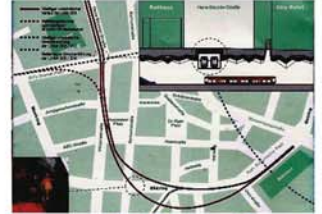




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ITC NEWS

- 15- 2003



The JV Tunnel for the Underground Section of Line 306 of the Bochum Metropolitan Railway, from the Town Hall to the Central Station

A Two Level Tunnelling System to reduce the Construction Phase



Fig. 1: Schaeff Tunnel Heading & Loading Machine Type ITC 312H1 in conventional tunnelling in the second tube tunnel

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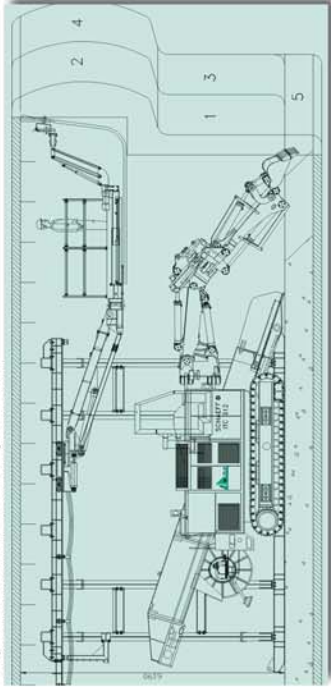
A Tunnelling Unit consisting of a Tunnel Heading & Loading Machine made by Schaeff, Type ITC 312 together with a GTA Tunnelling Gantry with Slewing Platform and Boring Equipment

Tramway line No. 306, connecting the Wanne Eickel area of Herne with the Central Station is the last tramway line in the city centre that needs tunnels to be built for linking it with the Bochum Metropolitan Railway. The obvious advantages are: shorter journey times, weather protected tracks in the station area and a city centre boulevard that is to a great extent kept separate from traffic; all this will ensure a better environment to live in. To construct the shell will take approximately three years. The cost will be approximately € 25 million. The largest part of the tunnelling work will be carried out by using a mining construction method, which means that it will interfere with life in the city centre hardly at all.

The greatest challenge with regard to this construction site was the development of a system, which would allow, within the extremely narrow area available, the achievement of the desired flexibility that is dependent upon the differing geological conditions. In this area work has traditionally been carried out with extremely heavy road header, which naturally will achieve a very good result given a certain type of ground structure. The geology of this construction site was described as being from silt on top of sand to semi solid to solid marl. On account of the very small amount of cover, there was also a high risk of settlement. In very soft formations only a load-carrying capacity giving relatively low ground pressures should be used. Against this background, it was clear

that conventional solutions could not lead to a successful result.

Excavation and protective cover had to take over from one another, without either one or the other causing any interference. The basic idea was to work at two levels, the bottom one being dedicated to tunnelling and the top one to building the protective cover. Because of the roof cover, it was not possible for anything to be suspended on the tunnel extension. For this reason the use of an overhead rail track suspended from the roof was precluded.



construction segment of the Southern Circle in Bochum. Because of the TVP, plant such as drill carriages, loading and cutting gear, discharge conveyor systems, spray manipulators, etc. can be split up and installed on two levels.

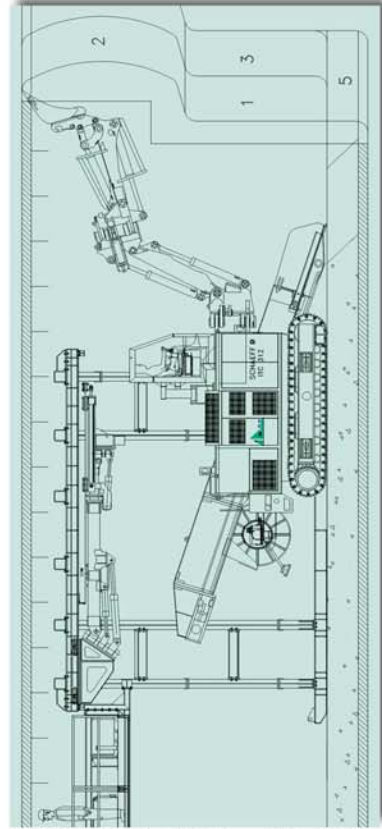
The second level allows flexible adaptation of the system as well as a maximum amount of parallel working of the operations to be carried out in the field of tunnelling. The setting up times are limited to that needed for travelling the clear short roadways in the roof to the road head, because the power, air and water supplies remain permanently connected to the system by trailing supply lines. The GTA TVP machine is driven electrically. The mine floor is kept free for the efficient:

Schaeff Tunnel-Heading & Loading Machine Type ITC 312

Shunting work backwards and forwards is to a great extent eliminated. It creates more free working space on the mine floor. A further advantage is the increase in safety of work at the road head.

