The URM 700: the first machine enabling ballast cleaning in turnouts in assembly-line method

The current methods applied to ballast cleaning in turnouts are regarded as time-consuming, labour-intensive and cost-intensive. Plasser & Theurer has now brought the URM 700 onto the market. For the first time ever, this machine allows ballast cleaning in turnouts to be performed using the assembly-line method. The first operations have been satisfactory. The machine's outstanding features are short maintenance times, versatility and excellent quality.

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▶ Turnouts are an important investment good for all railways and make up a substantial share of the fixed assets. The capital outlay for a turnout, type EW 500, for instance, is equivalent to 450 m of track. Consequently, it is in the interest of the railways to operate turnouts as cost-efficiently as possible.

To achieve this, the following aspects are crucial: Firstly, maintaining turnouts cost-efficiently in the long term requires expert maintenance right from the beginning. Secondly, systematic and mechanised turnout maintenance is required.

1. REDUCED MECHANISED MAINTENANCE CAUSES HIGHER COSTS

Neglecting maintenance can result in damage to the track, making speed restrictions necessary. Depending on the duration of the hindrance, the costs for the speed restriction can exceed the costs incurred by the maintenance department when correcting the fault. The speedy correction of faults, however, reduces the number of speed restrictions and, thus, the costs.

FIG. 1: Ballast cleaning in turnouts using the URM 700

Moreover, practical operation has shown that the reduction of mechanised maintenance causes a progressive rise in the costs for repairs as it results in an increase in cost-intensive manual work.

2. MECHANISED TURNOUT MAINTENANCE PAYS OFF

Dr. Dipl.-Ing. Peter Veit, Institute of Railway Engineering and Transport Economy of Graz University of Technology (TU Graz), found that systematic maintenance performed in good time extends the service life of turnouts by 20 to 30 %. Faults that are neglected lead to decreases in the service life. Studies carried out by TU Graz and ÖBB Infrastruktur AG further evidence the cost-efficiency of expert turnout maintenance. Figure 2 shows an overview of the factors that contribute to the life cycle costs of turnouts and tracks. For all types of traffic loads examined, depreciation has a dominating position. As regards the cost-efficient operation, the extension of

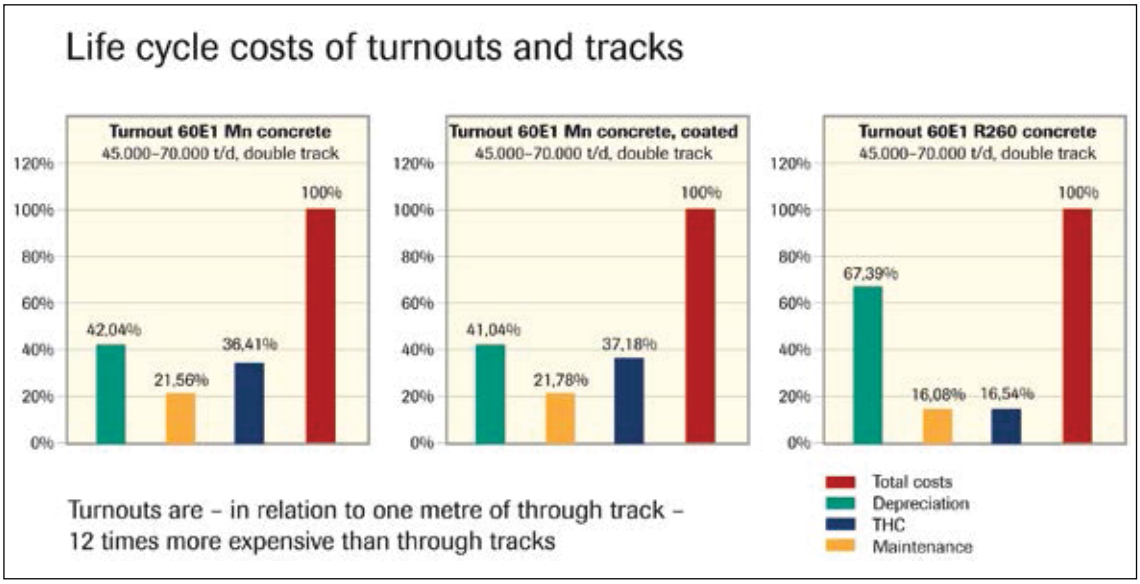


FIG 2: Life cycle costs of turnouts and tracks

the service life is, therefore, of utmost importance. It can only be achieved by systematic and mechanised turnout maintenance.

