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Short Tunnel Operations

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DOCUMENT CONTROL

REV	DOCUMENT TITLE & COPY NUMBER	Date	Prepared by	Reviewed by	Approved by
0	Short Tunnel Operations Copy____of _____	15th December 2009	Dennis Pek (OE)	Alfred Loh (SOE)	Soh Ling Tim (MOPN)
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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

Abbreviations

EMAS	Expressway Monitoring Advisory Service
ITSO	Intelligent Transport Systems Operations
LTA	Land Transport Authority
LTM	Land Transport Authority Traffic Marshals
DM	Deputy Manager
OE	Operations Executive
OCC	Operations Control Centre
PTZ	Pan Tilt Zoom Camera
RC	Recovery Crew
SPF	Singapore Police Force
SCDF	Singapore Civil Defence Force
TM	Traffic Management
TP	Traffic Police
VRS	Vehicle Recovery Service
VMS	Variable Message Signs
IW	Integrated Workstation
ITPMS	Integrated Traffic and Plant Management System
FCP	Fallback Control Panel
WVT	Woodsville Tunnel
FCT	Fort Canning Tunnel
LSC	Local Sequential Controller
MCP	Master Control Panel
VZ	Ventilation Zone
DZ	Deluge Zone
FZ	Fire Zone
PMCS	Plant Monitoring and Control System
JFNG	Jet Fan Group
MCN	WVT Tunnel from Serangoon towards Upper Serangoon
MCS	WVT Tunnel from Upper Serangoon towards Bendemeer
MAC	WVT Tunnel from Macpherson towards Bendemeer

Section 1. Introduction

1.1 This document details the legislation, rules and procedures pertaining to the operations of short tunnels.

1.2 The objectives of this SOP are to provide information on the processes associated with the monitoring & operations of both tunnels (WVT & FCT), as well as providing guidelines to proper and expeditious handling of works/incidents in tunnels to ensure safety of the tunnel users.

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Section 2. Rules

2.1 This section highlights rules from the RTA that are in-place to support the short tunnel operations.

2.2 The various traffic rules in the RTA provide legislative powers and regulations for the LTA or its authorised agents to carry out its traffic operations. The Act empowers the Authority to regulate the behaviour of motorists in accordance to the rules.

2.3 Section 114 & 140 Chapter 276 of Singapore RTA defines both WVT & FCT as 'Road Tunnels'.

2.4 General restrictions in road tunnels and expressway tunnels
Except as otherwise directed or signaled by a police officer or conforming to any traffic sign, no person shall in any road tunnel or expressway tunnel

a) Stop any vehicle or permit it to remain at rest except when —
   i. Lawfully required to do so;
   ii. Compelled to do so by reason of accident, breakdown or emergency;
b) Enter therein on foot;
c) Alight from a vehicle except in an emergency or to summon assistance;
d) Use the horn, siren, whistle or any other noise making device except in an emergency;
e) Make any U-turn or reverse a vehicle
f) Change a tyre or wheel
g) Refuel or repair a vehicle
h) Propel a vehicle by pushing it, whether manually or by other means.

2.5 General restrictions in road tunnels and expressway tunnels
No person shall drive or cause or permit to be driven in or cause to remain in any road tunnel or expressway tunnel any of the following vehicles:

a) A vehicle which is not carrying sufficient fuel in its fuel tank to enable it to be driven through
b) A vehicle carrying animals or poultry which are not properly controlled or confined, or carrying garbage, fine particles or other similar materials which are not sufficiently covered.
c) A vehicle which is carrying any flammable or explosive substances

d) A vehicle with a load or the cover of the load, not properly secured so as to prevent such cover or any part of the load from falling off or coming into contact with the road, the tunnel structure or its fittings or fixtures; A vehicle carrying a person standing on the outside of the vehicle or seated with any part of his person overhanging the sides or rear of the vehicle
e) A vehicle whose overall height (including any load) is 4.5 metres or above.
f) A vehicle whose overall width (including any load) exceeds 2.6 metres
g) A vehicle whose overall length (including any load) exceeds 13 metres
h) A trailer conveying a standard container
i) A tanker carrying diesel fuel.

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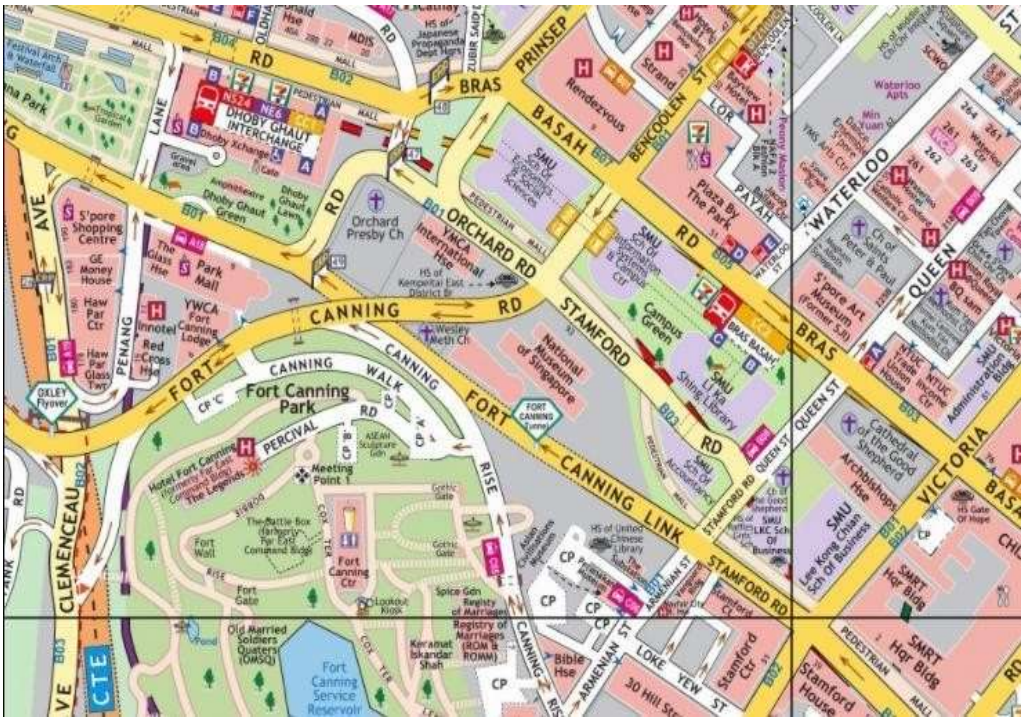
Section 3. Woodsville Tunnel (WVT) & Fort Canning Tunnel (FCT)

3.1 The Fort Canning Tunnel

3.1.1 The FCT is a 350m long, 3 lane one directional arterial road tunnel that runs below Fort Canning Park extends from the junction of Armenian Street and Stamford Road in a general north westward direction and goes into a road tunnel known as Fort Canning Tunnel and emerges at an end by joining Penang Road.

The arterial roads that are near FCT corridor are Armenian Street, Queen Street, Stamford Road, Hill Street, Victoria Street and Penang Road.



3.2 The Woodsville Tunnel

3.2.1 The Woodsville Tunnel consists of 3 tunnels running below existing PIE flyover connecting Serangoon Road, Upper Serangoon Road, Bendemeer Road and Macpherson Road and an Electrical and Mechanical (E&M) Facility Building.

