



Division/Section:
ITSO Division /ITSO OCC Traffic Operations

Rev No.
2

Effective Date:
Xx Dec 2020

Document No:
ITSO/OCC/SOP/GEN01.002

Singapore Road Network

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
------------------------	------------------------

Table of Contents

1. INTRODUCTION	5
2. EXPRESSWAY ROAD NETWORK.....	5
3. ARTERIAL ROAD NETWORK	6
4. OTHER USEFUL INFORMATION.....	6-8
5. ABBREVIATIONS.....	9
6. REFERENCES & ATTACHMENTS.....	9-21

.

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	2 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
------------------------	------------------------

DOCUMENT CONTROL

REV	DOCUMENT TITLE & COPY NUMBER	Date	Prepared by	Reviewed by	Approved by
0	Singapore Road Network Copy____of ____	15 th December 2009	Melvin Yeo (SOE)	Alfred Loh (SOE)	Soh Ling Tim (MOPN)
1	Singapore Road Network Copy____of ____	XX October 2013	Chiam Zhi Wei (DySOE) Chua Teck Leong (AOM, ITSO OCC)	Ng Soon Han, Frankie (DOM, ITSO OCC)	Yeo Se Lay (SM,Ops)
2	Singapore Road Network Copy____of ____	XX December 2020	Daniel Wu (AOM) Lye Keng Fatt (DM, ITSO OCC)	Ng Soon Han, Frankie (Mgr, ITSO OCC)	Yeo Se Lay (DDIT)

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	3 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
-------------------------------	-------------------------------

AMENDMENT HISTORY RECORD

Rev No.	Effective Date of Change	Section & Sub- Section Amended	Amendments/ References	Party Requesting for Change
1	XX Oct 2013	Whole Document	Due to organization change of division name from ITSC to ITSO.	DOM, ITSO OCC
2	XX Dec 2020	Whole Document	Due to change of Staff Designations in ITSO OCC. Delete SOE, insert DM Delete DySOE, insert DyAM	Mgr, ITSO OCC

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	4 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
------------------------	------------------------

Section 1. Introduction

- 1.1.1 This document gives a brief & general description of the Road network in Singapore (Refer to Attachments 1 & 2 for Map)
- 1.1.2 This is to ensure that this useful knowledge is made known to ITSO OCC staff, enabling them to use the information in their course of work.
- 1.1.3 In brief Singapore Road Network monitored by ITSO OCC consist of the following:
- (a) Expressway Road Network (Consist of Open Expressway and Tunnel road Corridors)
 - (b) Arterial Road Network (Major Arterial Road Corridors)

Section 2. Expressway Road Network

Sub-Section 2.1 Expressway & Tunnel Road Corridors

2.1.1 This network is made up of the following Expressway Corridors:

(a) Central Expressway (CTE) including the Tunnel section	16 km
(b) Bukit Timah Expressway (BKE)	11 km
(c) Pan Island Expressway (PIE)	42 km
(d) Ayer Rajah Expressway (AYE)	28 km
(e) East Coast Parkway Expressway (ECP)	19 km
(f) Tampines Expressway (TPE)	15 km
(g) Seletar Expressway (SLE)	12 km
(h) Kranji Expressway (KJE)	9 km
(i) Kallang Paya Lebar Expressway(KPE) including Tunnel section	12km
(j) Marina Coastal Expressway (MCE)	5.1km
(k) Woodsville Tunnel	0.77km
(l) Fort Canning Tunnel	0.30km
m) Sentosa Gateway Tunnel	1.4km
Total length:	171.57km

- 2.1.2 CTE Tunnel is divided into 2 sections Kampong Java (0.7km) and Chin Swee (1.7km). Fort Canning Tunnel is 300m. Woodsville Tunnel is 0.77km. Sentosa Gateway Tunnel (1.4km).
- 2.1.3 KPE Tunnel consists of the covered section which is 9km and the open section is 3km
- 2.1.4 All expressways are monitored by ITSO OCC except KPE&MCE which are monitored by KPE OCC
- 2.1.5 All expressways are patrolled by VRS and with LTM personnel standing by at strategic locations to respond to any incident. These expressways are also equipped with a total of **309 surveillance and 618** detection cameras linked to the respective OCC
- 2.1.6 These expressways and roads linking to the expressways are also equipped with various VMS signs to inform the motoring public of conditions on the expressways
- 2.1.7 The speeds on these expressways are between 70km/h-90km/h

