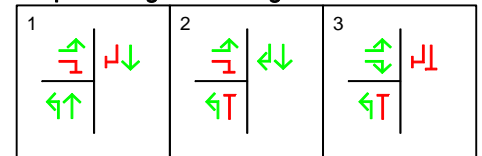
- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)

FUTURE YEAR 2038 OPERATIONAL PERFORMANCE PULAU INDAH HIGHWAY / PERSIARAN PELABUHAN BARAT SIGNALISED JUNCTION (J8)

FIGURE 5.25

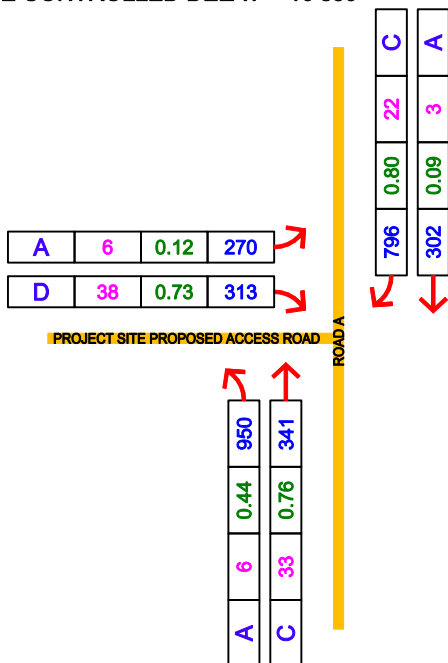


Proposed Signal Phasing



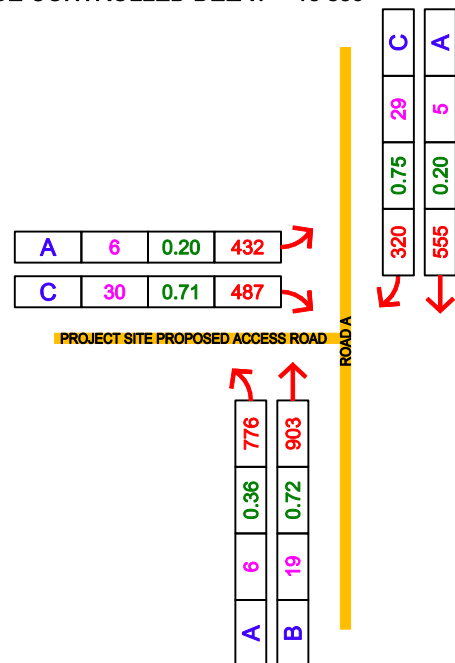
**AM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.80  
 TOTAL INFLOW = 2,972 pcu/hour  
 AVERAGE CONTROLLED DELAY = 16 sec