The north tunnel (MCN) is 2 lanes, 260m long connecting Serangoon Road and Upper Serangoon Road. The south tunnel (MCS) is 2 lanes to 3 lanes (40m), 245m long connecting Upper Serangoon Road and Bendemeer Road. The Macpherson tunnel (MAC) is single lane 185m long connecting Macpherson Road and Bendemeer Road. All three tunnels have a road shoulder of 2m. The speed limit of all three tunnels is 50km/h.

There is a depressed section at each tunnel entrance and exit except for MAC where there is only depress section at its entrance and its exit end at the south tunnel.

Section 4. Handling and Managing Roadworks

4. 1 Responsible Persons

4.1.1 Deputy Manager (DM)

4.1.2 Operations Executive (OE)

4.2 Planned Roadworks

4.2.1 Contractors will call to book in for roadworks. OE to manage as per SOP.

4.2.2 Allowable working hours in Tunnels

a. For one lane closure

Monday to Friday 2300 to 0500 hrs (Slow lane only)
0001 to 0500 hrs (Centre or Fast lane)

Sunday 0830 to 0500 hrs

Friday, Saturdays and eve of public holidays - ***NO work allowed.***

Work requiring two lanes closure will only be allowed between 0001hrs and 0500hrs.

b. Slip Roads

Require total closure and need to be gazetted and announced/published over mass media at least two weeks in advance.

4.3 Application to work

4.3.1 Before commencement of work, an EMAS Work application to work in tunnel must be submitted and approved by the ITSO EMAS Officer at least 7 (seven) working days before first date of work. A detail work program must be attached with the application. Application is available online through https://prompt.lta.gov.sg.

4.3.2 Priority will be based on urgency and first-come-first-served basis.

4.3.3 DM/OE has the right to stop all works that are affecting the safety of the tunnels users and/or causing congestion in the tunnels, even though approvals have been given for such works to be carried out in the tunnels.

4.4 Safety

4.4.1 The following must be strictly complied with;

i. Notify EMAS OE in ITSO Control Centre at Tel no: 6332 6428 before commencement of each activity (work), change of lane and upon completion of each activity (work).

ii. Obey all existing road/traffic rules and regulations.

a. Provide all necessary temporary traffic and directional signs, warning lamps, rubber cones, etc as required by the LTA Code of Practice Traffic Control at Work Zone throughout the duration of work.

b. All workers, supervisor, etc, must put on reflective vests at all times when working in the tunnels.

c. All vehicles used in the work must clearly display flashing revolving lights throughout duration of work. A vehicle with truck-mounted attenuator (**TMA**) attached **must** be provided at the site.

d. Work area will be according to the approved work program submitted. Any amendment is subject to exigency of work.

e. Maintain two-way communications with the control room duty officer.

f. There shall be no smoking in the tunnels.

g. Contractors working in the tunnels must co-ordinate with one another to ensure smooth flow of traffic in the tunnels and safety of the tunnels users.

h. Comply all instructions (in regard to lane closure and safety) by EMAS Officer, ITSO Operator, Traffic Police or other relevant authorities.

Section 5. Handling of Urgent or Emergency Ad-hoc Roadwork

5.1 Urgent Ad-hoc Road Works

5.1.1 Notification of urgent ad-hoc road works received can be from external agencies officers, LTA officers, contractors, VRS report, LTM report, spotted from PTZ, TP, members of public or due to an incident resulting in a need for road works

5.1.2 If OE is the one who received such urgent request, he / she is to inform the DM, who will decide if approval can be given for the urgent road works.

5.1.3 DM shall decide based on the following factors:

a. If the work left undone, does it pose an immediate danger to all road users or members of public or will result in a total closure of short tunnel, reclassify as emergency road works (refer to sub-section 4.2 for the appropriate actions).

b. If not, DM shall assess the impact on the flow of traffic if the roadwork is to be allowed. If it were to likely cause congestion or involve total tunnel closure before 0100hrs, do not allow the urgent roadwork. Re-schedule it to be carried out at after 0100hrs for road closures or to a time least likely to cause congestion i.e. after peak hours.

5.1.4 After consideration of the above factors and if DM gives the approval for an ad-hoc urgent roadwork to be carried out, DM shall direct the affected zone OE to take down the details of the urgent road works.

5.1.5 The OE will then open an incident record and implement the messages accordingly and manage the situation. OE shall also inform TW of the lane or lanes closure.

5.2 Emergency Ad-hoc Road Works

5.2.1 Notification of emergency ad-hoc road works received can be from external agencies officers, LTA officers, contractors, RC report, LTM report, spotted from PTZ, TP, members of public or due to an incident resulting in a need for road works.

5.2.2 If OE is the one who received such emergency request, he/she is to inform the DM, who will verify with the notifying source that if the emergency road work is not carried out it will pose an immediate danger to all road users or members of public or result in a total closure of short tunnel. If it does not, re-classify it as an urgent ad-hoc roadwork (refer to sub-section 4.1 for the appropriate actions)

5.2.3 If it does, DM shall give immediate approval and escalate to the management via sms, inform traffic watch, TP, the relevant agencies and traffic planning team (if adjusting of traffic light is involved)

5.2.4 DM is to follow up with a fax to TP and TW so that the latter can broadcast over the media to keep all motorists informed.

5.2.5 The OE will then open an IR and implement the VMS messages accordingly and manage the situation.

5.2.6 The DM will have to maintain close contact with the work party on the progress of the work and update the management and the relevant agencies until the work is completed and short tunnel is reopened.

Section 6. Handling & Managing of Road Incidents

6.1 Road incidents occurring in short tunnels, upon detection shall be promptly managed. Traffic accidents and vehicle breakdowns are generally categorized under road incidents. The complexity may vary from minor to major. OE will need to rely on their knowledge of the system, the road network, their initiative, intelligence and experience to better handle any incident encountered. The aims are to ensure safety to the tunnel users and to clear the incident at the soonest possible.

6.2 Handling Vehicle Breakdowns

6.2.1 Notification of vehicle breakdowns received can be from external agencies officers, LTA officers, contractors, RC report, LTM report, spotted from PTZ, TP or members of public. Upon confirmation of information, OE is to send VRS and LTM to site. The OE will then open an IR, implements the appropriate signaling plan and manage the situation.

6.2.2 With the aid of PTZ, OE can then monitor the incident site and traffic condition of which use to determine the length of congestion. Occurrences especially unusual ones are to be recorded in the comment entries. OE must also check to ensure that the right messages and LUS are displayed.

6.2.3 On arrival of VRS or LTM (Response Time: 8 mins), OE will gather essential information such as vehicle registration number, type of breakdown, number of passengers, whether Class 5 towing required. In the event no petrol causes the breakdown, LTM will summon the driver. As of 2012 only FCT incident necessitate the activation of LTM. For incident at WVT, it will be based on Ad-Hoc basis. The activation of LTM to WVT required the approval of DM.

6.2.4 Once VRS towed the breakdown vehicle(s), OE will close the IR and default the VMS and LUS.

6.3 Handling Traffic Accidents

6.3.1 Notification of traffic accidents received can be from external agencies officers, LTA officers, contractors, RC report, LTM report, spotted from PTZ, TP, SCDF control room or members of public. Upon confirmation of information, OE is to send VRS and LTM to site. The OE will then open an IR, implement the appropriate signaling plan and manage the situation.

