

## Appendix 1.2 - JAPAN – Chiyoda Tunnel in Tokyo

### 1. SUMMARY – A JUNCTION TUNNEL IN AN URBAN AREA

About 30 million people, equivalent to 1/4 of Japan's population, reside in the greater Tokyo region. The Metropolitan Expressway is a network of toll expressways with a total road length of 301.3 km which functions as an arterial route for the traffic system in this region.

The Chiyoda Tunnel is 1.9 km in length (**Figure 1**) and is located at the junction between the Inner Circular Route and Route No. 4 (Shinjuku Line). This tunnel is a part of the initial Metropolitan Expressway routes constructed in time for the October 1964 Summer Olympic Games. Construction began in January 1962 and was completed in less than three years.

Some sections of the route adjacent to the Imperial Palace, including the Chiyoda Tunnel, were built underground in order to preserve the environment and cultural heritage. The Chiyoda Tunnel was constructed by the open-cut method. During the construction work, the stone wall of old Edo Castle was partially dismantled and rebuilt to its original condition.

In some sections, the tunnel structure forms part of the foundations for the viaducts. It was really challenging for engineers to design and build this complex structure, at that time.

There were concerns about the deterioration of the environment inside the tunnel due to the exhaust gas because there was no other expressway tunnel with such high traffic volumes in Japan at that time. A previously unprecedented transverse ventilation system was therefore adopted after its efficacy was confirmed through experimental work.

