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1.0 INTRODUCTION

1.1 Background

1.1.1 The study area of the Proposed Development of an Integrated Petroleum Hub and Maritime Industrial Park including Reclamation, covering both state road(J111) and federal road(FR95) other affected local road. While the traffic model will forecast the traffic conditions of these road and affected junction within the Study Area.

1.2 Study Objectives

i. To assess the level of existing traffic condition along the affected routes at different times of day;

ii. To assess suitability of proposed access to the proposed site for vehicle sizes and types likely to be used during land preparation and reclamation;

iii. To investigate the presence of particularly sensitive development along the affected routes such as schools, gas station and other ongoing constructions;

iv. To recommend traffic schemes that are necessary to cope with the traffic conditions at three(3) phases of various development and transport infrastructure in the study area; and

v. To formulate a Transport Plan with preliminary implementation programme for the study area at the stage upon full completion and operation of all planned developments and transport infrastructure within the proposed site.

1.3 Study Approach

1.3.1 The general study approach is described below. The study was carried out in 5 stages involving the following key tasks:

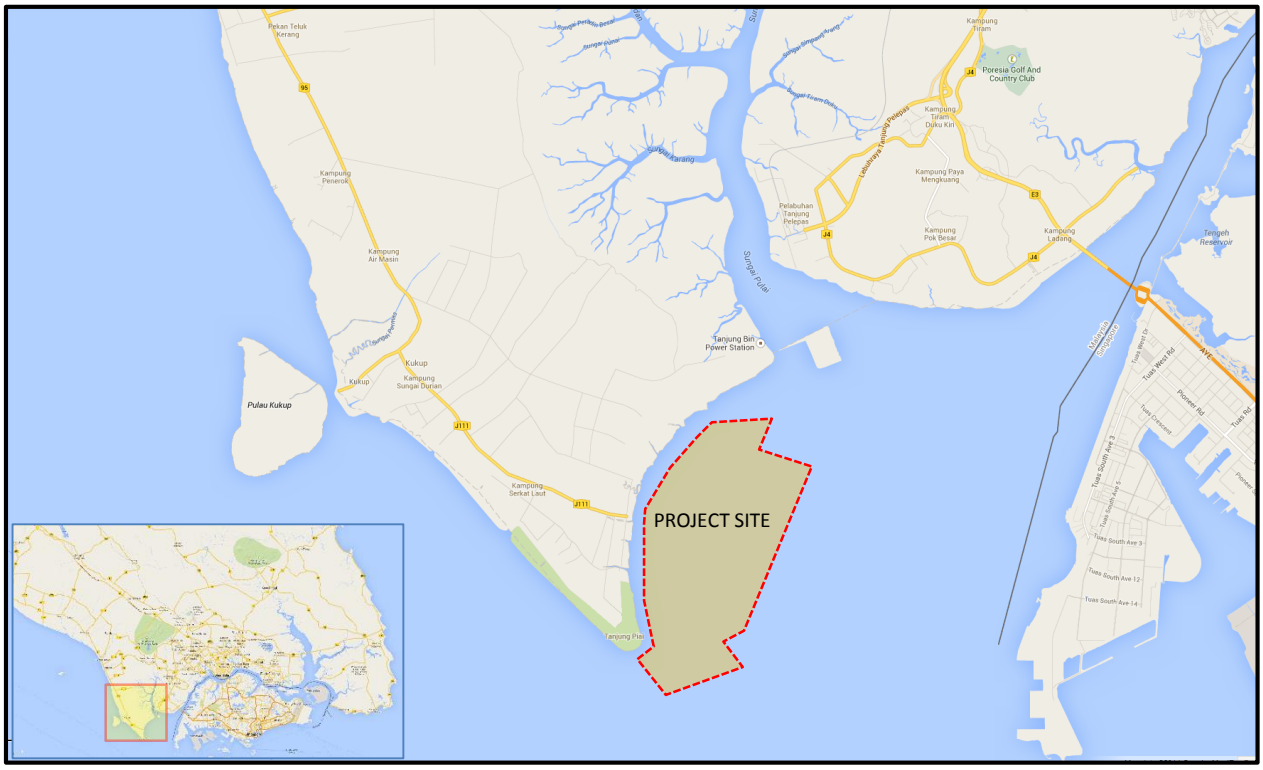
- ***Data Assembly and survey***- to collect relevant existing traffic data and carry out traffic count to quantify the existing traffic conditions(in terms of degree of saturation, junction delay) and also provide data for base year model validation. Trip generation model for various types of proposed development were based on HPU trips rate to estimate the traffic impact for future Tg.Piai development;
- ***Traffic modelling and Forecasting*** –to build up a based year transport model which covers all major roads and junctions in the study area;
- ***Traffic Assessment and Problem Identification-*** by using the observed traffic flows/queue and future traffic forecast flows, traffic assessments were carried out to identify both existing and future traffic problems;
- ***Formulation and Evaluation of Traffic Improvement Schemes***- to explore different road schemes and establish possible improvement schemes for various stages and;
- ***Interagted Implemention Plan-*** The preferred improvement schemes for the three(3) phase were brought together into a Final Transport Master Plan and preliminary implementation programme was also recommended.

2.0 PROJECT DESCRIPTION

2.1 Project Location

2.1.1 The proposed project site is at Mukim Serkat in the District of Pontian western part of the State of Johor. It is situated off Tg. Piai,which is the southernmost point of Peninsular Malaysia. The project site lies 8 km south of the Tanjung Bin Powerstation and 3 km east of Serkat town, while the international border 1 lies approximately 6 km from the project site. Key features of the project location are given in Figure 1.

Figure 1: Project Site Location



2.2 Project Components

2.2.1 The project proponent will be constructing the infrastructure within the Proposed Project site such as new roads, drainage, electricity, water supply, telecommunication facilities and sewage treatment plan.

2.2.2 There are three(3) major industrial clusters was identified to be developed for the Tanjung Piai Industrial Park as described below:

- Oil and gas;
- Integrated oil production and refinery;
- Utility providers and third party infrastructure.

2.2.3 There will be onshore development of the Industrial Park Master Plan is proposed to guide the subsequent development of the Industrial Park on the reclaimed land. Traffic production for this development will based on the initial master plan and detailed site analysis, design work will be establish prior to the commencement of any detail development within the park. The onshore development will be developed in three phases corresponding to the reclamation phases (see Figure 2). At the time of writing, Phase 1 of the project comprising a strategic oil storage terminal is committed and described further below.

2.2.4 The project development will be an integrated petroleum hub and maritime industrial park, which will include a strategic oil storage terminal, logistics terminal, petroleum midstream and downstream facilities, and ancillary facilities (such as utilities, amenity and security areas. The development model is that of an industrial estate, where land and infrastructure are provided, and plots within the park will be sold to third party investors for the development of individual plants or facilities. Anticipated investors will encompass multi-firm service providers, petrochemical manufacturers, petroleum storage, utility suppliers and integrated engineering service providers.

2.2.5 The project involves island reclamation of approximately 3,485 acres (1,410 hectares) and the construction of jetties for liquid product import and export. These jetties will be located to the south of the reclamation (for ships up to 300,000 DWT) and to the east of the reclamation (for ships up to 120,000 DWT). The construction stage will entail dredging, coastal protection, construction of onshore oil terminal facilities and industrial park facilities and infrastructure, and the construction of the jetties and marine facilities.

2.2.6 The proposed site access will be following the existing road which connects Pontian town with Tg.Piai (State Road J111), which will be upgraded and widened. A bridge will be constructed to connect this road to the western side of the project.

2.2.7 A total of 3,487 acres of a 'Man-made island' will be developed in three(3) phases and expected for overall completion in 15 year time. An expected time frame is described below;

- Phase 1(1080 acres)-2015-2020
- Phase 2(1,008 acres)-2020-2025
- Phase 3(1399 acres)-2025-2030

2.3 Expected Employment

2.3.1 In order to estimates an expected employment, the employee per acre density factors were utilized for other similar development particularly in Johor. The selection criteria of site, the consultants acquired the total number of three(3) site as described in Table 1.

Table 1: Employment Density

Comparable Site	Acres	Total Expected Employment	Employment/Acres
Pengerang Petroleum Terminal	500	1100	2.200
Tg.Langsat	1200	300	0.250
PIPC Pengerang	22000	8500	0.386
Tg.Bin	2255	500	0.222
Min			0.222
Max			2.200
Average			0.765

Source: Iskandar Malaysia

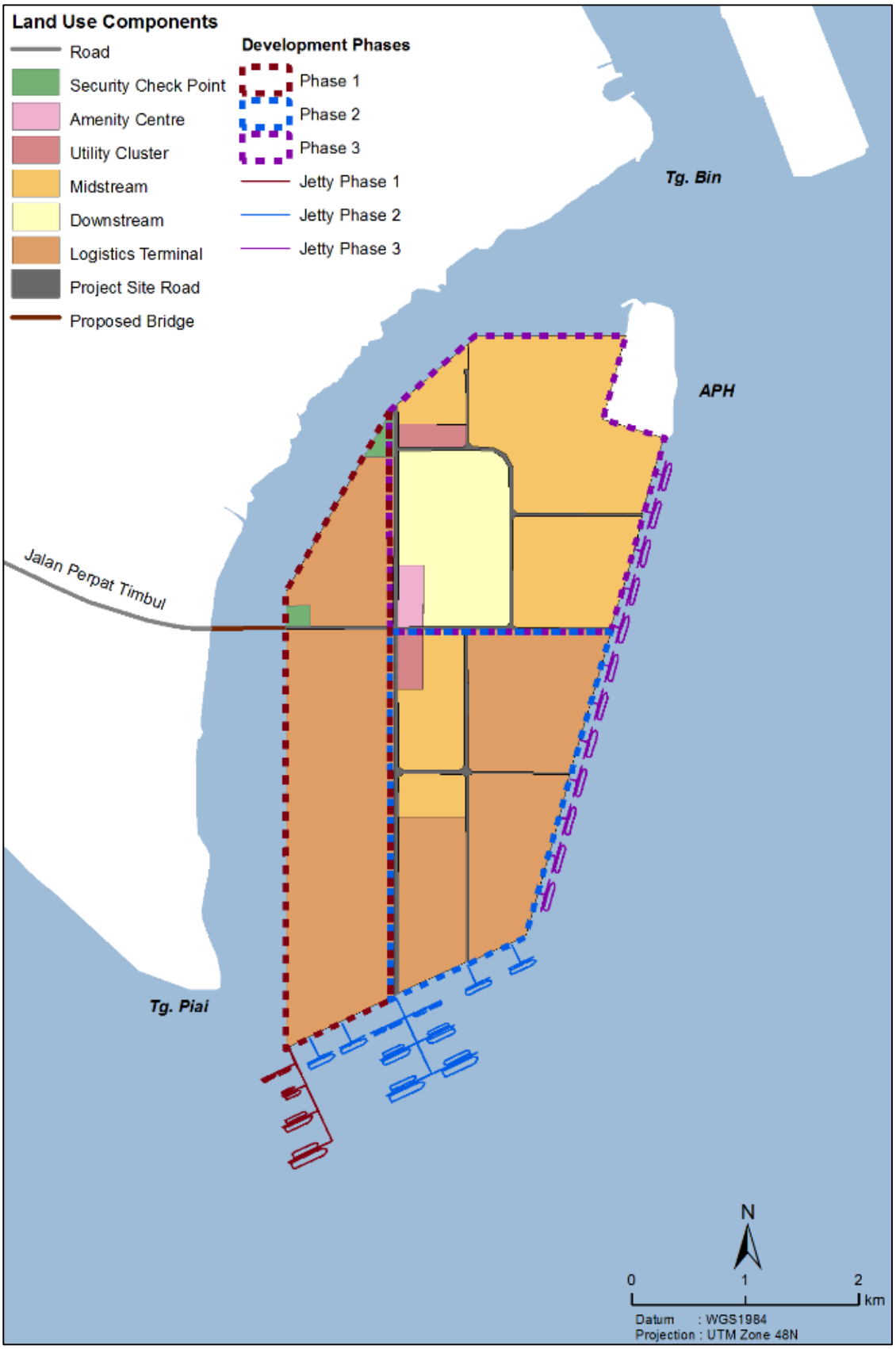
2.3.2 The above table indicated that the employment density contain variations by site, by design and slightly same industry. The minimum rate was observed at 0.22 employment per acres where the maximum density rate at 2.20. For the purpose of this assessment study an average density rate was applied and the expected employment was described below;

Table 2: Estimated Employment By Phase

Development Phase	Total Area(acres)	Total Employment	Construction Workers
Phase 1	1080	826	2,634
Phase 2	1008	771	2,459
Phase 3	1399	1,070	3,412
TOTAL	3487	2,666	8,505

2.3.3 Since there is no details information on the design work and construction method, a total number of construction worker was based on the recent site of Tg.Bin development where with 2,255 acres land deployed around **500 employment and 5,500 construction workers** at the construction site daily. Based on this assumptions, it was anticipated some 8,505 construction workers will be deployed for Tg.Piai development in total.

Figure 2: Details Component Of The Proposed Development



3.0 EXISTING TRAFFIC CONDITION

3.1 Introduction

3.1.1 Assessment of the existing traffic conditions for the surrounding road network in the immediate vicinity of the project site was ascertained through visual reconnaissance surveys. In addition, road inventory was also carried out to determine the characteristics of the existing roads and junctions in the study area. These will provide both a quantitative and qualitative measure of the existing traffic condition as well as understanding of the present traffic patterns and characteristics.

3.2 Existing Road Network

3.2.1 Road Inventory was carried out along the main road and junctions located in the immediate vicinity of the proposed project site to determine the existing characteristics of the roads/junctions such as roadway lanes, circulation, junction control and layout.

3.2.2 The proposed development site is linked to the other major town by the State Road J111 and Federal Route FR95. Federal Route 95 is a federal road connecting Pontian Kecil to town of Kukup. At most section this road was built under JKR R5 single lane road standard with maximum operating speed limit of up to 90km/h.

3.2.3 Jalan Serkat(Johor state road) is another major state road that linked from Kukup to Tg.Piai. This two lane single carrieageway was design based on R4 standard and generally flat with average travel speed 50 km/hr.

3.3 Surrounding Development

3.3.1 The proposed Integrated Petroleum Hub and Maritime Industrial Park employees and construction workers communting during the construction of the project may affect the roadways in vicinity of the Project site. Regional access to/from Project site is provided via Jalan Sekat(J111) which connects to Federal Route 95.