6.3.2 When motorist(s) are observed to be injured, OE shall notify TP and SCDF and provide information such as specific location, traffic situation, number of lanes affected, number of casualties, PTZ to view the accident and access route.

6.3.3 With the aid of PTZ, OE can then monitor the incident site and traffic condition of which use to determine the length of congestion. Occurrences especially unusual ones are to be recorded in the comment entries. OE must also check to ensure that the right messages and LUS are displayed if not modify accordingly. In addition, OE is to check congestion area CO level.

6.3.4 On arrival of VRS or LTM (Response Time: 8 mins), OE will gather essential information such as vehicle registration number, number of lanes affected, number of casualties (any trapped person(s) in accident vehicles), government property damaged and oil spillage. OE shall take command and control of the situation. As of 2012 only FCT incident necessitate the activation of LTM. For incident at WVT, it will be based on Ad-Hoc basis. The activation of LTM to WVT required the approval of DM.

6.3.5 OE is to instruct LTM is to conduct On-Scene-Investigation (OSI) before the arrival of TP when accident involved cause damage to government property, foreign vehicle or casualty conveyed by ambulance.

6.3.6 If casualty/casualties are conveyed, VRS will inform OE the extent of injuries sustained, whether conscious or unconscious when conveyed. OE shall update TP of current situation and seek permission to shift accident vehicles from lane (to shoulder) to reduce the impact of congestion.

6.3.7 OE will call One-Call Center to report any government property damaged, make entries in IR and update the record on government property-damaged-file.

6.4 Short Tunnel Total Closure

6.4.1 A traffic accident or fire in the tunnel could necessitate total closure of the tunnel. If there is immediate danger or if all lanes are impassable to traffic, DM shall give immediate approval to close the tunnel on both bounds.

6.4.2 If it does, DM shall escalate to the management via sms, inform TW, TP, the relevant agencies and traffic planning team (if adjusting of traffic light is involved). DM is to follow up with a fax to TP and TW so that the latter can broadcast over the media to keep all motorists informed.

6.4.3 OE shall inform VRS and LTM DO to deploy their men to tunnel entrances to prevent vehicles from entering. OE will then open an IR and implement the appropriate closure messages on VMS and manage the situation. If needed, open new IRs for other adjacent affected arterial roads and relate it to the closure incident IR.

6.4.4 OE will take the following concurrent actions before the arrival of response teams:

a) Implement full tunnel closure message on LUS and VMS and activate tunnel closure traffic light scheme

b) Make announcements through RBBI to initiate evacuation

c) Activate appropriate beacon lights to warn motorist of the emergency

d) Facilitate traffic downstream of the incident to leave the tunnel

e) Mitigate traffic impact to adjacent roads.

6.4.5 For WVT, the entrance ramp barrier and traffic signal are not integrated into the proposed plan by IW or ITPMS. Therefore, OE has to click on the icon display on IW tunnel schematic or ITPMS schematic to control the equipments. Prior to that, OE need to first change the traffic signal from green, amber to red. Thereafter, check the surrounding of tunnel entrance for oncoming vehicles before bringing the ramp barrier down.

6.5 WVT Radio ReBroadcast Break-In (RBBI)

6.5.1 During Emergency Tunnel Closure an announcement such as "This is an emergency announcement from the LTA. If you are able to proceed, please drive out of the tunnel immediately. If you can't, please do not attempt to reverse. Stop your vehicle and turn off your engine. Walk and leave the tunnel."

6.5.2 Concurrently, RBBI broadcast for FCT can only be done on RBBI console. As for WVT, RBBI can be activated using IW, ITPMS and RBBI consoles. RBBI messages are stored in four languages. OE is to verify the correct message by running a preview before broadcasting.

6.6 Traffic light adjustment in the event FCT is closed

Traffic situation	Upstream traffic light junction from tunnel	Downstream traffic light junction from tunnel	Traffic light phase to increase	Traffic preemption / Incident manager (plan no)	Nearest CCTV camera to view site situation
If Stamford Rd is congested	506		A	20003	CAM 20901, JEYE 100505 and 100506
If Armenian Street is congested			B	20003	
Alternate route to bypass FCT		507	A	NIL	JEYE 100507
Flushing traffic along Penang Rd		420, 419, 421 and 422	A	20005	CAM 20904, JEYE 100421 and 100508

6.7 Traffic light junctions at Woodsville Tunnel

6.7.1 In the event of emergency situation e.g. fire in the tunnel. There is a need to clear the vehicles at the down stream of Woodsville tunnel exits. This is to prevents motorist been blanket by the smoke that was push down stream by the tunnel ventilation system during fire. In additional the emergency services may access the incident location through the incident down stream.

6.7.2 To prevent vehicle trapped in the down stream of incident, the first two/three traffic light junctions at the down stream of the exit will be change to green to allow the affected motorist to have a "Green wave" after the tunnel exits.

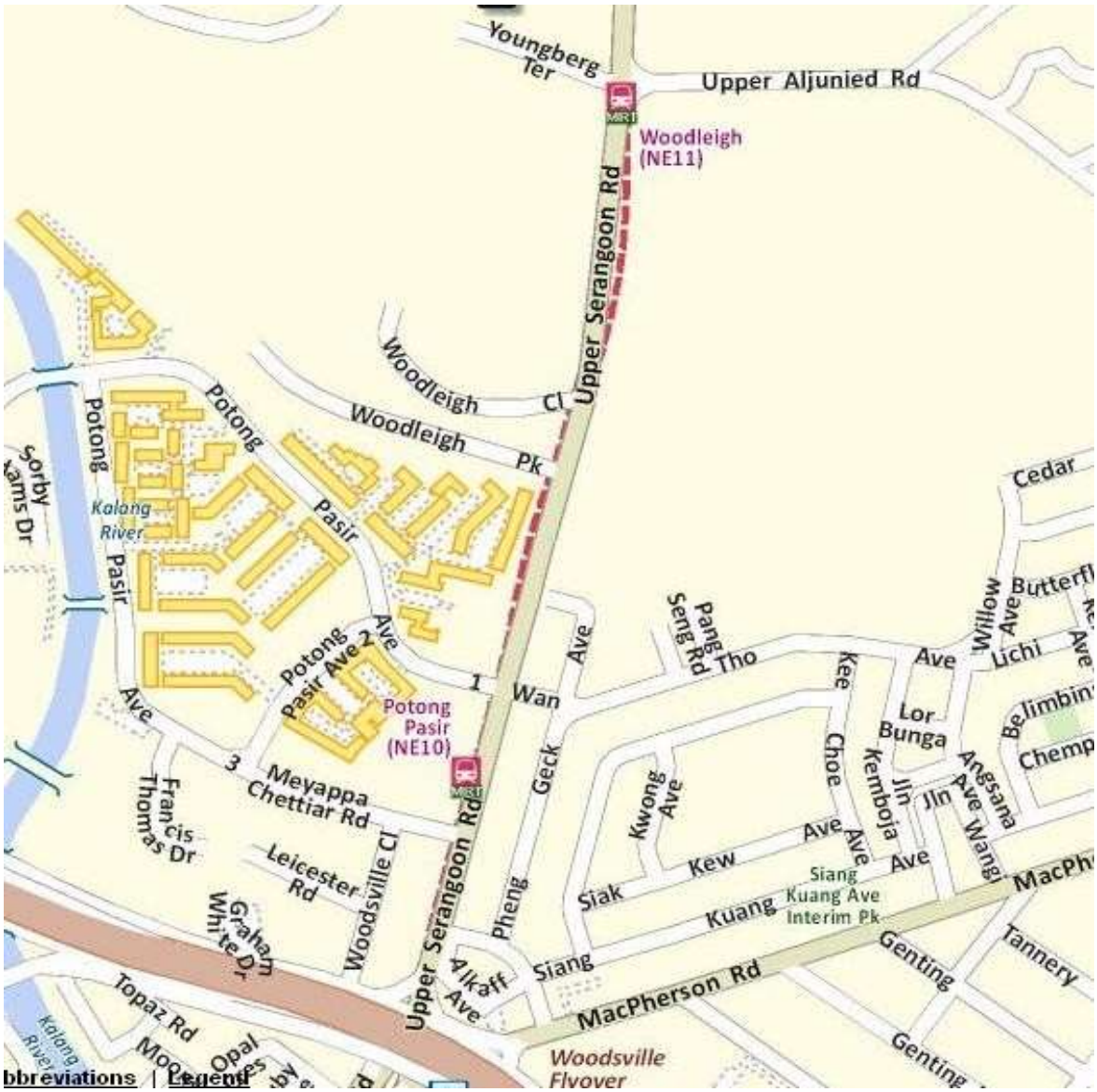
6.7.3 Below are the details of the traffic junction location and the associate special phase number.