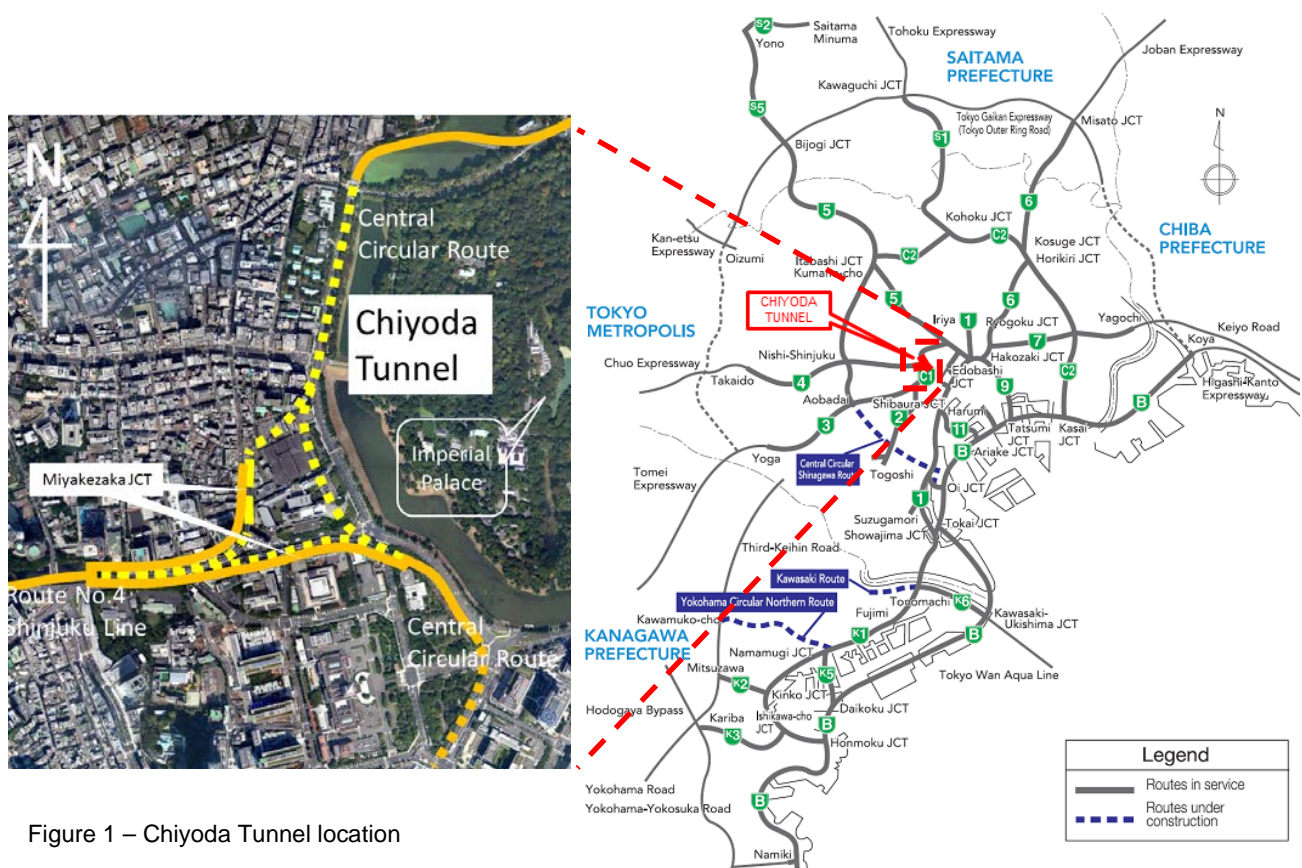


Figure 1 – Chiyoda Tunnel location

### 2. MAIN CHARACTERISTICS

#### 2.1 GEOMETRY

- Tunnel length: 1.9 km
- Maximum gradient: 5.9%
- Minimum radius of curve: 106 m

## 2.2 CROSS SECTION

A standard cross section is shown in **Figure 2** below. The main characteristics of the cross section are:

- Number of unidirectional lanes (per tube): 2
- Width of one lane: 3,25 m
- Vertical clearance 4,50 m (+0.2m for design)
- Restriction: dangerous goods vehicles are prohibited

## 2.3 ESCAPE ROUTE

- Distance between emergency exit doors along the road: about 400m
- Type of escape route: direct stair shafts to the ground level

## 2.4 TRAFFIC CONDITIONS

- AADT (annual average daily traffic): 25,000 veh. / day
- Speed limit 60 km/h
- Prohibited for bicycles and pedestrians
- No regular traffic queuing inside the tunnel
- CCTV, vehicles detectors and automatic fire detectors are installed in the tunnel to rapidly alert operators to incidents. For drivers, fire extinguishers, push button alarms, emergency phones and emergency exits are also installed. Instructions are given by operators to drivers through loud speakers and a radio rebroadcasting system in case of fire or other emergency.