The tunnel extension and platform machinery, installed by GTA in the mining industry for 20 years for second level working, is normally suspended on monorail overhead rail track in the section of the extension or on anchors that can be traversed. The possibility of using suspension on extensions or anchors is, as a rule, not possible in the construction of underground railways with thin roof cover or poor surrounding rock formations.

The TVP consists of a gantry carrier construction mounted on skids, which on the roof is equipped with two longitudinal sets of traverse rails. A slewing platform runs on one of the sets of traverse rails, which can be driven forwards or backwards and is fitted with a built-in spray manipulator. The slewing



platform can be moved in the space available so that it is capable of being used for all normal tunnelling work. The built-in spray manipulator coats the whole of the tunnel cross-section and, when idle, is parked next to the operating cage of the slewing platform.

On the second set of traverse rails, there is a complete drilling attachment that is capable of being moved forwards or backwards. This drilling attachment can be used for the fitting of broaches and boards and also for anchoring.

Because of the units, which are capable of being traversed longitudinally and operate independently of each other, four different working operations can be carried out in parallel.

The complete electro-hydraulic power pack with 80 kW power output is suspended on a carrying frame at the back of the gantry construction. Underneath both of the suspended items of equipment, in the case of the tunnelling work in Bochum, is fitted a:

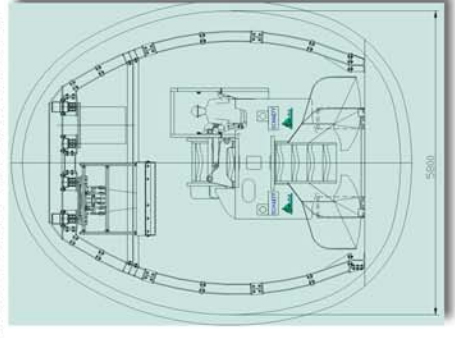
Schaeff Tunnel-Heading & Loading Machine Type ITC 312

Technical Specifications	ITC 312
Basic machine Schaeff, Type	mm 2300
Chassis width	mm 770
Conveyor internal width	mm 110
Electric drive power (400 V)	kw/h 0-3.6
Travel speed, for- & backwards	m/s 0.5
Conveyor chain speed	m ² /h 250
Conveying capacity	KN 139
Break out force	KN 280
Pulling force	t 30
Weight approx.	

Further information can be obtained from:
www.ifesa.com
www.bemo.co.at and
www.gta-maschinensysteme.de

the tunnelling gantry:

The GTA Tunnelling Gantry Type TVP - An innovation in driving stretches of underground railway is the Tunnelling Gantry Type TVP that has been developed by GTA in co-operation with Beton- und Monierbau. This equipment is currently in operation on Plot 306 of the underground railway



In order to achieve a compromise, GTA developed a tunnelling gantry.

Schaeff Tunnel-Heading & Loading Machine Type ITC 312

This set of equipment was chosen because of its great strength, its compact design and electric drive. The boom equipment "H1" has a console capable of rotating and slewing, which is fitted between two jibs and a short shovel bucket boom. With the axis of rotation in the horizontal position, profile cutting of the cap surface in the region of $\pm 45^\circ$ can be carried out. In each case the additional slewing movement of 105° in relation to the axis of the direction of work, make it possible to dig out behind steel arches and with the axis of rotation in the vertical position to break down the side walls faces parallel to the machine. Even the break down of the cap surface for its forward movement can be done. Load counter-pressure valves were fitted, in order to be able to install the steel arches on site with this working equipment.

The machine was equipped with a



Fig. 2: Spraying robot



Fig. 3: Remote control panel

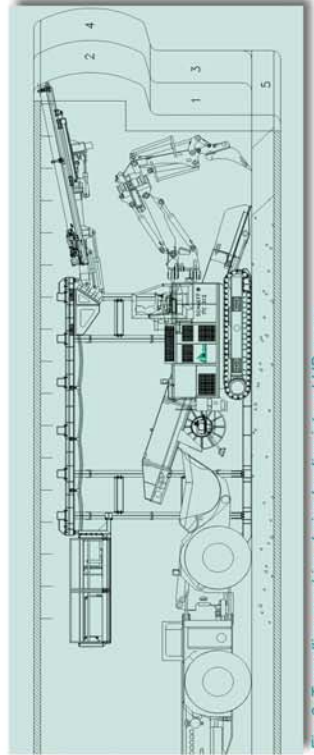


Fig. 8: Tunnelling machine during loading into a LHD scoop



Fig. 9: Tunnelling gantry with tunnelling machine in restricted space



Fig. 10: ITC 312 in the mucking position



Fig. 11: ITC 312 when breaking down the right-hand side walls



Fig. 12: ITC when excavating the hard marl clay



Fig. 13 – 15: Drilling gear on the GTA Tunnelling Gantry



Fig. 16: ITC 312, with the cab slewed to the left



Fig. 17: Fore polling top heading



Fig. 18: Carrying out precise work

**TUNNEL HEADING and LOADING MACHINE
SCHAEFF Type ITC 312 H1**