



3rd European Tunnel Safety Officers Forum
26-28 March 2014

Tunnel Safety - a Joint Effort

Emergency Response Planning

Stakeholders Plan and Procedures

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Tunnel Safety Officer

Hindhead Tunnel

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Case Studies

Two Emergency Response Planning Scenarios will be discussed:

- Hindhead Tunnel, Surrey United Kingdom – *Role; Tunnel Safety Officer*
- Hai Van Tunnel, Da Nang, Vietnam – *Role Emergency Planning Coordination and Fire Team Training*

Planning Process

- Stakeholder engagement / consultation
- Understand resources available
 - Tunnel Operator
 - External Emergency Services / Support Agencies
 - Tunnel Systems and operational philosophy
- Understand capabilities and limitations
- Develop plans and procedures complimenting local and regional plans
- Test plans and procedures for effectiveness



Hindhead Tunnel Joint Emergency Services Response Plans and Procedures

Emergency Services Documentation

- Surrey Major Incident Plan
- Highways Agency Area 3 Contingency Plan
- Tunnel Emergency Plan
- Joint Emergency Services Response Plan
 - Tunnel Operator Procedures
 - Surrey Fire & Rescue Service - S.I.P (Specific Incident Plan)
 - Surrey Police - Speed Sheet
 - South East Coast Ambulance Service - Speed Sheet
 - Vehicle Recovery Services Speed Sheet

Joint Emergency Services Response Plan

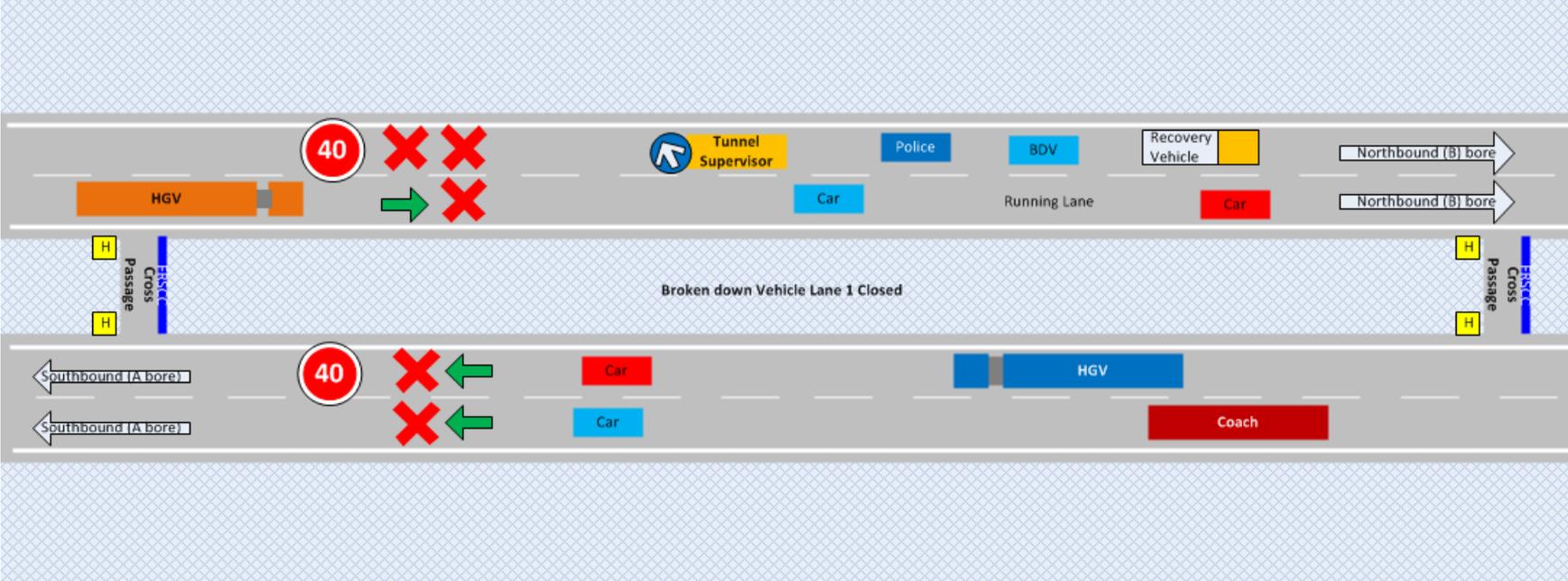
- Developed following table top exercise to address identified need of a coordinated response to tunnel incidents.
- Continuous review process during planning for major exercise.
- Communicated to emergency services through familiarisation visits and inductions including draft instructional video.
- Tested 14th June 2011 Full Scale Emergency Exercise Stag.
- Further tested and refined from FRS Perspective by 5 further full scale FRS Exercises.
- Final review following feedback from Exercise Stag debrief.
- Instructional video produced for on-going familiarisation
- Individual service plans developed based on the joint plan.
- On going emergency exercises and review meetings

Command and Control

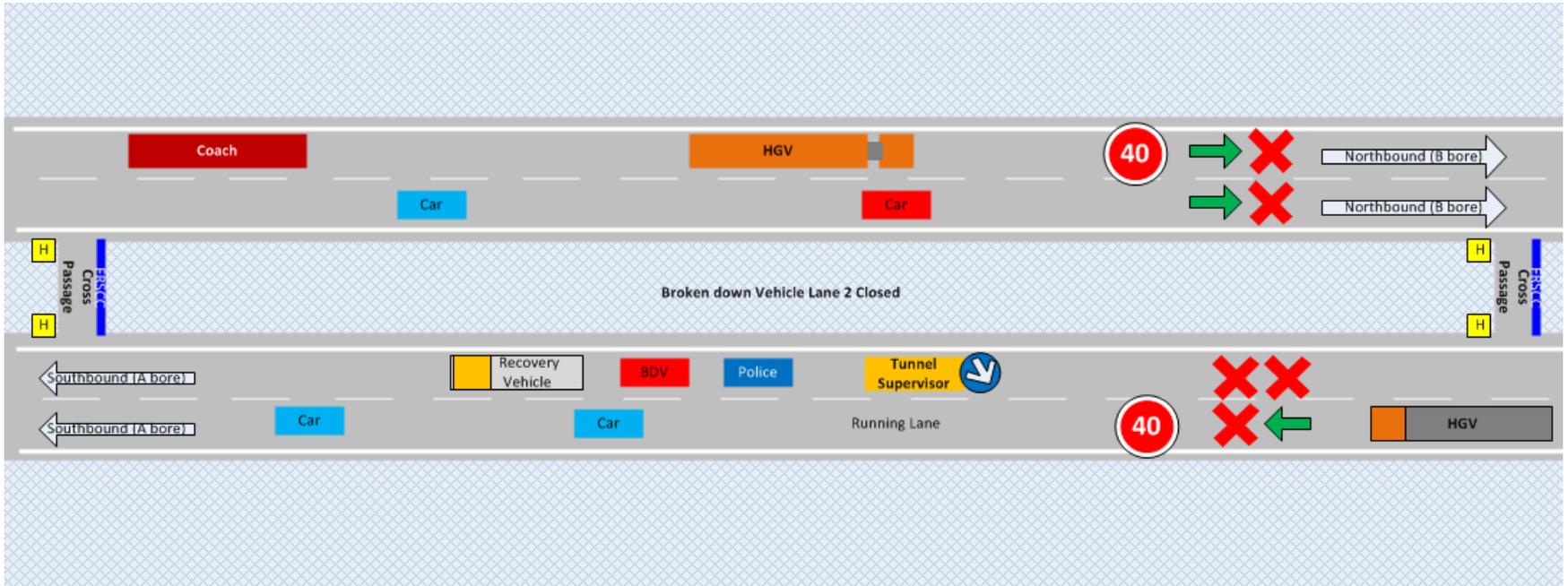
Levels of Incident Response:

- Single lane minor incident i.e. breakdown
- Single lane incident requiring bore closure to resolve incident, i.e. RTC
- Incidents affecting both tunnel lanes requiring emergency service access from non-incident bore (full tunnel closure)
- Fire / Hazmat incidents (full tunnel closure)
- Incidents during maintenance contra-flow (full tunnel closure)