3.3.2 There are a few sensitive area particularly the primary school allocated along Jalan Serkat(J111) namely;

- Sekolah Kebangsaan Seri Perpat;
- Sekolah Jenis Kebangsaan Serkat;
- Sekolah Kebangsaan Sekat.

3.3.3 With some additional traffic mainly heavy truck travel via this route will potentially create a conflict between school trips particularly pedestrian(Crossing) and bicycle.

4.0 TRAFFIC SURVEY

4.1 Manual Classified Traffic Count

4.1.1 The classified traffic count surveys were conducted in February 2013 to record the volumes of turning vehicle movement at critical junctions and screenlines for different type of vehicle consistent with those in the yearly Highway Planning Unit(HPU) traffic count. The survey were conducted for at least 3 hours in the morning peak(07:00-10:00), 3 hours in the afternoon off peak(11:00-13:00) and 3 hours in the evening peak(16:00-19:00) on a normal weekday.

4.1.2 The surveyed junction is located at 1° 20´ 05.56" N of equator and 1030° 27´ 21.68" E.

4.1.3 Table 3 to Table 5 shows the hourly traffic profile along Jalan Federal Route 95 and State Road J11. It was observed that the highest one hour traffic volume was recorded during the day are described below;

- Morning Peak Hour : 07:00-08:00
- Off Peak : 12:00-13:00
- Evening Peak Hour : 18:00-19:00

Table 3: Existing Traffic Flow Along Federal Route FR95 Towards Pulau Kukup

Description	Screenline 1-(Towards Kukup)						
	Both Direction						
	Car/ Van/Taxi	Med.Lorry	Hea.Lorry	Bus	Motorcycle	Total Veh	Tot.PCU
07:00-08:00	***312***	***2***	***0***	***5***	***125***	***444***	***421***
08:00-09:00	193	14	0	8	148	363	358
09:00-10:00	204	14	2	3	129	352	344
11:00-12:00	212	19	0	4	119	354	353
12:00-13:00	***315***	***19***	***2***	***5***	***181***	***522***	***512***
13:00-14:00	281	28	3	6	165	483	496
16:00-17:00	278	41	2	4	148	473	503
17:00-18:00	358	27	0	7	251	643	627
18:00-19:00	***484***	***9***	***0***	***7***	***373***	***873***	***803***

4.1.4 Based on the traffic counts that consist of both through traffic as well as the local traffic, it is determined that the peak hours for the study area are:-

- Morning Peak Hour = 07:00 to 08:00 am
- Afternoon Peak Hour = 12:00 to 13:00 pm
- Evening Peak Hour = 06:00 to 07:00 pm

Table 4: Existing Traffic Flow Along Federal Route FR95 Towards Pontian

Description	Screenline 2-(Towards Pontian)						
	Both Direction						
	Car/ Van/Taxi	Med.Lorry	Hea.Lorry	Bus	Motorcycle	Total Veh	Tot.PCU
07:00-08:00	***452***	***13***	***0***	***7***	***214***	***686***	***660***
08:00-09:00	305	17	0	9	183	514	508
09:00-10:00	332	17	1	7	176	533	524
11:00-12:00	298	33	3	5	166	505	522
12:00-13:00	***435***	***34***	***4***	***6***	***247***	***726***	***727***
13:00-14:00	414	35	3	4	251	707	706
16:00-17:00	366	44	3	5	199	617	643
17:00-18:00	464	41	1	7	315	828	820
18:00-19:00	**571**	**15**	**0**	**11**	**428**	**1025**	**956**

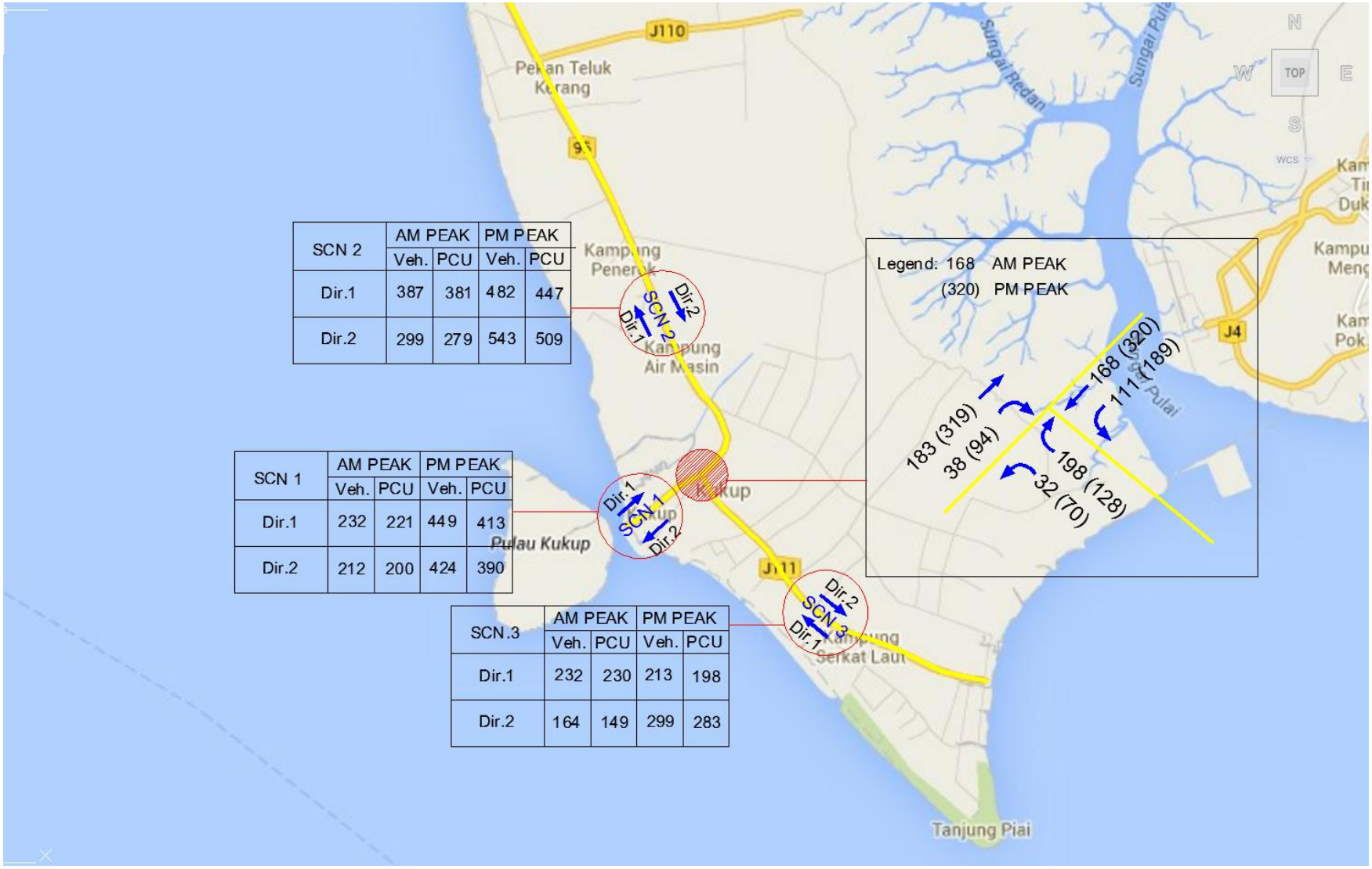
Table 5: Existing Traffic Flow Along State Route J111 Towards Tg.Piai

Description	Screenline 3-Towards Tg.Piai						
	Both Direction						
	Car/ Van/Taxi	Med.Lorry	Hea.Lorry	Bus	Motorcycle	Total Veh	Tot.PCU
07:00-08:00	***254***	***11***	***0***	***2***	***129***	***396***	***379***
08:00-09:00	168	9	0	1	83	261	250
09:00-10:00	184	9	1	4	69	267	266
11:00-12:00	156	22	3	1	99	281	291
12:00-13:00	216	17	2	1	114	350	345
13:00-14:00	***227***	***23***	***2***	***6***	***130***	***388***	***400***
16:00-17:00	168	13	1	3	93	278	276

17:00-18:00	220	18	1	0	116	355	349
18:00-19:00	307	10	0	4	191	512	481

4.1.5 Figure 3 shows the peak period of traffic along affected route Jalan Federal Road FR95 and State Road(J111) at the main entrance to project site. Generally the above affected road is currently under capacity where the maximum traffic during peak period between 200-500 pcu' depends on the section.

Figure 3: Existing Peak Hour Traffic, Year 2013



SCN 2	AM PEAK		PM PEAK	
	Veh.	PCU	Veh.	PCU
Dir.1	387	381	482	447
Dir.2	299	279	543	509

SCN 1	AM PEAK		PM PEAK	
	Veh.	PCU	Veh.	PCU
Dir.1	232	221	449	413
Dir.2	212	200	424	390

SCN.3	AM PEAK		PM PEAK	
	Veh.	PCU	Veh.	PCU
Dir.1	232	230	213	198
Dir.2	164	149	299	283

4.1.6 In order to know if the road network peaks in weekend would be more critical than commuting peaks on weekday, the classified count data were also established from One(1) weeks count from Highway Planning Unit Census, 2012. An average number of 17,453 vehicle was observed along Jalan FR95 between Pontian and Kukup over 16 hours period. The total number of traffic was constant over weekday and weekend as described in Table 6.

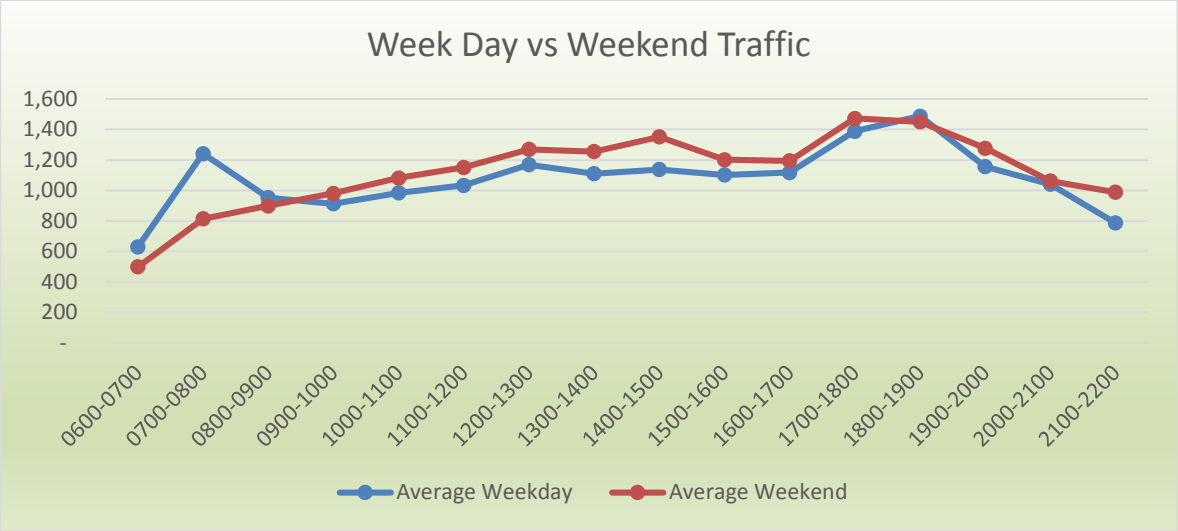
Table 6: Existing Traffic Data Along Jalan FR95,2012

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0600-0700	578	667	613	657	635	560	438
0700-0800	1,157	1,268	1,233	1,339	1,213	848	780
0800-0900	848	1,005	1,021	967	922	967	832
0900-1000	858	939	909	944	918	940	1,022
1000-1100	982	1,052	827	1,011	1,051	1,087	1,077
1100-1200	908	955	1,149	1,029	1,130	1,174	1,130
1200-1300	1,182	1,145	1,061	1,251	1,211	1,183	1,358
1300-1400	1,044	1,255	1,213	1,153	886	1,210	1,301
1400-1500	815	1,003	1,538	1,148	1,187	1,224	1,481
1500-1600	1,153	866	1,144	1,180	1,168	1,181	1,222
1600-1700	1,124	1,172	1,052	1,076	1,168	1,195	1,194
1700-1800	1,422	1,312	1,356	1,443	1,413	1,457	1,489
1800-1900	1,493	1,458	1,426	1,423	1,637	1,516	1,386
1900-2000	1,170	1,162	1,082	1,146	1,227	1,444	1,112
2000-2100	1,036	983	1,015	937	1,234	1,186	939
2100-2200	795	792	760	695	891	1,212	766
Jumlah	16,561	17,029	17,394	17,396	17,885	18,380	17,522

Source: Highway Planning Unit, Ministry of Works, 2012

4.1.7 Generally the total number of traffic profile during weekday and weekend was generally same pattern except during Am Peak period during weekday where generally this traffic are related to commuting traffic to work. The average weekend and weekdays traffic is listed Figure 4.

Figure 4: Weekend and Weekday Traffic Profile



4.2 Existing Traffic Composition

4.2.1 The traffic composition in the study area was estimated based on the manual classified vehicle counts. The analysis of the collected data shows that road traffic is still dominated by private cars with a share of between 53% to 70%, followed by motorcycle with 26% to 43% share, then medium lorry with 4% to 9% while Heavy lorry and Bus make only 1% to 2% of road traffic respectively.