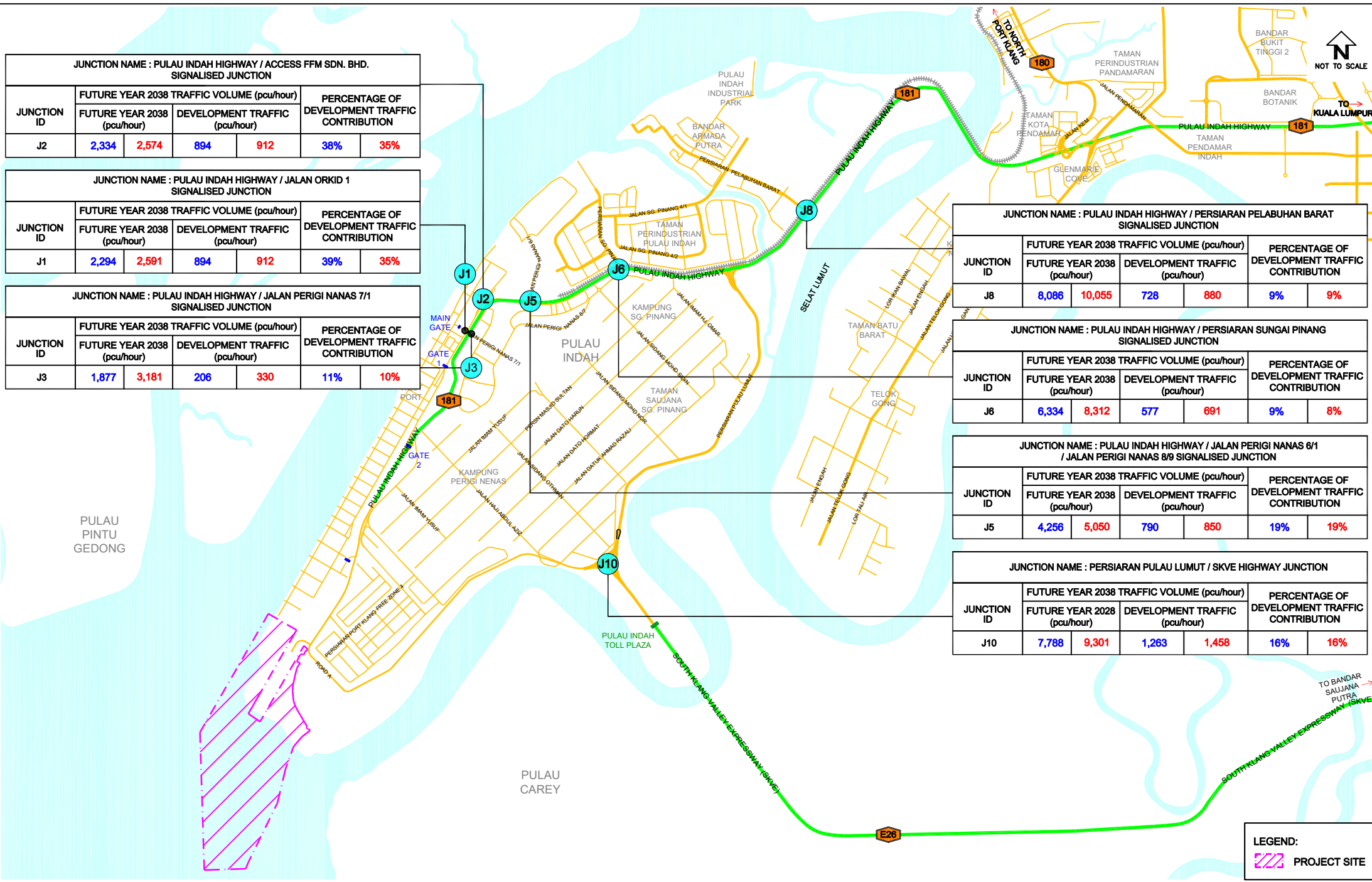
**PM PEAK HOUR**

OVERALL PERFORMANCE = LOS B  
 DEGREE OF SATURATION = 0.75  
 TOTAL INFLOW = 3,473 pcu/hour  
 AVERAGE CONTROLLED DELAY = 15 sec



LEGEND :

- 123 AM TRAFFIC VOLUME (pcu/hour)
- 123 PM TRAFFIC VOLUME (pcu/hour)
- 0.12 DEGREE OF SATURATION
- 1 AVERAGE CONTROLLED DELAY (second)
- A LEVEL OF SERVICE (LOS)



**JUNCTION NAME : PULAU INDAH HIGHWAY / ACCESS FFM SDN. BHD. SIGNALISED JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J2	2,334	2,574	894	912	38%	35%

**JUNCTION NAME : PULAU INDAH HIGHWAY / JALAN ORKID 1 SIGNALISED JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J1	2,294	2,591	894	912	39%	35%

**JUNCTION NAME : PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 7/1 SIGNALISED JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J3	1,877	3,181	206	330	11%	10%

**JUNCTION NAME : PULAU INDAH HIGHWAY / PERSIARAN PELABUHAN BARAT SIGNALISED JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J8	8,086	10,055	728	880	9%	9%

**JUNCTION NAME : PULAU INDAH HIGHWAY / PERSIARAN SUNGAI PINANG SIGNALISED JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J6	6,334	8,312	577	691	9%	8%

**JUNCTION NAME : PULAU INDAH HIGHWAY / JALAN PERIGI NANAS 6/1 / JALAN PERIGI NANAS 8/9 SIGNALISED JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J5	4,256	5,050	790	850	19%	19%

**JUNCTION NAME : PERSIARAN PULAU LUMUT / SKVE HIGHWAY JUNCTION**

JUNCTION ID	FUTURE YEAR 2038 TRAFFIC VOLUME (pcu/hour)				PERCENTAGE OF DEVELOPMENT TRAFFIC CONTRIBUTION	
	FUTURE YEAR 2038 (pcu/hour)	DEVELOPMENT TRAFFIC (pcu/hour)				
J10	7,788	9,301	1,263	1,458	16%	16%

