

## Appendix 2.4 – CZECH REPUBLIC – Prague – Prague City ring – Tunnel complex Blanka

### 1. SUMMARY – TUNNEL COMPLEX BLANKA

This series of tunnels is located on the Prague City Ring (Czech Republic). The city of Prague has about 1,2 million inhabitants. The series of tunnels is on the western and northern part of the Prague City Ring and includes the underpass Zlíchov (ZAT), the Mrázovka (ATM) and the Strahov (SAT) tunnels and the Tunnel Complex Blanka (TCB) (Figure 1).

The tunnels on the Prague City Ring are owned by the City of Prague and operated by the “Technical Road Authority” state founded institution of the City of Prague.

All tunnels on the City Ring have two unidirectional tubes with two lanes in each. Exit and merging lanes enlarge two lane tunnels to three lanes over the required length. Exit and entrance ramps are one lane during normal operations and one and half or two lanes in the emergency situation.

Tunnel Complex Blanka consists of three tunnels: Brusnice, Dejvice and Bubeneč. Their total length is 5.516 km.

TCB was designed according to Czech standards “Design of the road tunnels“. However, the design does not comply with all requirements of the Czech Standard where there are entrance and exit ramps

Tunnel Complex Blanka (TCB) is planned to be put into operation in 2014.

Two main construction methods have been used for the TCB:

- TCB total length 5.516 m,
- Drill & blast construction method: 2.776 m,
- Cut & Cover construction method 2.740 m.

