Annex 8A

Route 16 Tunnel Ventilation Details

1. TUNNEL VENTILATION

1.1 Introduction

From tunnel ventilation viewpoint, the main advantages of the Alternative Alignment are:

- reduction in gradient inside tunnel;
- shorter tunnel length;
- shorter distance (more direct connection) between the ventilation plants and the concerned tunnel sections; and
- relatively less stringent portal emission constraint in the south portal due to increased distance from the densely built-up area of high background pollutant levels, which was not allowed in the Conforming Alignment.

Basically, the new tunnel ventilation scheme has utilized the decentralized system philosophy instead of the centralized scheme as adopted in the Conforming Alignment. The main advantage of this scheme is a substantial reduction on ventilation plant size, ventilation adit requirement and fresh air requirement. Moreover, the tunnel ventilation control philosophy for the Alternative Alignment is much simpler than the Conforming Alignment.

1.2 System Description

Both northbound and southbound tunnels are considered as two sections on the tunnel ventilation system, namely:

a) Middle section (1km), and

b) North section (1km).

A ventilation air flow schematic diagram is shown in Figure 7.1.

1.3 Normal Operation

1.3.1 Middle Section (1km)

This is the section located close to the original vent building site of the Conforming Scheme. A Mid Vent Building is retained at this location but with a much reduced plan size compared with the Conforming Scheme. Only one ventilation adit, 400m in length, and with a total cross-sectional area of 170m^2 is required. The adit has four compartments; two for supply and the other two for exhaust. Four groups of tunnel ventilation fans will be installed in the vent building as supply and exhaust to the tunnel sections. Jet fans are required only for the southbound tube to further induce outdoor air into the tunnel from the north portal.

1.3.1.1 North Bound Uni-directional Traffic

Outdoor air is supplied along this section with extraction points located in the middle of this section. The extraction system will be designed to extract the vitiated air for the first 0.5km of this 1km section near the south portal. With this arrangement and under the worst situation, the vitiated air will no be traveled over 2km and therefore the NO_2

conversion will not be over 10%. This results in a less amount of NO_2 inside the tunnel as well as a smaller extraction requirement.

1.3.1.2 North Bound Bi-directional Traffic

Since piston effect is insignificant with bi-directional traffic, consequently the tunnel ventilation system of this section will be operated as full transverse system. Outdoor air will be supplied along the tunnel with extraction point located in the middle of this 1km section. The extraction system will also be used to extraction the part of the vitiated air from the traffic in the other 1km section on northern side.

1.3.1.3 South Bound Uni-directional Traffic

As outdoor air is induced into the tunnel from the north portal, to minimize the amount of portal emission in Kowloon side, extraction point is located in the middle of this 1km section to extract the vitiated air emitted by the vehicles between the north portal to this extraction point (for 1.5km). For the rest of the 0.5km section, outdoor air is supplied along this section and extracted near the south portal. This scheme avoids further NO_x to NO_2 conversion and therefore results in a smaller tunnel ventilation requirement.

1.3.1.4 South Bound Bi-directional Traffic

The ventilation operating scheme is basically identical to the northbound tube during bi-directional traffic.

1.3.2 Northern Section (1km)

In both northbound tube and southbound tube, a vent duct will be provided along the whole tunnel length (1km). Under normal operation, the operating mode of these air ducts will be different.

The plan size of the current North Portal Building of the Conforming Alignment will need to be increased to provide additional floor space for housing five ventilation fans for ventilating this tunnel section.

1.3.2.1 North Bound Uni-directional Traffic

Similar to the northbound middle section, outdoor air is supplied along this section by the overhead vent duct. Vitiated air will be exhausted through the north portal.

1.3.2.2 North Bound Bi-directional Traffic

Since piston effect is insignificant with bi-directional traffic, consequently the tunnel ventilation system of this section will be operated as semi-transverse system. Outdoor air will be supplied along the tunnel through the vent duct. Part of the vitiated exhausted from the north portal and the rest will be extracted from the extraction point in the middle section.

1.3.2.3 South Bound Uni-directional Traffic

Outdoor air is induced into the tunnel from the north portal by moving vehicle. Depending on traffic throughput and traffic speed, tunnel jet fans will need to be operated to induce additional outdoor air into the tunnel. Vitiated air will be carried towards south by the vehicle piston effect and extracted by the extraction system in the middle section.

1.3.2.4 South Bound Bi-directional Traffic

The ventilation operating scheme is basically identical to the northbound tube during bi-directional traffic.

1.4 Emergency Operation

1.4.1 Middle Section (1km)

The overhead vent duct will be used as smoke extraction duct to maintain the required smoke clear height. The tunnel ventilation system in the other bound will be operated in supply mode such that smoke will not pass through the cross passage doors for passenger evacuation. The operation will be identical for uni-directional traffic as well as bi-directional traffic.

1.4.2 Northern Section (1km)

The emergency tunnel ventilation scheme will be identical to the 1 km middle section.

1.5 Chlorine Leakage

In the event of a chlorine leakage from the chlorine store at Tai Po Road Water Treatment Works or from the chlorine store at Shek Lei Pui Water Treatment Works, the outdoor air supply from the mid-ventilation building will be activated to minimize the risk of ingress of chlorine drawn into the tunnel.