Tunnel Traffic Light Junction and Number

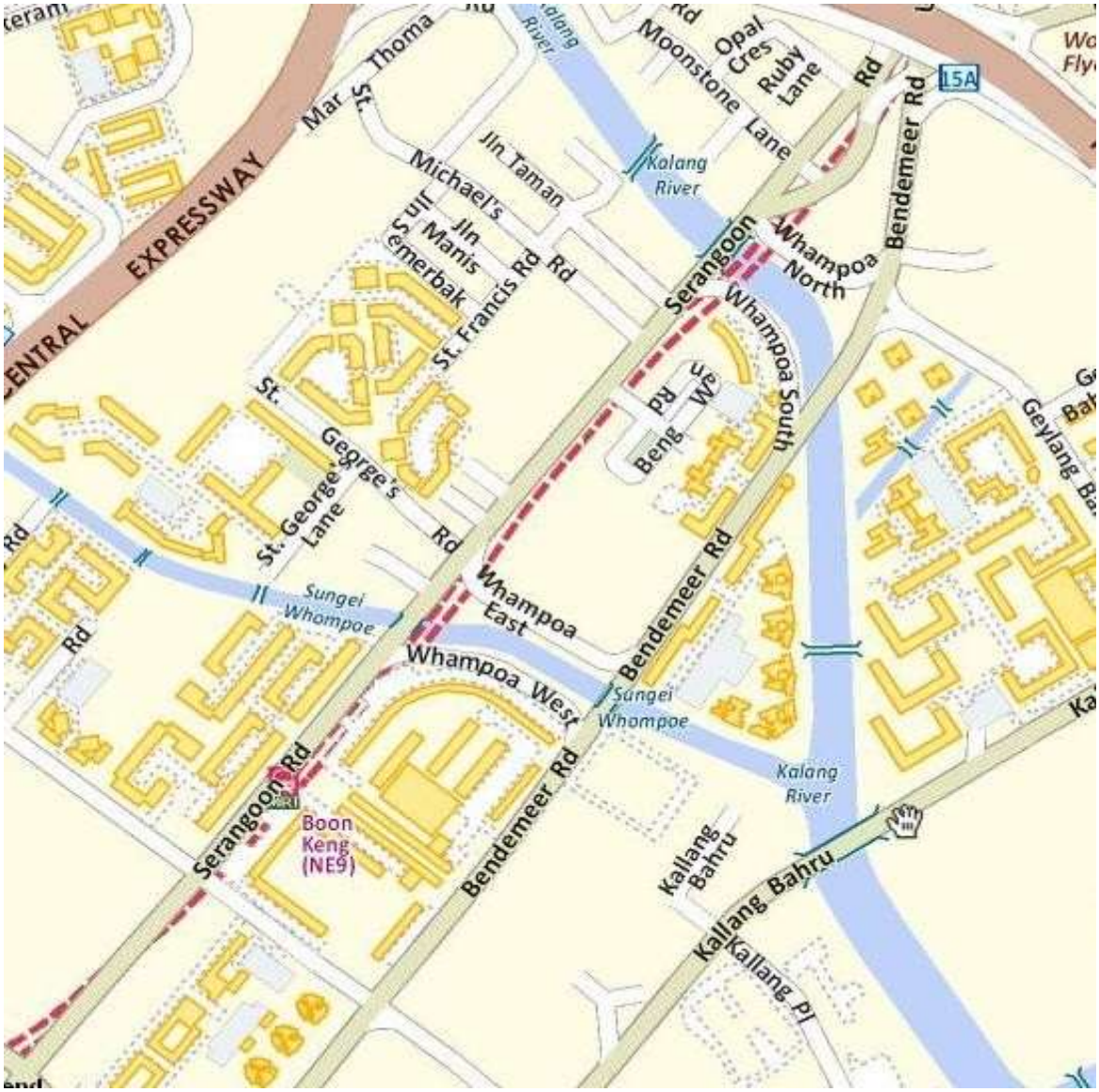
MCN Int 7221 – Upp Serangoon Rd / Wan Tho Ave
Int 7217 – Upp Serangoon Rd / Upp Aljuneid Rd

MCS Int 811 – PC near Blk 44
Int 812 – PC near Kallang Tengah
Int 813 – Bendemeer Rd / Boon Keng Rd

WVT Tunnel	Alternate route to bypass WVT	Traffic light junction	Traffic light phase to increase / dwell	Nearest CCTV camera to view site situation
Upp Serangoon Rd> Bendemeer Rd	Jln Toa Payoh junction	7231 and 7232	B	PTZ 5997, JEYE 107231, CAM 21915, 21914, 21913
Macpherson Rd> Bendemeer Rd	Jln Toa Payoh junction	7231 and 7232	G	PTZ 5997, JEYE 107504, 207231, CAM 21963, 21961
Serangoon Rd> Macpherson Rd / Upp Serangoon Rd	Jln Toa Payoh junction	7231 and 7232	D	JEYE 307231, CAM 21902, 21904



Affected traffic light along Upper Serangoon Road for "Green Wave" during WVT MCN emergency closure



Affected traffic light along Bendemeer Road for "Green Wave" during WVT MCS emergency closure

Section 7. Handling & Managing of Fire Incidents

7.1.1 Notification of fire incidents received can be from external agencies officers, LTA officers, contractors, RC report, LTM report, spotted from PTZ, TP, SCDF control room or members of public. Upon confirmation of information, OE is to send VRS and LTM to site. The OE will then open an IR, implement the appropriate signaling plan and manage the situation.

7.1.2 OE shall execute traffic assigning plan to activate ventilation emergency mode, close tunnel, RBBI announcement, and activate beacon lights.

7.1.3 OE shall activate the emergency fire plan based on the correct zone. Activation of fire plan will trigger RBBI announcement to initiate evacuation, implement messages on VMS for total closure and changes on LUS.

