San Bernardo

Logistics systems: Renovation 1998

Project details
Country: Switzerland
Plant owner: Kantonales Tiefbauamt Graubünden
Contractor: JV Tunnel San Bernardo
Demand to Rowa: Overhaul, lowering of ventilation duct bottom and cable track

Technical details
Tunnel length: 6,800 m
Average daily performance with 2 shifts (2 x 8.5 h): 15.0 m
Peak performance per day: 20.0 m
Outbreak volume: 6.0 m³/h = 120.0 m³/15 h
Peak outbreak volume: 8.0 m³/h

About the project
The road tunnel was built in the years from 1962 to 1967. With its length of 6800 meters it was then the longest in Europe. It was excavated by conventional methods. The San Bernardo road tunnel connects Northern with Southern Switzerland.

The roadway was damaged to such a degree, especially by the continuous accumulation of salt, that a complete overhaul became unavoidable.

There are three channels running under the roadway. The middle one is the ventilation duct. In order to avoid diminishing the ventilation cross section as a result of the reinforcement of the roadway, it was necessary to lower the bottom of the ventilation duct. During the overhaul works the road traffic remains unimpeded.
About the logistics system

Developing a logistics system with specially designed installations and machinery able to overcome the handicap of the limited height of the middle channel (only 1,70 m), was an extraordinary challenge for Rowa.

A challenging feasibility study for the lot “lowering of the duct bottom and cable track” (consolidation of the channels under the roadway) enabled us to find and propose solutions for the supply and removal installations, which guaranteed optimal technical and economic conditions. The excavated material from the lowering of the bottom is removed through the middle channel. At the same time the installation supplies concrete elements to the eastern channel.

Rowa’s main concern, besides making sure that the installations guarantee the required performance, was safety at the work place. The muck is brought by a special excavator through a funnel to the loading installation, which guarantees a continuous loading of the transport baskets. These are positioned under the loading conveyor, on a trailer with all-wheel steering. A diesel tractor pulls or pushes the transport unit equipped with a manoeuvrable rear axle. For the removal of the muck the emergency siding recesses, which are placed every 700 m in the road tunnel, are used. The four transport baskets are removed from the trailer over an integrated roller conveyor system with driven rollers into the elevator shaft and handed over to the portal crane. The empty baskets are then returned to the trailer. During these operations the trailer does not have to move lengthwise. The portal crane empties the muck (1,6 m³ per transport basket) into the trough waiting in the siding recess. Only one operator is needed to take care of the filling of the baskets, their transportation and their emptying into the trough.

A self-propelled vehicle with its own diesel engine transports the concrete elements (3 units of 2 m each) from the siding recess to the installation site and places them into the prepared channel.

Technical details machinery

Special low level trailer Rowa:
- Length: 11,5 m
- Width: 1,47 m
- Height with basket: 1,05 m
- Net weight: 6,3 t
- Load capacity: 14,7 t
- Total weight: 21,0 t

Conveyor loading installation
- Transport capacity: 8 m³/h (loose rubble)
- Length: 17,5 m
- Width of belt: 800 mm
- Available power: 5,5 kW

Discharging and transverse conveyor installation
- Speed roller conveyor: V = 0,4 m/s
- Speed longitudinal movement: V = 0,2 m/s
- Weight: 2,8 t
- Available power: 5,9 kW

Transloading crane siding recess
- Carrying force: 4 t
- Stroke: 6 m
- Height of hook over roadway: 3,5 m
- Driving range: about 19 m
- Length: 6,5 m
- Width: 3,5 m
- Height: 4,2 m
- Weight: 7,5 t

Transport vehicle for concrete elements
- Length: 12,5 m
- Width: 0,9 m
- Height: 1,6 m
- Weight: about 3,3 t
- Diesel generator: 13 kVA

Tractor
- Tractor: Tigre Trac 8008

Scope of delivery

- Feasibility study
- Loading installation
- Transport baskets
- Trailer
- Discharging and transverse conveyor installation
- Transloading crane in siding recess
- Transport vehicle for concrete elements
- Remote control for loading conveyor
- Access and work place surveillance