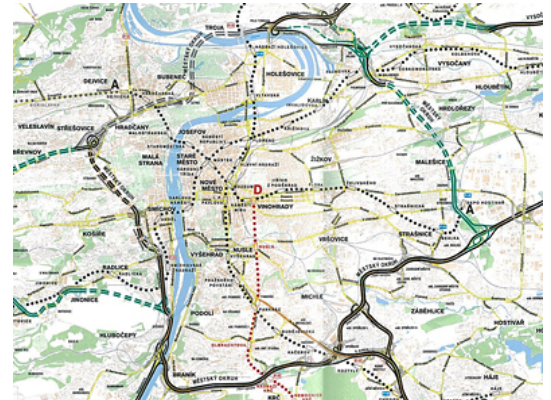


Figure 1 – Prague City ring - situation

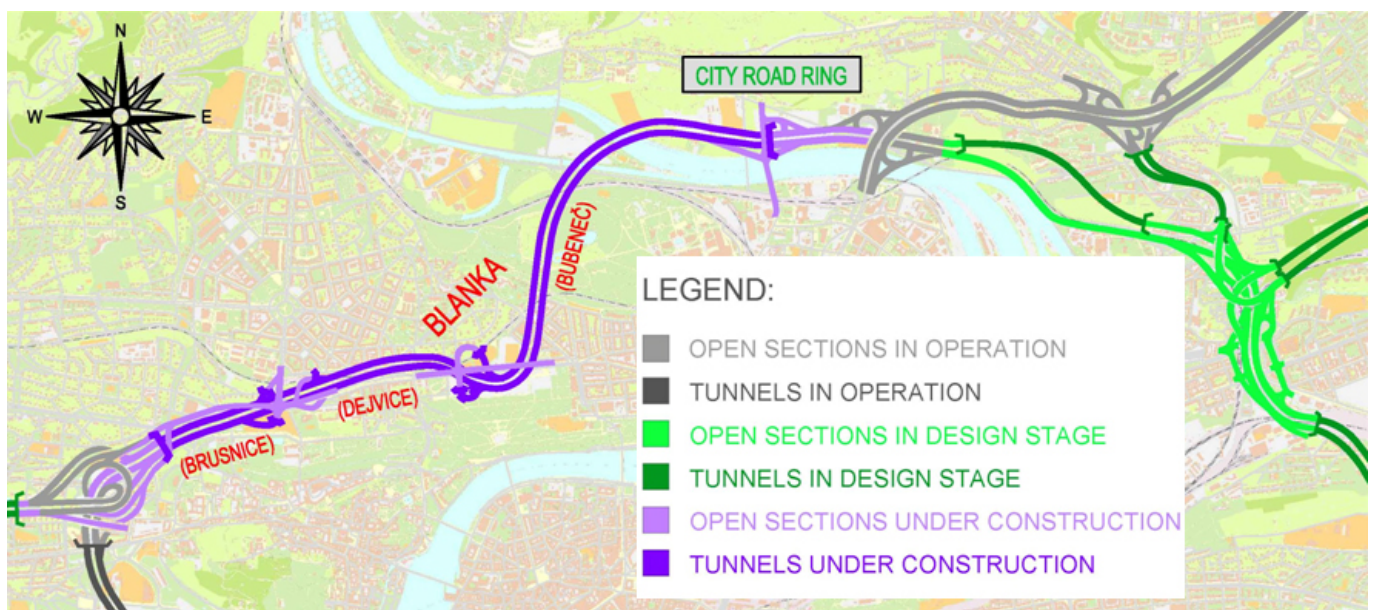


Figure 2 – Tunnel Complex Blanka

## 2. MAIN CHARACTERISTICS

### 2.1 GEOMETRY

- Tunnel length 5.516 m,
- Horizontal alignment: minimum radius of the curve : 205 m,
- Vertical alignment : maximum gradient of 5,0% in the tunnel and 8,0% for the ramps.

### 2.2 CROSS SECTION

#### 2.2.1 General cross section

- Lane width of 3.50 m (regardless of the number of lanes or type of construction),
- Vertical clearance 4.80 m,
- HGV traffic is forbidden.

The cross sections are shown figures 3 to 7 and pictures in figures 10 & 11.