3. PREVIOUS METHODS OF BALLAST CLEANING IN TURNOUTS

In the past, basically two methods have been applied to ballast cleaning in turnouts. The majority of the machines used work in cyclic action; for instance the RM 80 UHR. Using this machine, intermediate links are inserted to extend or reduce the excavating width step by step (fig. 3). As an alternative to the use of these machines, the ballast can be cleaned or exchanged during a complete replacement of the turnout.

However, both methods are regarded as time-consuming, labour-intensive and cost-intensive. Therefore, Plasser & Theurer has developed a machine concept based on the principles of the assembly-line method.

4. REQUIREMENTS TO BE MET BY THE NEW MACHINE CONCEPT OF THE URM 700

The impulse to develop a new machine concept originally came from the US. In particular, Burlington Northern and Santa Fe Railway (BNSF) requested a machine enabling heavily-used turnouts to be cleaned faster, safer and more cost-efficiently. As a consequence, Plasser & Theurer prepared a list of requirements including the following criteria:

- Short set-up times
- Deployment in short track possessions
- No need to cut the rails
- Variable excavating width of up to 5.5 m
- Straight cut
- High level of recycling thanks to screening unit
- Supply of new ballast

The URM 700 meets all these requirements. It was presented at the iaf 2013 in Münster for the first time. Since then, it has been used on the network of Austrian Federal Railways (ÖBB). It enables turnouts, connecting tracks and shoulders to be cleaned in continuous working action.

5. COMBINING WELL-PROVEN AND INNOVATIVE COMPONENTS

The URM 700 combines well-proven components, such as the shoulder excavating unit, the vibrating screening unit, conveyor units and the drive unit, with innovative new components. This includes state-of-the-art control engineering via PLC and bus systems.

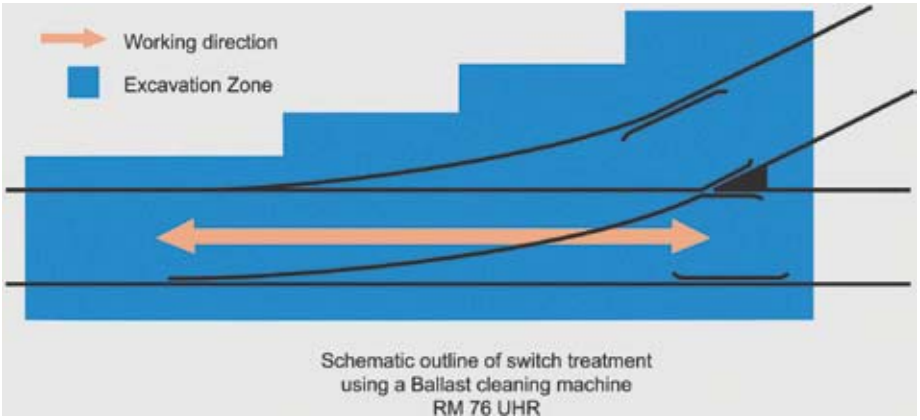
The new excavating chain posed a particular challenge: it is approx. 5.5 m long, suspended on one side and can be slewed in either from the left or the right. This design allows the excavating width to be varied depending on the setting angle. Another challenge posed to the Plasser & Theurer engineers was the design of the lifting unit which has to perform under the special conditions during continuous-action turnout maintenance.

6. THE WORKING PRINCIPLE OF THE URM 700

Using the URM 700, ballast cleaning in turnouts is performed in assembly-line method.