4.2.2 The traffic composition by hour for each screenline also tabulated in Table 7 to Table 9.

Table 7: Existing Traffic Composition Along Federal Route FR95 Towards Pulau Kukup

Description	Screenline 1				
	Both Direction				
	Car/ Van/Taxi	Med.Lorry	Hea.Lorry	Bus	Motorcycle
07:00-08:00	*70%*	*0.5%*	*0.0%*	*1.1%*	*28.2%*
08:00-09:00	*53%*	3.9%	0.0%	2.2%	40.8%
09:00-10:00	*58%*	4.0%	0.6%	0.9%	36.6%
11:00-12:00	*60%*	5.4%	0.0%	1.1%	33.6%
12:00-13:00	*60%*	*3.6%*	*0.4%*	*1.0%*	*34.7%*
13:00-14:00	*58%*	5.8%	0.6%	1.2%	34.2%
16:00-17:00	*59%*	8.7%	0.4%	0.8%	31.3%
17:00-18:00	*56%*	4.2%	0.0%	1.1%	39.0%
18:00-19:00	*55%*	*1.0%*	*0.0%*	*0.8%*	*42.7%*
Min	53%	0%	0%	1%	28%
Max	70%	9%	1%	2%	43%
Average	59%	4%	0%	1%	36%

Table 8: Existing Traffic Composition Along Federal Route FR95 Towards Pontian

Description	Screenline 2				
	Both Direction				
	Car/ Van/Taxi	Med.Lorry	Hea.Lorry	Bus	Motorcycle
07:00-08:00	*66%*	*2%*	*0%*	*1%*	*31%*
08:00-09:00	*59%*	*3%*	*0%*	*2%*	*36%*
09:00-10:00	*62%*	*3%*	*0%*	*1%*	*33%*
11:00-12:00	*59%*	*7%*	*1%*	*1%*	*33%*
12:00-13:00	*60%*	*5%*	*1%*	*1%*	*34%*
13:00-14:00	*59%*	*5%*	*0%*	*1%*	*36%*
16:00-17:00	*59%*	*7%*	*0%*	*1%*	*32%*
17:00-18:00	*56%*	*5%*	*0%*	*1%*	*38%*
18:00-19:00	*56%*	*1%*	*0%*	*1%*	*42%*
Min	56%	1%	0%	1%	31%
Max	66%	7%	1%	2%	42%
Average	60%	4%	0%	1%	35%

Table 9: Existing Traffic Composition Along State Route J111 Towards Tg.Piai

Description	Screenline 3				
	Both Direction				
	Car/ Van/Taxi	Med.Lorry	Hea.Lorry	Bus	Motorcycle
07:00-08:00	*64%*	*3%*	*0%*	*1%*	*33%*
08:00-09:00	*64%*	*3%*	*0%*	*0%*	*32%*
09:00-10:00	*69%*	*3%*	*0%*	*1%*	*26%*
11:00-12:00	*56%*	*8%*	*1%*	*0%*	*35%*
12:00-13:00	*62%*	*5%*	*1%*	*0%*	*33%*
13:00-14:00	*59%*	*6%*	*1%*	*2%*	*34%*
16:00-17:00	*60%*	*5%*	*0%*	*1%*	*33%*
17:00-18:00	*62%*	*5%*	*0%*	*0%*	*33%*
18:00-19:00	*60%*	*2%*	*0%*	*1%*	*37%*
Min	56%	2%	0%	0%	26%
Max	69%	8%	1%	2%	37%
Average	62%	4%	0%	1%	33%

4.3 Existing Road Capacity

4.3.1 Road Capacity is defined as the maximum number of vehicles per unit time(one hour) which can be accommodated under given conditions with a reasonable of occurrence. Capacity is independent of the traffic demand.

4.3.2 In order to represent the varying composition of vehicular traffic on a road, it is necessary to convert the counted vehicles into the passenger car units. The factors used in converting the PCU for each vehicle class are shown in Table 10.

Table 10 : Conversion Factors to PCU

Types Of Vehicles	Equivalent Value In PCU
Passenger Cars	1.00
Motorcycles	0.33
Light Vehicle	1.75
Heavy Vehicle	2,25
Bus	2.25

4.3.3 Analysis of link capacity or mid-block is carried out to understand the current operational performance of the existing roads especially in the immediate vicinity of the affected route. However prior to undertaking the analysis, the link capacity of the road needs to be estimated. Road capacity is usually dependent upon several factors such as the carriageway width, number of lanes, road environment etc. In this study, the mid-block analysis will focus on Federal Route FR95 and State Route J111(Jalan Serkat). Based on existing road characteristic the Federal Route(FR95) is assumed to have 1,600 pcu/hour/lane, while Jalan Serkat(J111) is assumed to carry 1,400 pcu/hour/lane.

Table 11: Level Of Service Definitions

LOS	V/C Ratio	Definition
A	< 0.28	Free flow wi00th volume densities and high speeds. Drivers can maintain their desired speeds with little or no delay.
B	0.28-0.44	Stable flow. Operating speeds beginning to be restricted somewhat by traffic conditions. Some slight delay.

C	0.45-0.64	Stable flow. Speed and manoeuvrability are more closely controlled by higher volume. Acceptable delay.
D	0.65-0.85	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 baking up from a restriction downstream.

Source: Highway Capacity Manual, 2000.

4.3.4 Table 12 and Table 13 lists the existing peak period traffic design capacity, volume-to-capacity(V/C) ratios and level of service(LOS) on the roadway segment that may be affected by the project during construction and operation.

Table 12: Existing Am Peak Roadway Traffic Conditions In The Project Area

Locations	Direction	Numb.Of Lane	Am Peak				
			Capacity (C)	Total Pcu (V)	V/C	LOS	Remarks
Screenline 1	Dir 1	1	1600	221	0.14	A	Free Flow With No Delay
	Dir 2	1	1600	200	0.13	A	Free Flow With No Delay
Screenline 2	Dir 1	1	1600	381	0.24	A	Free Flow With No Delay
	Dir 2	1	1600	299	0.19	A	Free Flow With No Delay
Screenline 3	Dir 1	1	1400	230	0.16	A	Free Flow With No Delay
	Dir 2	1	1400	149	0.11	A	Free Flow With No Delay

Table 13: Existing Pm Peak Roadway Traffic Condition In The Project Area

Locations	Direction	Numb.Of Lane	Capacity (C)	Pm Peak			
				Total Pcu(V)	V/C	LOS	Remarks
Screenline 1	Dir 1	1	1600	413	0.26	A	Free Flow With No Delay
	Dir 2	1	1600	390	0.24	A	Free Flow With No Delay
Screenline 2	Dir 1	1	1600	447	0.28	A	Free Flow With No Delay
	Dir 2	1	1600	509	0.32	A	Free Flow With No Delay
Screenline 3	Dir 1	1	1400	198	0.14	A	Free Flow With No Delay
	Dir 2	1	1400	283	0.20	A	Free Flow With No Delay

4.4 Junction Analysis

4.4.1 Evaluation of existing junction operational performance is carried out using the SIDRA(Signalised 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 performance of each junction was measure based on degree of saturation as described in Table 14 for thresholds.

Table 14 : Degree Of Saturation Threshold

Level of Service	Degree of Saturation (x)		Description
	Stop Control Junction	Signalised Junction	
A	$x \leq 0.50$	$x \leq 0.60$	Little or no delay
B	$0.50 < x \leq 0.70$	$0.60 < x \leq 0.75$	Short traffic delays
C	$0.70 < x \leq 0.80$	$0.75 < x \leq 0.90$	Average Traffic delays
D	$0.80 < x \leq 0.90$	$0.90 < x \leq 0.95$	Long Traffic Delays
E	$0.90 < x \leq 1.00$	$0.95 < x \leq 1.00$	Very Long Delays
F	$x > 1.00$	$x > 1.00$	Failure of Junction

4.4.2 There is one major affected junction which currently operate with 3 legged stop(priority junction) control.

4.4.3 The results of junction analysis indicated that presently this junction is currently operate at Level of Service(LOS) 'A' with average travel speed at 55km/hr and degree of saturations less than 0.5 for both Am and Pm peak period.

4.4.4 The summary of the existing junction performance analysis results is shown in Figure 5 for both Am peak and Pm peak period.

Figure 5: Existing Junction Performance During Peak Period

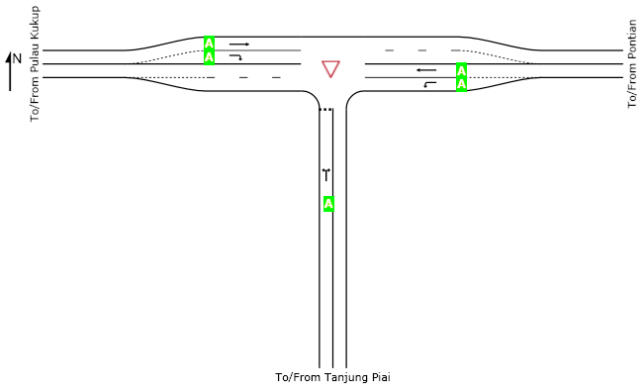
LEVEL OF SERVICE

Site: AM PEAK

New Site
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	West	Intersection
LOS	A	NA	NA	NA



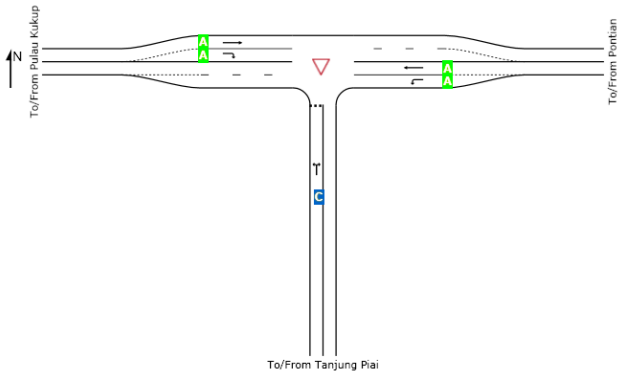
LEVEL OF SERVICE

Site: PM PEAK

New Site
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	West	Intersection
LOS	C	NA	NA	NA



MOVEMENT SUMMARY

Site: AM PEAK

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	32	0.0	0.349	10.0	LOS B	1.8	12.6	0.54	0.81	50.3
3	R2	198	0.0	0.349	10.0	LOS A	1.8	12.6	0.54	0.81	50.1
Approach		230	0.0	0.349	10.0	LOS A	1.8	12.6	0.54	0.81	50.1
East: To/From Pontian											
4	L2	111	0.0	0.060	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
5	T1	168	0.0	0.086	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		279	0.0	0.086	2.2	NA	0.0	0.0	0.00	0.23	57.3
West: To/From Pulau Kukup											
11	T1	183	0.0	0.094	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	38	0.0	0.035	6.6	LOS A	0.1	0.9	0.36	0.59	52.3
Approach		221	0.0	0.094	1.1	NA	0.1	0.9	0.06	0.10	58.5
All Vehicles		730	0.0	0.349	4.3	NA	1.8	12.6	0.19	0.37	55.2

MOVEMENT SUMMARY

Site: PM PEAK

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	70	0.0	0.445	15.6	LOS C	2.3	16.2	0.66	0.93	46.7
3	R2	128	0.0	0.445	15.6	LOS C	2.3	16.2	0.66	0.93	46.5
Approach		198	0.0	0.445	15.6	LOS C	2.3	16.2	0.66	0.93	46.6
East: To/From Pontian											
4	L2	189	0.0	0.102	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
5	T1	320	0.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		509	0.0	0.164	2.1	NA	0.0	0.0	0.00	0.21	57.4
West: To/From Pulau Kukup											
11	T1	319	0.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
12	R2	94	0.0	0.111	8.1	LOS A	0.4	3.0	0.51	0.72	51.5
Approach		413	0.0	0.164	1.9	NA	0.4	3.0	0.12	0.16	57.8
All Vehicles		1120	0.0	0.445	4.4	NA	2.3	16.2	0.16	0.32	55.3

4.5 Traffic Growth

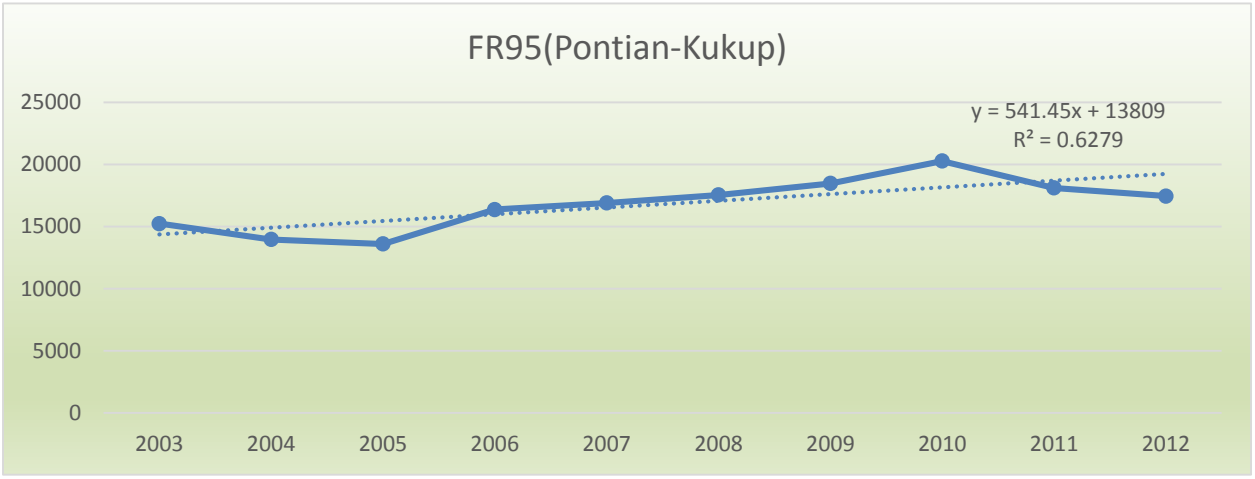
4.5.1 Future background conditions are typically derived by calculating the annual rate of growth on a transportation facility through a review of historical traffic volumes and or by accounting for traffic generated by other known area developments that were recently approved or that are currently in the planning approvals process.

4.5.2 Traffic growth information at these HPU traffic census stations provides indication of traffic growth trends within the study area. It was estimated the normal traffic growth for this study area was 3.3% per annum as described in Table 15 and Figure 6.

Table 15: Normal Traffic Growth

YEAR	FR95(Pontian-Kukup)
2003	15231
2004	13957
2005	13590
2006	16372
2007	16891
2008	17535
2009	18470
2010	20268
2011	18103
2012	17452
2012 Normal Growth (%/yr)	3.3
Rsqr	0.63

Figure 6 : Traffic Growth Trend



4.6 Trip Generation

4.6.1 Trip Generation Rates Code(08 03 00-heavy industry) from Highway Planning Unit, provides a well-defined and accepted set of land-use categories for estimating trips rate. This category was developed because they is of particular interest in traffic impact studies and well explain the various ability in trip rates. Heavy Industrial where the industries located within heavy industrial areas are generally large manufacturing concern and include industries considered to be 'polluting' Vehicle manufacturing and petroleum refining plant are example heavy industrial uses.

4.6.2 With reference to the proposed development, an employees and construction workers commuting during the construction of the project may affect the existing roadways in the vicinity of the project sites.