7.1.4 Unique to WVT, the entrance ramp barrier and traffic signal are not integrated into the proposed fire plan by IW or ITPMS. Therefore, OE has to click on the icon display on IW tunnel schematic or ITPMS schematic to control the equipments. Prior to that, OE need to first change the traffic signal from green, amber to red. Thereafter, check the surrounding of tunnel entrance for oncoming vehicles before bringing the ramp barrier down.

7.1.5 The main difference between CTE Tunnel Fire Plan and Short Tunnel Fire Plan is that in CTE the activation of Traffic Fire Plan are activated separately from Plant Fire Plan whereas for Short Tunnel the activation of the Tunnel Fire Plan is both inclusive of Traffic Fire Plan and Plant Fire Plan.

7.1.6 Rendezvous (RV) point in the event of <u>Fire Incident in Ford Canning Tunnel(FCT)</u>

Possible response route to fire incident by rescue agencies:-

a) Approaching from Stamford Road and if the Stanford Road is jammed, rescue agencies are to approach tunnel via Armenian Street. More green time will be given to Armenian Street to facilitate fast response from rescue agencies.

a) Approaching from Armenian Street and if Armenian Street is jammed, rescue agencies approached tunnel via Stamford Road. Traffic will be diverted towards Queens Street direction and more

green time will be given to Stamford Road to facilitate fast response from rescue agencies.

7.1.7 Five RV points in the event of Fire Incident in Woodville Tunnel(WVT)

Fire at MCN Tunnel	**Fire in MCN Tunnel (Jam on Serangoon Road)**
Possible response route to fire incident by rescue agencies: Point (1) approached tunnel via Serangoon Road Point (1) approached tunnel via Macpherson Road Point (4) & (5) approached from via Upper Serangoon Road (Sengkang)	Recommended route : a) approached tunnel from Jalan Toa Payoh into Upper Serangoon Road. U turn into MCN travelling in opposite direction. b) approached tunnel from Macpherson Road making a u turn into Serangoon Road via Whampoa North into MCN Tunnel
Fire in MCS Tunnel	**Fire in MCS Tunnel (Jam on Upp. Serangoon Rd)**
Possible response route to fire incident by rescue agencies: Point (5) approached tunnel via Upper Serangoon Road Point (2) approached tunnel via Macpherson Road Point (5) approached from PIE via Jalan Toa Payoh	Recommended route : a) approached tunnel via Upper Serangoon Road (Sengkang) and u turn at Potong Pasir Ave 1 junction. b) approached tunnel from Bendemeer Road, making u turn into MCS travelling in opposite direction

Fire in MAC Tunnel (single lane carriage way)	Fire in MAC Tunnel (Jam on Macpherson Road
Possible response route to fire incident by rescue agencies: Point (3) Approached tunnel via Macpherson Road Point (2) & (5)Approached tunnel via MCS	Recommended route : a) Approached tunnel via MCS and enter MAC at adjoining tunnel section. c) approached tunnel from Bendemeer Road, making u turn into MCS travelling in opposite direction and enter MAC at adjoining tunnel section.

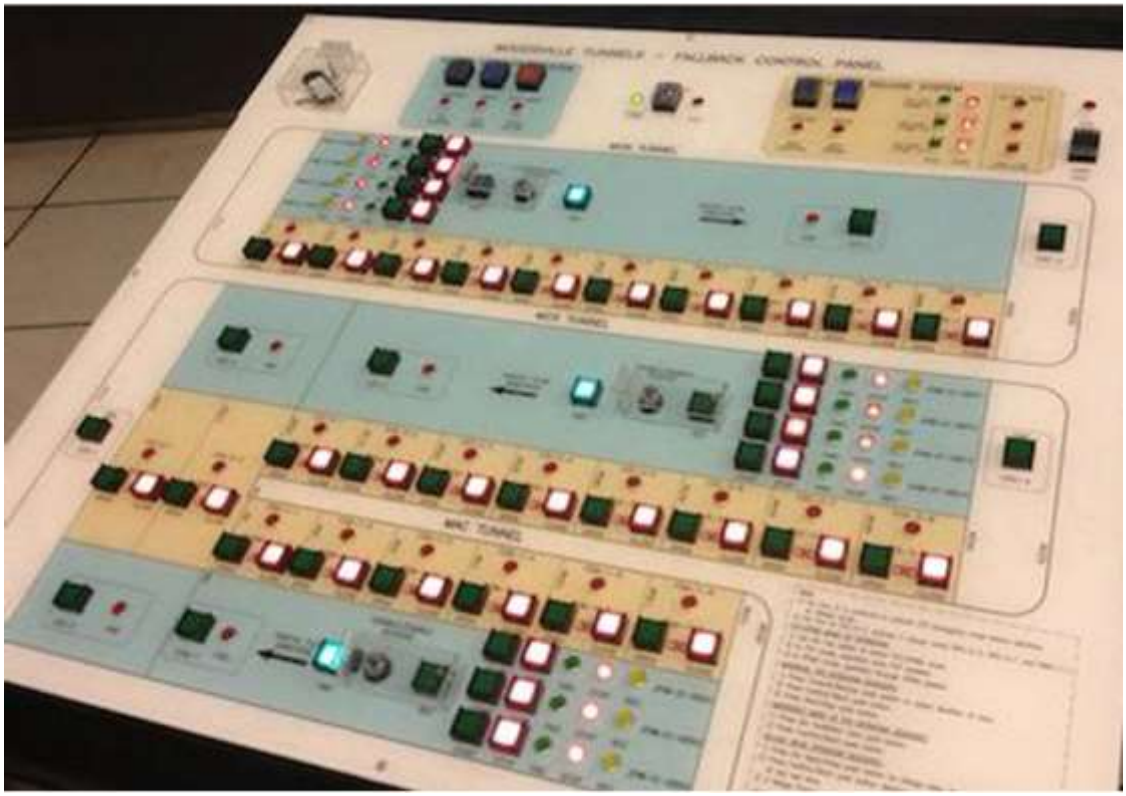
7.2 Deluge System

7.2.1 The primary means of fire zone detection is the LHD (Linear Heat Detection) alarm. Once fire had been detected, deluge will activate if timer is not stopped within 180 seconds.

7.2.2 Deluge system is unique to WVT and the activation of deluge is done remotely using ITPMS or IW. It can be activated either manually or fire response plan.

7.2.3 In the event of ITPMS / IW failure, OE shall activate through the Fallback Panel inside OCC. It is important to select the appropriate deluge zones (The fire zone plus the zone upstream). OE shall then inform SCDF the deluge zones being activated.

7.2.4 If activation of deluge cannot be done remotely at OCC, OE shall instruct resource to activate the deluge using **Deluge Main Control Panel** which is located at the **WVT FB** or **Deluge Local Control Panel** at the **Niche** in the **WVT tunnel** but if all else fails then the resource will use the deluge valve located inside emergency niches along the tunnels. To operate the Deluge Master Control Panel or Deluge Local Control Panel the panel key is located within a break glass panel.



7.3 Tunnel Ventilation System (TVS)

7.3.1 TVS is designed to provide an acceptable air quality and visibility inside the tunnel under normal/congestion traffic conditions and also to provide an effective means of controlling smoke flow during emergency.

7.3.2 TVS under normal circumstance is set in 'Auto' mode by Local Sequential Controller (LSC) with aid of Air Monitoring System (AMS). For manual control, OE is to set the mode to 'Semi-Auto'. Under 'Emergency' mode, OE can manually activate any fan(s) without the 15 minutes interlock.

