

Is It Safer to Switch Ventilation off in a Tunnel Fire?

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Motivation

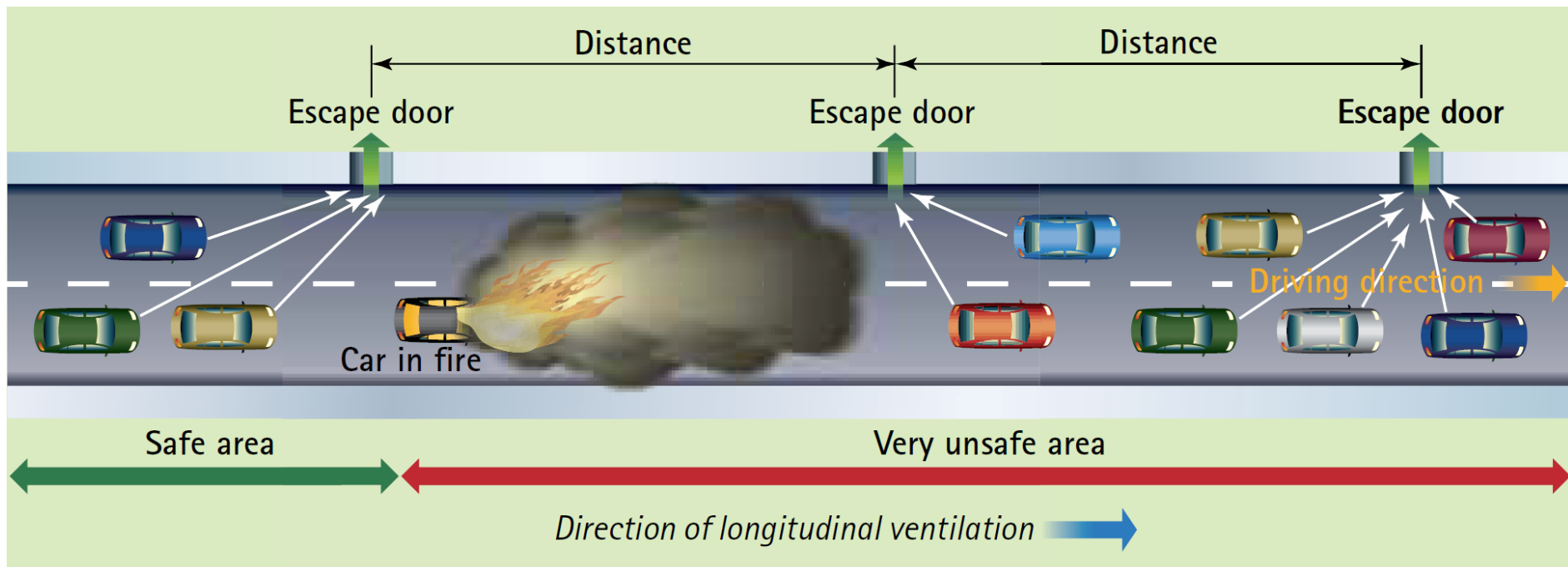
- Ventilation should be switched off in bidirectional tunnels
- Many tunnels switch off their ventilation system initially, if an incident is detected
- Excessive airflow can 'fan the fire'
- Fire suppression can be more effective if ventilation is switched off
- So: is it safer to switch ventilation off in a tunnel fire?



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Longitudinal Smoke Ventilation





Longitudinal Ventilation

World Road Association Guidance

CASE	TRAFFIC PRIOR TO INCIDENT	PRINCIPLE FOR LONGITUDINAL VENTILATION
A	Unidirectional traffic <u>without</u> traffic congestion	Flow velocities in the direction of traffic to prevent or at least minimize backlayering of smoke
B	Unidirectional traffic <u>with</u> traffic congestion	Relatively low flow velocities (e.g. 1.2 ± 0.2 m/s) in the direction of traffic in order to minimize flow spread upstream, allow smoke stratification, support dilution of toxic gases and enable people to escape.
C	Bidirectional traffic	Relatively low flow velocities should be maintained, to avoid flow reversal unless circumstances dictate otherwise (for example fires near portals), allow smoke stratification and enable people to escape in both directions.