4.6.3 The development traffic forecast focuses on two critical hours of the day i.e. morning and noon peak hours. It is expected that on a typical weekday the highest traffic volumes be recorded during these hours. Thus, the performances of road and junction can be tested based on this critical condition and design/improvement of roads/junctions can be made accordingly. It is expected during these hours, traffic volumes are the highest peak provide the greatest test of the road capacity.

4.6.4 The trips generation for this study is related to onshore development of the Industrial Park with the components and key construction activities described below:

- Pilling;
- Erection of tanks;
- Erection for petrochemical processing facilities(phase 3);
- Pipelines and pumps;
- Buildings and Services;
- Internal roads;
- Construction of bridge to link mainland to reclaimed island;
- Drainage system;
- Landscaping.

4.6.5 Since most of the heavy bulk of construction materials(e.g steel plate for tank construction piles, gravel, sand) will be delivered to site primarily by barge, an expected construction land traffic are minimum.

4.6.6 Detailed plans currently are not available for potential developments within the park. However trip generation model was based on preliminary information on the proposed projects.

4.6.7 Four(4) primary sources of traffic generation at the Tg.Piai Development have been identified over 15 years construction period of the project;

- Construction of Phase 1(1 to 4 years),2015-2019
- Construction of Phase 2 (6 to 10 Years),2020-2025
- Construction of Phase 3 (11 to 15 years)2025-2030
- Full Completion and operational,2030

Construction Traffic Generation

4.6.8 The construction traffic for an assessment has identified indicative traffic generation (for light and heavy vehicles) associated with each section of the route, based on the estimated number of vehicles required to construct an onshore facilities where the key activities include piling, erection of tanks, pipelines and pumps, buildings and services, internal road, construction of bridge to mainland to reclaimed island, drainage system and landscaping.

4.6.9 Construction traffic generation has been calculated on the basis of a 'per worker' for each phase of development . This has allowed for a gross estimate of the number of vehicles which would be needed to serve the development over its period of construction in each geographical section of the proposed project.

4.6.10 Table 16 presents summaries of the estimated vehicle numbers required to construct the proposed onshore facilities for the Proposed development of an Integrated Petroleum Hub and Maritime Industrial Park for the key sections of the route over the whole period of construction.

Table 16: Estimated Vehicle Requirements During Construction

	By Mode	FACTOR	PHASE1	PHASE 2	PHASE 3
Person Trips	Car/Taxi	30.0%	1,580	1,475	2,047
	Motorcycle	45.0%	2,371	2,213	3,071
	Small Lorry	9.0%	474	443	614
	Big Lorry	15.0%	790	738	1,024
	Bus	1.0%	53	49	68
	Total	100.0%	5,268	4,917	6,824
Vehicle Trips	Car/Taxi	1.5	1,053	983	1,364
	Motorcycle	1.8	1,317	1,229	1,706
	Small Lorry	1.2	395	368	511
	Big Lorry	1.5	526	491	682
	Bus	30	1	1	2
Pcu Factor	Car/Taxi	1	1,053	983	1,364
	Motorcycle	0.33	435	406	563
	Small Lorry	1.75	691	644	894
	Big Lorry	2.25	1,184	1,105	1,535
	Bus	2.25	2	2	5
TWO WAY DAILY TRAFFIC			3,365	3,140	4,360
TWO WAY PEAK TRAFFIC			672	627	872
AM PEAK	Gen	0.35	235	219	305
	Att	0.65	436	408	567
PM PEAK	Gen	0.66	443	413	575
	Att	0.34	228	213	296

4.6.11 Based on assumptions regarding the phasing of each stage of the construction works, the predicted construction vehicle numbers for development phase have been grouped(total Pcu) and predicted traffic movements assigned to the nearest affected roads for each key section of the proposed route.

Operations Traffic Generation

4.6.12 The trip generation for the proposed development after completion based on trip rates produced by Highway Planning Unit(HPU), Ministry of Works Malaysia(*Code 08 03 00)* where the expected traffic was based on the number of employee with already determined in Table 2.

4.6.13 Based on HPU trip rates and the proposed development component, the proposed development are expected to generate 397 pcu/hour and attract 737 pcu/hour during morning peak whilst in the evening peak it is expected to generate 651pcu/hour and attract 335 pcu/hour in total. An expected trips by development phase are also described in Table 17.

Table 17: Expected Operational Traffic

Development Description	Operation Phase	AM Peak			PM Peak		
		Gen	Att	Total	Gen	Att	Total
PHASE 1	2015-2020	123	228	351	201	104	305
PHASE 2	2020-2025	114	212	326	188	97	285
PHASE 3	2025-2030	159	295	454	260	134	394
TOTAL		396	735	1131	649	335	984

4.7 Traffic Distribution and Assignment

4.7.1 The future background travel pattern was determined from the existing turning movement count conducted at the existing junction in the vicinity of the proposed development site. It is assumed that the current travel pattern will be reflective of the future travel pattern.

4.7.2 Trip assignment involves the determination of the amount of traffic that will use/travel certain routes of the road network. By taking into account the entry and exit points of the development and the generated and attracted volumes, the trips were assigned accordingly.

Table 18: Existing Traffic Distribution

Directional	AM Peak	Pm Peak
From Tg.Piai-Pontian	86%	65%
From Tg.Piai To Kukup	14%	35%
From Pontian To Tg.Piai	40%	37%
From Pontian To Kukup	60%	63%
From Kukup to Pontian	83%	77%
From Kukup to Tg.Piai	17%	23%

5.0 TRFFFIC IMPACT ASSESSMENT

5.1 Introduction

5.1.1 This chapter presents an overview of the key traffic and transport implications associated with implementation of the proposed project. The principal transportation effects of the project are those associated with the construction phase when there would be a requirement to import significant quantities of new construction materials to construct an onshore facilities where the key activities include piling, erection of tanks, pipelines and pumps, buildings and services, internal road, construction of bridge to mainland to reclaimed island, drainage system and landscaping.

5.1.2 The peak construction period will be the first quarter of 2015, so the year of interest for the study will be 2015. The four other sources of traffic will be used in the 2015 cumulative impacts analysis. In year 2030 Refinery plan is expected to be fully operational. Therefore, the following scenario have been delineated;

- 2015 Baseline Condition;
- 2015 Baseline plus proposed Project Construction conditions Phase 1;
- 2020 Baseline Plus Proposed Project Construction Condition Phase 2;
- 2025 Baseline Plus Proposed Project Construction Phase 3;
- Future 2030 conditions assuming Refinery full operations.

5.2 Background Traffic

5.2.1 In order to project year 2030 traffic volumes, an annual traffic growth factor was determined and applied to the existing traffic volume data. According to The Highway Planning Unit traffic census), traffic in the study area has a linear growth rate of 3.3% annually. The resultant 2030 background conditions traffic volumes for the AM and PM peak hour were determined by applying the growth rate of 2.0-3.00% per annum. The adoption of these growth rates over the analysis years is expected to provide a realistic forecast for future demand. The background traffic volume conditions are presented in Figure 7 to Figure 10.

