



# **Airport Link (APL)**

## **Air Quality, Ventilation and Monitoring**

# Presentation Overview

- **The APL Project.**
- **Air quality design goals.**
- **How tunnel air quality is managed.**
- **Air quality requirements for the APL.**
- **Air quality performance for other tunnels.**
- **Future trends, and**
- **Pollution reduction options for tunnels.**

# APL Emissions to Air

- **Vehicles are the primary emission source.**
- **APL includes open roads and vehicle tunnels.**
- **Ventilation is used to manage in-tunnel emissions.**
- **External road emissions disperse in the open air.**

# Air Emission Design Parameters

## In-tunnel air quality goals manage:

- Exposure of vehicle occupants
- Exposure of motorcyclists (where use is permitted).
- External road emissions disperse in the open air.

## External air quality goals manage:

- Community exposure in the tunnel surroundings.

# Inter-Relationships Between the Air Quality Management Goals

Ambient air quality goals apply externally to dispersed emissions



Emissions from ventilation outlet disperse in environment

In-tunnel goals determine design ventilation rates

# Air Pollution Management in Road Tunnels

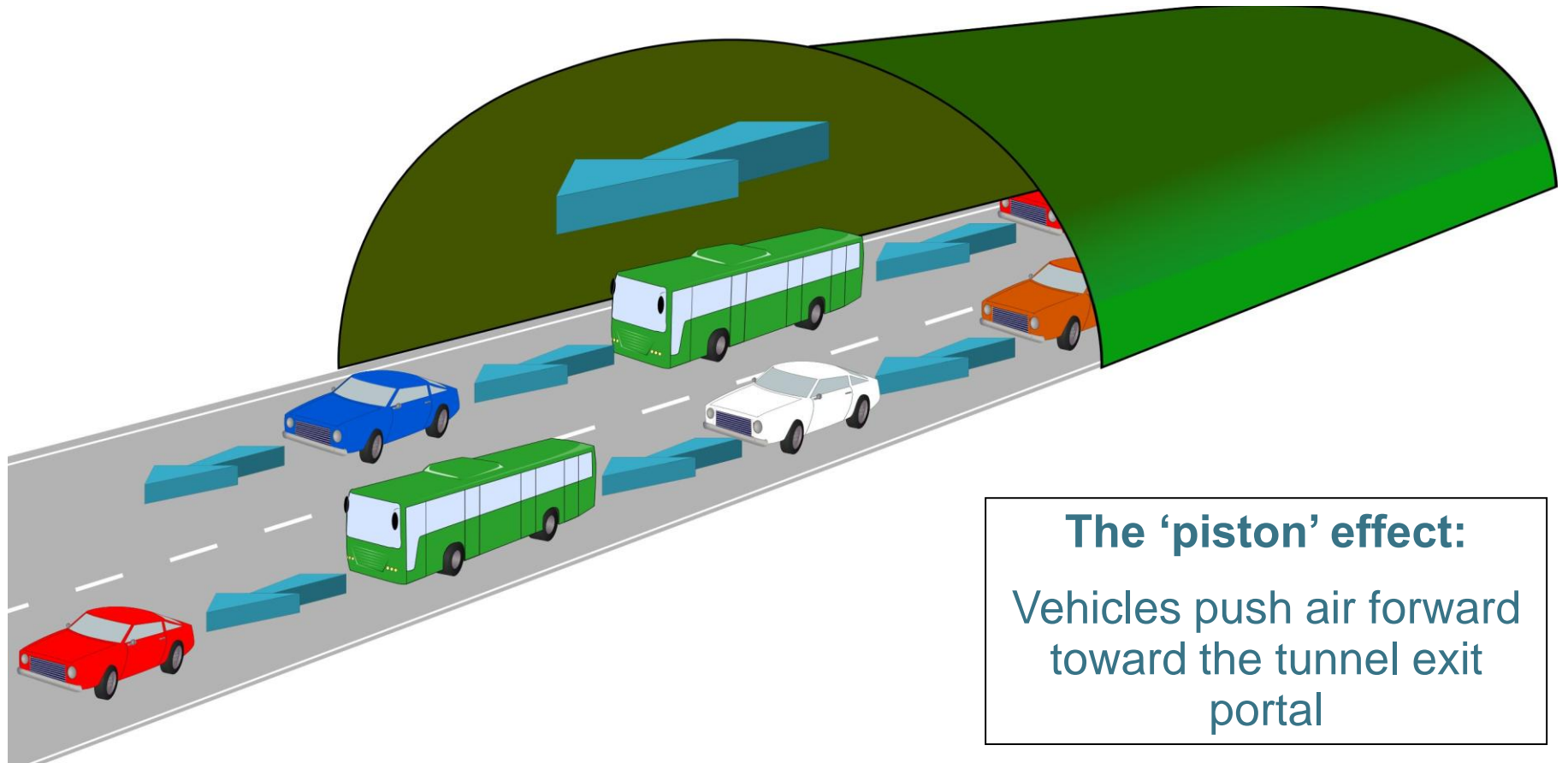
## Natural Ventilation:

- uses the 'piston effect' of vehicles pushing air forward through the tunnel.