**PROJECT SITE TRAFFIC CONTRIBUTION AT JUNCTIONS IN YEAR 2038**

**FIGURE 5.27**

# **SUMMARY AND RECOMENDATIONS**

## **6.0 SUMMARY AND RECOMMENDATIONS**

### **6.1 Introduction**

6.1.1 Messrs. Westports Malaysia Sdn. Bhd., herein refer as WMSB the container terminal operator of Westport, Port Klang plans to build new container terminals CT 10-CT 17 for container vessels at Pulau Indah, Selangor. With the launch of Container Terminal 10 to Container Terminal 19 (CT 10-CT 17), Westports Malaysia Sdn. Bhd. is expecting to achieve its 26.8 million twenty-foot equivalent units (TEUs) by 2040.

6.1.2 The project site (CT 10-CT 17) which will consist of 8 nos of berth with 600meter berth length each total up 4,800meter quay length were anticipate to produce additional 12 million TEUs capacity.

### **6.2 Site Location and Access Point**

6.2.1 The project site is located to the southern of Pulau Indah, Selangor. Currently, Pulau Indah Highway serves as the main road to the Westport which ends at the roundabout of Persiaran Port Klang Free Zone 4 / Persiaran Port Klang Free Zone 7. It is has been assumed that Pulau Indah Ring Road (PIRR) will commence in the Year 2024 which connect Pulau Indah Highway with Persiaran Pulau Lumut (Referenced as Road A in all road network figures). The current plan for the Westport extension is to have an access point off Road A in the form of a signalised junction (AJ1).

### **6.3 Existing Traffic Condition**

6.3.1 Peak hour traffic count surveys were conducted on Wednesday and Thursday, 5<sup>th</sup> and 6<sup>th</sup> September 2018 between 7.00am to 10.00am for the morning peak and 4.30pm to 7.30pm for the evening peak.

- i. Pulau Indah Highway / Jalan Orkid 1 Junction (J1),
- ii. Pulau Indah Highway / Access FFM Sdn. Bhd. Junction (J2),
- iii. Pulau Indah Highway / Jalan Perigi Nanas 7/1 Junction (J3),
- iv. Pulau Indah Highway / Jalan Perigi Nanas 8/2 Junction (J4),

- v. Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Junction (J5),
- vi. Pulau Indah Highway / Persiaran Sungai Pinang Junction (J6),
- vii. Pulau Indah Highway / Persiaran Pulau Lumut Junction (J7),
- viii. Pulau Indah Highway / Persiaran Pelabuhan Barat Junction (J8),
- ix. Pulau Indah Highway / Jalan Kem Junction (J9), and
- x. Persiaran Pulau Lumut / SKVE Highway Junction (J10).

6.3.2 The results of the roadway volume over capacity analysis indicated that the existing roads within the study area/Pulau Indah are currently operating at acceptable level of service ranging from LOS A to LOS C during morning and evening peak hour periods except Pulau Indah Highway (FT181) road section 6 eastbound direction which currently is operating at near capacity; LOS E during evening peak hour.

6.3.2 The junction performance analysis indicated that the existing junctions within the study area are currently operating at acceptable level of service; ranging from LOS A to LOS C except Pulau Indah Highway / Jalan Orkid 1 Priority Junction (J1) and Pulau Indah Highway / Jalan Perigi Nanas 7/1 Priority Junction (J3) during morning and evening peak hour period. These junctions were already required to upgrade to a signalised junction based on the existing condition and traffic count survey.

#### **6.4 Forecast of Future Traffic**

6.4.1 Forecast of total future traffic is divided in two traffic components, which are the non-site (base traffic) and project site traffic. The design year used in the study are Year 2028 and Year 2038 which represents ten (10) and twenty (20) years traffic projection, respectively.

6.4.2 It is reported in the RTVM 2018 the normal growth rate of Selangor is -0.60% per annum. Thus, this study has adopt an annual traffic growth of 0.5% percent per annum for the non-site base traffic to reflect the current natural growth of the locality. The adoption of these growth rates over the future years is expected to provide a realistic forecast for future traffic demand.