Figure 7 : Peak Hour Background Traffic Year 2015

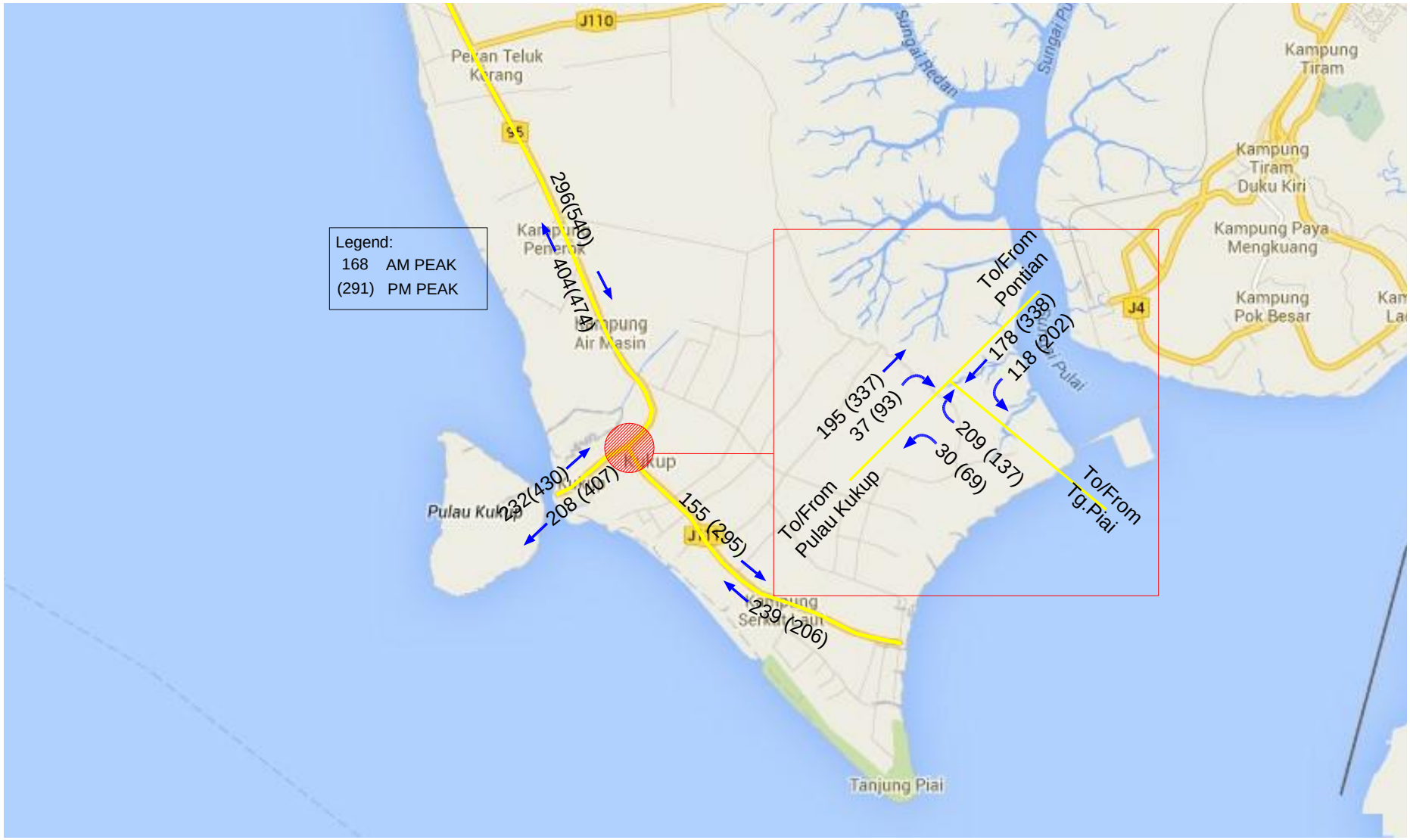


Figure 8: Peak Hour Background Traffic Year 2020

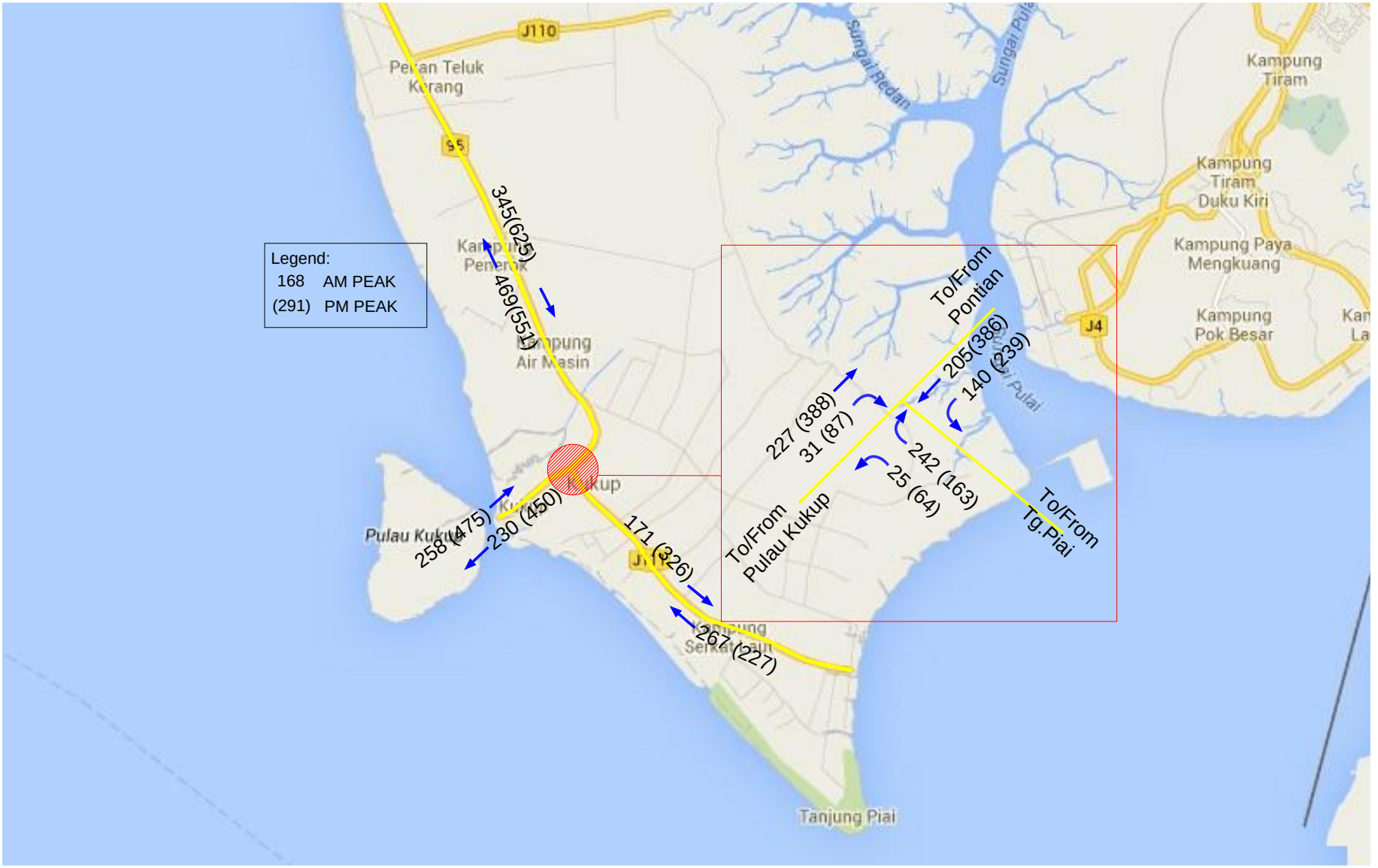


Figure 9: Peak Hour Background Traffic Year 2025

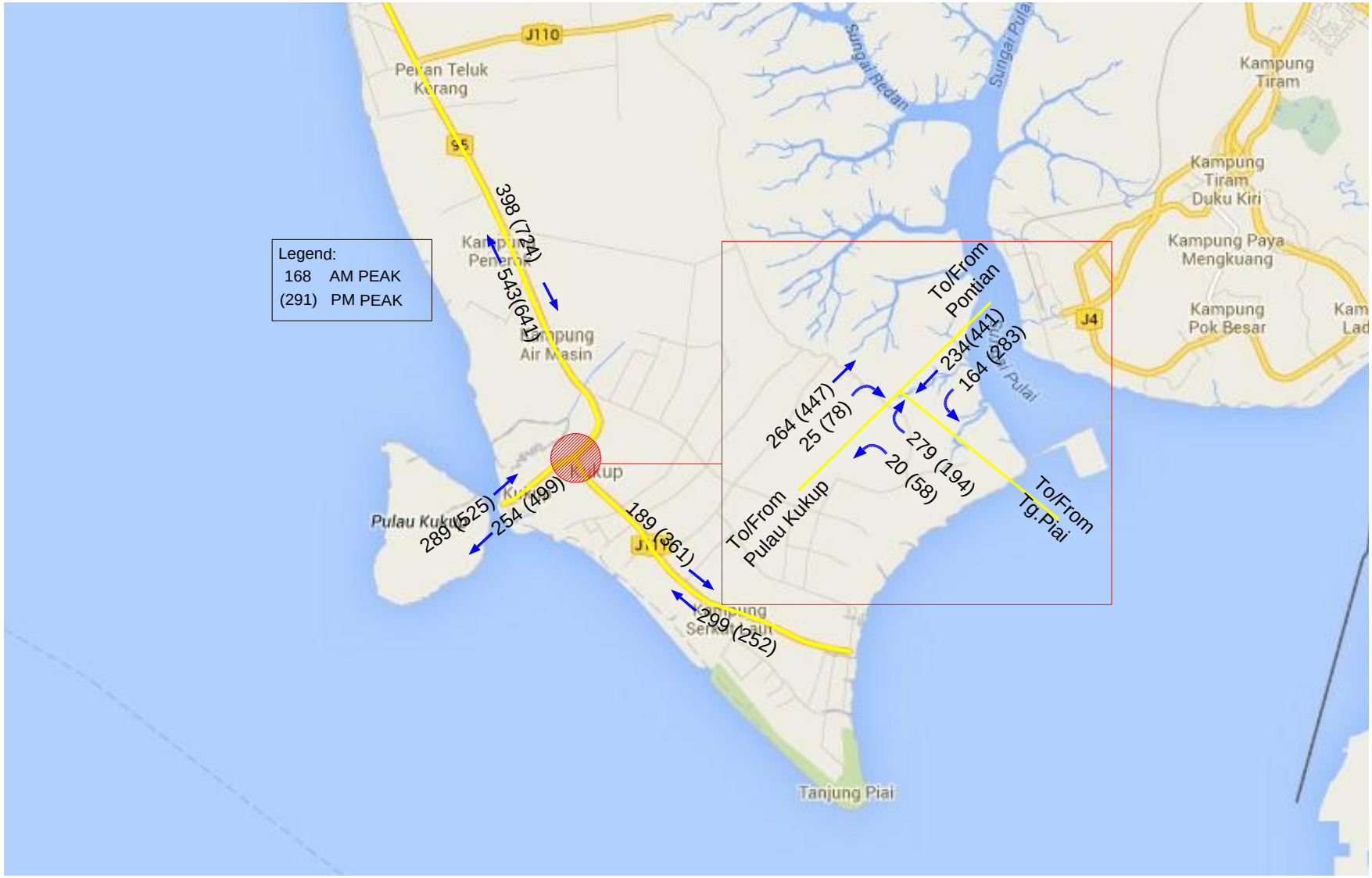
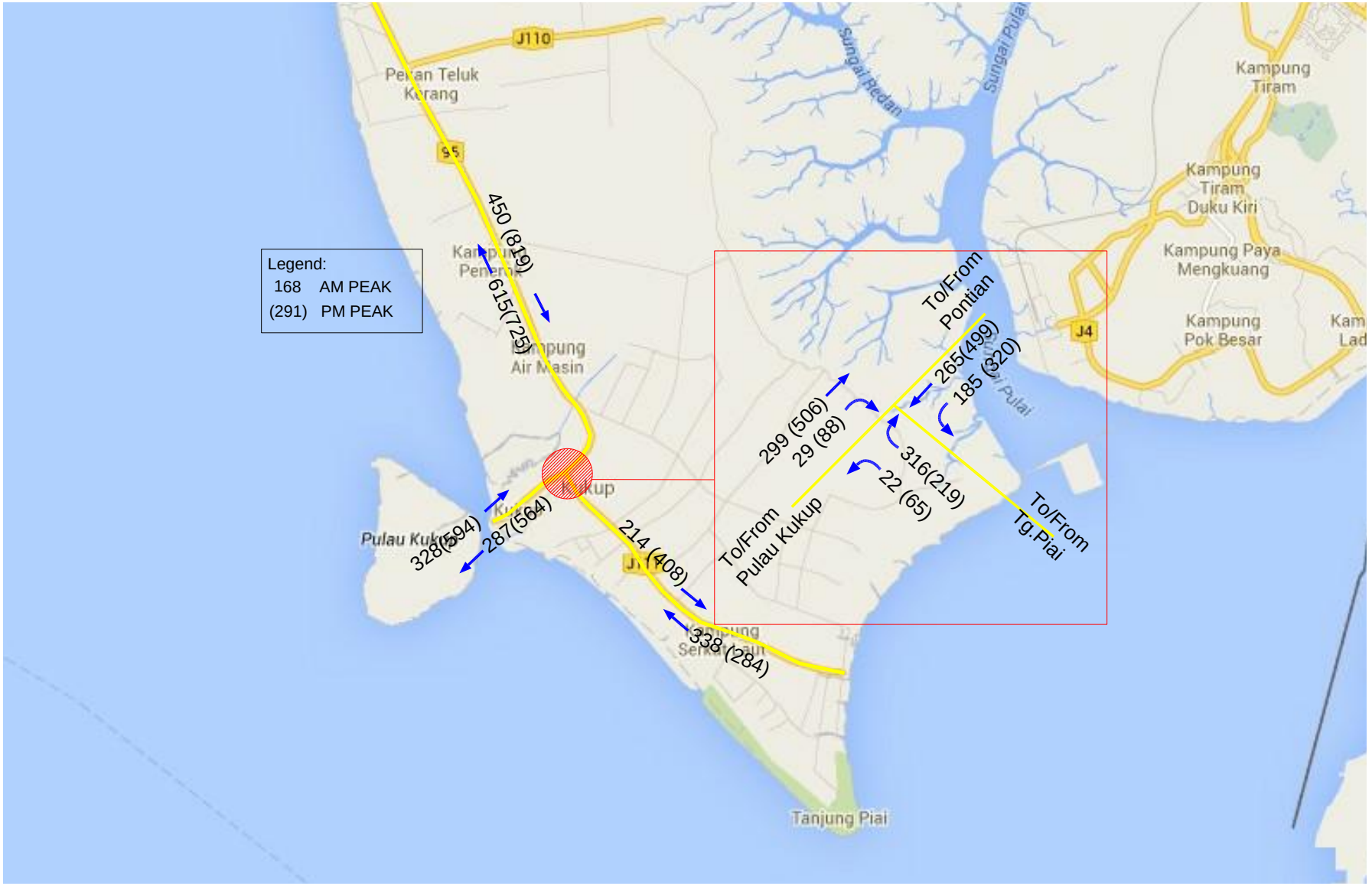


Figure 10: Peak Hour Background Traffic Year 2030



5.3 Construction Traffic

5.3.1 As part of the development of the each phase, the additional of traffic was expected to increase between 443 pcu's to 575 pcu's during peak period. The traffic flow were then derived for these road based on predicted period of time for each phase of construction activity. The traffic flow data derived for the road sections which would used for construction vehicle access are presented in Table 19.

5.3.2 The three phases of construction traffic have been identified on the basis of total construction activities which are predicted to identify a worst case indication of traffic generation during construction period.

5.3.3 With reference to the expected traffic data, indicates that the largest number of traffic movements on each route would occur during Phase 3 (575 Pcu's) of construction.

5.4 Operation Traffic 2030

5.4.1 In addition to the construction traffic for the project phases, the effects during full completion have been considered in terms of traffic generation. The proposed development site is expected to be full operation in year 2030.

Table 19: Estimated Peak Background Traffic Flow and Construction Traffic Flow on Key Roads

Section	Description	Background Traffic					
		AM PEAK (Phase 1)	PM PEAK (Phase 1)	AM PEAK (Phase 2)	PM PEAK (Phase 2)	AM PEAK (Phase 3)	PM PEAK (Phase 3)
Section 1, Federal Route 95	Kukup-Pontian	232	429	258	474	289	525
	Pontian-Kukup	208	407	230	450	254	499
Section 2, Federal Route 95	Kukup-Pontian	404	474	469	550	543	641
	Pontian-Kukup	295	539	344	625	397	724
Section 3, Jalan Serkat(J111)	Tg.Piai-Kukup	239	205	266	227	298	251
	Kukup-Tg.Piai	155	294	171	325	189	361
Section	**Description**	Construction Traffic					
		AM PEAK (Phase 1)	PM PEAK (Phase 1)	AM PEAK (Phase 2)	PM PEAK (Phase 2)	AM PEAK (Phase 3)	PM PEAK (Phase 3)
Section 1, Federal Route 95	Kukup-Pontian	255	442	280	486	319	540
	Pontian-Kukup	235	450	252	492	307	556
Section 2, Federal Route 95	Kukup-Pontian	612	874	666	923	795	1159
	Pontian-Kukup	709	756	731	828	936	1005
Section 3, Jalan Serkat(J111)	Tg.Piai-Kukup	474	649	486	640	604	827
	Kukup-Tg.Piai	591	522	579	539	756	657

Figure 11: Estimated Peak Traffic (Background + Construction) Flow on Key Roads, 2015-2020

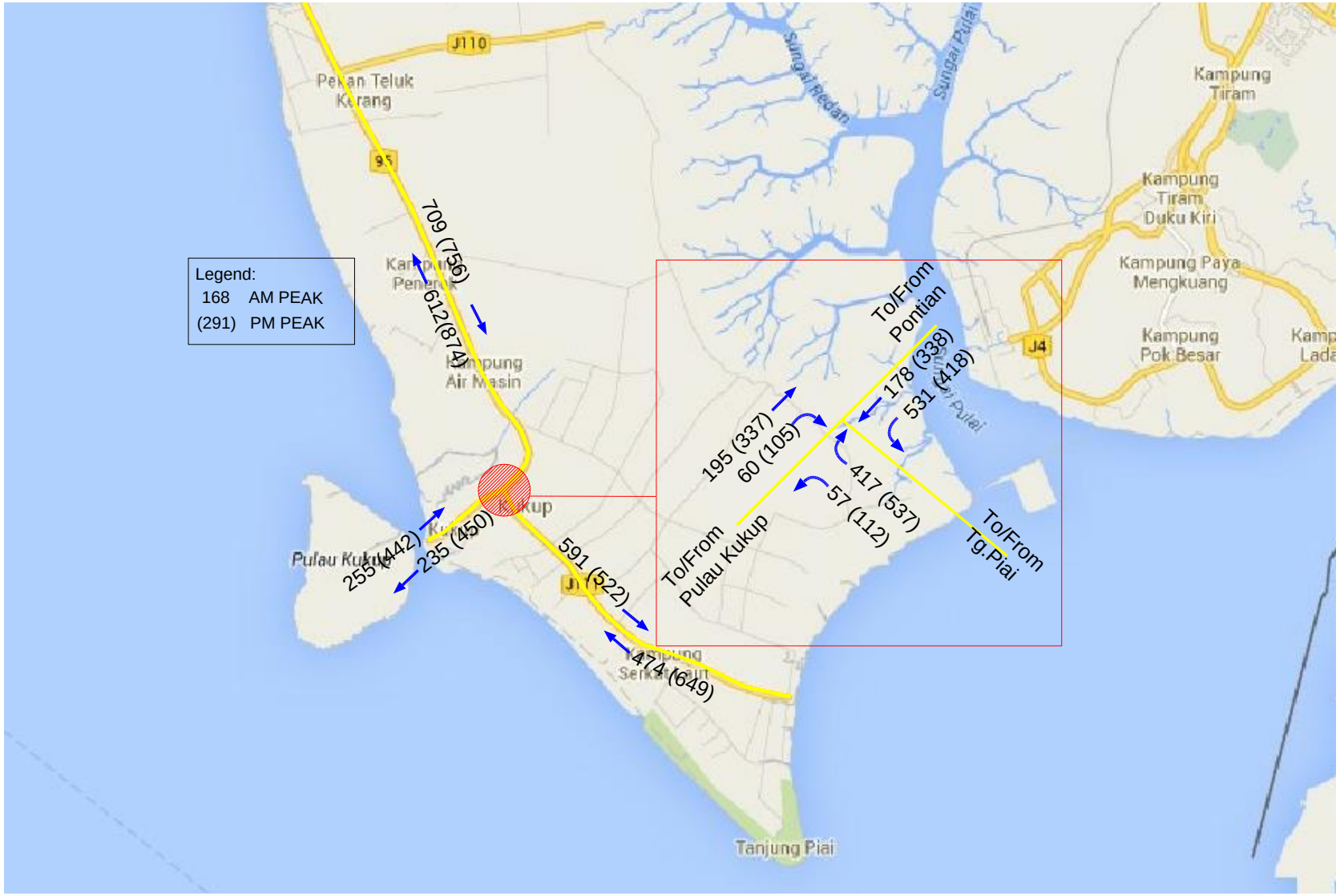


Figure 12: Estimated Peak Traffic (Background + Construction) Flow on Key Roads, 2020-2025