7.3.3 FCT has only one ventilation zone whereas WVT has total of 7 ventilation zones. Therefore, it is important for OE to select the correct zone.

Appendix 1

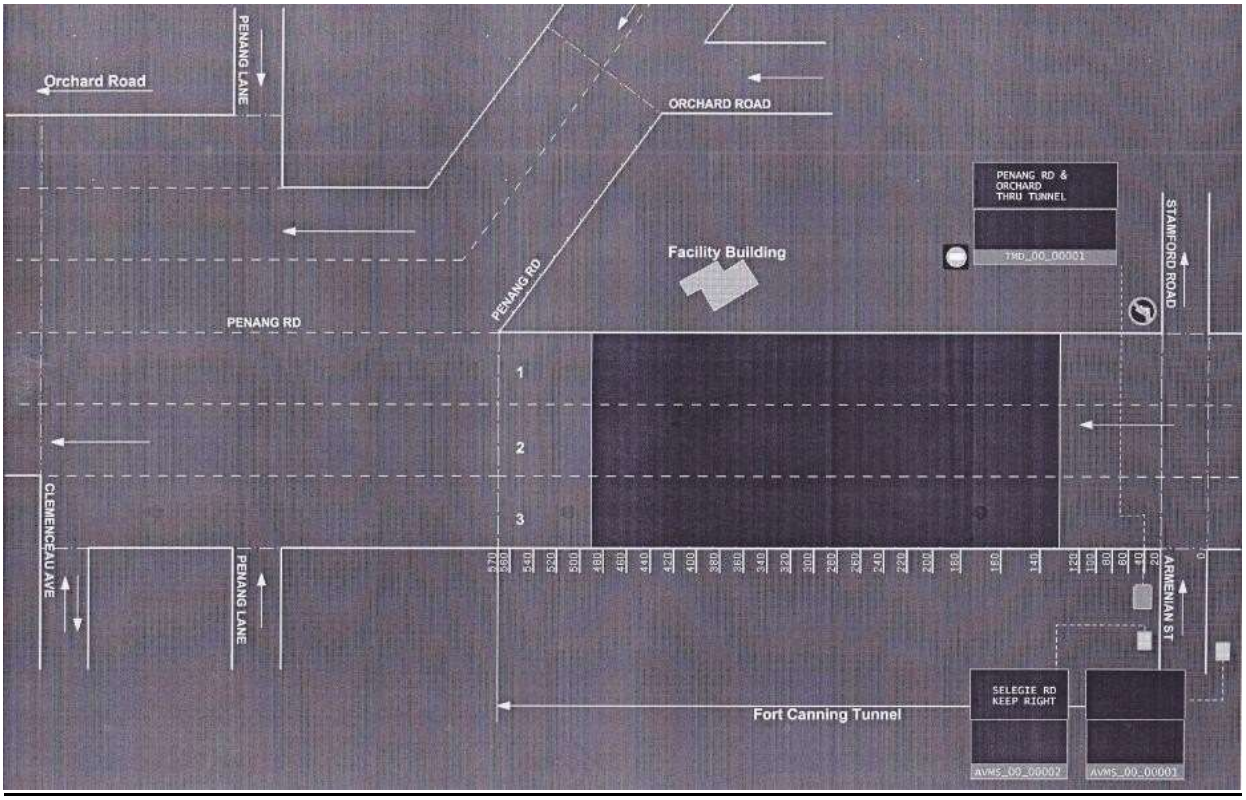


Figure 1 FCT : VMS Numbering and Locations

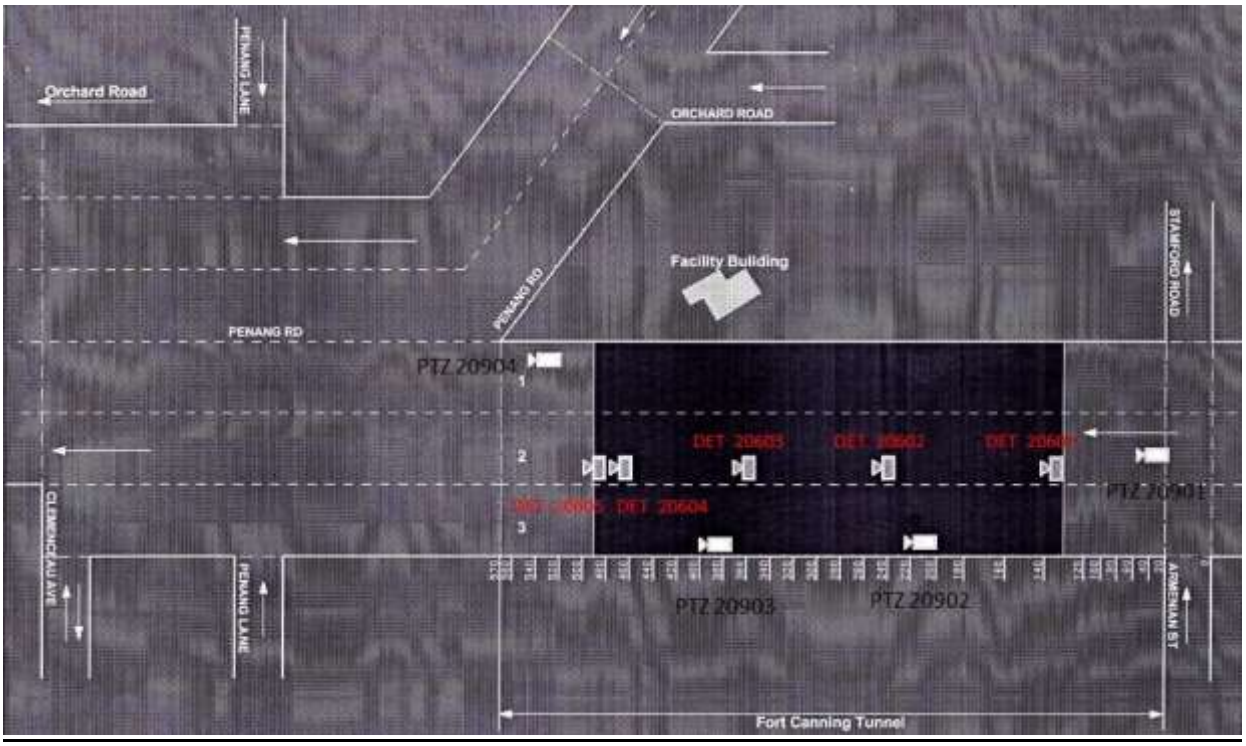