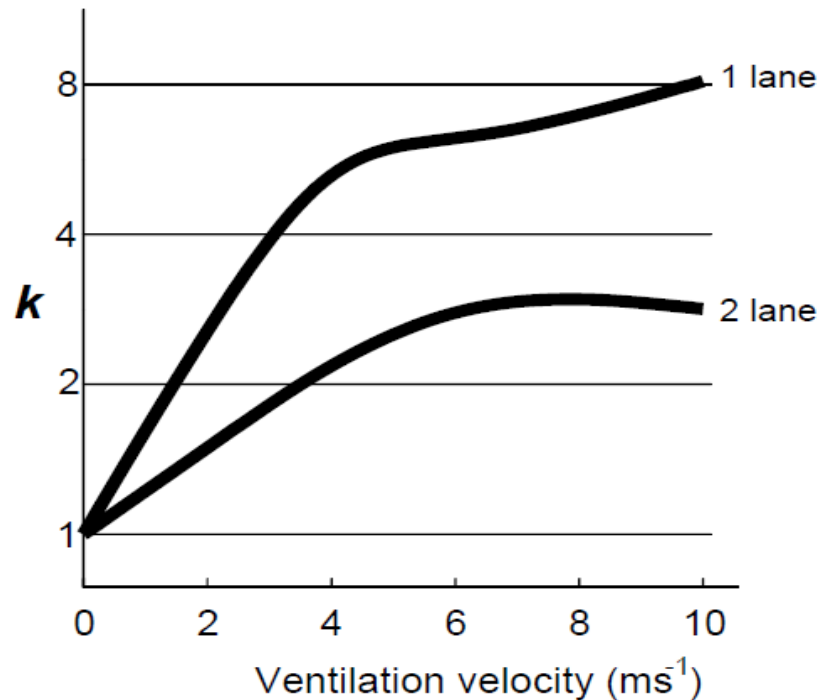


Differing Country Approaches

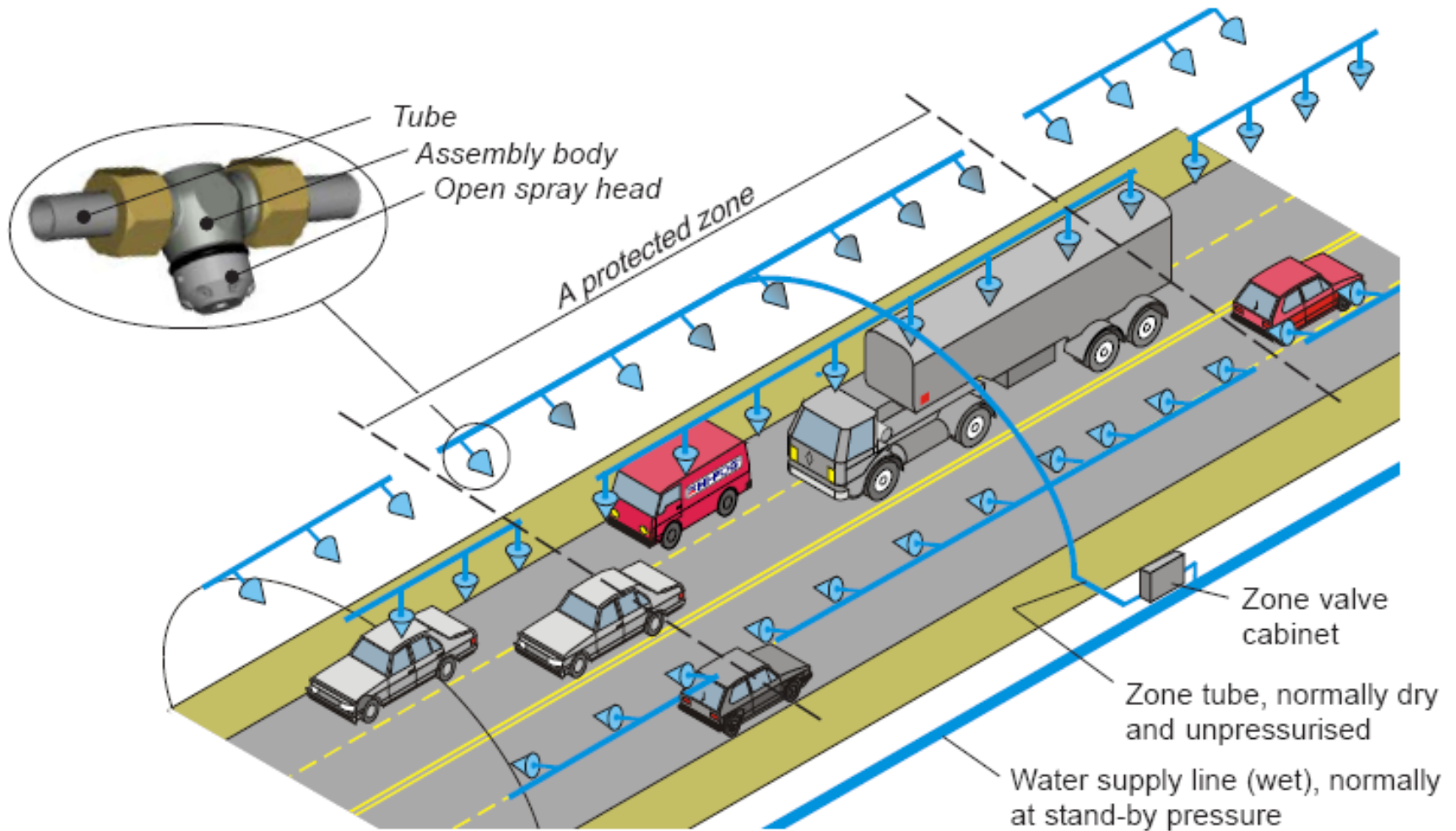
- Ventilation control system is considered standard in a number of European countries including Switzerland and Austria, but not in the UK.
- Austria: air velocity in unidirectional traffic between 1.5 m/s to 2 m/s, and for bidirectional traffic between 1 m/s and 1.5 m/s.
- For unidirectional traffic without congestion, German RABT guidelines require a minimum velocity of the air flow exceeding the critical velocity for smoke control.

Risks of Over-Ventilation

- Destruction of any smoke stratification
- Lengthening of affected tunnel chainage
- Enhancement of fire heat release rate