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	5 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
------------------------	------------------------

Section 3. Arterial Road Network

Sub-Section 3.1 Arterial Road Major Corridor

- 3.1.1 This consists of all other major road corridors in Singapore excluding the expressways.
- 3.1.2 For the arterial road network only major or critical road junctions are equipped with J-eye cameras linked to ITSO OCC to enable the monitoring of incidents at these junctions. There are at present **276 J-eye cameras**.
- 3.1.3 Incidents occurring on arterial roads they are mostly managed by TP. RC & LTM are usually not sent to arterial roads incidents unless it is a major incident or if the incident causes congestion. These dispatches are done at the discretion of the duty DM.
- 3.1.4 The only exception would be the whole length of Telok Blangah-Pasir Panjang viaduct, the major arterial Road of Bukit Timah-Dunearn Road from the junction of Bukit Timah/Cavanagh to Jln Anak Bukit junction near McDonalds, the Fort Canning Tunnel (FCT), Woodsville Tunnel (WVT) and Sentosa Gateway Tunnel (SGT). This is because the CERTIS CISCO VRS contract covers these areas.
- 3.1.5 The arterial road also has an Outer Ring Road system. This Outer Ring Road System (ORRS) is a network of major roads that forms a 'ring' along the outer areas of the city (Refer to Attachment 4). It provides an alternative route for motorists to travel between the east and west of Singapore without going through the city. Hence, it helps to reduce the traffic volume on city-bound roads.
- 3.1.6 Arterial Roads traffic light junctions are monitored and controlled by ITSO OCC via the glide system; these traffic lights may be adjusted to ease congestion if required and if practicable.
- 3.1.7 Speeds on major arterial roads and semi-expressways are between 50-70km/h

Section 4 Other Useful Information

Sub-Section 4.1 Singapore Road Network According To Function & Purpose

- 4.1.1 For OCC operational purpose & function the Singapore Road Network is divided into Zones (Refer to ITSO/OCC/SOP/GEN01.004 for zonal concept & Map).
- 4.1.2 For other function and purpose for e.g. Ops & Planning or traffic light maintenance the Road Network is divided according to Divisions and Regions (Refer to Attachment 3 for Map details)

Sub-Section 4.2 ROCP Group For Singapore Road NetWork

- 4.2.1 Within the ITSO division besides ITSO OCC, there is Ops and planning that deals with planning and handling of known scheduled events that may affect road operations. For maintenance, there is the maintenance department that maintains all EMAS & Tunnel equipment and facilities, including ITSO OCC and traffic lights, these are done with the help of outsourced contractors. Another department ITSO DV, deals in the development and improvement of ITSO equipment and software so as to ensure ITSO has the technological edge to manage Singapore Road Network
- 4.2.2 In addition, there are other divisions within the ROCP group that deals with other aspects of road operations. In brief they consist of:

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	6 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
-------------------------------	-------------------------------

- a) Road Infrastructure Management (RIMS): Manages all road infrastructure, road furniture, road assets, facilities, lightings and road work regulations.
- b) Traffic Management (TM): Manages traffic demand on the road. To signalise major junctions & optimise traffic signal operations. Fix traffic bottlenecks by strategising the use of traffic signs / markings, directional signs and road widening to manage conflicts between road users
- c) Road Safety Engineering: Deals mainly with the safety aspects of road design and investigations of road accidents in order to enhance road safety for road users through recommendations.

Sub-Section 4.3 Singapore Road Network Information & Characteristics

4.3.1 Peak hour traffic for Singapore roads are morning peak traffic resulting from city-bound trips and evening peak traffic resulting from home-bound trips. Peak hour traffic timings are as follow: Mondays to Fridays

Morning Peak : 7:00 am to 9:30am

Evening Peak : 5:30pm to 9:00pm

4.3.2 Other predictable timings where that might be a surge in traffic volumes are the school hours. The typical timings for school hours (excluding school holidays) in Singapore school zones are: 6:45 am to 7:30 am, 12:15 pm to 1:30 pm, 5:45 pm to 6:40 pm.