Figure 2 FCT : AID & PTZ Cameras Numbering and Locations

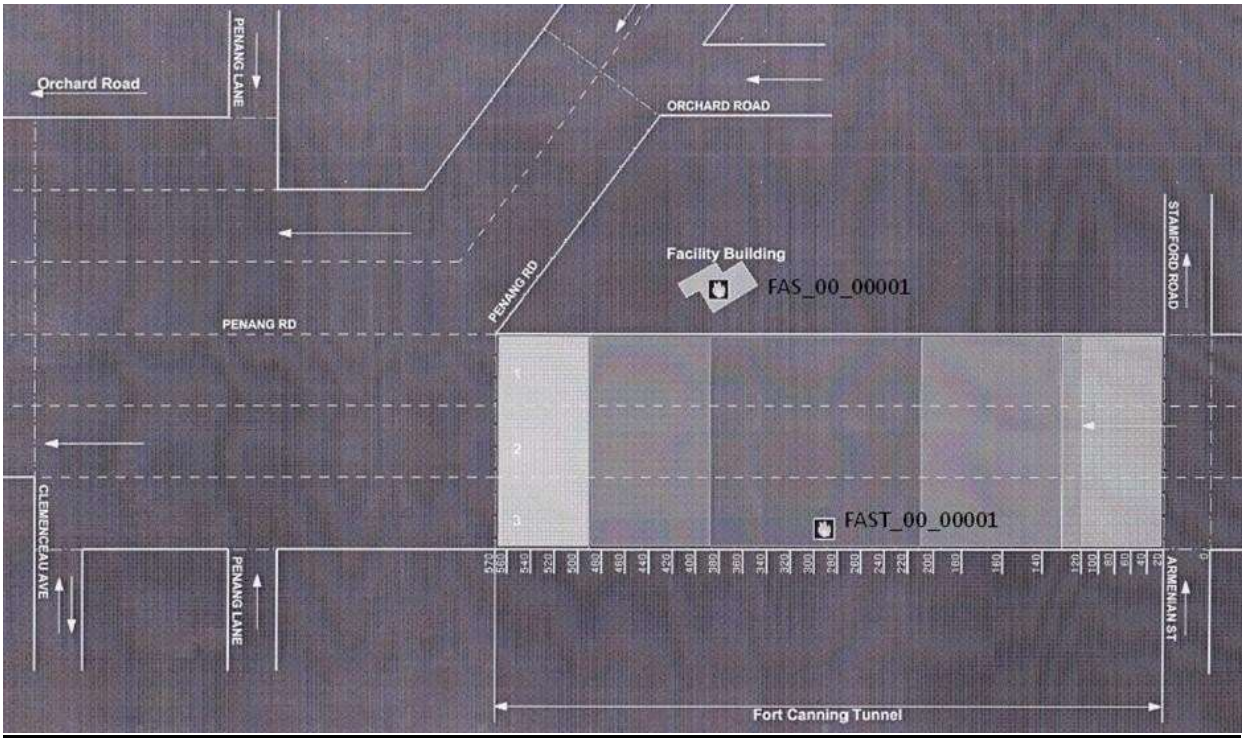


Figure 3 FCT : Fire Zone

Appendix 2

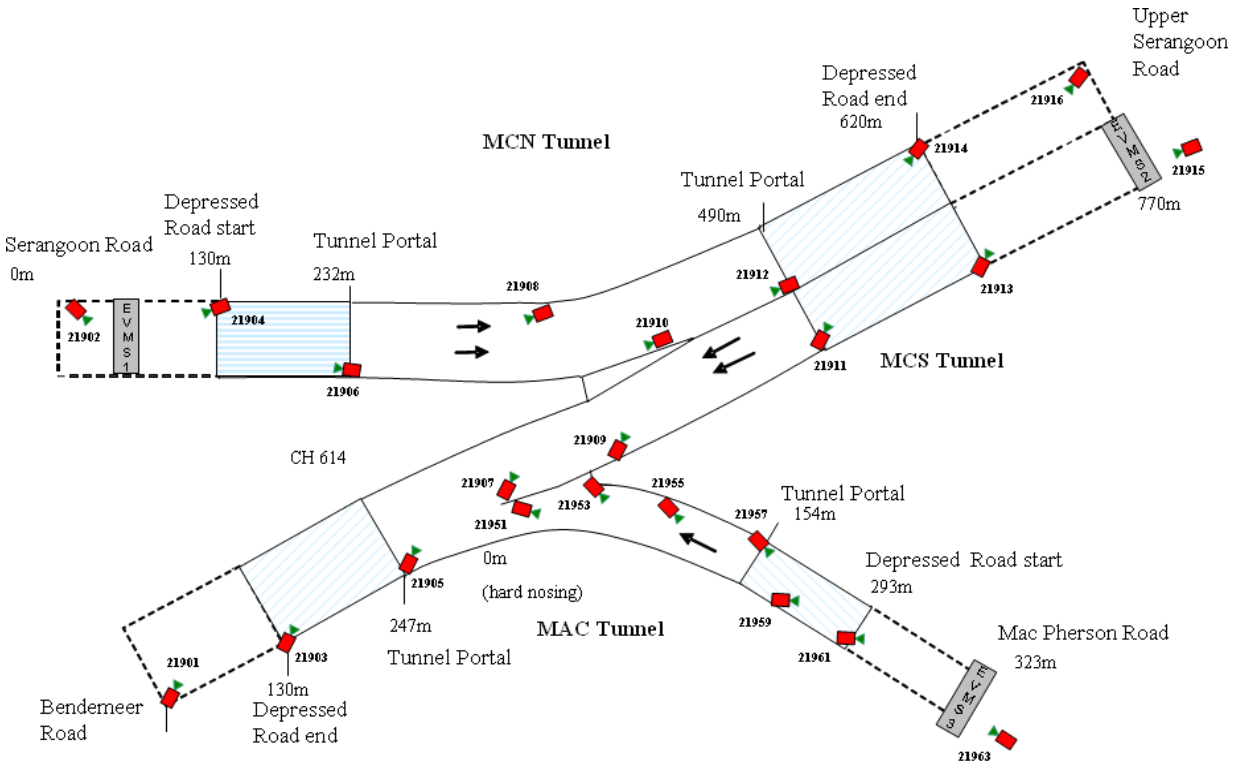


Figure 4 WVT : Tunnel CCTV Numbering and Locations

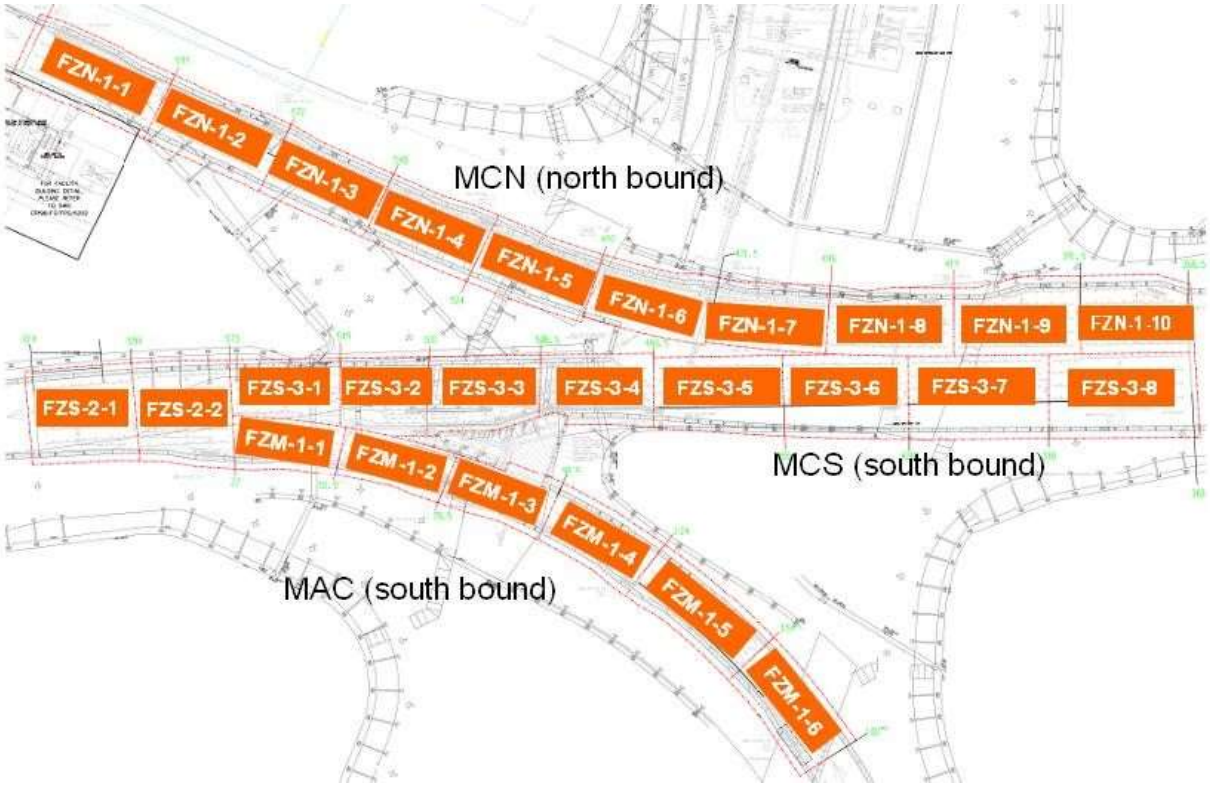