1.6 Comparison of Conforming Alignment and Alternative Alignment

The main differences between the Conforming Scheme and Alternative Scheme are summarized as follows:

	Conforming Alignment	**Alternative Alignment**
Portal Emission	Not allowed in south portal	Max. allowed quantity of NO_2 is 0.17g/s from south portal
Gradient	1.85% for 2.5km (N/B); -0.5% for the last 0.1km (N/B)	-0.7% for tunnel (N/B)
Max. Airflow Requirement	1240 m^3/s	1020 m^3/s
No. of Tunnel Ventilation Fans	Axial fan: 38 Jet fan: 46	Axial fan: 24 Jet fan: 16
No. of Ventilation Adits (X-Sect Area)	3 No: ($160m^2$, $122m^2$, $40m^2$)	1 No: ($170m^2$)
No. of Vent Building (Plan Size/ Plan Area)	1 No: Mid Vent Bldg - 100m x 50m	2 No: Mid Vent Bldg - $2100m^2$ North Portal Bldg - $1500m^2$ *

* NOTE – Includes space allocation for other tunnel services equipment.

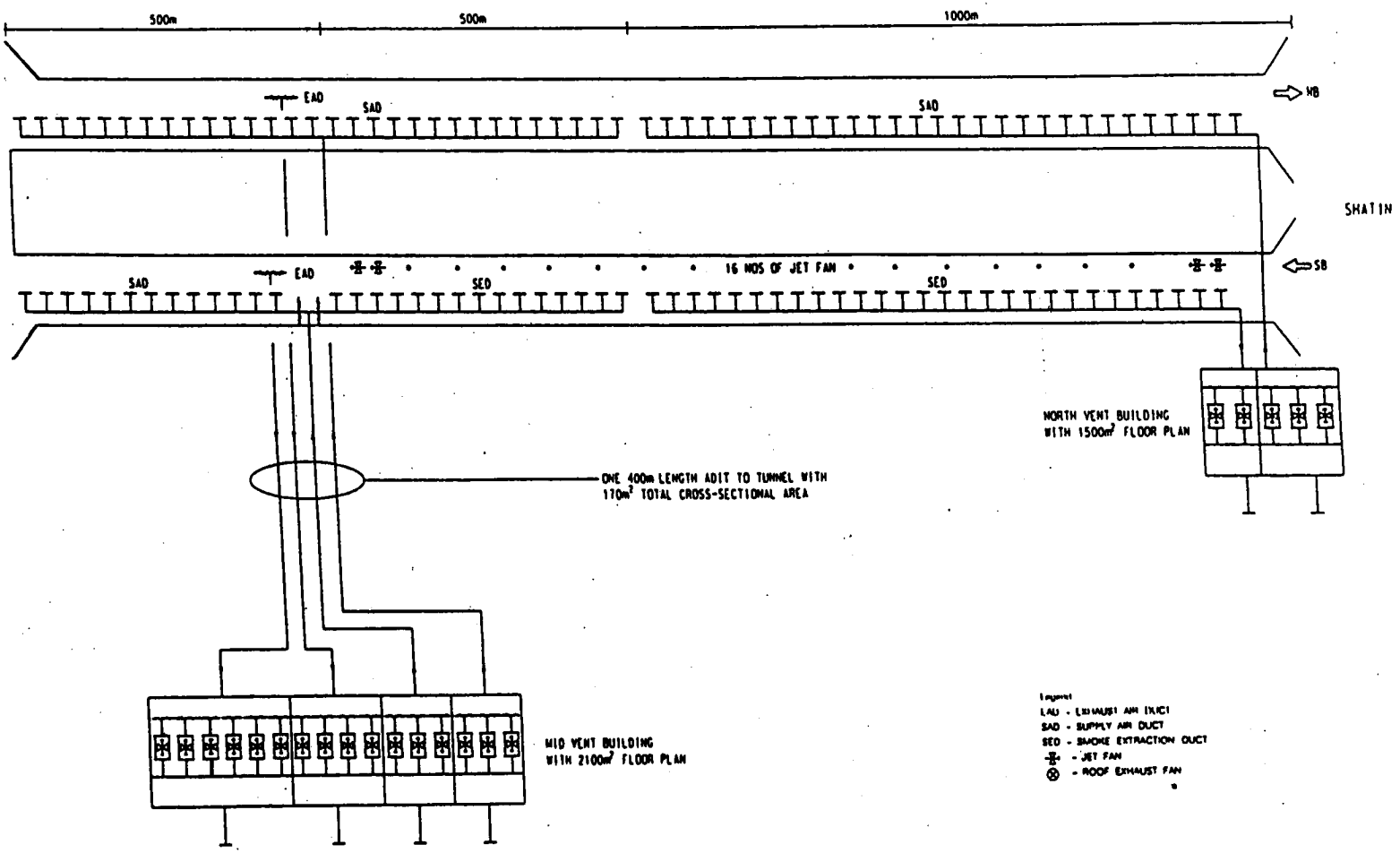

FIGURE 7.1 VENTILATION AIRFLOW SCHEMATIC DIAGRAM