4.3.3 The Electronic Road Pricing System was started to control congestions on heavily used roads during peak hours and to regulate vehicle usage during these times. Operational timings for Expressways ERP are:

ERP Location	Timings (Morning)
Central Business District	Mon – Fri; 8am – 10am
ECP (West Bound), AYE (East Bound), CTE (South Bound)	Mon – Fri; 7.30am – 9.30am
BKE (South Bound)	Mon – Fri; 7.30am – 9.00am
PIE (East Bound)	Mon – Fri; 7.30am – 9.00am
PIE (West Bound)	Mon – Fri; 7.30am – 9.00am
PIE (West Bound) Before Eunos Link	Mon – Fri; 7.00am – 8.00am
CTE (South Bound) Aft AMK Ave 1	Mon – Fri; 7.00am – 11.00am
KPE (Southbound) at exit slip C (ECP-Westbound)	Mon – Fri; 7.30am – 9.30am

ERP Location	Timings (Afternoon & Evening)
Central Business District	Mon – Fri; 12 noon- 8pm
Riverline	Mon – Sat; 12 noon- 8pm,
Orchard Cordon	Mon – Fri; 12 noon- 8pm Sat; 11am-8pm
Eu Tong Sen & Fullerton Rd	Mon – Fri; 6pm – 8pm, Sat 12:30pm-8pm
ECP (East Bound)	Mon – Fri; 6pm – 8pm
CTE (North Bound) after PIE (Changi) exit	Mon – Fri; 6pm – 8pm
CTE (Northbound) after Jln Bahagia exit	Mon – Fri; 5.30pm – 10.30pm

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	7 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
-------------------------------	-------------------------------

4.3.4 Bus lanes are also in use for Singapore Roads for better flow of public bus services. Timings are as follow:

- a) Normal bus lanes (Yellow line Bus lane markings) timings are Mon – Fri 7.30am – 9.30am, 5pm – 8pm (excluding Sun & Public Holidays).
- b) Full day bus lanes (Red line Bus lane markings) timings are Mon – Sat 7.30am – 8pm

4.3.5 The equipments and road furniture terminology can be found on Attachment 5 of this document.

4.3.6 The distance between lampposts on Singapore expressways is about 38.5 meters and these are numbered on site.

4.3.7 The standard width for our road lanes are, maximum 3.7meters wide and minimum 3.3meters wide

4.3.8 The average height for overhead structures on Singapore roads are about 5.4 meters, from the road surface to the lowest point of the overhead structure.

4.3.9 All EMAS equipment are coded for ITSO OCC reference, using examples below for illustration:

Expressway code(Indicates which Expressway the Equipment is located)	Equipment Code (Indicates the Type of equipment)	Equipment Serial Number Code (Indicated by two digits)
9 (SLE)	1-indicates TIP	02
9(SLE)	3-indicates TTP	04
6(PIE West)	4-indicates TSP	01
5(PIE East)	9-indicates surveillance PTZ cameras	58
9 (SLE)	6-indicates detection camera	01

4.3.10 The TIP maximum display is 18 characters and 2 lines with toggling function.

4.3.11 The TTP maximum display is 15 characters and 2 lines with toggling function.

4.3.12 The TEP maximum display is 6 characters and 3 lines.

4.3.13 The TSP only displays graphics and the LUS displays green arrow or red or amber cross for lane usage status. Green means lane can be use, Amber means proceed with caution get ready to change lane, Red means lane is unusable must change lane.

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	8 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
-------------------------------	-------------------------------

Section 5 Abbreviations

GLIDE Green Link Determining System
 ITSO Intelligent Transport Systems Operations
 J-eye Junction eye
 LTA Land Transport Authority
 LTM Land Transport Authority Traffic Marshal
 LUS Lane usage Signs
 OCC Operations Control Center
 ROCP Road Operations & Community Partnership
 TIP Traffic Information Panel
 TTP Travel Time Panel
 TEP Tunnel Entrance Panel
 TSP Traffic Sign Panel
 VRS Vehicle Recovery Service