- 6.4.3 The estimation of the trips generation and attraction by the project site is based on the growth rate calculated from the forecast of total trucking traffic, twenty-foot equivalent unit (TEU) for design year 2028 and 2038.
- 6.4.4 Based on the truck traffic growth, it is estimated the project site will generate 389pcu/hour and attract 1,066pcu/hour during morning peak whilst in the evening peak it is expected to generate 1,199pcu/hour and attract 833pcu/hour for design year 2028, whilst for design year 2038 it is forecasted to generate 583pcu/hour and attract 1,746pcu/hour during morning peak whilst in the evening peak it is expected to generate 1,679pcu/hour and attract 1,042pcu/hour. In addition to the port traffic, a free zone development which consisting industrial plots have also been considered 50% by year 2028 and 100% by year 2038.
- 6.4.5 Traffic generated by the committed development in vicinity of the project site are also considered and included as part of other development traffic forecast. The central spectrum development is estimated to generate 4,471pcu/hour and attract 7,999pcu/hour during morning peak and is expected to generate 9,105pcu/hour and attract 6,918pcu/hour during the evening peak.
- 6.4.6 By taking into account the proposed entry and exit point for the project site and future planned road network; Pulau Indah Ring Road (PIRR) which is assumed to be completed by the Year 2028, the trips were assigned accordingly. The Pulau Indah Ring Road will be completed with road connection from Pulau Indah Highway at Westports to the Persiaran Pulau Lumut and thus, it is assumed the SKVE Highway is anticipated to be the major road for the development traffics from Pulau Indah to the external areas instead of Pulau Indah Highway.

## **6.5 Traffic Impact Assessment**

6.5.1 Analysis of the future traffic on the studied road is undertaken based on two future years traffic projection which are as follows:-

- i. Future Year 2028 (Ten years traffic projection); and
- ii. Future Year 2038 (Twenty years traffic projection)

### **Future Year 2028 Traffic Analysis**

6.5.2 Based on the predicted future year 2028 traffic flows, the recommended traffic proposal for the studied road and junctions at Pulau Indah are as following.

- i. Road upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at Jalan Kem and Pulau Indah Highway stretching from Persiaran Pulau Lumut (J7) to KESAS Highway by others. The Pulau Indah Highway road upgrading had been originally proposed by Ministry of Work; KKR),
- ii. Committed Pulau Indah Ring Road (PIRR) 2-lane dual carriageway road connection from Westports to Persiaran Pulau Lumut by others (originally proposed by KKR),
- iii. Flyover upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at Pulau Indah Highway / Persiaran Pelabuhan Barat Junction (J8) by others,
- iv. Junction upgrading from priority junction to signalised junction at Pulau Indah Highway / Jalan Orkid 1 Junction (J1) and Pulau Indah Highway / Jalan Perigi Nanas 7/1 Junction (J3),
- v. Junction improvement at Pulau Indah Highway / Persiaran Sungai Pinang Signalised Junction (J6) which includes additional lane at north approach for left turn movement and signal phasing modification by others and
- vi. Junction improvement at Pulau Indah Highway / Persiaran Pelabuhan Barat Signalised Junction (J8) which includes lane marking and signal phasing modification by others.

### **Future Year 2028 Mid-Block Capacity Analysis**

6.5.3 Future year 2028 mid-block capacity analysis of the roads in vicinity of the project site is based on the future Year 2028 peak hour traffic volumes and the carrying capacity of the existing and upgraded road sections.

- 6.5.4 The results of future mid-block capacity analysis indicated that with road upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at Jalan Kem and Pulau Indah Highway stretching from Persiaran Pulau Lumut (J7) to KESAS Highway and J8 Flyover; Flyover 2, all studied road sections are expected to operate at acceptable level of service; ranging from LOS A to LOS D during morning and evening peak hours in the Year 2028.
- 6.5.5 The contribution of the project site traffic along Pulau Indah Highway and Persiaran Pulau Lumut is ranging from 7% to 35%. Project site is expected to contribute high traffics at SKVE Highway due to SKVE Highway's low current traffic flow and approximately 40% trip distribution assumption.