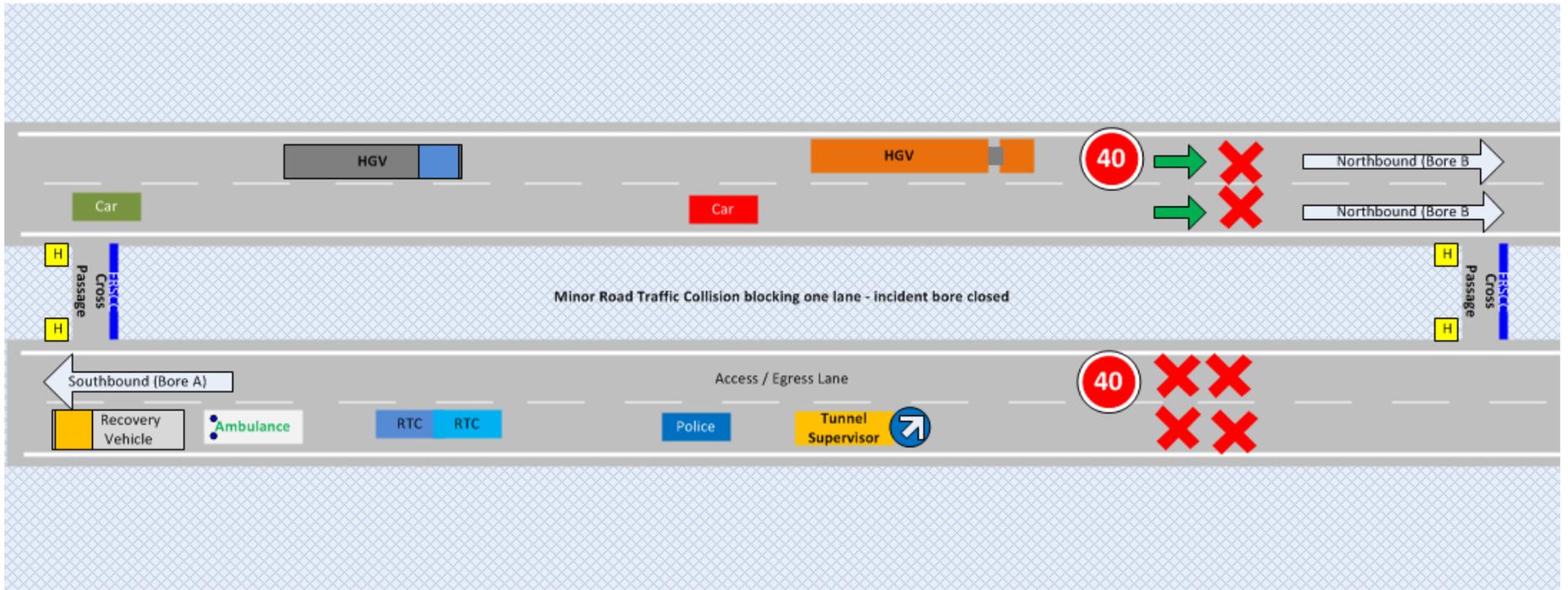
Lane 1 Closure



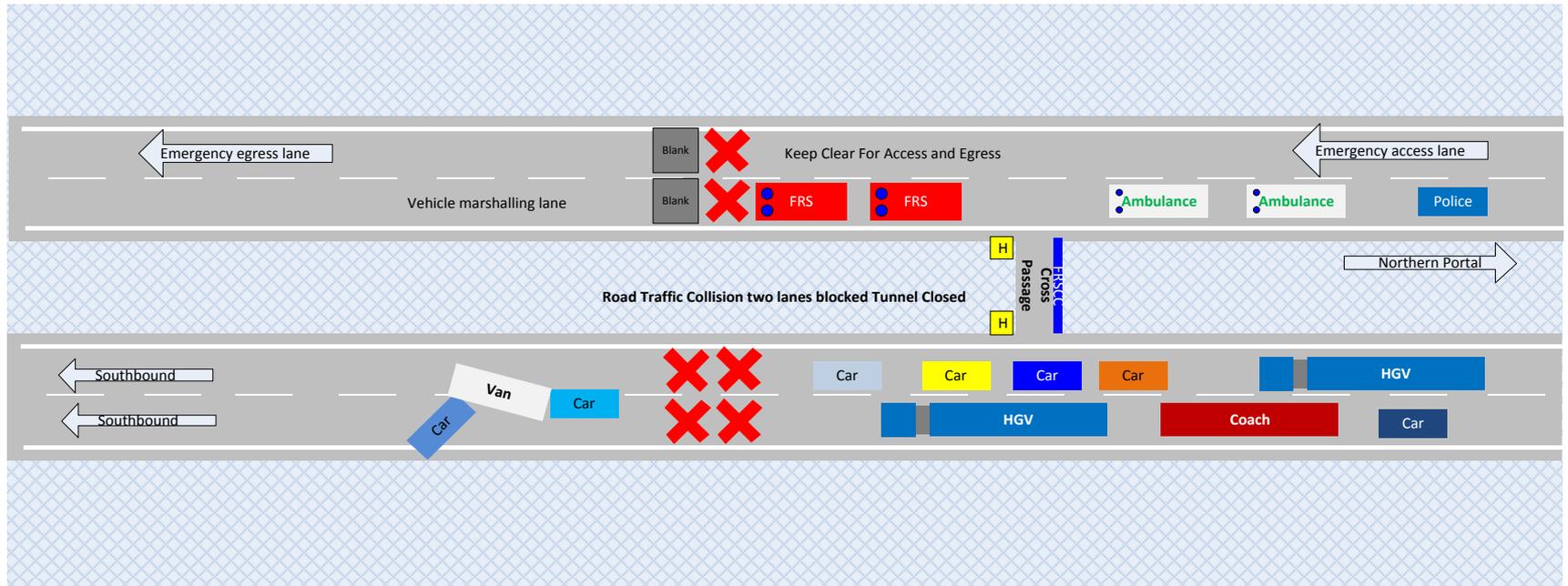
Lane 2 Closure



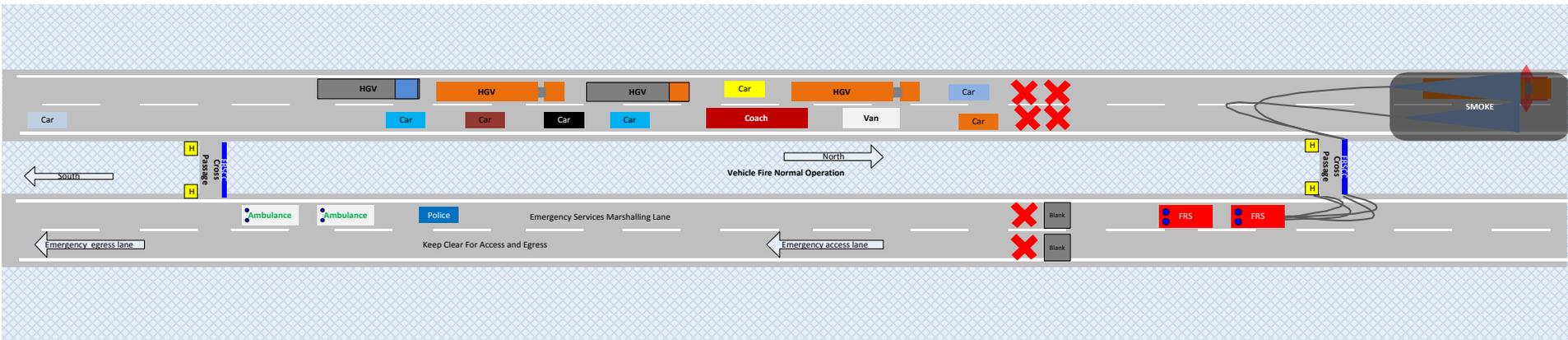
Bore Closure



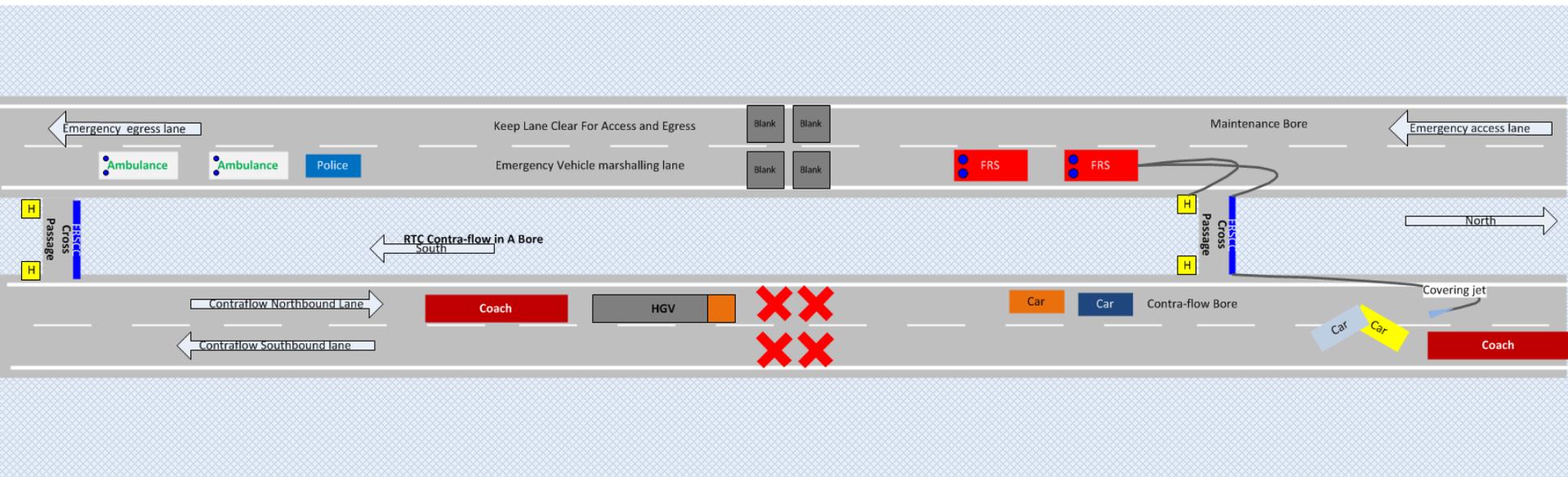
Tunnel Closure RTC



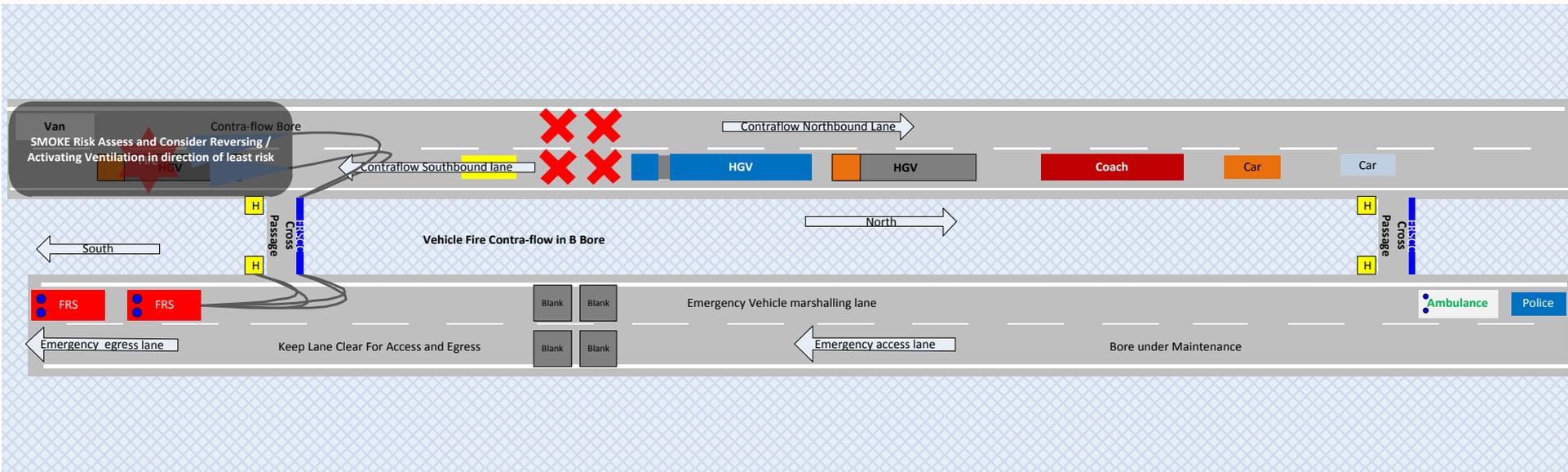
Tunnel Closure Fire



RTC Incident During Contra-flow



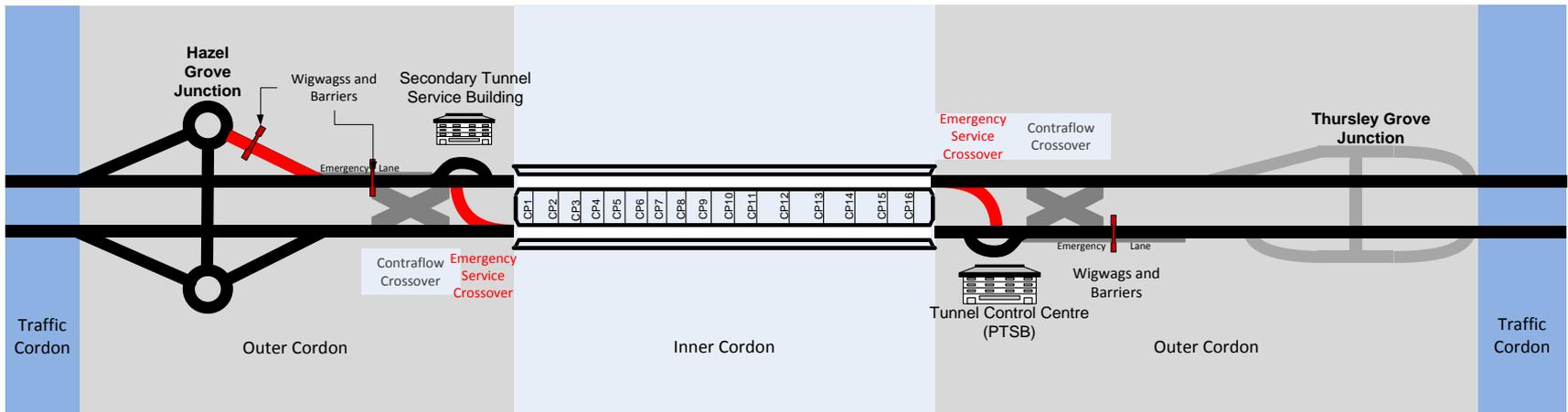
Fire Incident During Contra-flow



Agreed Portal and Access Control Principles for incidents requiring full tunnel closure

- RVP's Established,
- Command points designated,
- Deployment waiting area designated,
- Parking area for Emergency vehicles (not needed for deployment) designated,
- Access control arrangements designated,
- Liaison and communication protocols adopted.