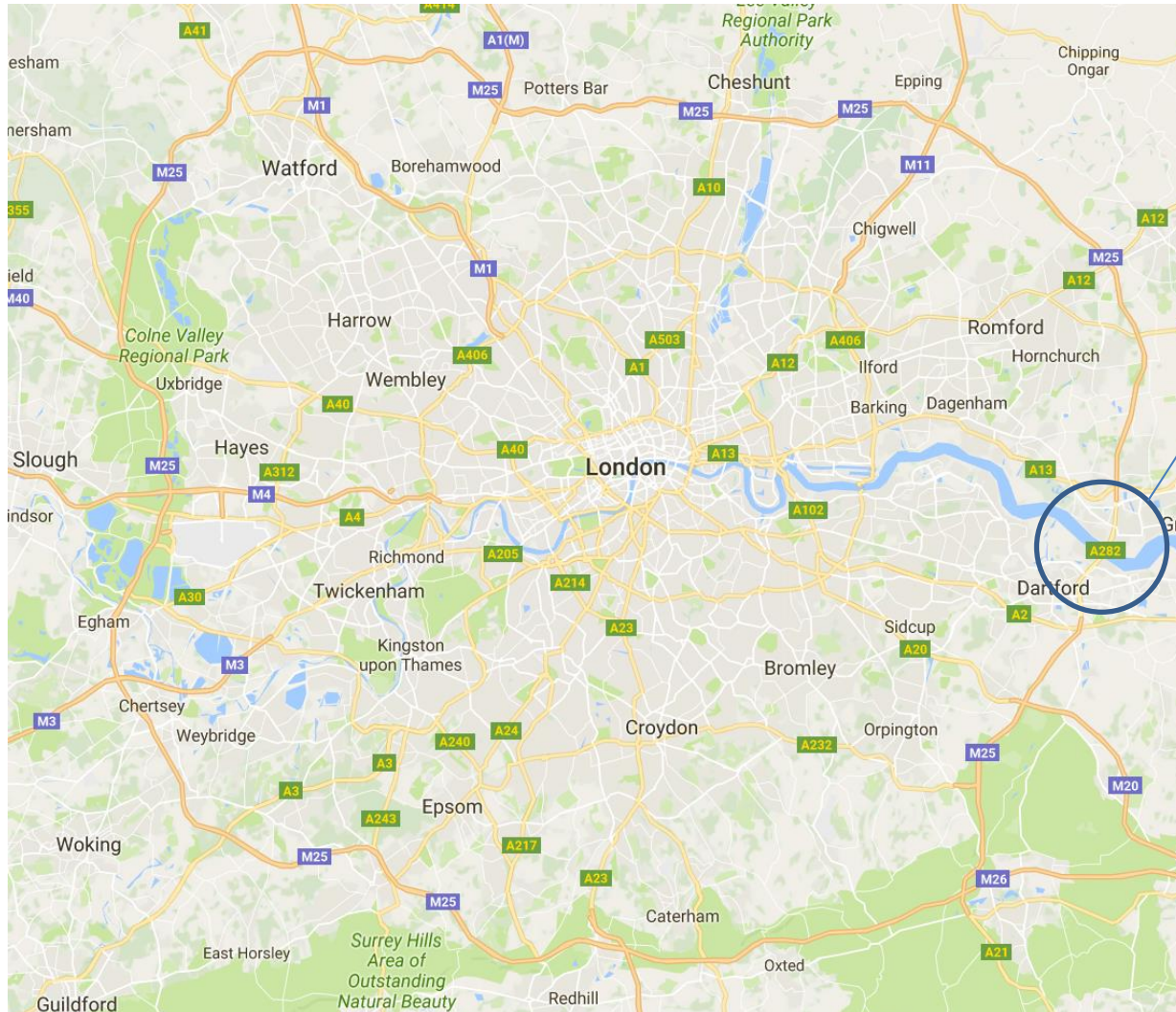
Tunnel Fire Suppression





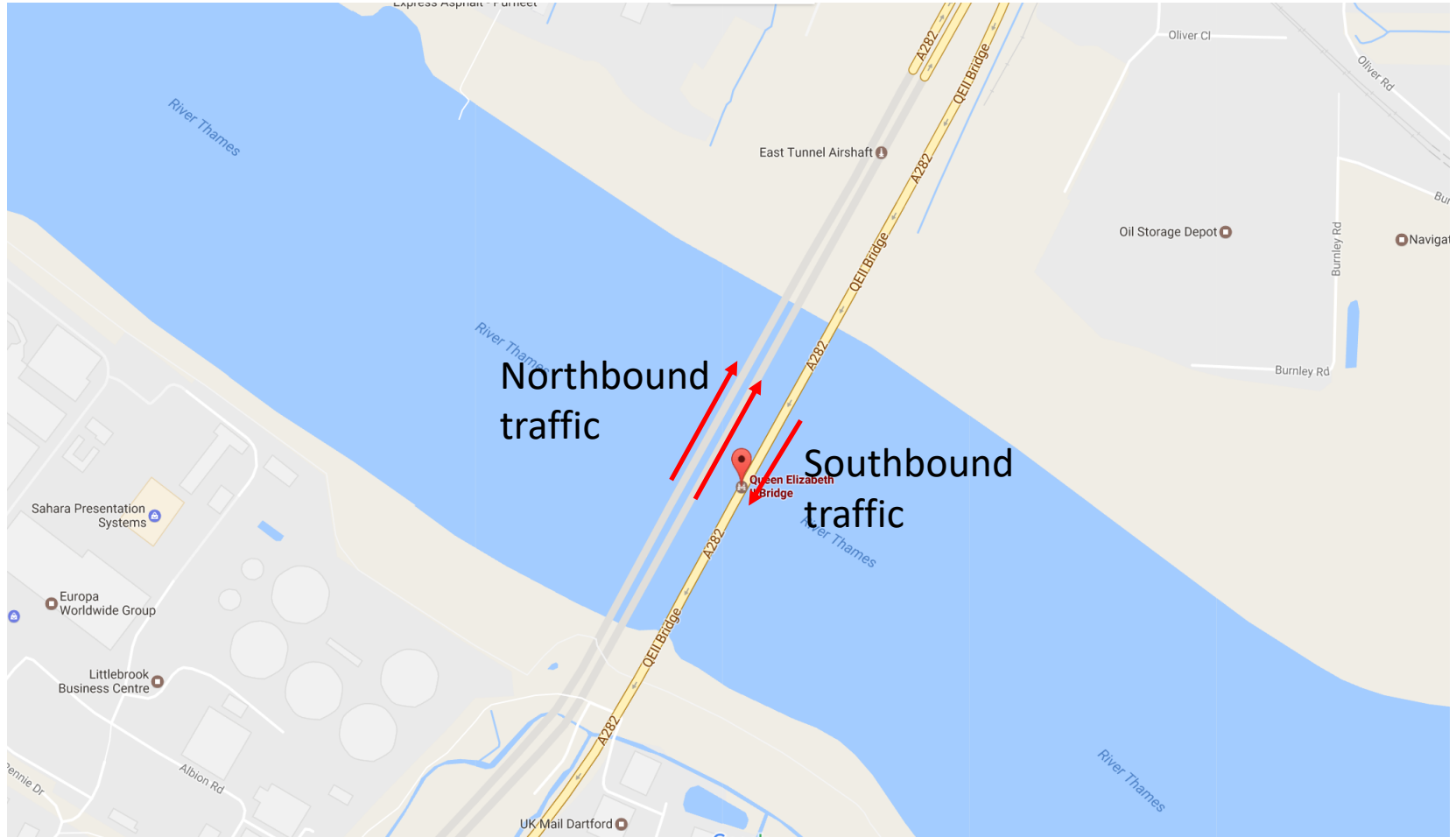
Dartford Tunnel Fires 2016

Dartford Crossing



Dartford Crossing

Dartford Crossing





Dartford Tunnels

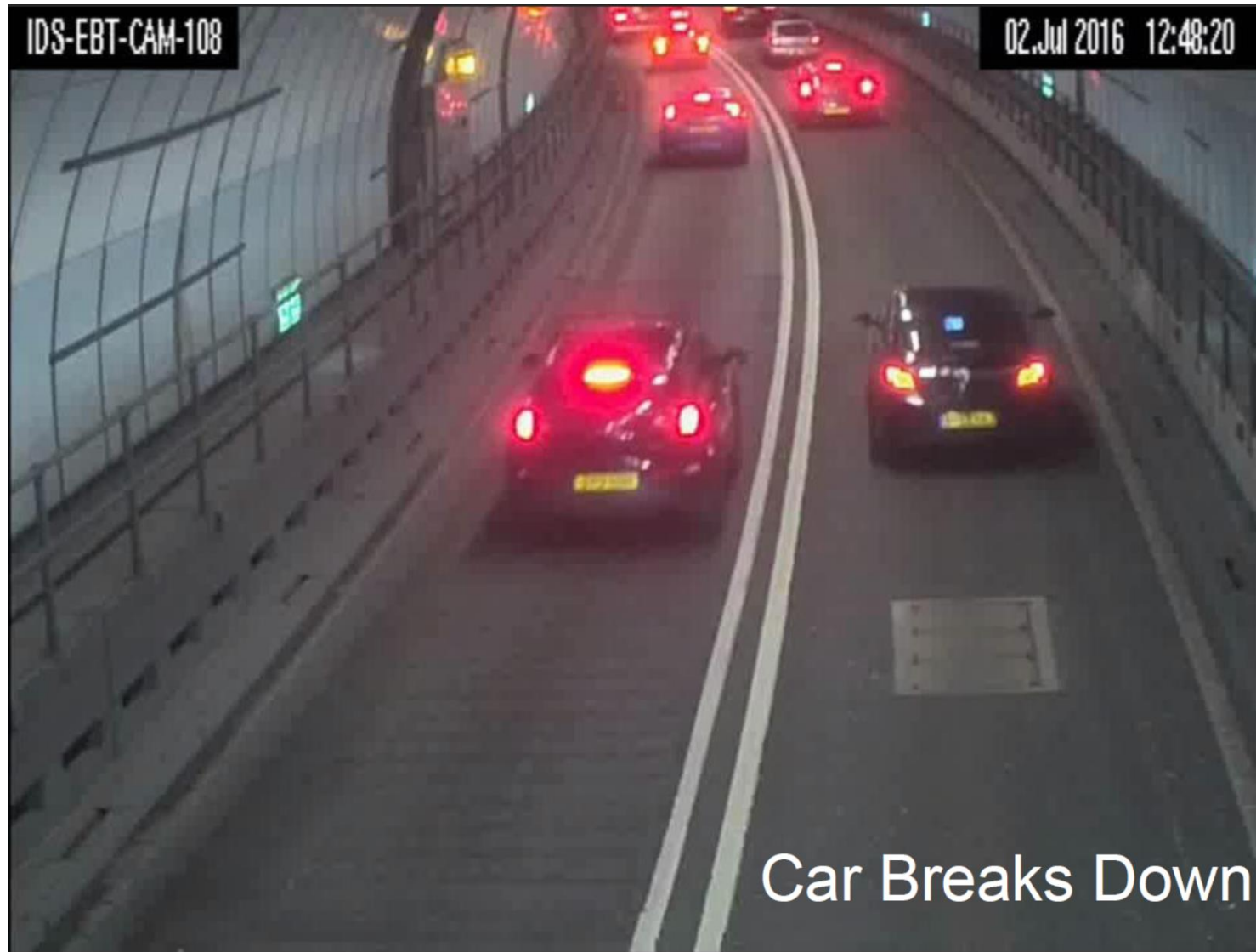
- Two tunnels, each 1,430 m long
- Northbound traffic in both tunnels (normal operation)
- Longitudinal ventilation via jetfans
- Fire suppression via high-pressure deluge
- Ventilation switched off initially in case of an incident
- Slides originally presented by Graham Pearce and David Cook of Connect Plus Services at UK Tunnel Form, Oct 2016



Fire Incident 1

- Saturday 2nd July 2016
- Time: 12:48
- East (right-hand) tunnel, northbound direction
- Approximately 300m from entrance portal
- Relatively light traffic with low % HGVs