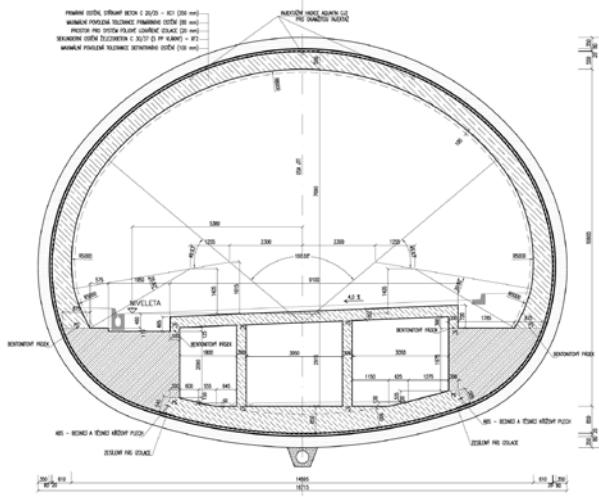


Figure 3 – TCB – drill & blast cross section

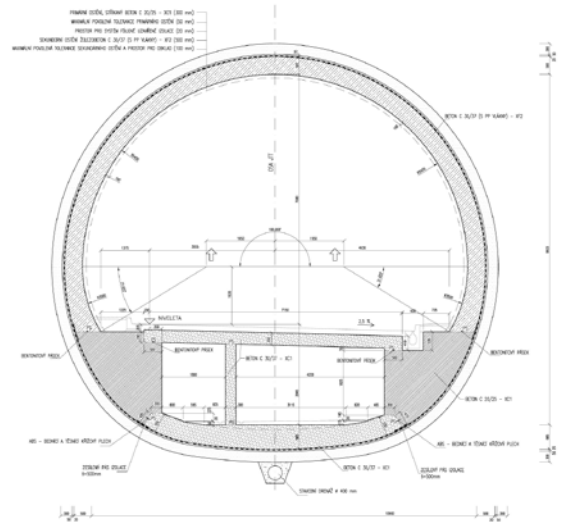


Figure 4 – TCB – drill & blast cross section

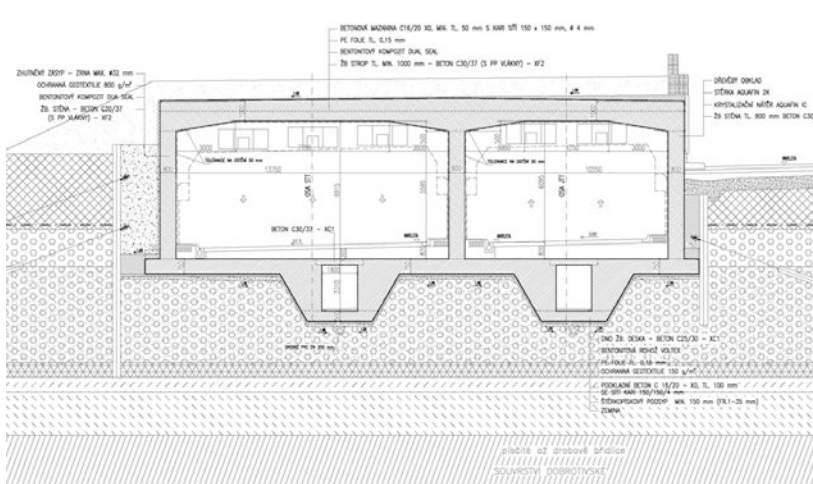


Figure 5 – TCB – cut & cover cross section

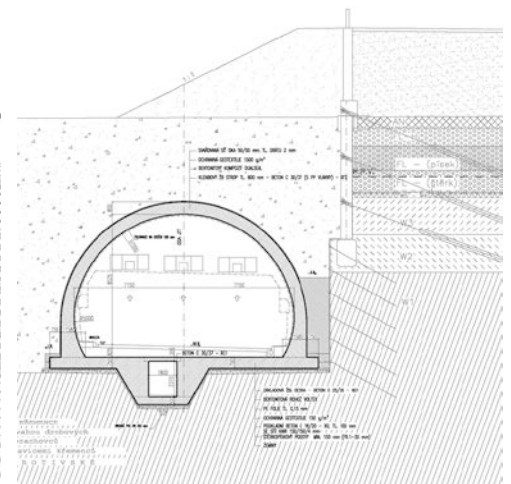


Figure 6 – TCB – cut & cover cross section



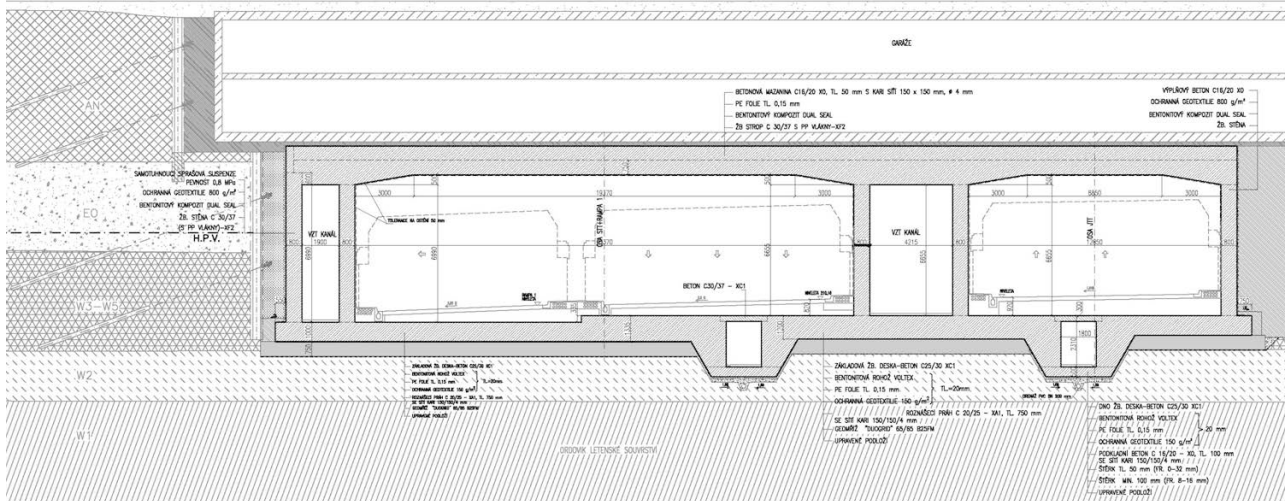


Figure 7 – TCB – cut & cover cross section

### 2.2.2 Escape route

- 23 cross passages between the two tubes, 6 for Fire Brigade vehicles (**figure n° 8**),
- maximum spacing of 250 m,
- cross passages are closed by doors and are pressurised.