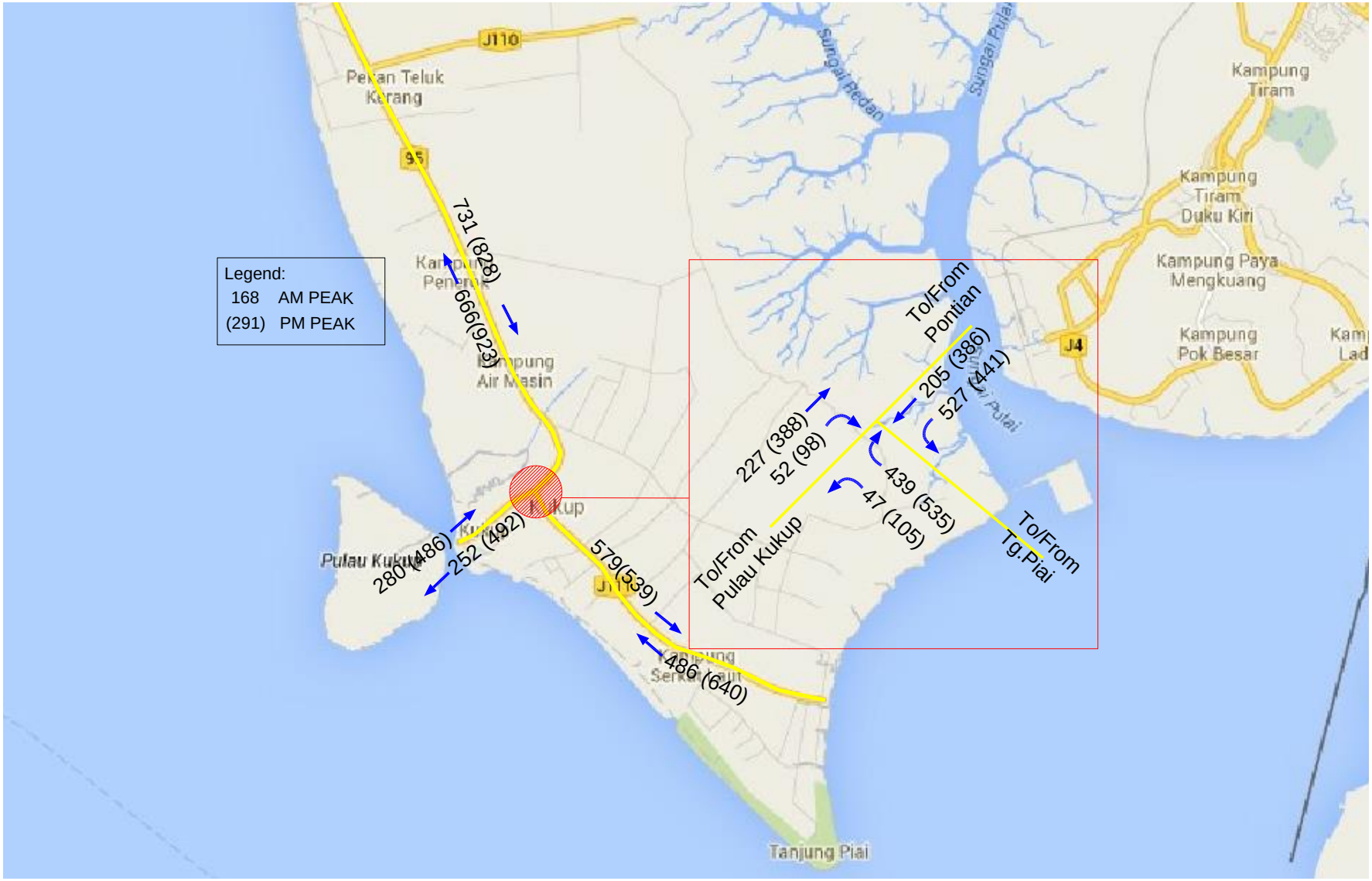


Figure 13: Estimated Peak Traffic(Background+Construction) Flow on Key Roads, 2025-2030

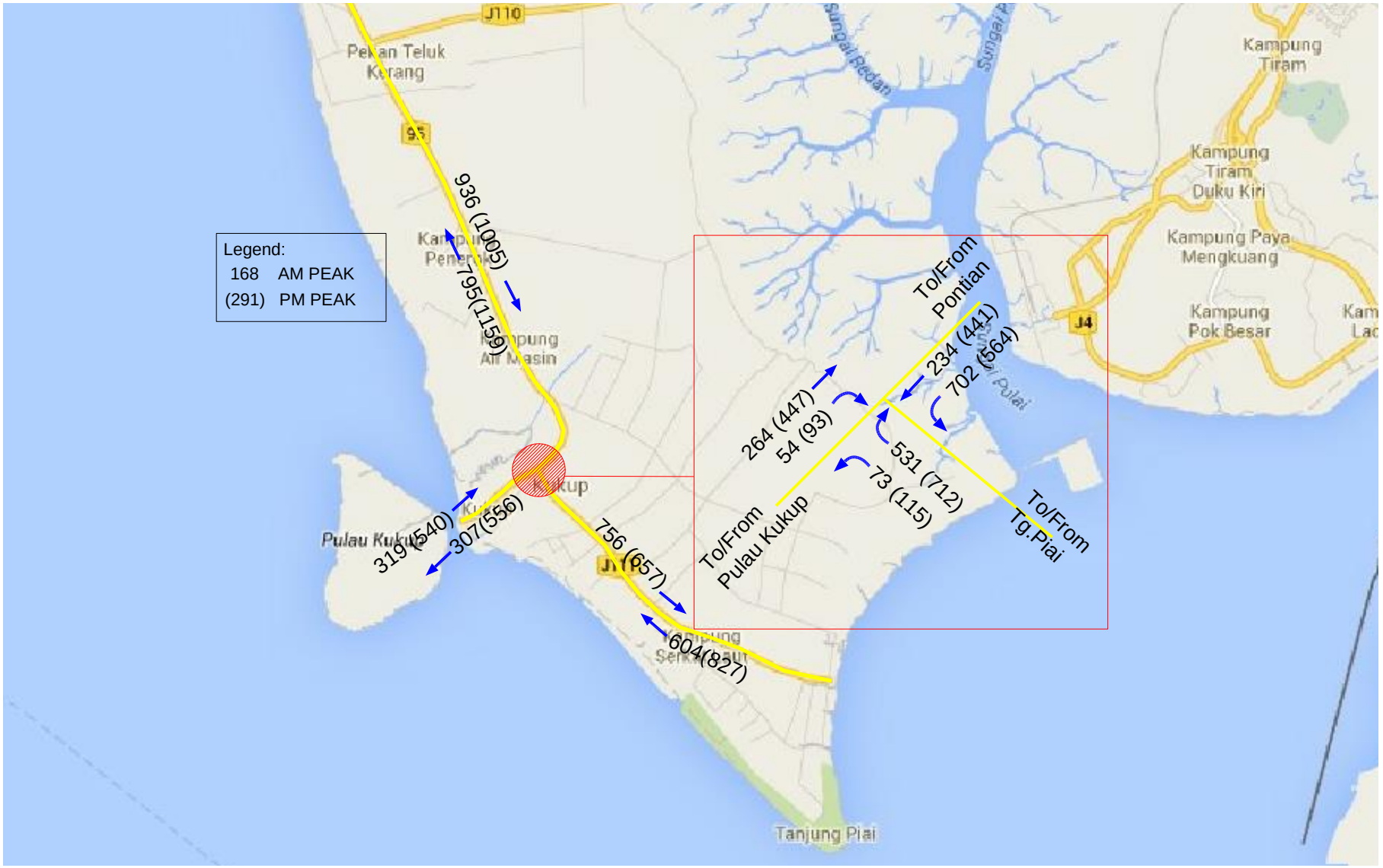
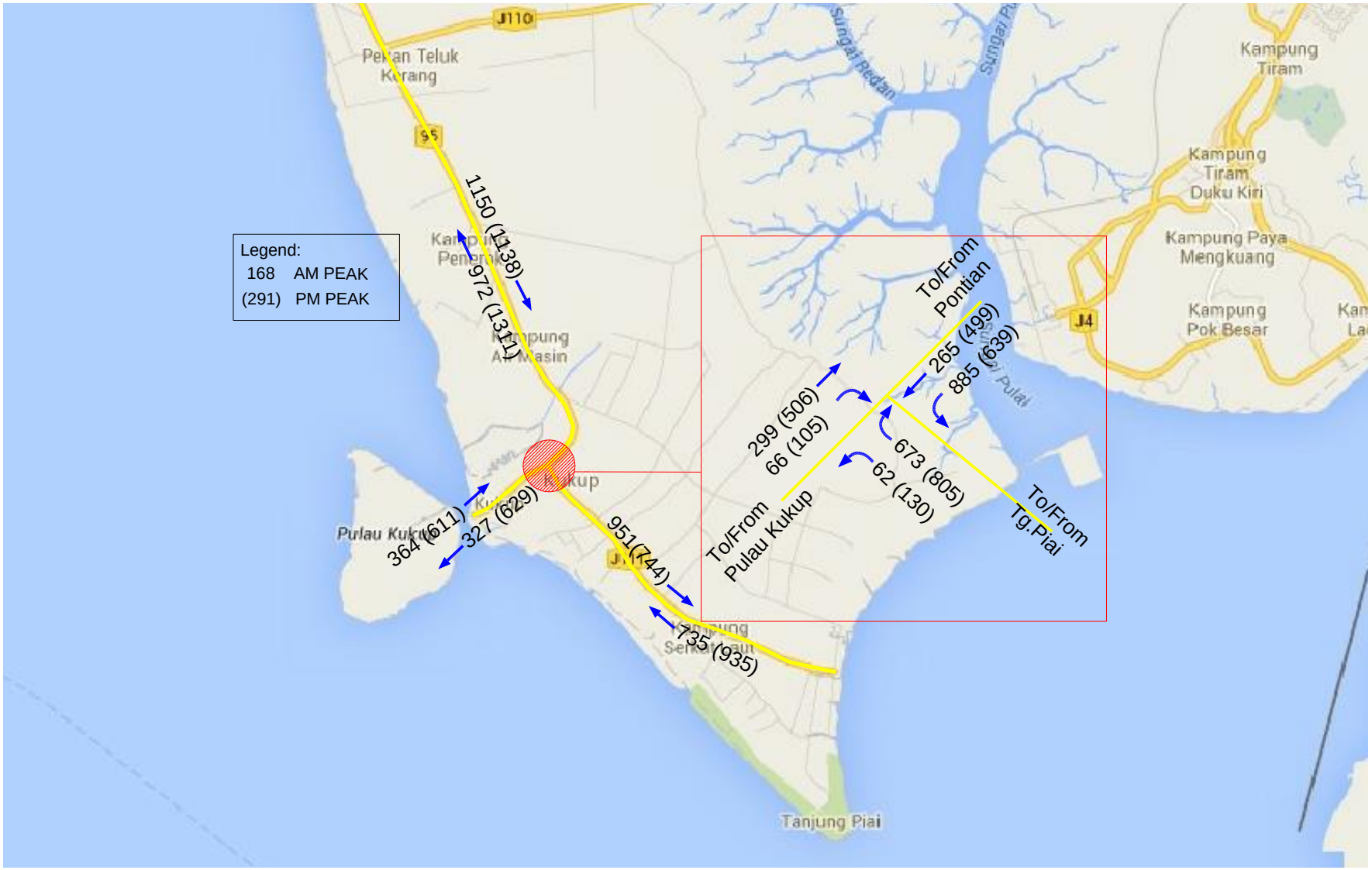


Figure 14: Estimated Peak Traffic(During Operational) Flow on Key Roads, 2030



5.5 Roadway Performance

5.5.1 The analysis of total traffic during construction along the effected route are based on comparing the maximum peak hour future traffic volume and carrying capacity of the road sections. Table 20 show the future mid-block capacity analysis of the future road network during construction of proposed development by phase until year 2030.

5.5.2 The mid-block capacity analysis indicated that with the predicted of future construction traffic, the present capacity of the effected road sections expected to have the V/C ratios less than 0.8. The roadway analysis indicated that single lane of Jalan Federal Route 95 and Serkat(J111) is anticipated to operate at the worse Level of service "C" and "B" during morning and evening peak hours by year 2030.

5.5.3 An outline assessment also has been made of the numbers of traffic during operation in each key section of the route corridor. The estimated of operation traffic have been established by combining the background traffic and operation traffic during full operation of development in year 2030.

5.5.4 The result of mid-block analysis indicated that with full operational traffic, Jalan Serkat(J111) and Federal Route 95(FR95) are predicted to operate at acceptable LOS B and LOS D during peak hours in year 2030. It means that the present capacity of these roads is still able to accommodate the future traffic demand in year 2030.

5.5.5 Howeve, in order to enhance accessibility for the proposed development site as well as to ensure smooth flow of traffic and acceptable level of service performance, Jalan Sekat(J111) is recommended to be widened to four(4) lane with 3.5 meter lane width and proper road marking. This is mainly to cater for additional heavy truck from/to development site.

Table 20: Predicted Future Peak Hour During Construction

Section	Description	Phase 1		Phase 2		Phase 3	
		AM Peak	Pm Peak	AM Peak	Pm Peak	AM Peak	Pm Peak
Section 1, Federal Route 95	Kukup-Pontian	255(0.16)(A)	442(0.28)(A)	280(0.18)(A)	486(0.3)(A)	319(0.2)(A)	540(0.34)(A)
	Pontian-Kukup	235(0.15)(A)	450(0.28)(A)	252(0.16)(A)	492(0.31)(A)	307(0.19)(A)	556(0.35)(A)
Section 2, Federal Route 95	Kukup-Pontian	612(0.38)(A)	874(0.55)(A)	666(0.42)(A)	923(0.58)(A)	795(0.5)(A)	1159(0.72)(C)
	Pontian-Kukup	709(0.44)(A)	756(0.47)(A)	731(0.46)(A)	828(0.52)(A)	936(0.59)(A)	1005(0.63)(B)
Section 3, Jalan Serkat(J111)	Tg.Piai-Kukup	474(0.34)(A)	649(0.46)(A)	486(0.35)(A)	640(0.46)(A)	604(0.43)(A)	827(0.59)(A)
	Kukup-Tg.Piai	591(0.42)(A)	522(0.37)(A)	579(0.41)(A)	539(0.39)(A)	756(0.54)(A)	657(0.47)(A)

253- Peak Volume
(0.16)- Degree of Saturation(Volume/Capacity)
(A)- Level of Service

Table 21: Predicted Future Peak Hour During Operation

Section	Description	Estimated Peak Traffic During Operation, Year 2030					
		Expected Traffic		Degree of Saturation		Level Of Service	
		AM PEAK	PM PEAK	AM PEAK	PM PEAK	AM PEAK	PM PEAK
Section 1, Federal Route 95	Kukup-Pontian	364	611	0.23	0.38	A	A
	Pontian-Kukup	327	629	0.2	0.39	A	A
Section 2, Federal Route 95	Kukup-Pontian	972	1311	0.61	0.82	B	D
	Pontian-Kukup	1150	1138	0.72	0.71	C	C
Section 3, Jalan Serkat(J111)	Tg.Piai-Kukup	735	935	0.53	0.67	A	B
	Kukup-Tg.Piai	951	744	0.68	0.53	B	A

5.6 Future Junction Performance

5.6.1 The study intersections were analyzed with the combined maximum peak volumes with new proposed geometry. The summary of the results of the intersection analyses were described in Table 22. The level of service is presented for the overall main intersection and the analysis output is attached to the appendix A of this report.