Tunnel Layout Access Arrangements



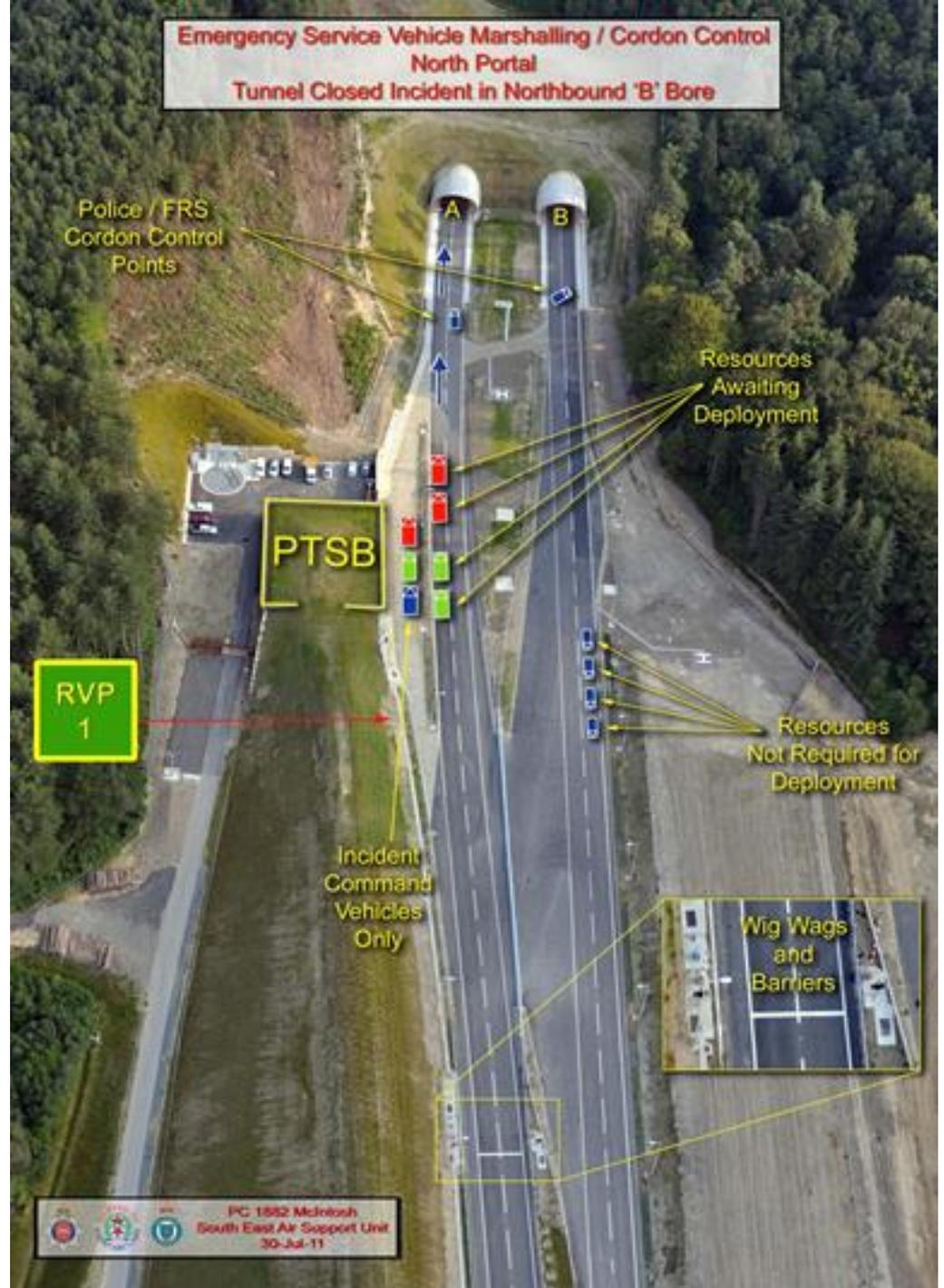
Thursley Interchange



Hazel Grove Interchange



**North Side
Full Tunnel Closure
Incident in B Bore**



**South Side
Full Tunnel Closure
Incident in A Bore**

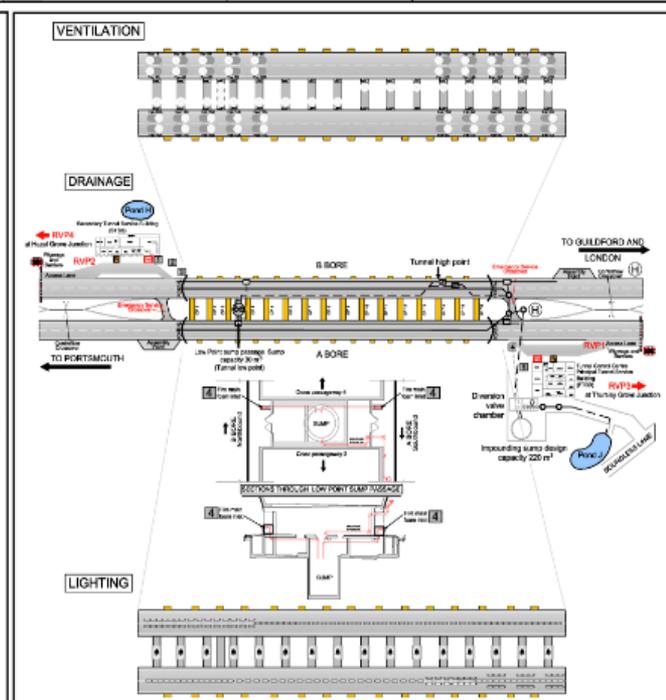
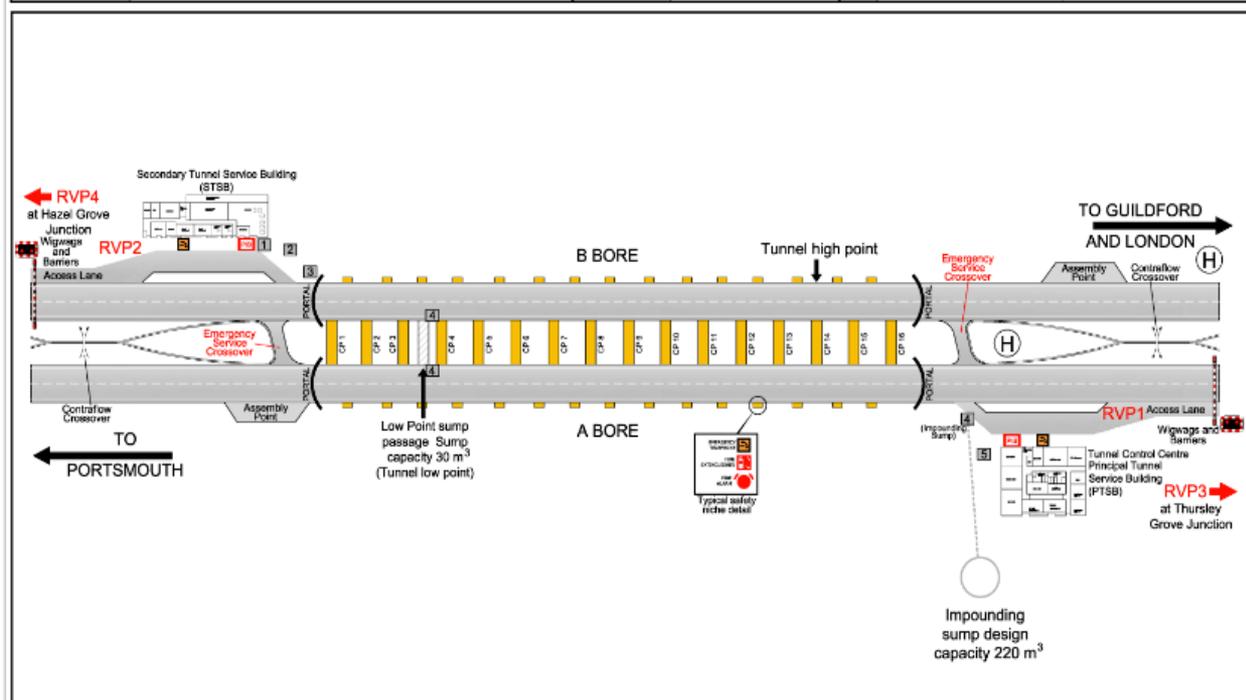


**Emergency Service Vehicle Marshalling / Cordon Control
South Portal
Tunnel Closed Incident in Northbound 'B' Bore**

**South Side
Full Tunnel Closure
Incident in B Bore**



Date:	Time:	: Hrs	Cordons:	North Portal	South Portal	Casualties:	Resources standing by RVP 1. RVP 2. RVP 3. RVP 4.	Remarks:		
Incident No.:	Board Updated:	: Hrs	Traffic:							
Incident Bore:	A	B	Inner Cordon:			Hazards:	FRS Deployment			
Closure (Full / Bore)			Evacuation				OIC (Silver) Commander	Tactical Plan	Sector Commander 1	Tactical Plan
Air Quality:	Ventilation:		Emergency Services Contra flow:			Access:	Radio Channel		Radio Channel	
	NOx Levels						Resources Assigned		Resources Assigned	
	CO Levels					Location:	OIC OPS (Bronze) Commander	Tactical Plan	Sector Commander 2	Tactical Plan
	Gas Monitoring (FRS)						Radio Channel		Radio Channel	
Multi-Agency Communications / Contacts details						Emergency Services	Type:	Resources Assigned		
Tunnel Supervisor										
Police						Tactical Mode:				
Ambulance										
Local Authority										



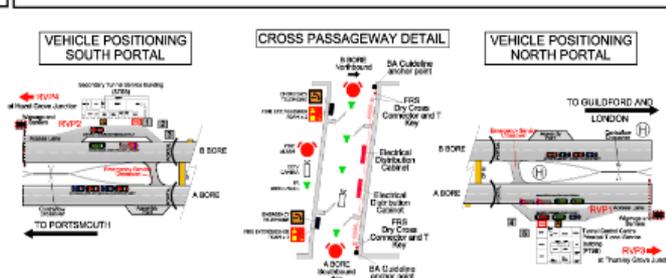
INCIDENT / SAFETY BRIEF		
ARA RECEIVED TIME:	OFFICER:	
HAZARDS	CONTROL MEASURE	SECTOR