During the first stage of work, the ballast is excavated at the shoulder using the shoulder excavating units. Then, it is cleaned and stored. During the second stage of work, the excavating chain is slewed in the previously prepared hole and positioned underneath the sleepers. »

FIG 3: Diagram of turnout maintenance using the RM 80 UHR / RM 75 UHR ballast cleaning machine



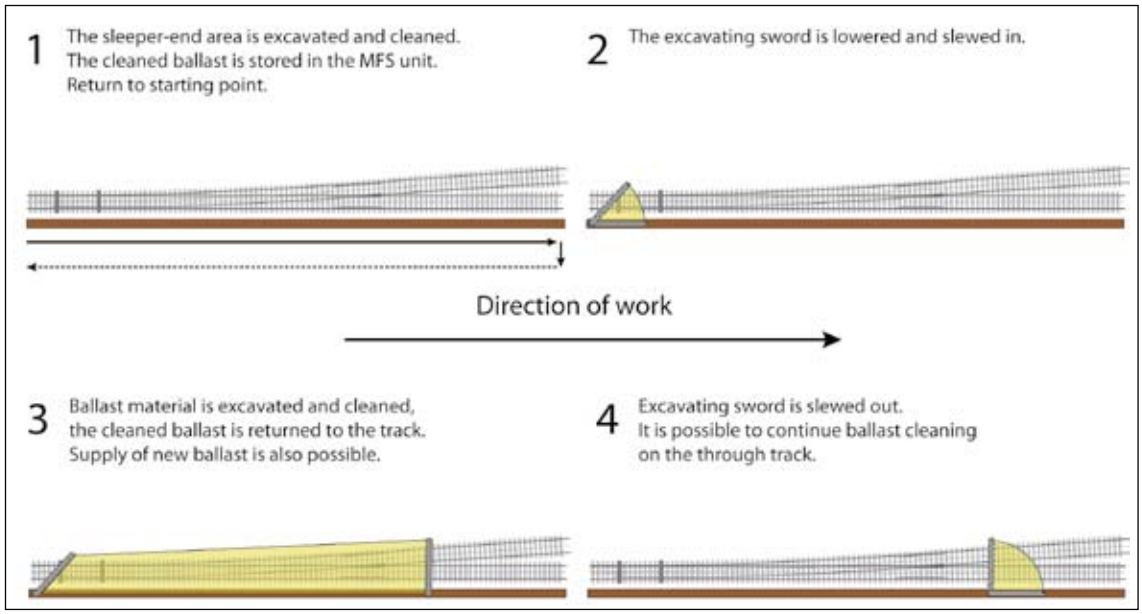


FIG 4: Work sequences in the turnout area using the URM 700

Using this chain, the ballast is conveyed to the shoulder excavating unit (fig. 5). From there, the ballast is transported via the conveyor belt to the screening unit. The cleaned ballast is returned to the sleeper area using two slewing conveyor belts. The spoil material is transported to the MFS material conveyor and hopper units located at the front. If required, new ballast can be placed from MFS units coupled at the rear of the machine.

During maintenance, the turnout is held in position using a combined lifting unit with roller clamps and lifting hooks used as required.

7. ADVANTAGES OF THE CONTINUOUS-ACTION BALLAST CLEANING IN TURNOUTS USING THE URM 700

The new machine concept enables ballast bed cleaning to be performed without removing the turnout and allows a continuous working progress to be achieved. Moreover, shoulder cleaning and cost-efficient ballast cleaning in short track sections are two major advantages offered.

There is no need to cut the rails, neither at the start nor at the end of work. The set-up times are short. The screening car allows thorough cleaning of the ballast and enables returning large quantities of ballast to the turnout. Thanks to the MFS units coupled at the rear, material can be transported to and from the machine.

The URM 700 is equipped with a separate drive unit (two diesel engines) with a total engine output of 857 kW. Therefore, the machine can travel short distances at a maximum speed of 20 km/h without the need to be towed by a locomotive. The screening car is fitted with a 168 kW drive unit to operate the screen. If necessary, the screening car can be separated from the machine and used for ballast bed cleaning.

FIG 5: Excavating chain and sword of the URM 700 in operation

8. SUMMARY

To extend the service life of turnouts cost-efficiently, the URM 700 can perform all standard working methods of on-track ballast cleaning, particularly ballast cleaning in turnouts and plain track. Based on experience gained so far, it is estimated that cleaning and ballasting of diamond crossings with single slips takes between 3.5 and 4.5 hours. In addition to this, it can be used to clean the ballast shoulders only. The supply of new ballast is an integral feature of the concept in all variations and it is even possible to perform a complete exchange of ballast. Due to the fast and independent installation and removal of the excavating unit, the URM 700 can also work cost-efficiently on short sections of track. ◀