## Forced Ventilation:

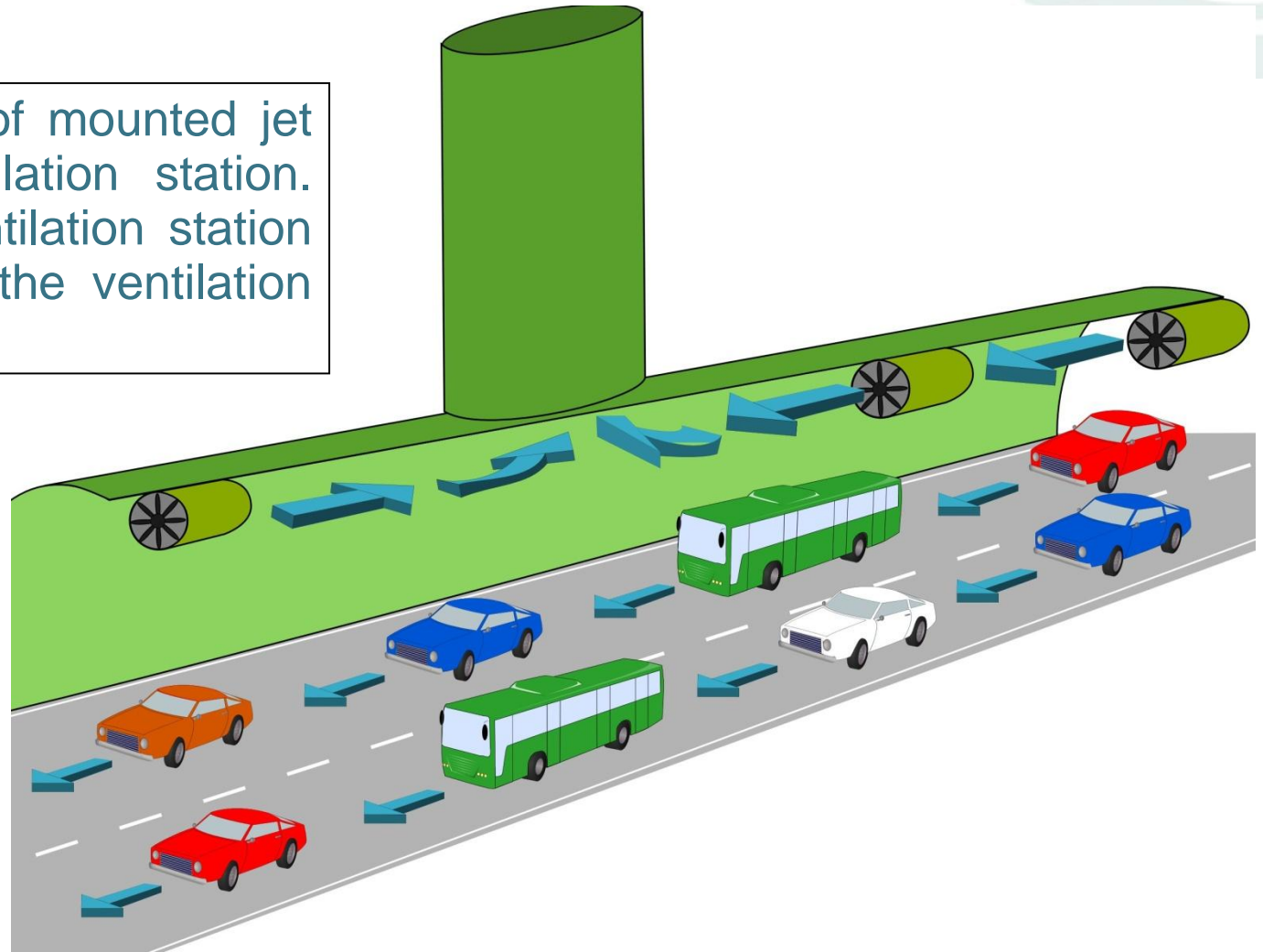
- uses mechanical ventilation to manage and direct air flows.

# Natural Ventilation



# Forced Ventilation

Air is directed by roof mounted jet fans toward a ventilation station. Axial fans in the ventilation station force the air out of the ventilation outlet.