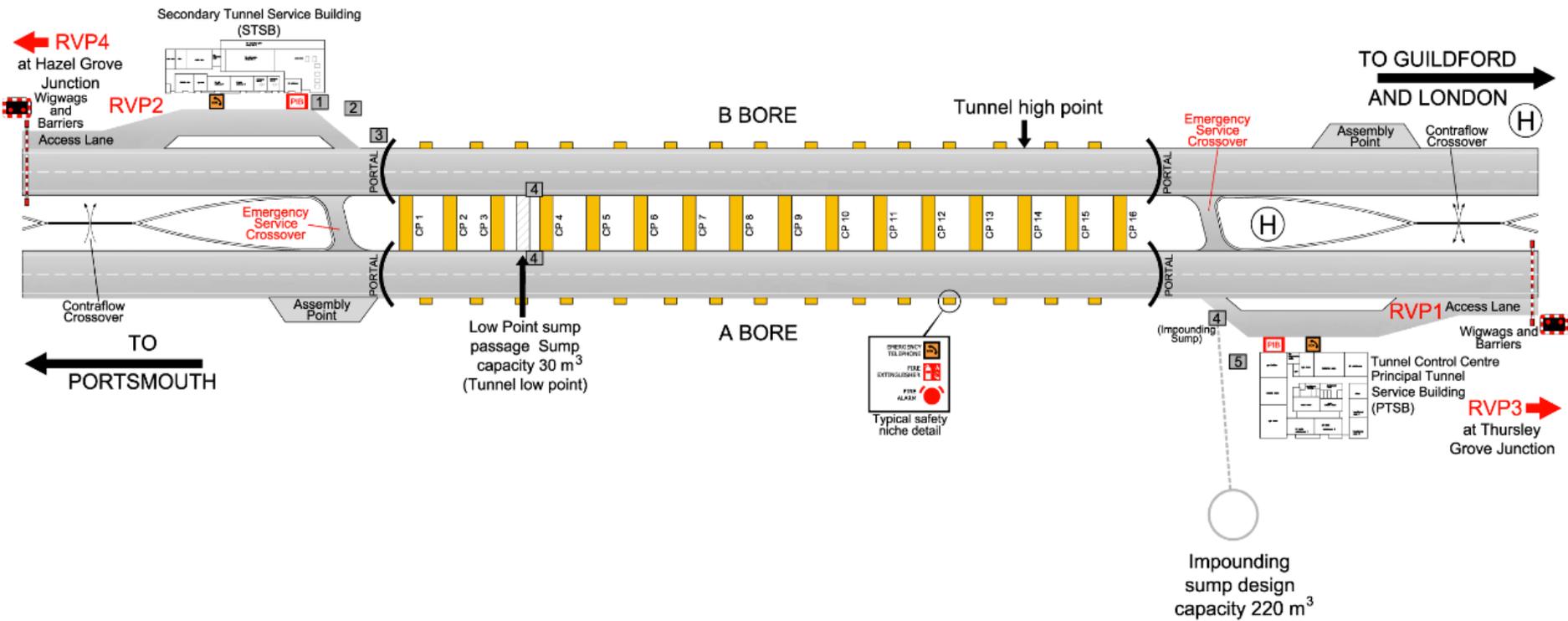
HIGHWAYS AGENCY

HINDHEAD TUNNEL
Tactical deployment briefing board

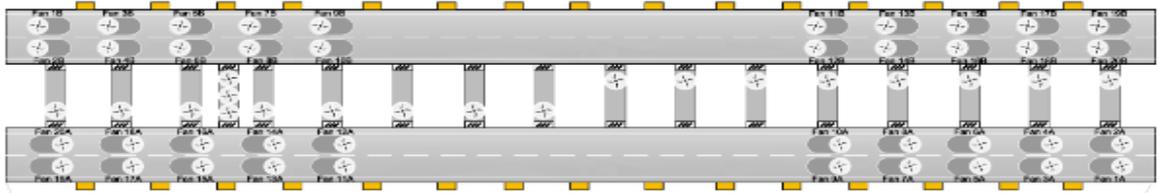
KEY

- 1 Fire main back flow
- 2 Fire main back seal
- 3 Fire main control valve
- 4 Fire main back seal
- 5 Fire main control valve
- 6 Fire main information box
- 7 Emergency Transition
- 8 Self seal
- 9 Hydraulic Latching Valve
- 10 Pump
- 11 Drainage
- 12 Hydraulic Mainline
- 13 Drainage (F)
- 14 Isolation valve
- 15 Isolation valve cables
- 16 Drainage (Bore 1)
- 17 Drainage (Bore 2)
- 18 Drainage (T)
- 19 Drainage (H)

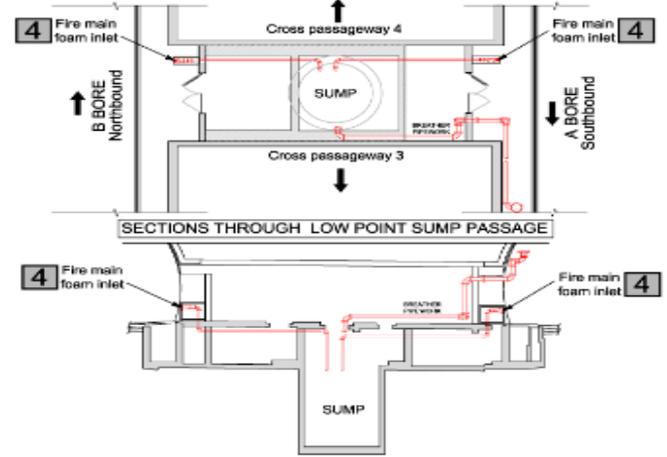
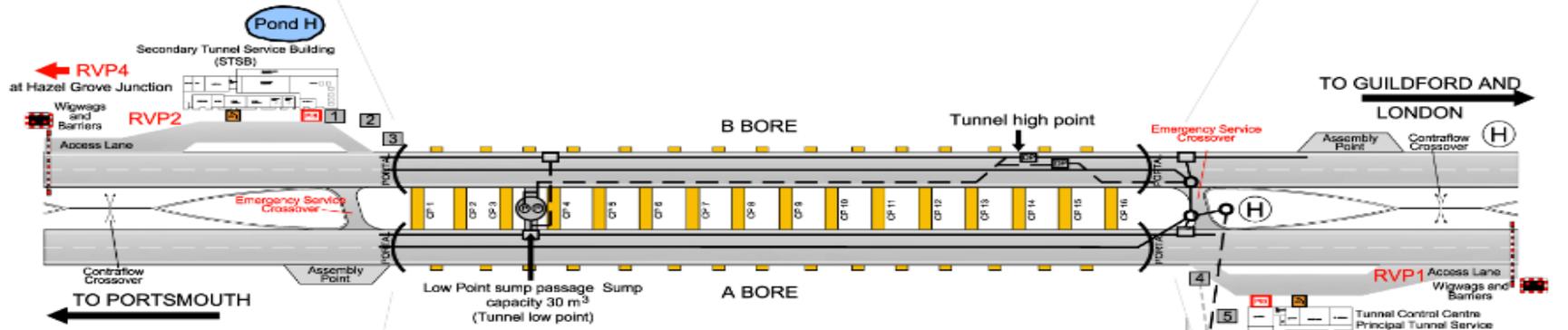




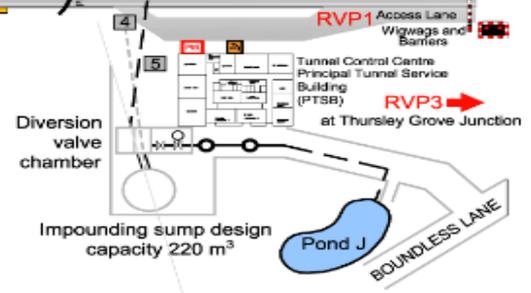
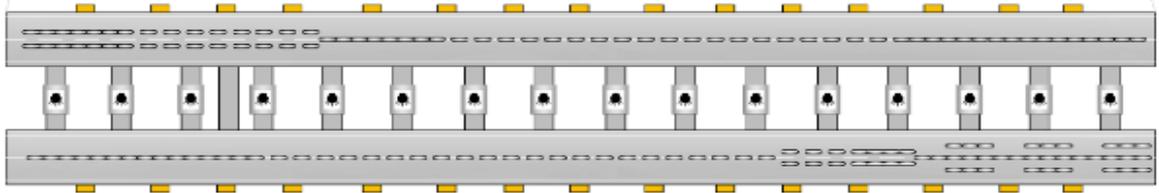
VENTILATION



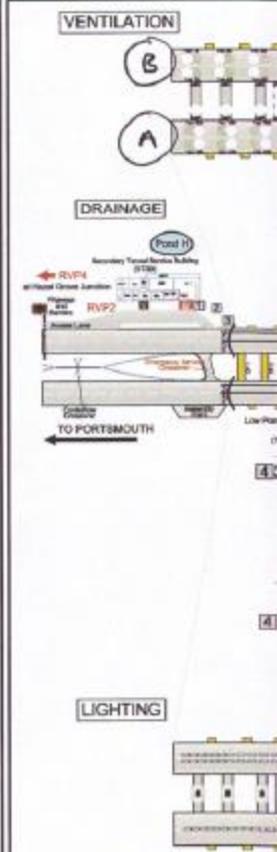
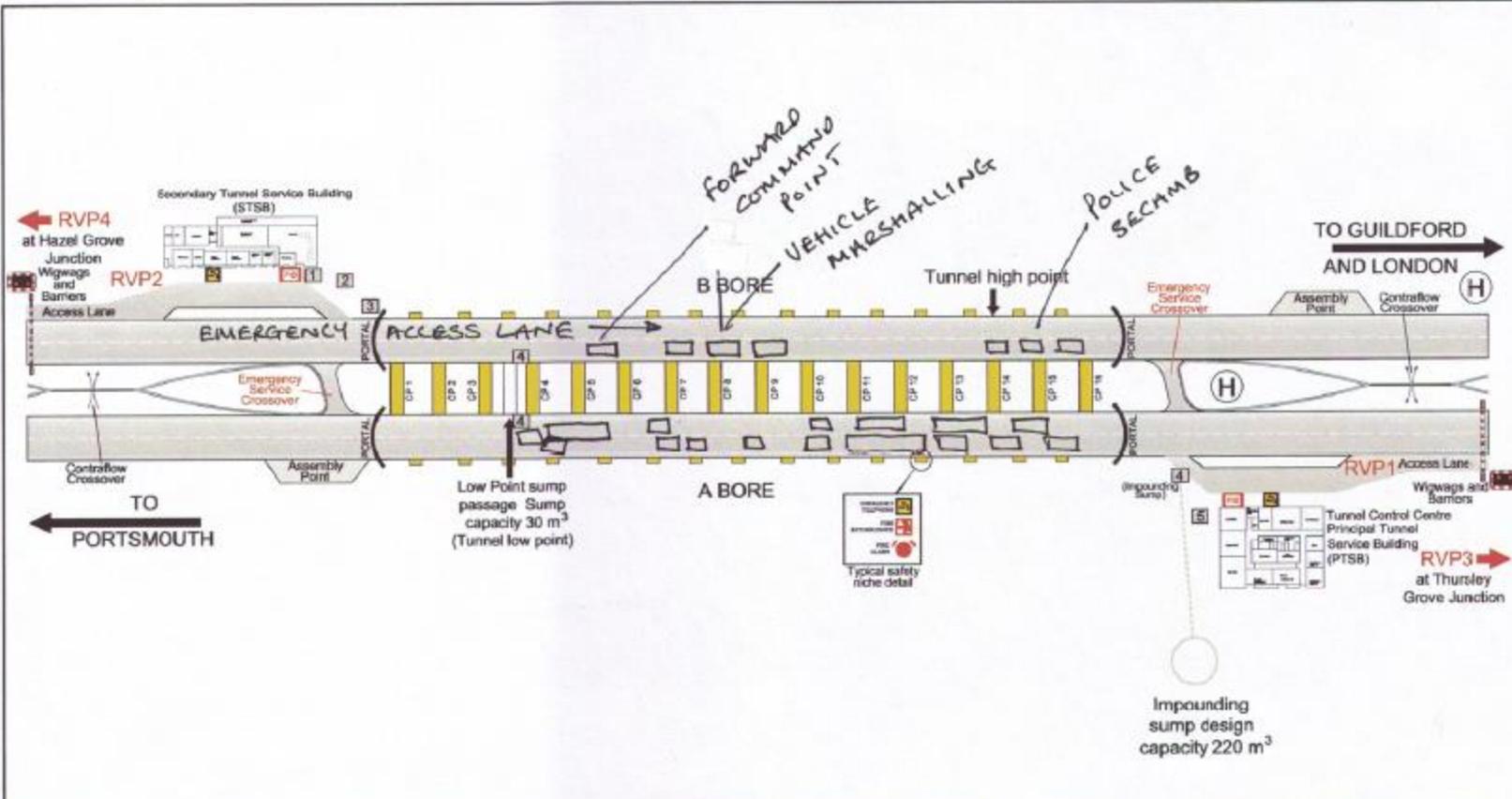
DRAINAGE