#### **Future Year 2028 Junction Performance Analysis**

- 6.5.6 Future junction capacity analysis indicated that with recommend upgrading from priority to signalised junction at J1 and J3 and certain junction improvements at J6, all studied junctions at Pulau Indah includes the project site proposed access junction (AJ1) are expected to operate at acceptable level of service; ranging from LOS A to LOS D during both morning and evening peak hours in Year 2028.
- 6.5.7 The contribution of the project site traffic to the junctions at Pulau Indah ranges from 8% to 37% of the total future forecasted Year 2028 peak hour traffic volume with maximum traffic contribution at Persiaran Pulau Lumut / SKVE Highway Priority Junction (J10). This is due to current low traffic inflow and fully developed Phase 1 committed development; Central Spectrum Development

#### **Future Year 2038 Traffic Analysis**

- 6.5.8 The future traffic Year 2038 traffic volume is first been analysed with the Year 2028 proposed traffic improvement before come out with further traffic recommendations. Future Year 2038 traffic analysis can be considered as the ultimate future year analysis for Pulau Indah as most of the development are expected to be completed during that year. Based on the predicted forecasted Year 2038 and with assumption year 2028 traffic improvement have been complied, the further traffic recommendations for Pulau Indah's roads and junctions are as following.

- i. Road upgrading from 2-lane dual carriageway road to 3-lane dual carriageway road at SKVE Highway Pulau Indah Highway stretching from Persiaran Sungai Pinang (J6) to Persiaran Pulau Lumut (J7),
- ii. Road upgrading from 3-lane dual carriageway road to 4-lane dual carriageway road at Pulau Indah Highway stretching from Persiaran Pulau Lumut (J7) to Jalan Kem (J9) by others,
- iii. Road widening of Pulau Indah Highway eastbound direction between Jalan Perigi Nanas 6/1 at (J5) and Persiaran Sungai Pinang at (J6) from 2-lane to 3-lane by others,
- iv. Road widening of Pulau Indah Highway eastbound direction between Jalan Kem and KESAS Highway from 3-lane to 4-lane by others,
- v. Road widening of Jalan Kem southbound direction from 3-lane to 4-lane by others,
- vi. Committed road upgrading of Persiaran Pulau Lumut from 2-lane dual carriageway road to 3-lane dual carriageway road by others,
- vii. Junction upgrading of Pulau Indah Highway / Access FFM Sdn. Bhd. Junction (J2) from priority junction to signalised junction,
- viii. Junction improvement at Pulau Indah Highway / Jalan Perigi Nanas 6/1 / Jalan Perigi Nanas 8/9 Signalised Junction (J5) which includes additional lane at north approach for left turn movement, signal phasing and lane marking modification by others, and
- ix. Committed junction upgrading to a free-flow interchange at Persiaran Pulau Lumut / SKVE Highway Junction (J10) by others.

### **Future Year 2038 Mid-Block Capacity Analysis**

- 6.5.9 Similarly to future year 2028 mid-block capacity analysis, future year 2038 mid-block capacity analysis of the roads at Pulau Indah site is based on the future year 2038 peak hour traffic volumes and the carrying capacity of existing and upgraded road sections.
- 6.5.10 The results of future year 2038 mid-block capacity analysis indicated that with road widening and upgrading, all studied road sections are expected to operate at acceptable level of service; ranging from LOS A to LOS D during morning and evening peak hours except Flyover 2 eastbound direction is expected to operate at near capacity level of service; LOS E during evening peak hour. It is assumed the flyover at interchange to have a maximum upgrading of 3-lane dual carriageway road due to availability space and road reserve.
- 6.5.11 The contribution of the project site traffic along Pulau Indah Highway, Persiaran Pulau Lumut and SKVE Highway is ranging from 4% to 20%. The maximum project site traffic contribution is located at SKVE Highway.

### **Future Year 2038 Junction Performance Analysis**

- 6.5.12 Future junction capacity analysis indicated that with upgrading from priority to signalised junction at J2 and junction improvement at J5, the studied junctions are expected to operate at acceptable level of service; ranging LOS A to LOS D during both morning and evening peak hours in Year 2038. The maximum degree of saturation is 0.92 at J5 with 49 second average controlled delay.
- 6.5.13 The contribution of the project site traffic to the junctions at Pulau Indah ranges from 8% to 39% of the total future forecasted Year 2038 peak hour traffic volume. The project site traffic contribution is high at Pulau Indah Highway / Jalan Orkid 1 Signalised Junction (J1) and Pulau Indah Highway / Access FFM Sdn. Bhd. Signalised Junction (J2). The contribution of project site traffic at Persiaran Pulau Lumut / SKVE Highway Junction (J10) has become low as the junction have been contributed more by the committed developments.