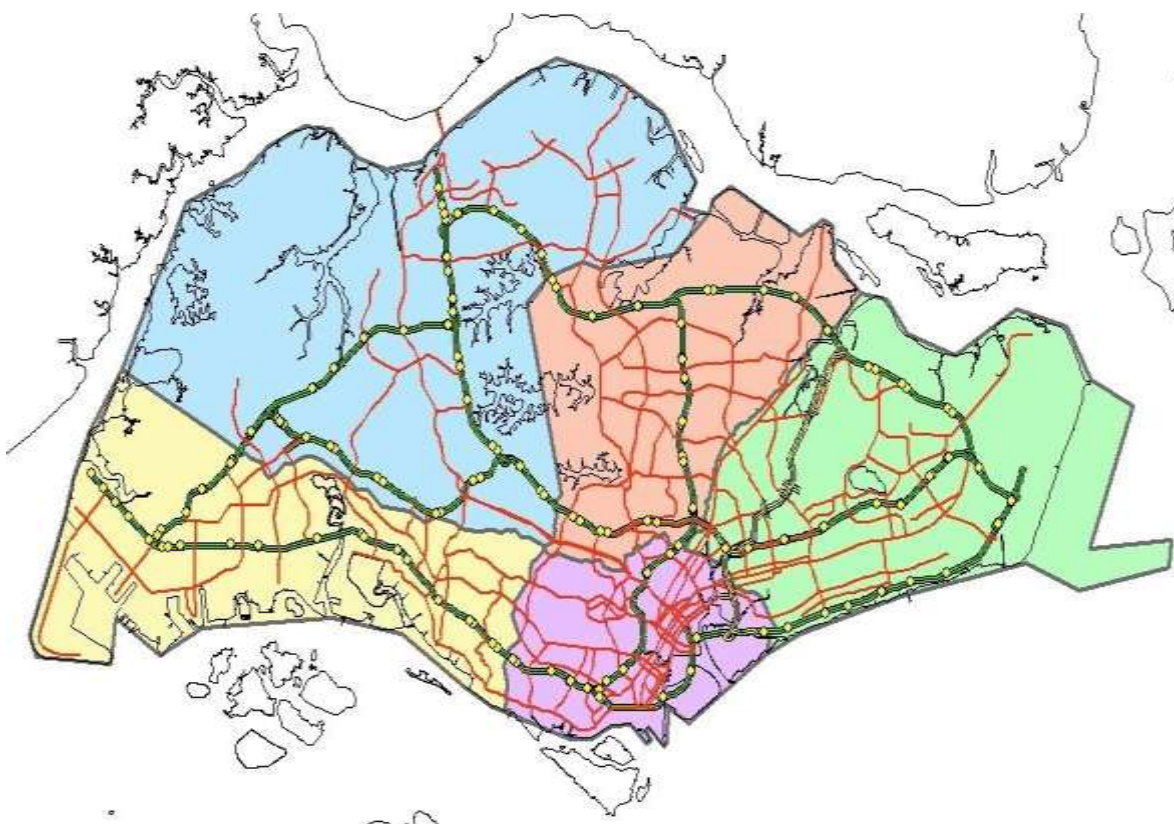
Section 6 References & Attachments

References:

1. Intelligent Transport Systems Operations, Integrated Standard Operating Procedures

INTENTIONALLY LEFT BLANK

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	9 of 21
File	Singapore Road Network		