LIGHTING



Date:	29/12/12	Time:	14:37 Hrs	Cordons:	North Portal	South Portal	Casualties:	24 ACCOUNTER FOR ALL EVACUATED TO ASSEMBLY POINT	Resources standing by:	RVP 1. S24P2 S29P1	
Incident No.:	002948	Board Updated:	15:10 Hrs	Traffic:	BARRIER CLOSED	BARRIER CLOSED			RVP 2. GRAYSHOTT		
Incident Bore:	A ✓	B		Inner Cordon:	SECURE S24P1	SECURE GRAYSHOTT			RVP 3.		
Closure (Full / Bore):	FULL		FULL	Evacuation:	IN PROG				RVP 4.		
Air Quality:	Ventilation:	100% NKS	100% PRESS	Emergency Services Contra flow:	NOT IN OPERATION	NOT IN OPERATION			FRS Deployment		
	NOx Levels:	NORMAL	NORMAL						OIC (Silver) Commander	Tactical Plan	
	CO Levels:	NORMAL	NORMAL						S.M. WEBB		
	Gas Monitoring (FRS):	/	/						Radio Channel	FG 2	
Multi-Agency Communications / Contacts details								Access:			
Tunnel Supervisor:	DEREK BRADLEY 07946 023321							Location:	BETWEEN CROSS PASSAGEWAYS 4,5, BORE A	OIC OPS (Bronze) Commander	Tactical Plan
Police:	SOFT TAYLOR 07321 657123							Emergency Services:	SFRS HFRS SECAMB SURREY POLICE WANDERLEY B.C. H.A.	WM OAKLEY	TCC LIASON IMPLEMENT ICS COMMUNICATION AND DECISION LOG
Ambulance:	JOHANNA JONES 07341 721721							Type:	RTC	Radio Channel	GPS1, FG 2
Local Authority:	SIMON SNORKEL 07590 019744							Tactical Mode:	OFFENSIVE		
									Resources Assigned	S24P1 S25P1 S22P1	
									Resources Assigned	S26P1 S25P2	
										Sector Commander 2	
										Radio Channel	





Hai Van Tunnel Emergency Ventilation Response Plans and Procedures

Ventilation System

Hai Van Ventilation Systems

System	Descriptions
Ventilation system	Jet fan system
	Supply/Exhaust fan system
	Electrostatic precipitator system
	Sensors
	Ventilation control systems

Hai Van Ventilation Systems

1 Jet fan system



2

Electrostatic precipitator system



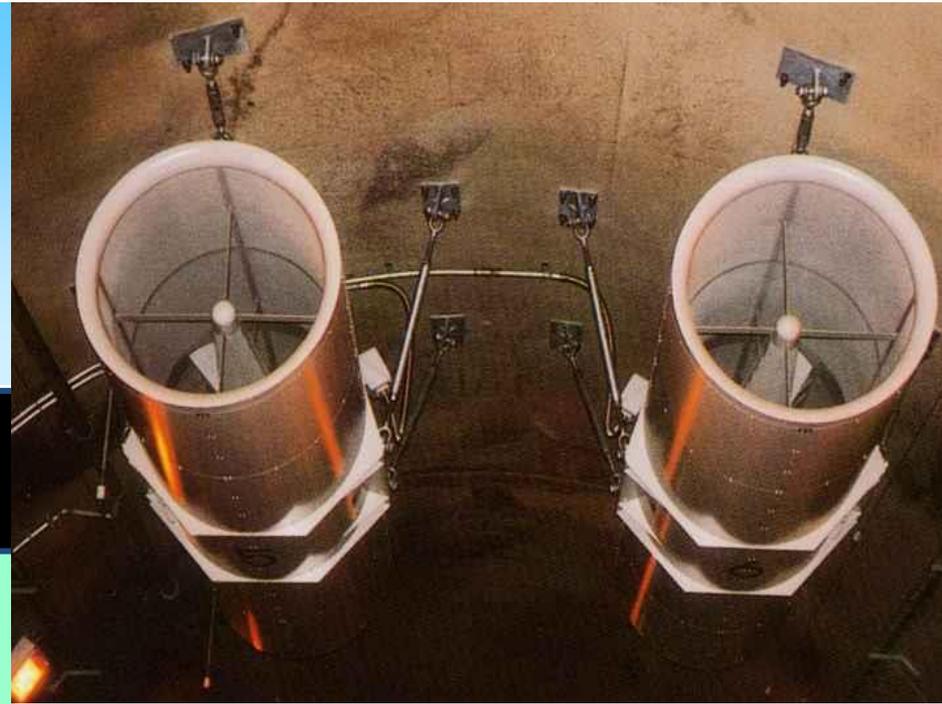
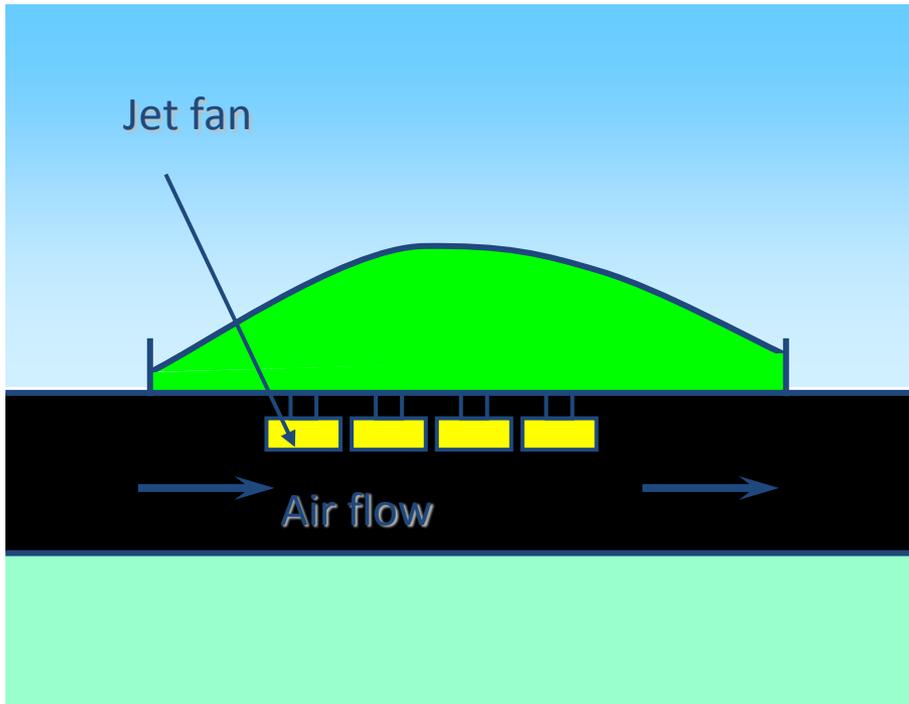
3