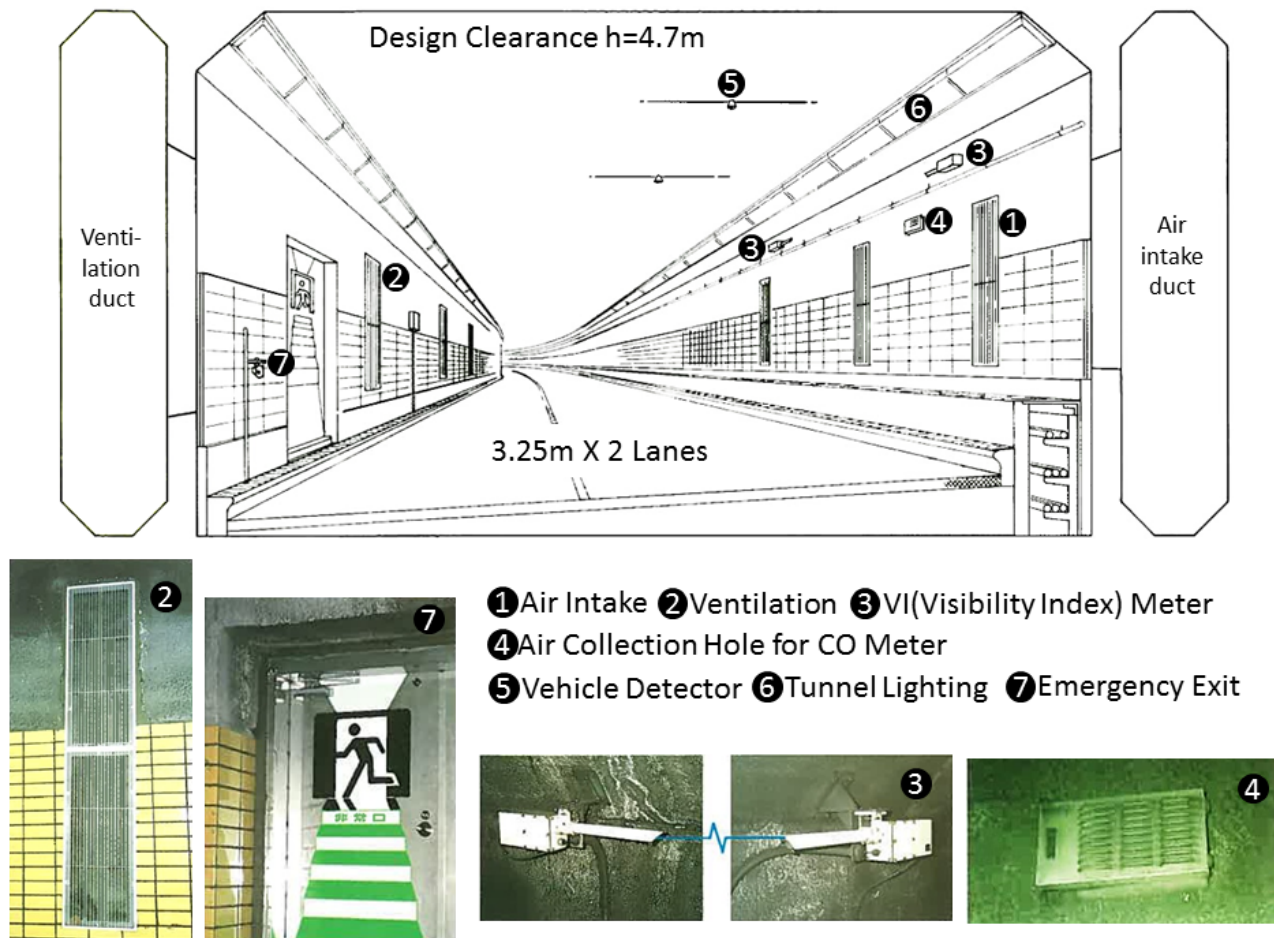


Figure 2 – Standard cross section and facilities

## 2.5 SAFETY & OPERATING EQUIPMENT

The main safety and operating equipment is shown **Figures 3 to 10** below.



Figure 3 - Warning Sign Board



Figure 4 - Emergency Phone



Figure 5 - CCTV Camera



Figure 6 - Automatic Fire Detector



Figure 7 - Push Button



Figure 8 - Fire Extinguisher



Figure 9 - Water Shower



Figure 10 - Foam Fire Hydrant

## 2.6 VENTILATION

- Number of ventilation stations: 9
- Type of ventilation system: transverse ventilation
- Air cleaners are installed in every ventilation station.
- VI (Visibility Index) meters and CO meters are installed and fans operated in response to monitored levels

**Figure 11** below shows the general layout of the Chiyoda tunnel, some characteristic cross sections (AA, BB, and CC) in front of the interchanges and the main ventilation stations.

The ventilation ducts for fresh air intake or smoke exhaust are installed on each side of the cross section (**Figure 2**) or above the cross section (**Figure 11**).