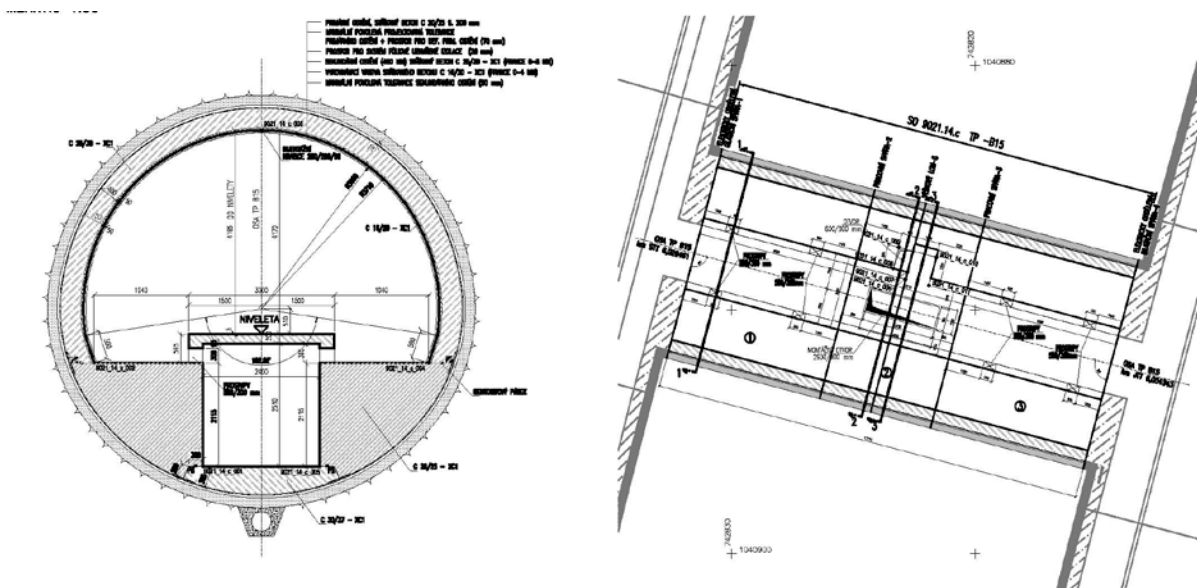


Figure 8 – TCB – escape route cross section

## 2.3 TRAFFIC CONDITIONS – BREAKDOWNS AND ACCIDENTS

### 2.3.1 Traffic conditions

The predicted traffic volume AADT (annual average daily traffic) and proportion of HGVs for the opening year 2014 are:

- |                    |        |          |        |
|--------------------|--------|----------|--------|
| • I.part Brusnice  | 75 000 | veh./day | HGV 4% |
| • II.part Dejvice  | 85 000 | veh./day | HGV 4% |
| • III.part Bubeneč | 78 000 | veh./day | HGV 4% |

The diurnal traffic volume is shown figure n° 9 below; this is the same as the one for the Strahov tunnel (western and middle tunnel tubes) for the year 2008.