Air supply & Exhaust ventilation system



Hai Van Ventilation Systems

1 Jet fan system



Hai Van Ventilation Systems

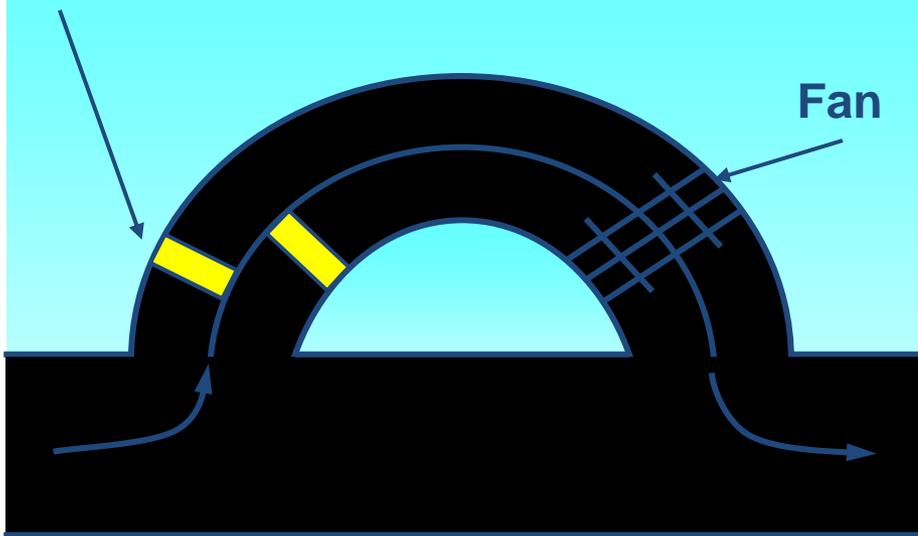
2

Electrostatic precipitator system



Electrostatic precipitator

Fan



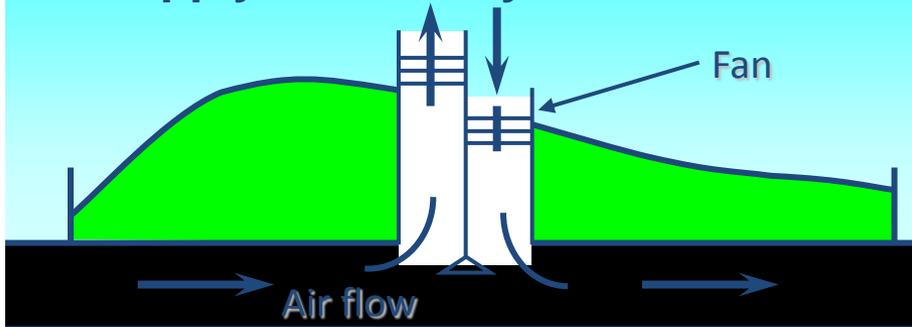
Hai Van Ventilation Systems



3

Air supply & Exhaust ventilation system

Air supply/Exhaust system

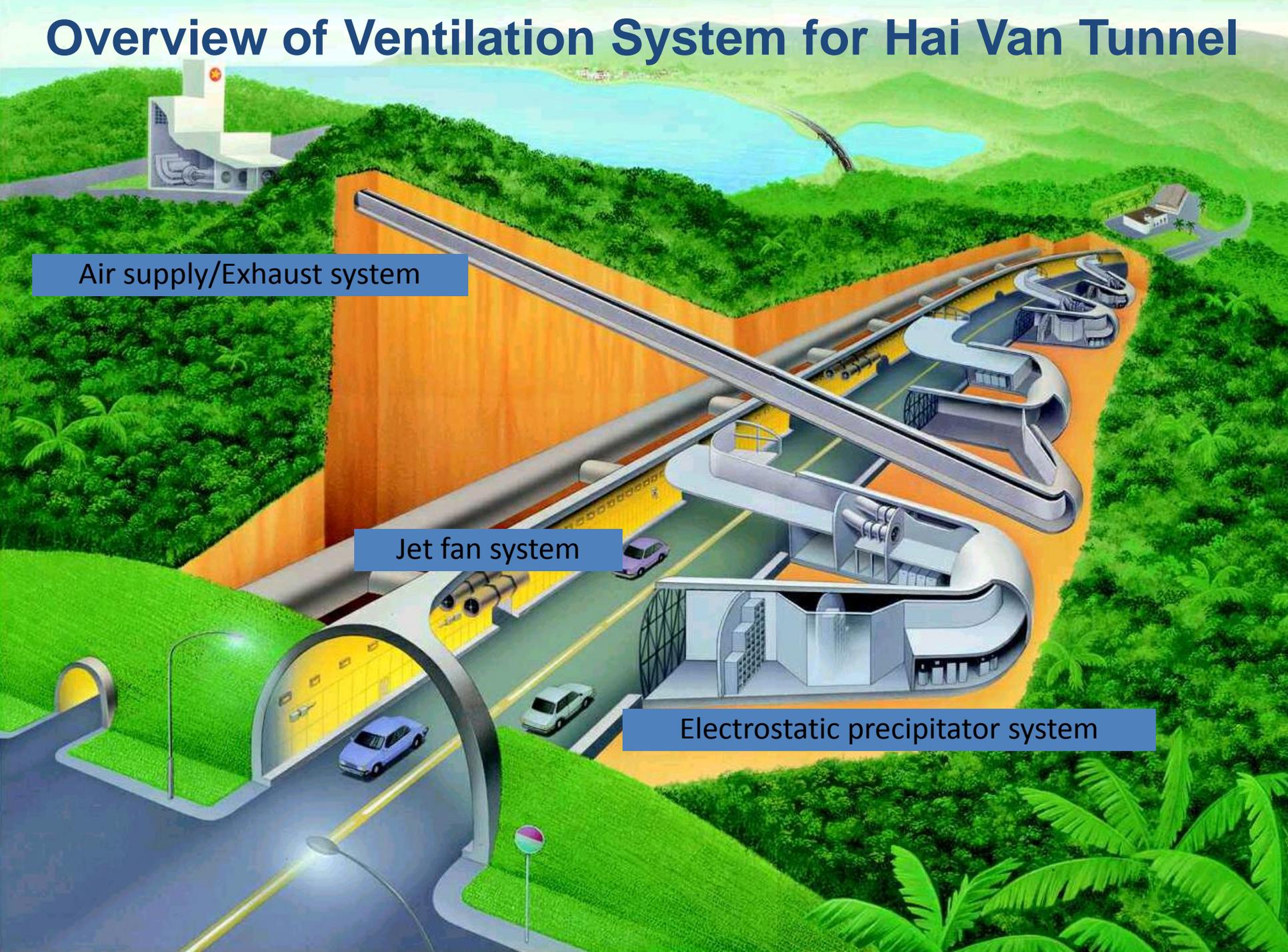


Overview of Ventilation System for Hai Van Tunnel

Air supply/Exhaust system

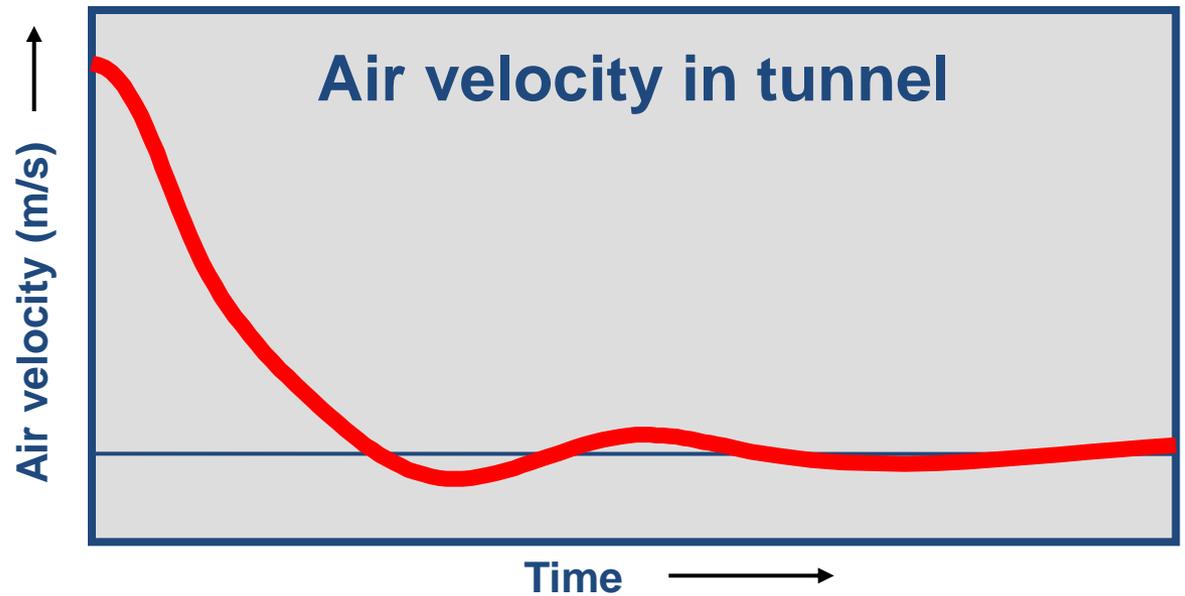
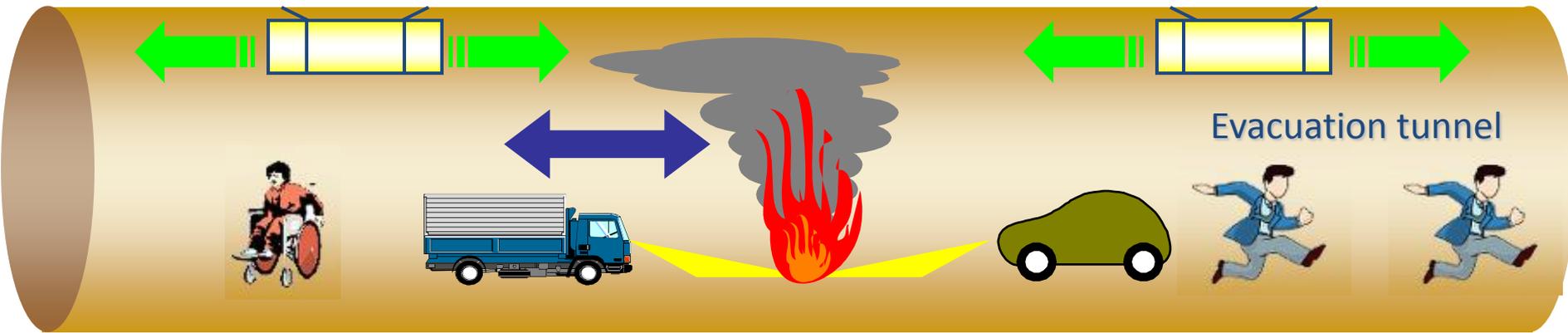
Jet fan system

Electrostatic precipitator system



Safety in Fire Emergency

Air velocity control for reducing of smoke/gas diffusion



Emergency Response Procedure

SOCIALIST REPUBLIC OF VIETNAM
MINISTRY OF TRANSPORT
PROJECT MANAGEMENT UNIT No. 85 (PMU85)



CONSULTING SERVICES
FOR
HAI VAN PASS TUNNEL CONSTRUCTION PROJECT
CONTRACT No. 01/HVT/97
(OECF Loan Agreements No. VNIV-5, VNVI-5 and VNIX-4)

STANDARD OPERATING PROCEDURES EMERGENCY RESPONSE

ISSUE NO.:	1 (ORIGINAL)
ISSUE DATE:	09 JUNE 2005
ISSUED BY:	ICHIZURU I SHIMOTO (PROJECT CONSULTANT)
APPROVED BY:	

JOINT VENTURE OF
NIPPON KOEI CO., LTD. and LOUIS BERGER INTERNATIONAL INC.
in association with
TRANSPORT ENGINEERING DESIGN INCORPORATION

Classes of Incident

Incident Classification

1: Normal Operation

2: Disturbance to Normal Operation

3: Fire Incident

2: Disturbance to Normal Operation

2A: High Traffic Flows Causing Congestion

2B: Congested/Stopped Traffic

2C: Broken Down Vehicle

2D: Road Traffic Collision - Minor No Fire/Injury

2E: Road Traffic Collision - Major Possible Injuries more than 2 Vehicles or involving Large Goods Vehicle, fuel spillage - no fire

3: Fire Incident

3A: Vehicle Fire in Free Flowing traffic

3B: Vehicle Fire in Congested traffic

3C: Vehicle Fire Following Road Traffic Collision

3D: Fire Involving Large Goods Vehicle

3E: Fire Involving Tunnel Equipment

Scale Class	HAMADECO Action	Incident Class
Major	Help from outside agencies required	2D, 2E, 3A, 3B, 3C, 3D, 3E.
Minor	No help required.	2A, 2B, 2C.

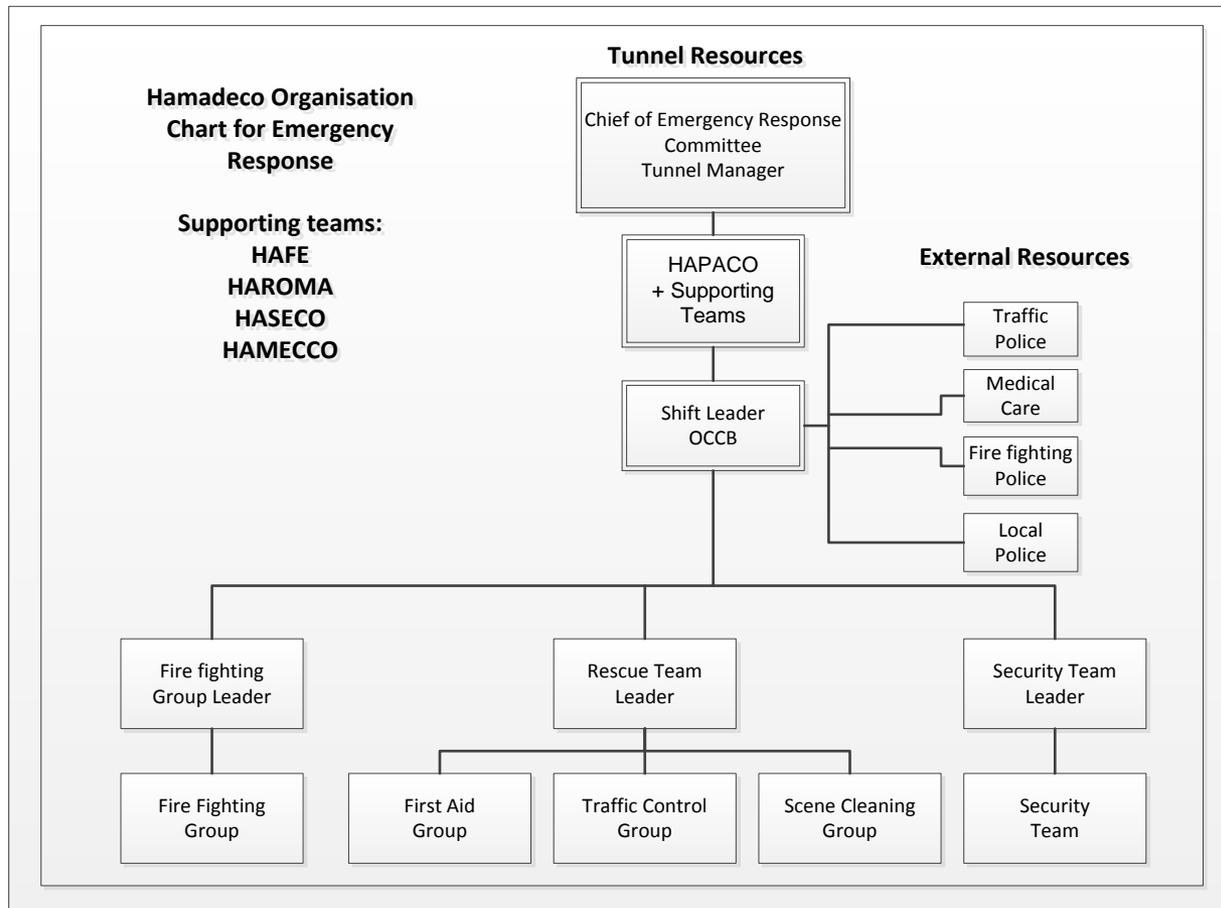


3D Fire in Hai Van 20/06/2013

Tunnel Systems for Emergency Response

1	Fire Alarm and Detection System
2	Radio Rebroadcast System
3	Telecommunication System
4	CCTV System
5	Power Distribution Monitoring & Control System
6	Lighting Control System
7	Traffic Control System
8	Main SCADA System
9	Ventilation System
10	Fire Hydrant System