# Benefits of Forced Ventilation

- Fresh air is drawn in to the tunnel, which dilutes the in-tunnel pollution levels.
- Portal emissions can be managed by directing polluted air against the traffic flow to the ventilation station.
- Allows emissions to be vented at a significant height above ground, providing improved dispersion in the atmosphere.
- Exit flow rates can be used to improve dispersion.

# Ventilation Design for APLNB

- 6.7 km tunnel, three ventilation outlets.
- Design ventilation rates were initially calculated based on air flow requirements required to meet in-tunnel air quality goals.
- Detailed atmospheric modelling of ventilation outlet emissions was then completed to assess compliance against external goals.

# Air Dispersion Modelling Studies

- Atmospheric dispersion modelling was completed for the ventilation outlets.
- Existing pollution concentrations and roadway emissions were added to the outlet predictions.
- Emissions from the Clem7 northern ventilation station were also added.
- Overall combined air quality impacts were calculated for the areas surrounding the ventilation outlets.

# Air Dispersion Modelling Results

- The air quality modelling has confirmed that the contribution of emissions from the APL ventilation outlets to local air quality is minimal.
- Predicted air quality contributions from the ventilation station emissions are well within the project air quality goals.
- The influence of existing background air concentrations and other local pollution sources such as major roads are the overwhelming influences on the predicted air quality.

# APL Air Quality Goals

- **Defined in the Co-Ordinator General's Report.**
- **Are consistent with the Queensland Legislation.**
- **Specify community exposure goals.**
- **Address the key health risk pollutants.**
- **Compliance monitoring is mandatory.**

# Co-ordinator General's Goals

<i>Pollutant</i>	<i>Goal</i>	<i>Unit</i>	<i>Measuring Period</i>
<i>Carbon Monoxide (CO)</i>	<i>8 or</i>	<i>ppm</i>	<i>8 Hour Maximum</i>
	<i>10</i>	<i>mg/m<sup>3</sup></i>	
<i>Nitrogen Dioxide (NO<sub>2</sub>)</i>	<i>63</i>	<i>µg/m<sup>3</sup></i>	<i>Annual Mean</i>
	<i>0.12 or</i>	<i>ppm</i>	<i>1 Hour Maximum</i>
<i>245</i>	<i>µg/m<sup>3</sup></i>		
<i>Nitrogen Dioxide (NO<sub>2</sub>)</i>	<i>50</i>	<i>µg/m<sup>3</sup></i>	<i>24 Hour Maximum</i>
	<i>50</i>	<i>µg/m<sup>3</sup></i>	<i>Annual Mean</i>
<i>Particulate Matter less than 10 µm (PM<sub>10</sub>)</i>	<i>25</i>	<i>µg/m<sup>3</sup></i>	<i>24 Hour Maximum</i>
	<i>8</i>	<i>µg/m<sup>3</sup></i>	<i>Annual Mean</i>
<i>Total Suspended Particulate Matter (TSP)</i>	<i>90</i>	<i>µg/m<sup>3</sup></i>	<i>Annual Mean</i>

# Performance Monitoring Requirements

Co-ordinator General's report defined operational monitoring requirements:

- **Six ambient air quality monitoring stations once tunnel operations commence.**
- **Two for each ventilation outlet.**
- **Each station to measure carbon monoxide, nitrogen dioxide and particulates (PM<sub>10</sub>, PM<sub>2.5</sub>, TSP).**

# Current Monitoring Station Locations



**Aviation High School**

**Monitoring  
Station**

# Current Monitoring Station Locations



**Monitoring  
Station**

**Kedron High School**

November 2011

# Performance of the Clem7 Tunnel

- Four ambient monitoring stations were installed prior to the Clem7 tunnel opening.
- Live monitoring data is presented on a website.
- Compliance reports are also provided on the website.
- Non-compliances have resulted from regional events such as bushfires, and are not attributable to ventilation station emissions.

# Future Trends

- **The focus for vehicle emissions is now related primarily to greenhouse gas emissions.**
- **Australia has recently proposed CO<sub>2</sub> emission standards for light vehicles.**
- **Internationally, the focus is moving toward fuel efficiency rather than control of specific pollutants.**
- **Emissions per vehicle kilometre travelled are expected to further reduce in the future.**

# Pollution Removal for Tunnels

- Proven technology for effective pollution reduction is not currently available.
- NSW RTA has been trialling pollution removal devices in the M5 East tunnel.
- This trial commenced in March 2010 and was to run for 18 months.
- Particulate and nitrogen dioxide removal devices were installed, with the objective of > 80% removal.
- Performance data has yet to be released.