Figure 5 WVT : Tunnel Fire Zones

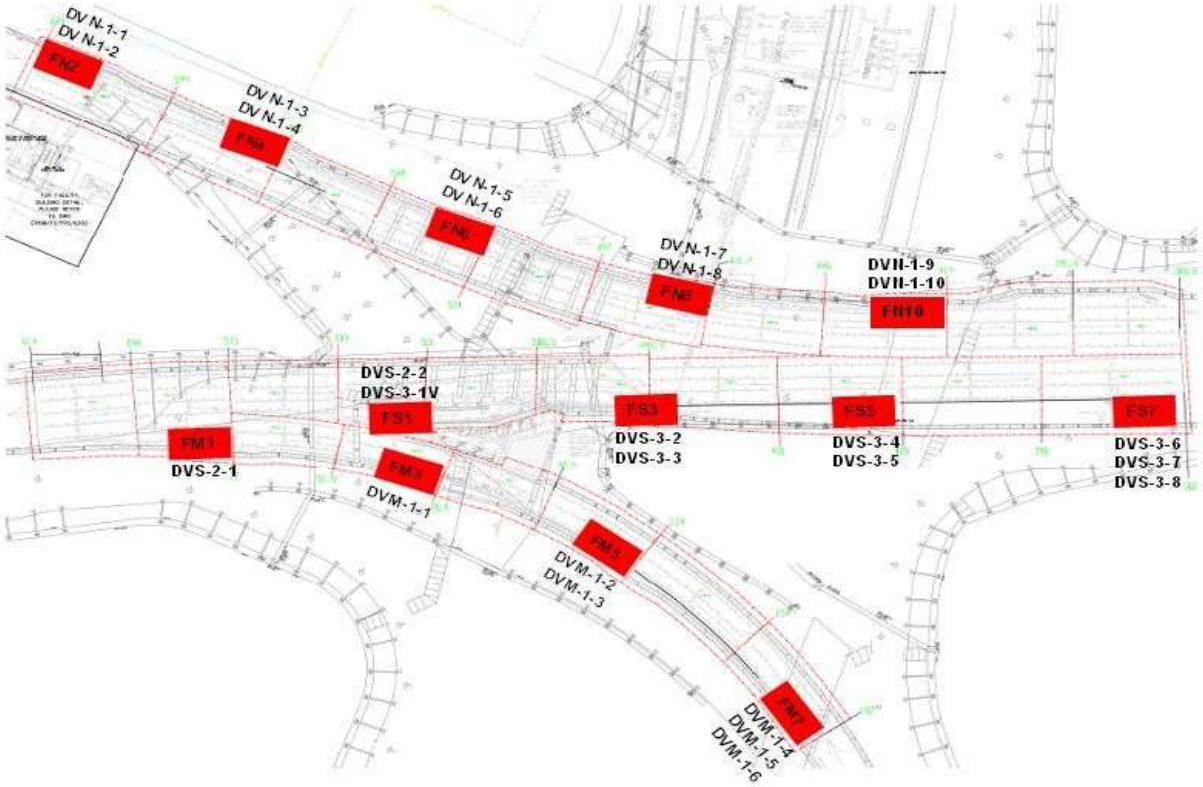


Figure 6 WVT : Deluge Valve Location in Emergency Niches

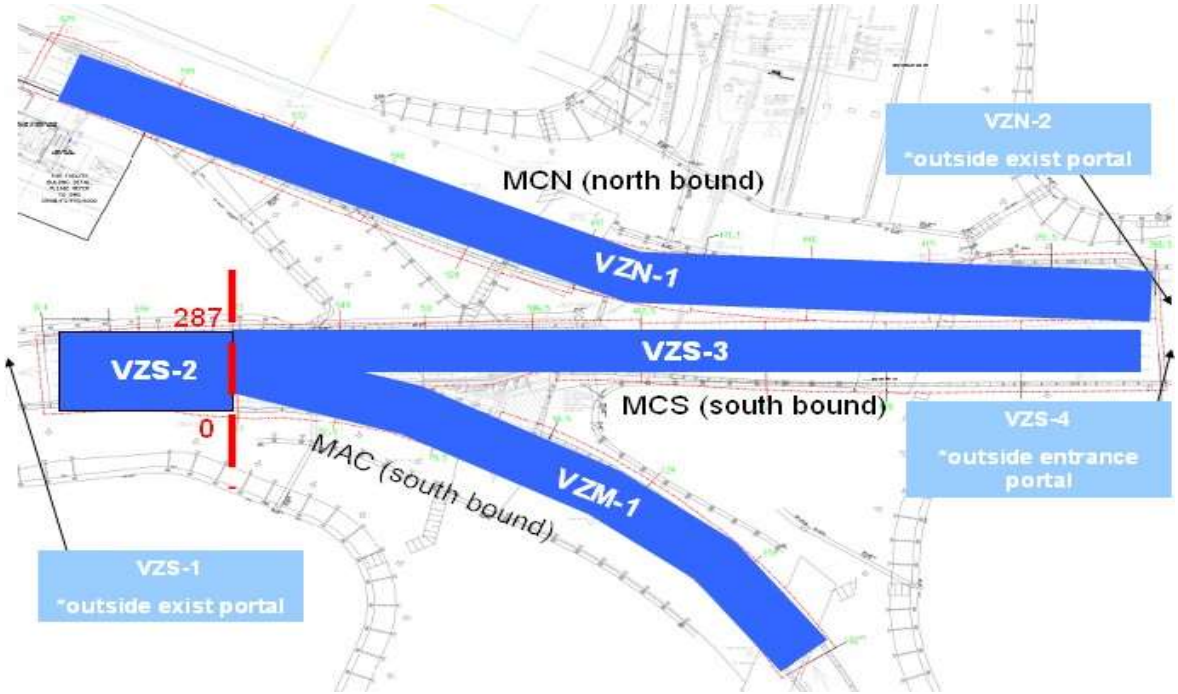


Figure 7 WVT : Tunnel Emergency Tunnel Ventilation Modes

Figure 8 WVT : VMS Numbering and Locations