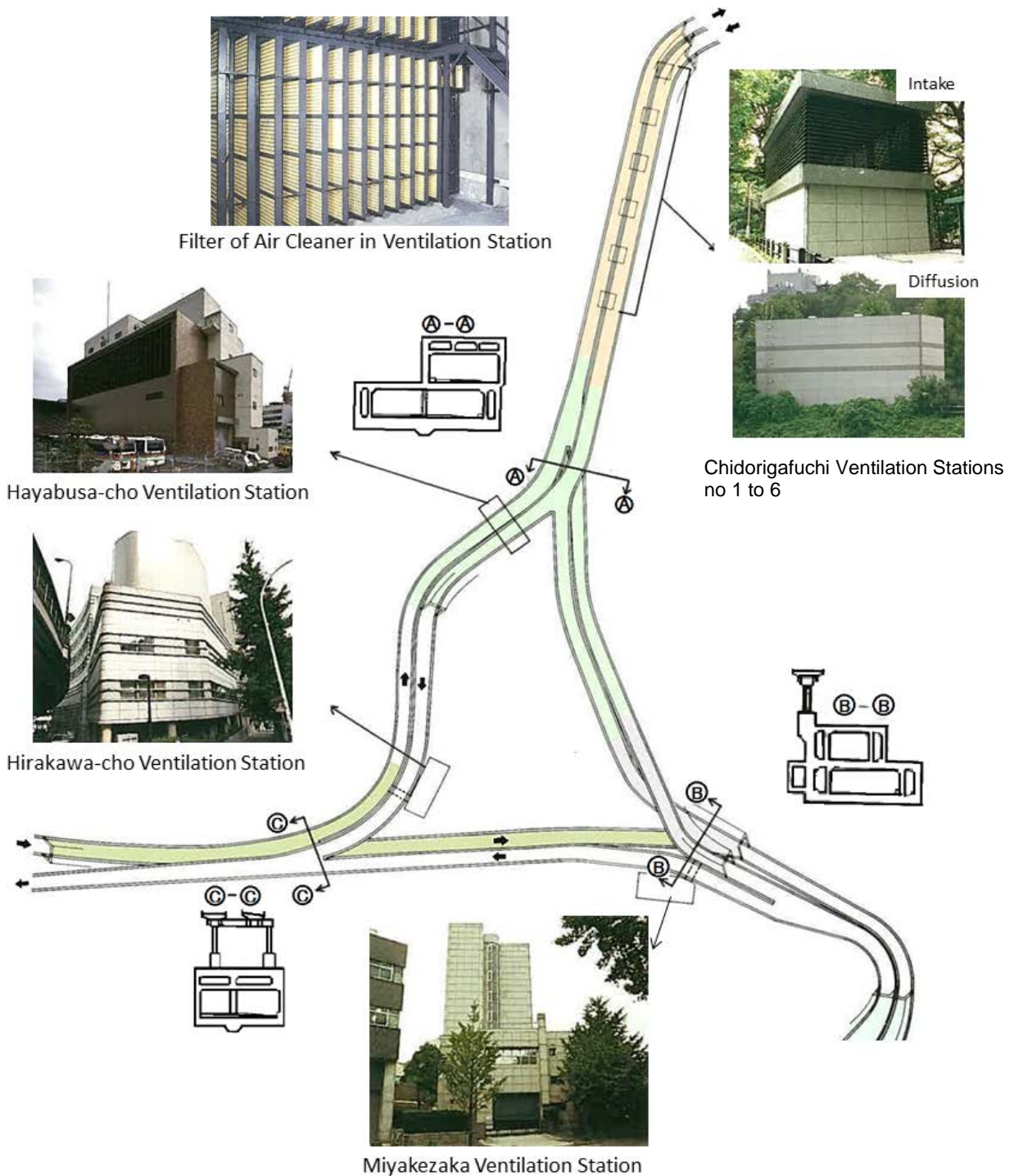


Figure 11 – Ventilation Stations on Chiyoda Tunnel

## 2.7 OPERATION

All the systems are controlled by operators in the operation room of the Hirakawa-cho Ventilation Station (**Figure 12**).



Figure 12 – Operation Room in the Hirakawa-cho Ventilation Station