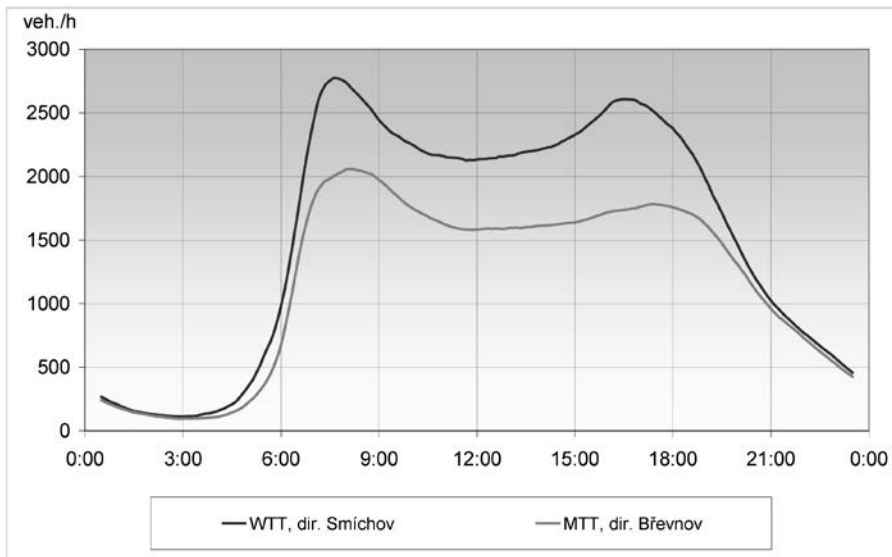


Figure 9 – distribution of the traffic volume

### 2.3.2 Road tunnels

- Speed limit 70 km/hour for the tunnel and 50 km/hour on the ramps,
- Prohibited for vehicles over 12 tonnes,
- Technical regulation TP 98 “technological equipment of the road tunnels” does not permit congestion in the tunnels”. If a queue appears in any part of the TCB the control system regulates, by traffic lights, the number of the vehicles entering the tunnels.

### 2.4 VENTILATION

The ventilation concept is defined in the table below. The Tunnel Complex Blanka comprises the three tunnels listed in the table.

tunnels	Length (km)	Type of ventilation systems in the main and secondary tubes	Normal ventilation strategy <sup>1</sup>	Emergency ventilation strategy for the main tubes <sup>2</sup>
Bubeneč	5500 m	Longitudinal with extraction	Natural with transfer of polluted air to the other tube (for NO <sub>2</sub> ); entrance ramps pressurised Global ventilation management with an expert system	Phase 1: air velocity $\geq 2$ m/s Phase 2: air velocity $>$ critical velocity Massive local extraction at 400 m <sup>3</sup> /s over sections between 400 to 600 m Transverse extraction at 280 m <sup>3</sup> /s over sections of 240 m
Dejvice		Longitudinal	Natural with transfer of polluted air to the other tube (for NO <sub>2</sub> ) Global ventilation management with an expert system	Phase 1: air velocity $\geq 2$ m/s Phase 2: air velocity $>$ critical velocity Massive local extraction at 300 / 400 m <sup>3</sup> /s over sections of 400 to 600 m
Brusnice		Longitudinal with extraction	Natural ventilation and transverse extraction Global ventilation management with an expert system	Phase 1: air velocity $\geq 2$ m/s Phase 2: air velocity $>$ critical velocity Massive local extraction at 300 m <sup>3</sup> /s over section between 400 to 600 m Transverse extraction at 220 / 280 m <sup>3</sup> /s over sections of 160 / 240 m

<sup>1</sup> No specific pollution and environmental control (like filtration, etc.)

<sup>2</sup> Note that ventilation of escapes routes is independent of tunnel ventilation

The ventilation system is designed for a fire power of 30 MW and a high probability of congested traffic inside the tunnel.

## 2.5 ENVIRONMENTAL ISSUES

### 2.5.1 Noise

The jet fans are equipped with noise attenuators. Passive noise reduction systems are installed inside the ventilation plant rooms.

### 2.5.2 Water quality

Water is not cleaned before discharge from the tunnels. In the case of an accident with spillage of dangerous substances, the operator is required to close the connection with sewerage system. Polluted water is removed to the water tank.

## 2.6 FACILITIES AND OPERATING EQUIPMENT

The tunnels are equipped with all the usual operation and safety equipment. Particular attention has been paid to the communication systems, the traffic management, safety and environmental conditions: monitors, CCTV, AID (automatic incident detection), loops, heat detection cables etc.

## 2.7 OPERATION

One organization (TSK) operates TCB and the city tunnels.

There are two operation centres in Prague:

- The technological centre operated by TSK. This centre operates, manages and supervises the equipment in all the tunnels,
- The traffic centre operated by the Police of the Czech Republic. This centre manages all the road traffic of the city.

Communication between the two control rooms is by telephone. The two control rooms receive information from all the control and monitoring systems and, in the case of detection of an incident, they inform each other immediately.

In the case of fire, the emergency services and fire brigade teams are at the two portals in less than 10 minutes.

## 3. PICTURES

The figures below show a ramp portal (**figure n° 10**) and a tunnel portal (**figure n° 11**).



Figure 10 – U Vorlíků intersection, ramp 1 (Dejvice) – view from the portal



Figure 11 – Eastern portal of the Tunnel complex Blanka (Bubeneč)