ATTACHMENT 1-MAP OF SINGAPORE ROAD NETWORK**Legend:**

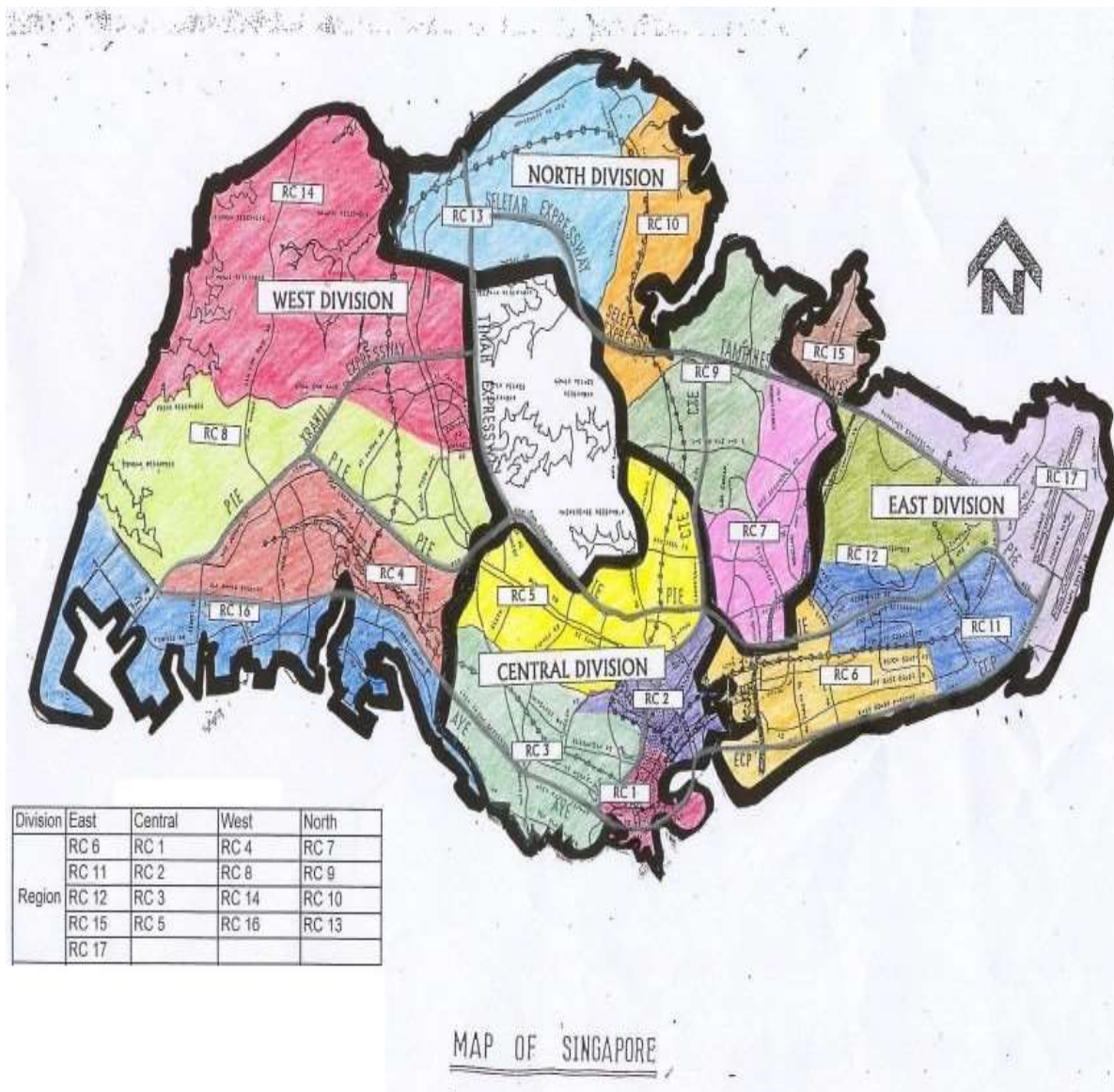
- Corridor (Arterial)
- Corridor (Expressway)
- TIPs

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	10 of 21
File	Singapore Road Network		