5.6.2 The junction operational analysis indicated that the proposed junction upgrading of Jalan Serkat(J111)/Jalan Federal FR95 signalised junction is anticipated to operate at acceptable traffic condition during construction until year 2025 i.e LOS 'C' and 'D' during morning and evening peak period.

Table 22: Future Junction Performance By Phase

Development Phase	**Phase 1**		**Phase 2**		**Phase 3**		**Full Operation**	
Description	Level Of Service (LOS)	Degree of Saturation (V/C)	Level Of Service (LOS)	Degree of Saturation (V/C)	Level Of Service (LOS)	Degree of Saturation (V/C)	Level Of Service (LOS	Degree of Saturation (V/C)
AM Peak	B	0.62	B	0.69	B	0.84	C	0.87
Pm Peak	C	0.77	C	0.82	C	0.87	C	0.90

5.6.3 Results of the future 2030 combined (with operations and background traffic) conditions capacity analyses indicate that an intersections and approaches are projected to operate with unacceptable levels of service(LOS) of C or better during Am and Pm peak period. The greatest traffic performance contribute by directional flow from Tg.Piai to Pontian/Johor Bharu where most this major movement has to stop at the traffic light.

6.0 KEY ISSUE

6.1 Construction Transport Routes

6.1.1 This section presents an overview of the potential access routes which would be used during construction. The only routes to the proposed site is via Jalan Sekat(J111) where currently a single lane road.

6.1.2 There are 3 key issues associated with the project in relation to traffic and transport;

- Site access arrangements;
- predicted impacts on the regional road network as a result of the construction of the projects;
- predicted impacts on the local road network as a result of the construction and operation of the project;
- predicted road accident.

6.1.3 Regional access to the project site is provided via Federal Route (FR5) which connects to Jalan FR95-Pontian-Kukup. Local access to development site is provided via Jalan Serkat(J111). The increase in traffic from/to project site on local roads would anticipated to give rise to a number of other related effects for example conflicts with local traffic and tourist traffic, emergency service vehicles and school buses or taxis.

6.1.4 These effect may be predicted during the busiest phases of project construction primarily along Jalan Sekat(J111) which is currently carry low flows of traffic and which are often unsuitable for large numbers of heavy truck. These has to be considered under road widening and proper traffic management plan to accommodate construction traffic.

6.1.5 A number of mitigation measures would be used to reduce the potential for conflicts between project construction traffic and other local traffic, school traffic and other local traffic.

7.0 FINDING AND RECOMMENDATION

7.1 Roadway Improvement

7.1.1 The first stage of the construction traffic assessment has identified requirements for roadway improvement to the public road system which would be required to allow for movement of heavy truck along the existing Jalan Serkat(J111). The roadway upgrading will include road geometry and bitumins resurfacing(pavement).

7.1.2 During the life of pavement, various traffic loadings will pass on design lane particularly along Jalan Serkat(J111) and Federal Route FR95. The passage of those vehicles on the design lane will deteriorate pavement structure. It is design that the lanes of pavement structure should not fail before total number of vehicles is reached its designed number of standard axle loads. There are various type of vehicles, total vehicle loads, axle types, and axle loads will pass on the pavement along the project road. Damaging effect of those axles on the pavement structure will be different from one to the others.

7.2 Intersection Improvement

7.2.1 Vehicular volume affects the efficiency and the Level of Service of an intersection. High traffic volume on the major road especially during peak hours, would invariably cause considerable delay for the traffic on the minor road .For the purpose of determining the need for signal control, both the traffic volumes on the major and minor roads should be considered. A signal control is warranted if the traffic volume for each of any 8 hour of an average day meets the minimum requirements as described in Table 23. For the major road, the total volume of both approaches is used. For the minor road, the higher volume approach (one direction only) is used. An "average" day is defined as a weekday representing volumes normally and repeatedly found at the location.

Table 23 : Vehicular Volume Requirements For Warrant 1

Number Of Lanes Each Approach		**Minimum Requirements(PCU's)**			
		Major Road(1)		Minor Road(2)	
Major Road	Minor Road	Urban	Rural	Urban	Rural
1	1	500	350	150	105
2 or more	1	600	420	150	105
2 or more	2 or more	600	420	200	140
1	2 or more	500	350	200	140

Note: (1) Total volume of both approaches
(2) Higher volume approach only
Source: Arahan Teknik Jalan 13/87, A guide to the Design of Traffic Signal

7.2.2 A total number of traffic during operations are expected to be higher than those traffic associated with the construction traffic. Base on the above analysis the proposed stop junction has to be upgraded to signalized junction with dedicated ramp from Tg.Piai to Pontian/Johor Bahru in order to maintain an acceptable level of service.

Figure 15: Proposed Traffic Light Junction With Dedicated Ramp, 2030

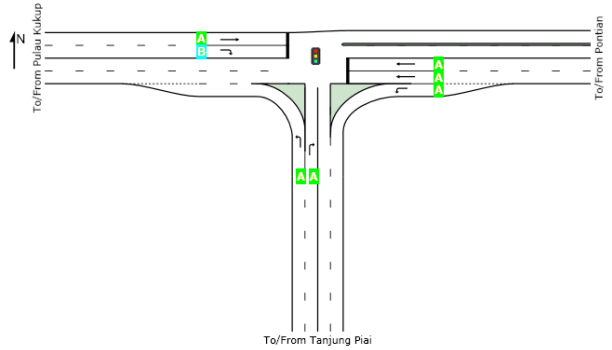
LEVEL OF SERVICE

Site: AM PEAK Phase 3 - OPERATIONS -DEDICATED RAMP

New Site
Signals - Fixed Time Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	South	East	West	Intersection
LOS	NA	A	A	A



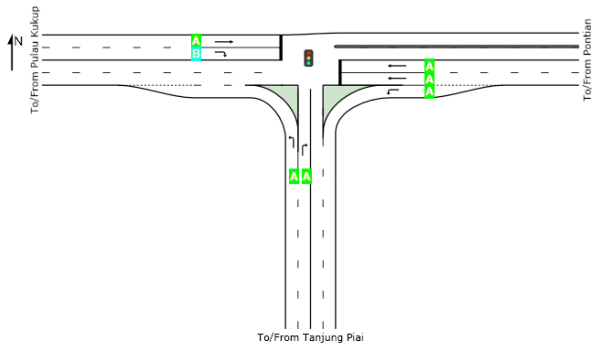
LEVEL OF SERVICE

Site: PM PEAK Phase 3 - OPERATIONS - DEDICATED RAMP

New Site
Signals - Fixed Time Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	South	East	West	Intersection
LOS	NA	A	A	A



MOVEMENT SUMMARY

Site: AM PEAK Phase 3 - OPERATIONS -DEDICATED RAMP

New Site
Signals - Fixed Time Cycle Time = 30 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	62	0.0	0.033	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	673	0.0	0.362	5.6	LOS A	0.0	0.0	0.00	0.57	53.8
Approach		735	0.0	0.362	5.6	NA	0.0	0.0	0.00	0.56	53.9
East: To/From Pontian											
4	L2	885	0.0	0.477	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
5	T1	265	0.0	0.226	9.0	LOS A	1.5	10.8	0.79	0.62	52.3
Approach		1150	0.0	0.477	6.4	LOS A	1.5	10.8	0.18	0.55	54.2
West: To/From Pulau Kukup											
11	T1	299	0.0	0.256	1.6	LOS A	1.1	7.7	0.50	0.34	57.7
12	R2	66	0.0	0.118	14.2	LOS B	0.7	5.2	0.76	0.71	47.8
Approach		365	0.0	0.256	3.9	LOS A	1.1	7.7	0.55	0.41	55.6
All Vehicles		2250	0.0	0.477	5.8	LOS A	1.5	10.8	0.18	0.53	54.3

MOVEMENT SUMMARY

Site: PM PEAK Phase 3 - OPERATIONS - DEDICATED RAMP

New Site
Signals - Fixed Time Cycle Time = 30 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	130	0.0	0.070	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	805	0.0	0.433	5.6	LOS A	0.0	0.0	0.00	0.57	53.8
Approach		935	0.0	0.433	5.6	NA	0.0	0.0	0.00	0.56	53.9
East: To/From Pontian											
4	L2	639	0.0	0.344	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	499	0.0	0.426	9.7	LOS A	3.1	21.9	0.85	0.69	51.8
Approach		1138	0.0	0.426	7.4	LOS A	3.1	21.9	0.37	0.60	53.5
West: To/From Pulau Kukup											
11	T1	506	0.0	0.432	1.9	LOS A	2.2	15.1	0.57	0.39	57.4
12	R2	105	0.0	0.188	14.4	LOS B	1.2	8.4	0.78	0.73	47.6
Approach		611	0.0	0.432	4.0	LOS A	2.2	15.1	0.61	0.45	55.5
All Vehicles		2684	0.0	0.433	6.0	LOS A	3.1	21.9	0.30	0.55	54.1

7.3 Transportation and Traffic Management

7.3.1 The following mitigating measures needed to be adopted to minimize the problems arise from traffic during the construction;

- All access/ public roads involved for the transportation will be regularly maintained and cleaned. The contractor will be responsible for the reinstatement and repair of any damage to public and private roads caused by the movement of the heavy vehicles;
- Transportation for construction activities to be scheduled on off-peak periods, such as, hour 1000 – 1600;
- Provision of egress and ingress that are adequately wide to facilitate turning and maneuver of heavy trucks to and from the site;
- Speed limit shall be imposed for all vehicles within the site using the temporary access and logistics roads;
- Movement of equipment and machinery shall be planned and closely monitored at various locations and stages of work to ensure smooth and safe flow of traffic;
- Traffic management and 'Flag Man' should be carried out at the junction turning off from the main road to the site access road to mitigate vehicle collision and safeguard road users during mining operation. " Flag Man" also required to be station in front of school to provide safe crossing;
- Warning Sign' indicating transport of quarrying products will be placed to alert oncoming vehicles. The sign will be placed at junction, 100m, and 200 m respectively off the proposed project;
- Suitable warning signs and traffic guides should be implemented.

7.4 Proposed Implementation Road Proggrammed

7.4.1 As part of the development of the access to/from development site, the phase 1 to Phase 3 of the construction has identified requirements for improvement to the public road access which would be required to allow for movement of heavy truck between the main road system to development site. The requirement for upgrading works described in Table 24.

Table 24: Proposed Road Improvement Programme

No		Phase 1	Phase 2	Phase 3	Operations
1	Jalan Serkat(J111) road widening From 2 lane single carriageway to 4 lane single carrieageway	√	√	√	√
2	Federal Route (FR95) Road Upgrading from 2 lane single carriageway to 4 lane single carriageway	√	√	√	√
3	Junction 1 Upgrading From All Stop to Signalise Junction	√ (Figure 16)	√ (Figure 16)	√ (Figure 16)	
4	Junction 1 Signalize Junction With Dedicated Ramp from Tg.Piai to Pontian				√ (Figure 17)

Figure 16: Proposed Schematic Diagram For Junction 1 Upgrading For Construction of Phase 1 to Phase 3