Response Structure



Agencies Related to Emergency of Haivan Tunnel

Location	Agency
Hanoi	Ministry of Transport (MOT)
	Directorate For Road Of VIETNAM (DRVN)
Danang	Regional Road Management Unit No. 5 (RRMU5)
	Traffic Police
	Fire Police
	Ambulance Service
	Danang TV
Hue	Regional Road Management Unit No. 4 (RRMU4)
	Traffic Police
	Fire Police
	Ambulance Service
	Hue TV

OCC Response

- Receive alert of disturbance to normal operation and classify accordingly using information available,
- Contingency the default classification if information is unclear or information systems fail should always be that for 3B, to ensure adequate joint response resources are mobilized.
- Instigate the traffic management system to control the flow of traffic or to prevent further vehicles entering the tunnel during recovery operations this will minimize risk and allow better access for recovery and emergency groups.
- According to classification, call and provide the Traffic control, break down, Fire Fighting & security groups with the necessary information to enact an initial response and implementation of the traffic control plan. Establishing communications with each group.
- Use Radio Re-broadcast to advise tunnel users of the problem and anticipated length of delay or implement evacuation
- Monitor the CCTV for incident conditions. Protect footage 30 minutes before and 90 minutes following a disturbance to operation.
- Maintain communications with HAMADECO emergency groups and supporting groups.

Joint Operation Primary Actions

- Establish RVP (Rendezvous point) near the South and North portals. RVP
- Approach incident from North side of incident using evacuation tunnel.
- Rapid intervention for fire fighting and rescue operations by HAMADECO Emergency Response, and supporting groups.
- CCTV monitoring of incident and establish effective communications Scene Commander.
- Carry out Scene Assessment and frequently review to ensure crews are not exposed to unacceptable risk.
- IC (Incident Commander) maintains effective communications, OCC, Scene Commander and RVP Commanders.

Joint Operation Primary Actions

- Ensure access/egress routes are secured and maintained.
- Consider the use of Breathing Apparatus
- Commit minimum number of persons to risk area to achieve to task.
- Consider defensive tactics, i.e., Allowing ventilation controlled fire to burn out.
- Strict cordon control of all persons entering and exiting the tunnel maintaining a log of names, organization, task and time of entry/exit.
- Establish early liaison between police, fire police, ambulance service and other agencies at RVP Command posts and upon arrival of resources at scene.

Joint Operations Secondary actions

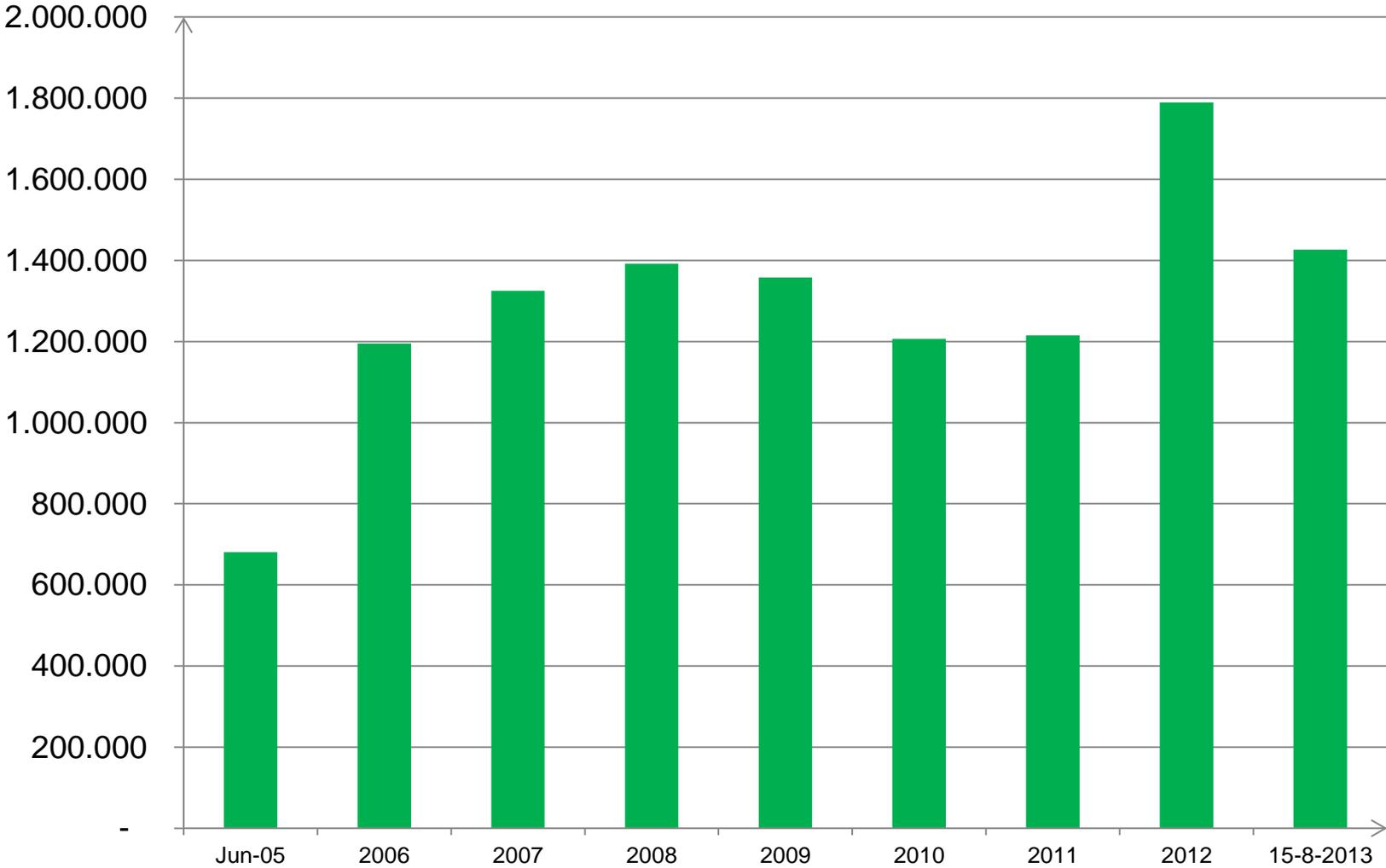
- Utilize technical information on tunnel safety systems:
 - Tunnel Plans
 - Ventilation
 - Hydrants
- Consider the need for shelter and care if significant numbers have been evacuated from the tunnel.
- Consider post-incident implications.

Hia Van Tunnel and Related Incidents

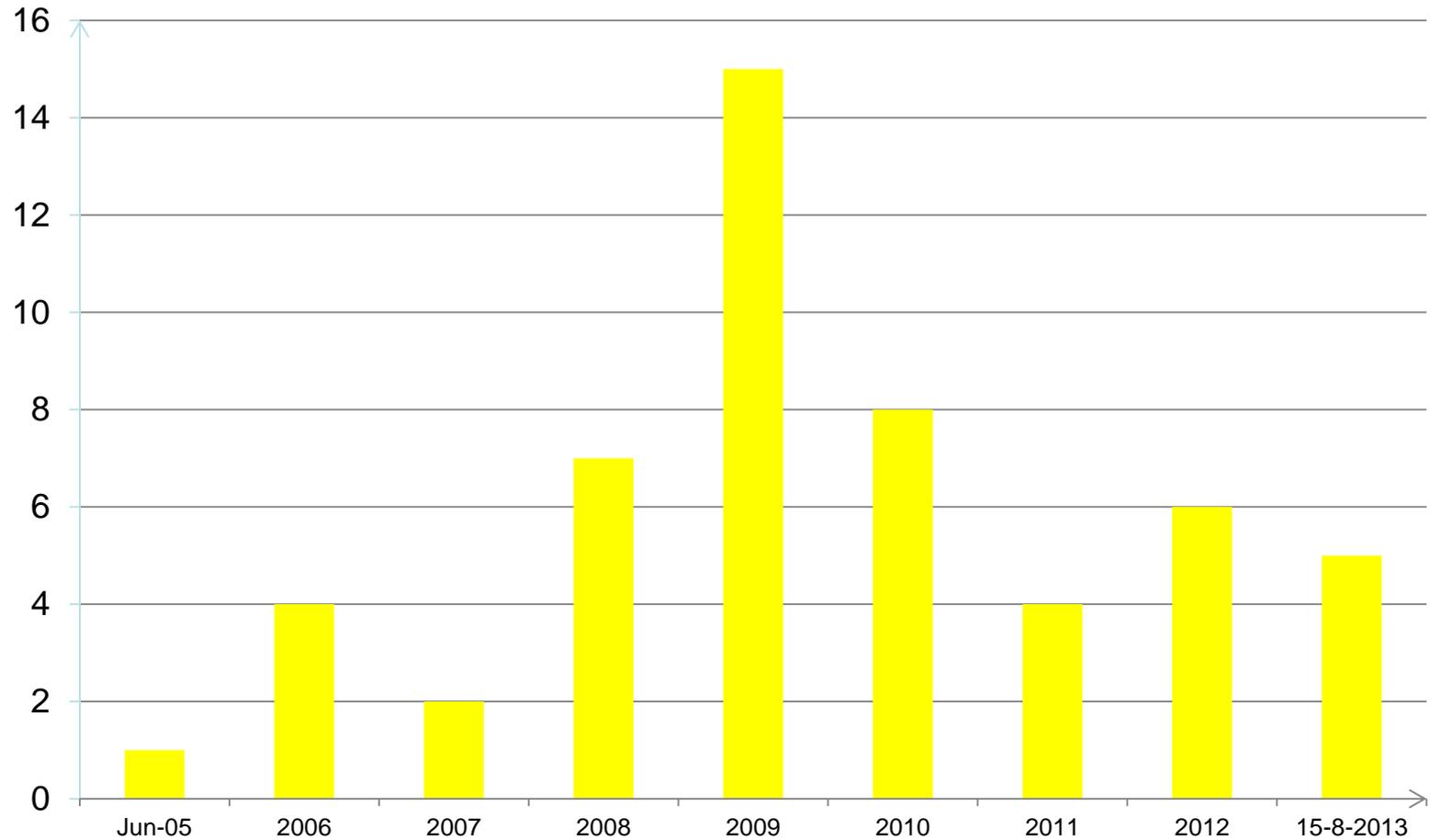
5th June 2005 to 15th August 2013

No.	Description	Quantity	Rate(per million)
1	Vehicles fires inside tunnel	40	3,6
2	Vehicles collisions inside tunnel	52	4,7
3	Vehicles fires outside tunnel	12	1,1
4	Vehicles collisions on tunnel approaches	89	7,6
5	Broken down vehicles inside tunnel	6.275	574,6
6	Vehicles violating Traffic law and regulations through tunnel	40.684	3.321,9