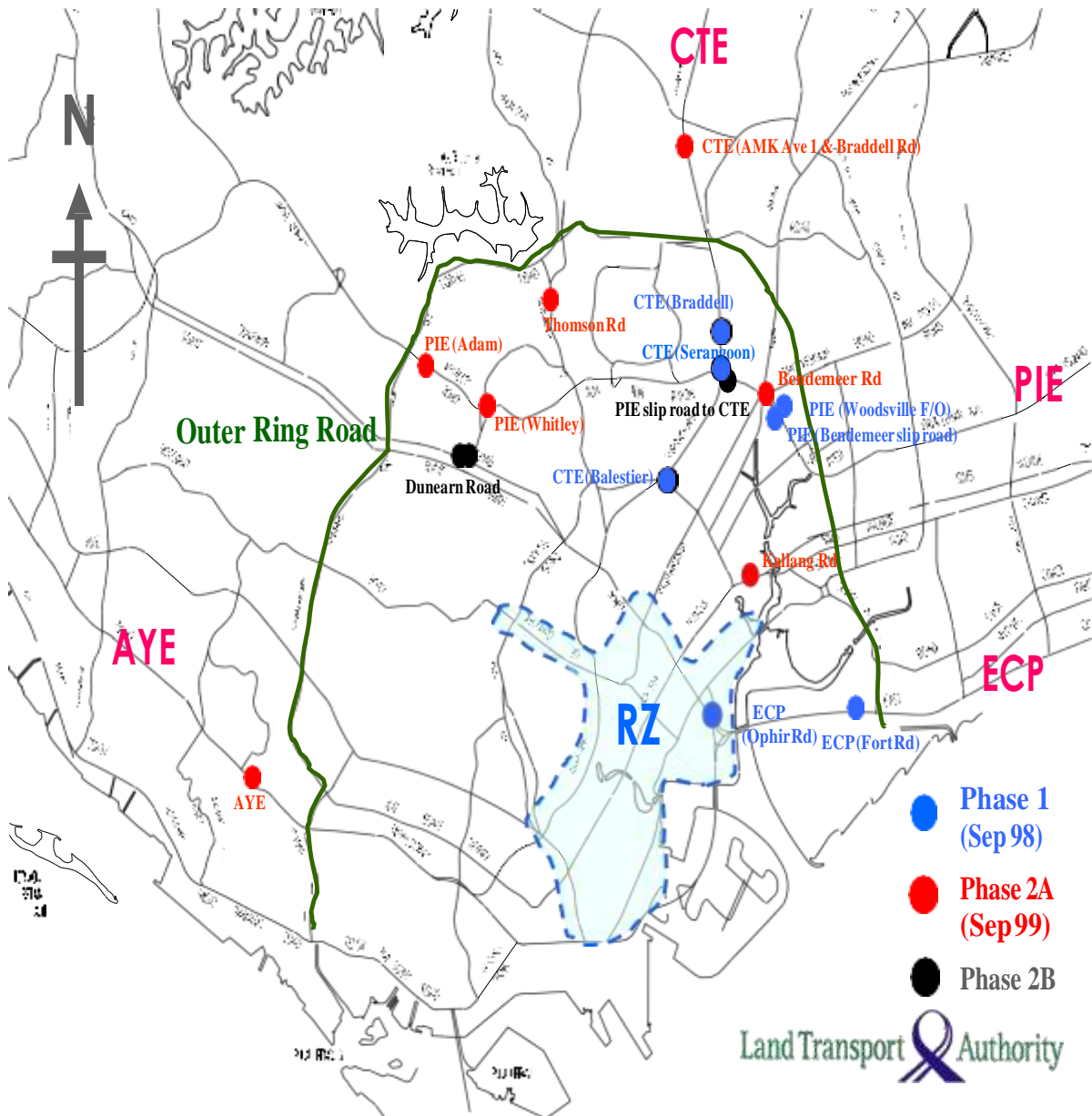
ATTACHMENT 2-MAP OF THE EXPRESSWAY ROAD NETWORK



ATTACHMENT 3-MAP OF SINGAPORE ROAD NETWORK (OPS & PLANNING & TRAFFIC LIGHTS).



ATTACHMENT 4-MAP OF OUTER RING ROAD



ITSO/OCC/SOP/GEN01.002	Singapore Road Network
------------------------	------------------------

ATTACHMENT 5- ROAD FURNITURE & SITE EQUIPMENT **A5a) EMAS SITE EQUIPMENT & SERVICE:**



Traffic Information Panel (TIP)



Travel Time Panel (TTP)



Traffic Signs Panel (TSP)



Tunnel Entrance Panel (TEP)



Tunnel Information Panel (TIP)



Lane Usage Signs (LUS)

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	14 of 21
File	Singapore Road Network		

A5a) EMAS SITE EQUIPMENT & SERVICES (CONTINUED):



Detection Camera



Surveillance Camera



Vehicle Recovery Service (VRS)



Land Transport Authority Traffic Marshals

:

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	15 of 21
File	Singapore Road Network		

A5b) GLIDE SITE EQUIPMENT:



Traffic Light (TL) poles with signal



TL signal push button (PB)



Regional Computer (RC) Cabin



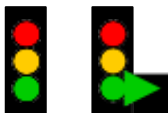
TL signal with countdown timer



Local TL controller box with number



Site Detector Loops



Conventional Traffic Signals



Left Turn Green Arrow (LTGA)



Full Control Right Turn (RAG)

A5c) OTHER ITS EQUIPMENT:

Electronic Regulatory Signs (ERS)



Junction Electronic Eyes (J-Eyes)



Parking Guidance Signs (PGS)

A5d) ROAD FURNITURE



Crush Cushion



Vehicular Impact Guardrail (VIG)

Doc No.	ITSO/OCC/SOP/GEN01.002	Page	18 of 21
File	Singapore Road Network		

ITSO/OCC/SOP/GEN01.002	Singapore Road Network
------------------------	------------------------

A5e) ROAD SIGNS:



Advance Directional Signs
– Mostly rectangular



Prohibitory Signs
– Mostly circular, with red border



Confirmation Directional Signs
– Rectangular, with chevron shape on one end to indicate direction



Warning Signs
– Indicated in a red triangle



Mandatory Signs
– Mostly circular, with blue background and white border



Information Signs



Doc No.	ITSO/OCC/SOP/GEN01.002	Page	19 of 21
File	Singapore Road Network		

A5e) ROAD SIGNS (CONTINUED):



Road Works-Work zone signs



Kilometer Sign

ATTACHMENT 6 - MAP OF ERP GANTRIES LOCATION