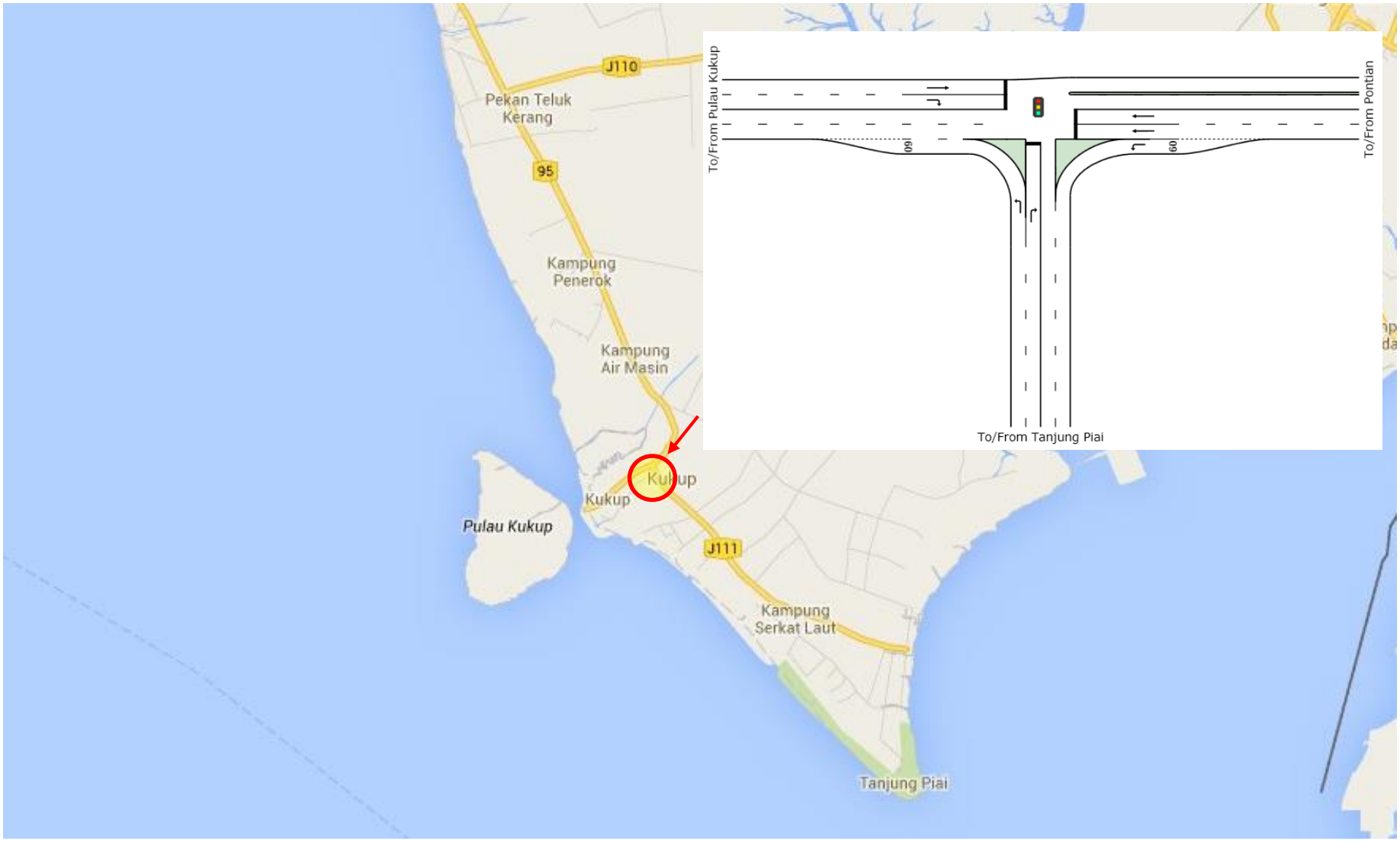
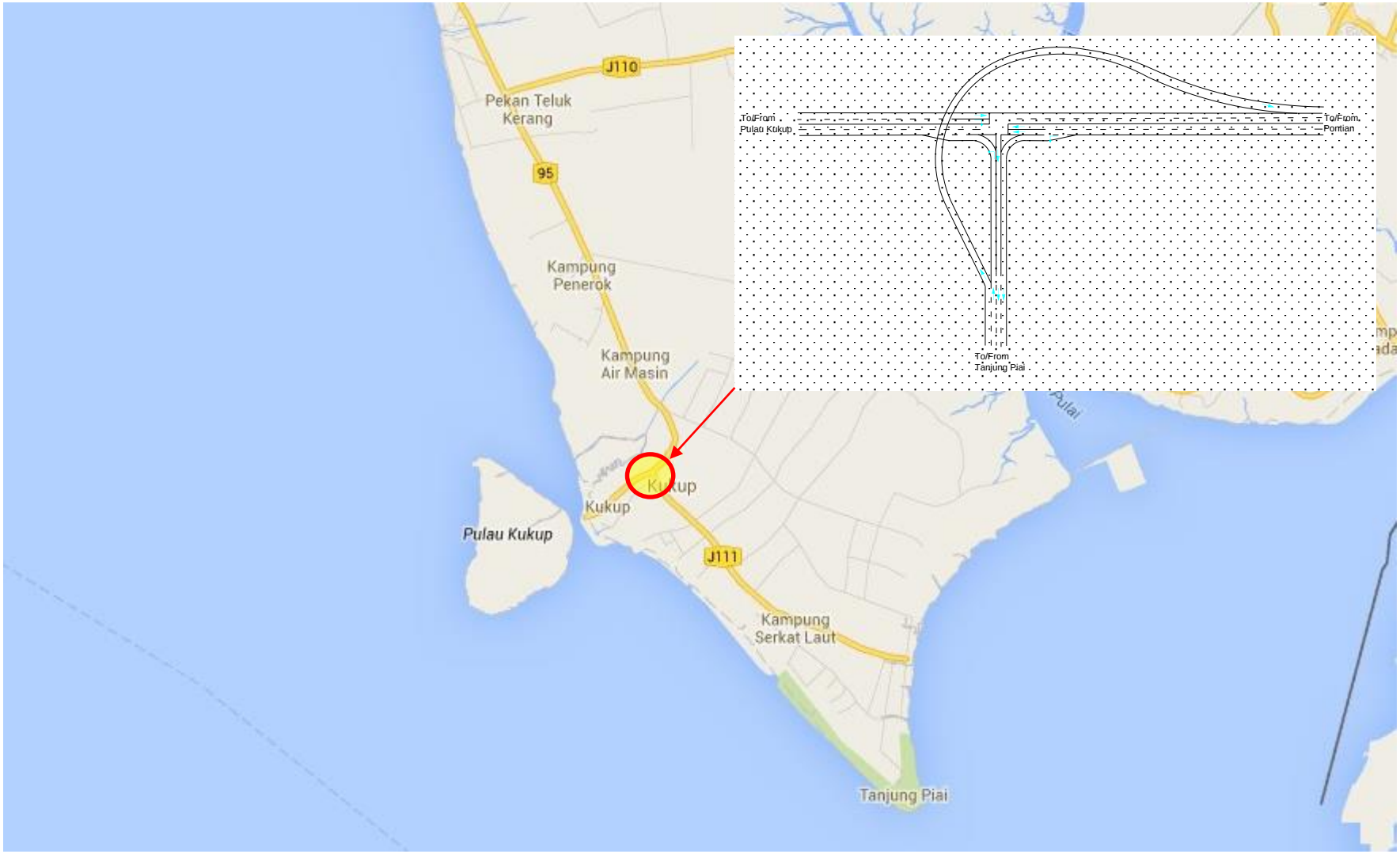


Figure 17: Proposed Road Upgrading For Phase 1 to Phase 3

Figure 18: Proposed Schematic Diagram For Junction 1 Upgrading During Operation 2030



APPENDIX A-Junction Performance Phase 1

MOVEMENT SUMMARY

Site: AM PEAK Phase1

New Site
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	57	0.0	0.031	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	417	0.0	0.624	20.3	LOS C	8.7	60.8	0.88	0.82	44.3
Approach		474	0.0	0.624	18.5	LOS B	8.7	60.8	0.77	0.79	45.4
East: To/From Pontian											
4	L2	531	0.0	0.286	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	178	0.0	0.285	21.1	LOS C	2.0	14.2	0.92	0.71	44.6
Approach		709	0.0	0.286	9.5	LOS A	2.0	14.2	0.23	0.57	51.9
West: To/From Pulau Kukup											
11	T1	195	0.0	0.625	23.0	LOS C	4.8	33.8	0.98	0.83	43.5
12	R2	60	0.0	0.269	28.8	LOS C	1.4	10.1	0.95	0.74	40.2
Approach		255	0.0	0.625	24.4	LOS C	4.8	33.8	0.97	0.81	42.7
All Vehicles		1438	0.0	0.625	15.1	LOS B	8.7	60.8	0.54	0.69	47.8

MOVEMENT SUMMARY

Site: PM PEAK Phase 1

New Site
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	112	0.0	0.060	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	537	0.0	0.904	36.3	LOS D	17.5	122.6	1.00	1.10	37.1
Approach		649	0.0	0.904	31.0	LOS C	17.5	122.6	0.83	1.00	39.3
East: To/From Pontian											
4	L2	418	0.0	0.225	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	338	0.0	0.433	19.9	LOS B	3.8	26.6	0.92	0.74	45.3
Approach		756	0.0	0.433	12.0	LOS B	3.8	26.6	0.41	0.62	50.2
West: To/From Pulau Kukup											
11	T1	337	0.0	0.864	28.7	LOS C	9.9	69.5	1.00	1.06	40.8
12	R2	105	0.0	0.471	29.6	LOS C	2.6	18.2	0.97	0.77	39.8
Approach		442	0.0	0.864	28.9	LOS C	9.9	69.5	0.99	0.99	40.6
All Vehicles		1847	0.0	0.904	22.7	LOS C	17.5	122.6	0.70	0.84	43.5

APPENDIX A-Junction Performance Phase 2

MOVEMENT SUMMARY

Site: AM PEAK Phase 2

New Site
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	47	0.0	0.025	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	439	0.0	0.695	22.5	LOS C	10.0	69.9	0.92	0.87	43.1
Approach		486	0.0	0.695	20.8	LOS C	10.0	69.9	0.83	0.84	44.1
East: To/From Pontian											
4	L2	527	0.0	0.284	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	205	0.0	0.292	20.1	LOS C	2.3	16.0	0.90	0.70	45.1
Approach		732	0.0	0.292	9.7	LOS A	2.3	16.0	0.25	0.58	51.8
West: To/From Pulau Kukup											
11	T1	227	0.0	0.647	22.4	LOS C	5.6	39.1	0.98	0.84	43.9
12	R2	52	0.0	0.233	28.7	LOS C	1.2	8.7	0.94	0.73	40.2
Approach		279	0.0	0.647	23.6	LOS C	5.6	39.1	0.97	0.82	43.1
All Vehicles		1497	0.0	0.695	15.9	LOS B	10.0	69.9	0.57	0.71	47.3

MOVEMENT SUMMARY

Site: PM PEAK Phase 2

New Site
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	105	0.0	0.057	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	535	0.0	0.823	30.4	LOS C	16.8	117.9	0.98	0.96	39.5
Approach		640	0.0	0.823	26.3	LOS C	16.8	117.9	0.82	0.89	41.4
East: To/From Pontian											
4	L2	441	0.0	0.237	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	386	0.0	0.396	20.8	LOS C	4.9	34.0	0.88	0.72	44.7
Approach		827	0.0	0.396	12.7	LOS B	4.9	34.0	0.41	0.62	49.7
West: To/From Pulau Kukup											
11	T1	388	0.0	0.796	27.1	LOS C	12.1	84.8	0.99	0.96	41.5
12	R2	98	0.0	0.528	35.6	LOS D	3.0	20.8	0.99	0.78	37.4
Approach		486	0.0	0.796	28.8	LOS C	12.1	84.8	0.99	0.93	40.6
All Vehicles		1953	0.0	0.823	21.2	LOS C	16.8	117.9	0.69	0.78	44.3

APPENDIX A-Junction Performance Phase 3

MOVEMENT SUMMARY

Site: AM PEAK Phase 3

New Site
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	73	0.0	0.039	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	531	0.0	0.841	28.8	LOS C	14.9	104.0	0.99	1.00	40.2
Approach		604	0.0	0.841	26.0	LOS C	14.9	104.0	0.87	0.94	41.5
East: To/From Pontian											
4	L2	702	0.0	0.378	5.7	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	234	0.0	0.333	20.3	LOS C	2.6	18.4	0.91	0.72	45.0
Approach		936	0.0	0.378	9.3	LOS A	2.6	18.4	0.23	0.58	52.1
West: To/From Pulau Kukup											
11	T1	264	0.0	0.752	24.4	LOS C	6.9	48.5	1.00	0.92	42.9
12	R2	54	0.0	0.242	28.7	LOS C	1.3	9.0	0.94	0.73	40.2
Approach		318	0.0	0.752	25.1	LOS C	6.9	48.5	0.99	0.89	42.4
All Vehicles		1858	0.0	0.841	17.4	LOS B	14.9	104.0	0.57	0.75	46.4

MOVEMENT SUMMARY

Site: PM PEAK Phase 3

New Site
Signals - Fixed Time Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	115	0.0	0.062	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	712	0.0	0.876	37.7	LOS D	31.0	216.9	0.98	0.98	36.6
Approach		827	0.0	0.876	33.3	LOS C	31.0	216.9	0.85	0.92	38.4
East: To/From Pontian											
4	L2	564	0.0	0.304	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	441	0.0	0.431	26.9	LOS C	7.3	51.0	0.88	0.73	41.7
Approach		1005	0.0	0.431	15.0	LOS B	7.3	51.0	0.39	0.62	48.2
West: To/From Pulau Kukup											
11	T1	447	0.0	0.873	40.1	LOS D	20.0	140.0	1.00	1.05	36.2
12	R2	93	0.0	0.668	48.5	LOS D	3.9	27.3	1.00	0.83	33.0
Approach		540	0.0	0.873	41.5	LOS D	20.0	140.0	1.00	1.01	35.6
All Vehicles		2372	0.0	0.876	27.4	LOS C	31.0	216.9	0.69	0.81	41.2

APPENDIX A-Junction Performance During Full Operations

MOVEMENT SUMMARY

Site: AM PEAK Phase 3 - OPERATIONS

New Site
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	62	0.0	0.033	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	673	0.0	0.870	32.3	LOS C	23.0	160.9	0.98	1.01	38.7
Approach		735	0.0	0.870	30.1	LOS C	23.0	160.9	0.90	0.97	39.7
East: To/From Pontian											
4	L2	885	0.0	0.477	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
5	T1	265	0.0	0.371	24.2	LOS C	3.6	24.9	0.92	0.73	43.0
Approach		1150	0.0	0.477	9.9	LOS A	3.6	24.9	0.21	0.58	51.6
West: To/From Pulau Kukup											
11	T1	299	0.0	0.836	31.9	LOS C	10.0	69.8	1.00	1.00	39.4
12	R2	66	0.0	0.355	34.9	LOS C	1.9	13.6	0.97	0.75	37.7
Approach		365	0.0	0.836	32.4	LOS C	10.0	69.8	0.99	0.96	39.1
All Vehicles		2250	0.0	0.870	20.2	LOS C	23.0	160.9	0.56	0.76	44.9

MOVEMENT SUMMARY

Site: PM PEAK Phase 3 - OPERATIONS

New Site
Signals - Fixed Time Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: To/From Tanjung Piai											
1	L2	130	0.0	0.070	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
3	R2	805	0.0	0.900	46.0	LOS D	47.1	329.8	0.99	0.98	33.8
Approach		935	0.0	0.900	40.4	LOS D	47.1	329.8	0.85	0.92	35.7
East: To/From Pontian											
4	L2	639	0.0	0.344	5.6	LOS A	0.0	0.0	0.00	0.53	54.9
5	T1	499	0.0	0.440	34.2	LOS C	10.9	76.4	0.86	0.73	38.4
Approach		1138	0.0	0.440	18.2	LOS B	10.9	76.4	0.38	0.62	46.3
West: To/From Pulau Kukup											
11	T1	506	0.0	0.892	52.2	LOS D	30.6	214.2	1.00	1.05	32.3
12	R2	105	0.0	0.888	72.4	LOS E	6.5	45.6	1.00	0.98	27.2
Approach		611	0.0	0.892	55.7	LOS E	30.6	214.2	1.00	1.04	31.3
All Vehicles		2684	0.0	0.900	34.4	LOS C	47.1	329.8	0.69	0.82	38.2