Time from incident: 00:00:00



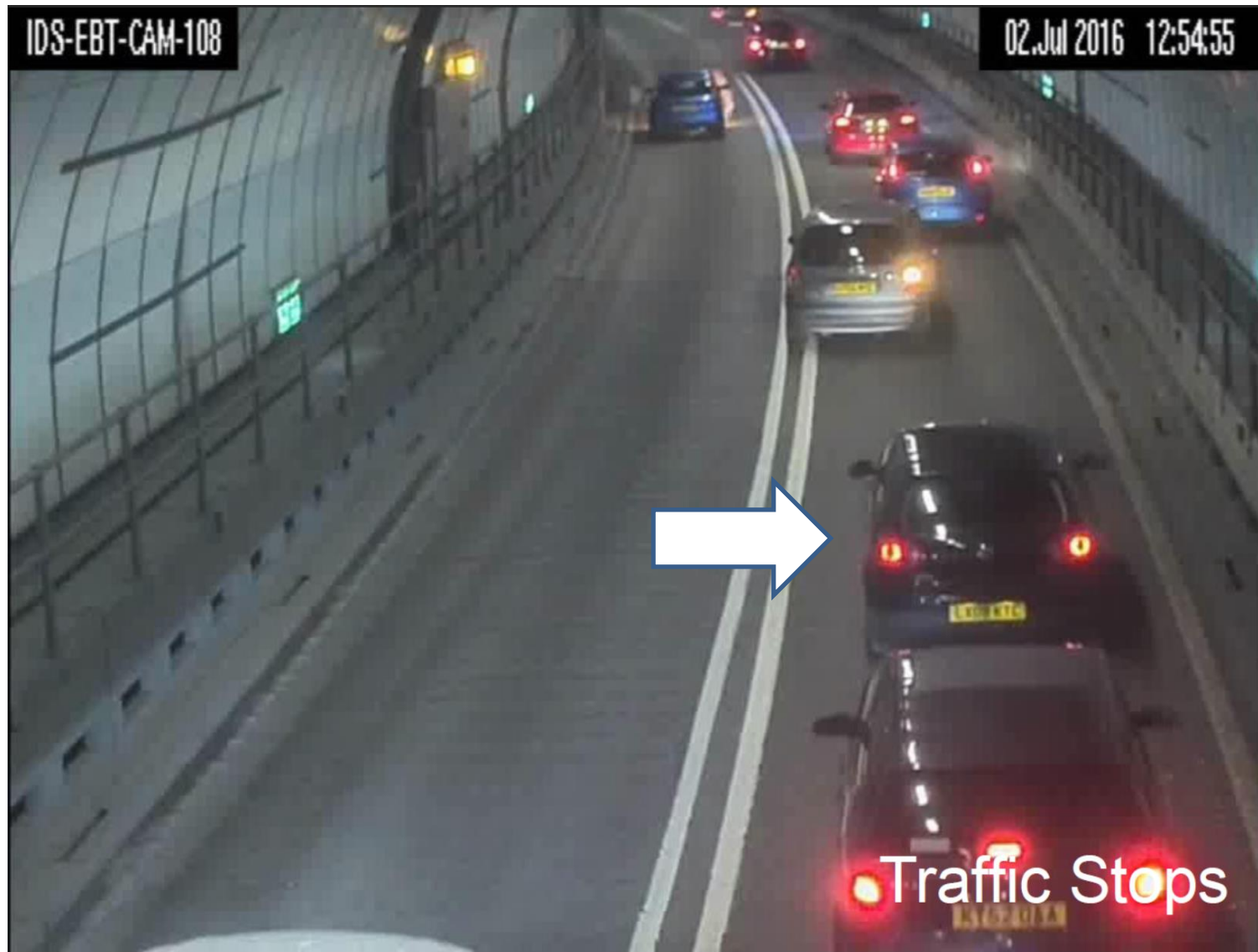
Time from incident: 00:02:40



Time from incident: 00:06:25



Time from incident: 00:06:35



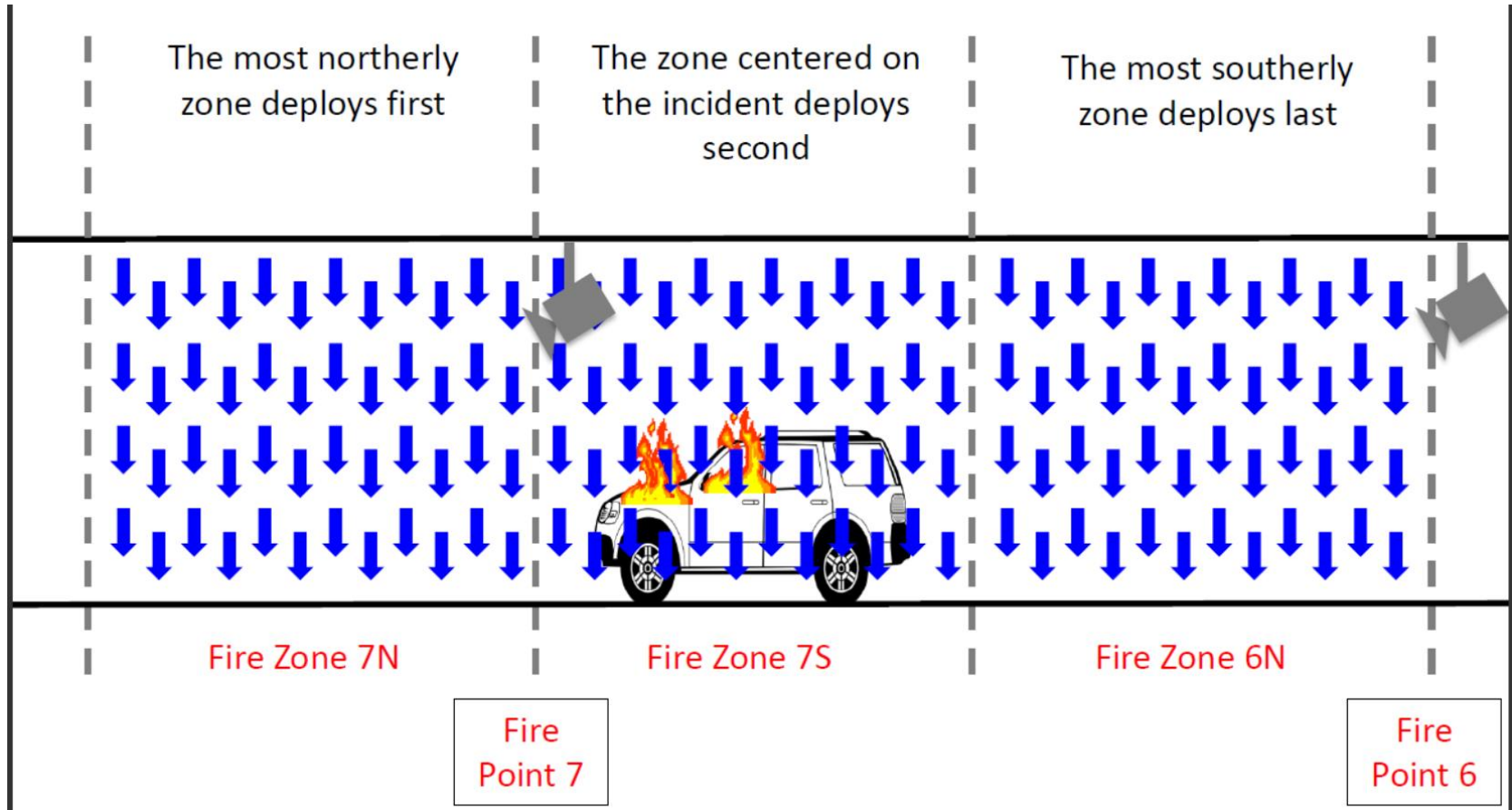


Evacuation

Time from incident: 00:10:20



Fire Suppression Deployment Sequence



Time from incident: 00:11:30

IDS-EBT-CAM-109

02.Jul 2016 12:59:50



Time from incident: 00:14:10



Time from incident: 00:21:15



Time from incident: 01:12:20





Fire Incident 1 - Outcomes

- From car stopping to both tunnels fully open to traffic: 1 hour 22 minutes
- No injuries
- Minor damage to anti-skid surfacing
- Self-evacuation reinforced by public address message
- Herd effect



Fire Incident 2

- Sunday 11th September 2016
- Time: 03:55
- East (right-hand) tunnel
- Approximately 400m from exit portal
- Light traffic with low %HGVs



Fire Incident 2 - Outcomes

- Stopped vehicles detected by incident detection system
- Traffic stopped immediately (no evacuation)
- Fire suppression activated
- Fire & Rescue Service responded in line with procedures
- Incident cleared and tunnels open in 1 hour, 23 minutes



Conclusions

- Only minimal ventilation may be required in case of fire in tunnel with fire suppression
- Consider piston effect, wind stagnating at portals and meteorological pressure differences
- Excessive ventilation may be counter-productive