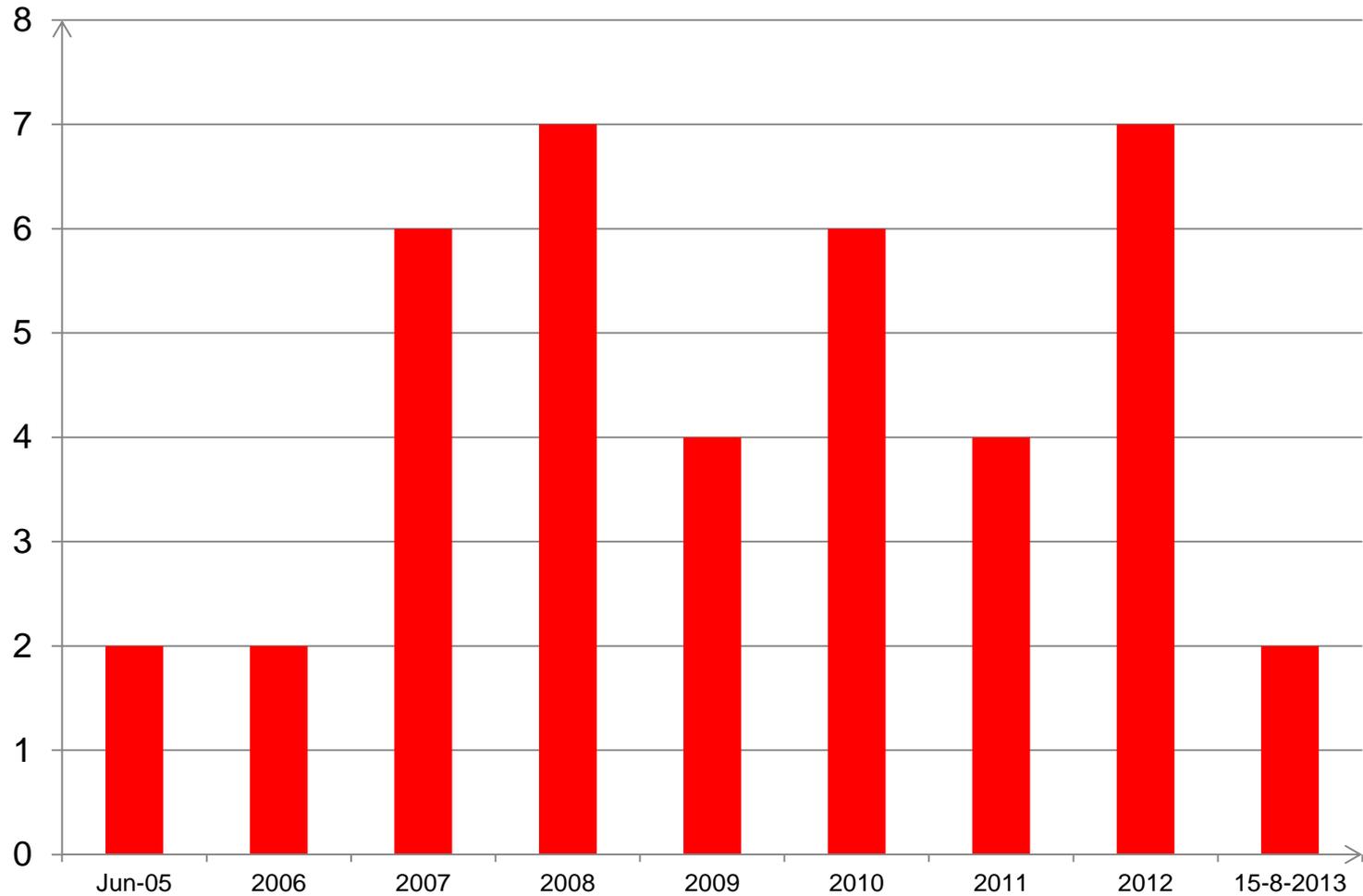
Hai Van Tunnel Traffic Volume



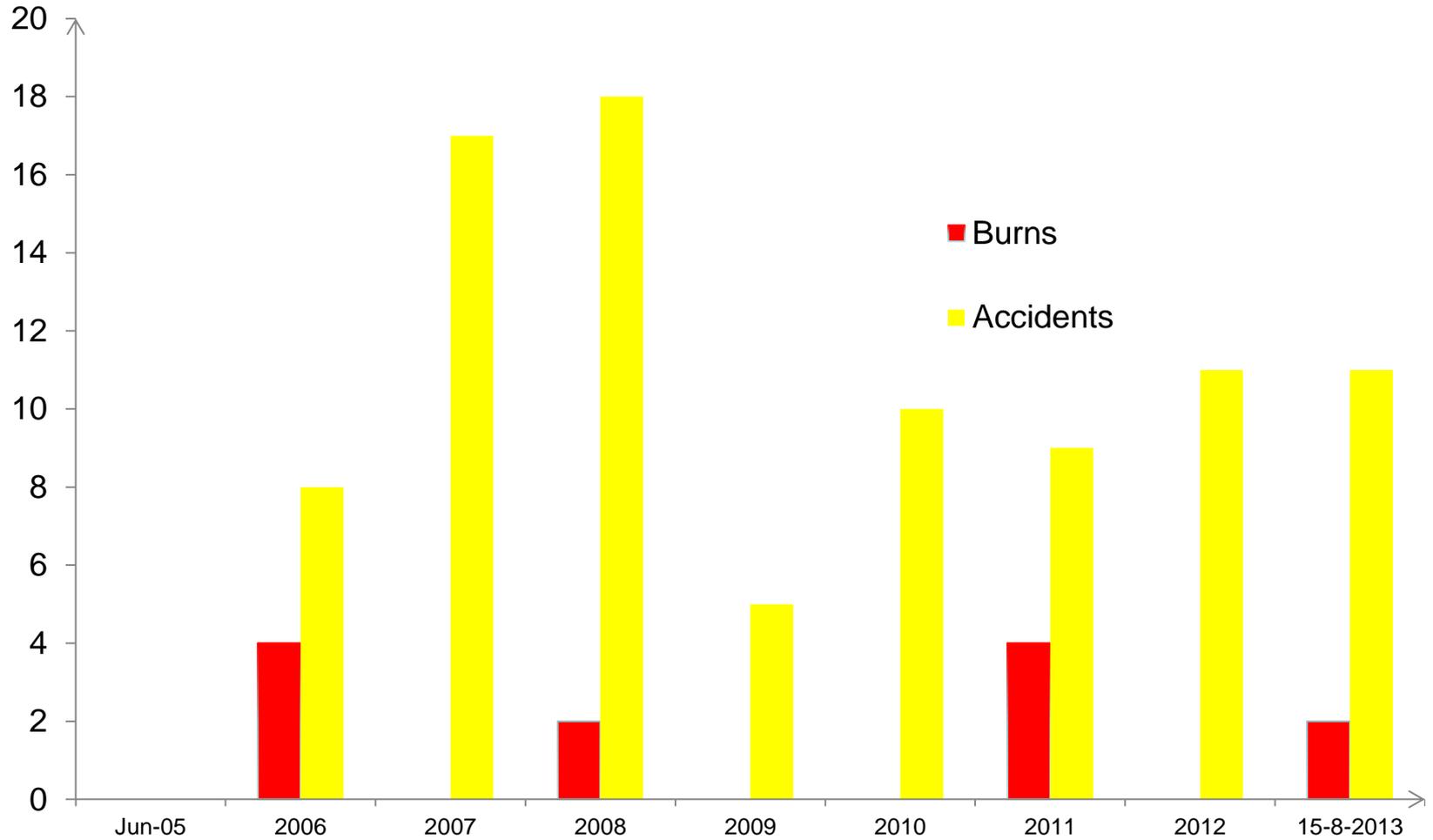
Collisions in the Tunnel



Vehicle Fires in Hai Van Tunnel



Vehicle Fires and Collisions on Tunnel Approaches



Hai Van Collisions 2011 - 2013

- 2011
 - 9 Collisions
- 2012
 - 21 Collisions
- 2013
 - 14 collisions to-date



Multi Vehicle Collision 08/06/2011



Multi Vehicle Collision 26/08/2011



Multi Vehicle Collision 17/09/2012

Hai Van Fires 2011 - 2013

- 2011
 - 24/05/2011 Vehicle Fire
 - 12/07/2011 – Large Goods Vehicle → Engine fire
 - 26/08/2011 Large Goods vehicle, smouldering brakes
 - 07/10/2011 Large Goods Vehicle, Tyre Fire



Divar name:	DIVAR-02	Camera input:	10
MAC address:	00-04-63-00-2C-C1	Unique ID:	9C9DEA4E
Recording mode:	Continuous	Image size:	720(H) x 576(V)
Camera name:	S1/ CAMERA 18	Compression:	0.69 bpp
Date and time:	12-07-2011 14:30:32	Image format:	4:2:2 wavelet compressed
Events:	None	Authenticity:	Image is authentic

Hai Van Fires 2011 - 2013

- 2012
 - 22/02/12 Coach fire in Battery compartment
 - 18/04/12 – Large Goods Vehicle Engine fire
 - 17/06/12 – Large Goods Vehicle Engine fire
 - 20/06/12 Large Goods vehicle, load fire →
 - 05/07/12 - Large Goods Vehicle Engine fire
 - 07/08/12 - Large Goods Vehicle Engine fire
 - 23/08/12 - Large Goods Vehicle Engine fire



Divar name: DIVAR=03
MAC address: 00-04-63-00-39-50
Recording mode: Continuous
Camera name: CAMERA 35
Date and time: 20-06-2012 14:31:31
Events: None

Camera input: 6
Unique ID: 8DBC8861
Image size: 720(H) x 576(V)
Compression: 0.73 bpp
Image format: 4:2:2 wavelet compressed
Authenticity: Image is authentic

Hai Van Fires 2011 - 2013

- 2013
 - 08/05/13 – Large Goods Vehicle Engine fire
 - 20/06/13 Large Good vehicle, Engine fire →
 - 17/08/2013 – Large Goods Vehicle Engine Fire



Divar name:	DIVAR_02	Camera input:	2
MAC address:	00-04-63-00-2C-C1	Unique ID:	3C8ED70C
Recording mode:	Continuous	Image size:	720(H) x 576(V)
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Fire Response Challenges (Coach Fire 01/09/2008)



Divar name: DIVAR-02
MAC address: 00-04-63-00-2C-C1
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Compression: 0.44 bpp
Image format: 4:2:2 wavelet compressed
Authenticity: Image is authentic

THANK YOU

