

RAIL ENGINEERING INTERNATIONAL

EDITION 2018
NUMBER 2



The no. 1 in measuring technology

Plasser & Theurer

Faster ballast bed cleaning of turnouts by means of the URM 700-2

Since its introduction in 2012 until late 2016, the Plasser & Theurer URM 700 universal ballast bed cleaning machine for plain track and turnouts has gained extensive operating experience on Austrian Federal Railways (ÖBB). Based on findings made during this time period, the operating concept of this machine has been re-designed, in order to further optimise the work processes and enhance safety for the work crew. This has resulted in the URM 700-2, which offers a high machine operating efficiency and achieves a high output in a safe, cost-efficient and environmentally-friendly manner. Using this machine, complete track closures are no longer necessary, and time windows needed for ballast bed cleaning of turnouts are very much shorter – precisely what railway administrations want: speedy, safe and high-quality ballast bed cleaning of turnouts without any lengthy traffic disruptions.

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Fig. 1: The Plasser & Theurer URM 700 universal ballast bed cleaning machine for plain track and turnouts – this multi-talented machine can perform non-stop mechanised maintenance of turnouts, without requiring any dismantling of the turnout or digging of an access hole

High-performance machine concept proven in practice (Fig. 1)

In 2012, the URM 700 was introduced, which masters all the prevailing functions required for on-track cleaning of the ballast bed, be it of turnouts, plain track or just the track shoulders (Fig. 1). This multi-talented machine can perform non-stop maintenance of turnouts, due to the guide bar design of its ballast excavation chain, which is infinitely adjustable up to a width of 6,100 mm, and can be inserted (and removed from) underneath the track panel without requiring any dismantling of the turnout or digging of an access hole. In all scenarios of application, the machine can be used for just supplying new ballast right up to completely replacing the ballast bed.



Fig. 2: No traffic disruption on the adjacent track – machine operations solely take place on the track under repair, without infringing the clearance gauge of the adjacent track

Due to the fast and independent insertion and removal of the ballast excavation chain, the machine can also work cost-efficiently on short sections of track where only short track possessions are available (spot cleaning).

Soiled ballast material is cleaned by three screens on-board the integrated ballast screening car, and any spoil is transferred to MFS material conveyor & hopper units at the front of the machine. The cleaned ballast is returned to the track, and any new ballast needed is supplied from MFS units that are coupled to the rear of the machine.

Experience gained on ÖBB

Since its introduction in 2012 until late 2016, the URM 700 has gained extensive operating experience on Austrian Federal Railways (ÖBB). During this time period, the machine has successfully cleaned or replaced the ballast of 36 turnouts, as well as of their respective connecting tracks – this mechanised maintenance of different turnout designs and crossings required only short track possessions. For instance, it was demonstrated that the URM 700 can completely clean the ballast bed of a turnout of type EW 1200 within 3.5 to 4.5 hours, with the supply and transfer of all the ballast material solely taking place on the track under repair, without infringing the clearance gauge of the adjacent track, thus allowing traffic on the adjacent track to continue without disruption (Fig. 2).

Valuable experience gained in practice results in a re-designed and optimised machine – the URM 700-2

Based on findings made during the extensive operations on ÖBB, the machine has been re-designed with the aim to further optimise the machine operating concept, as well as making it safer for the work crew – this has resulted in the URM 700-2. The re-design includes:

— *a work unit re-arrangement*: for instance, the shoulder ballast excavation unit has been re-positioned and is now located further towards the front of the machine. This brings very significant time savings, especially when cleaning the ballast bed of turnouts, as it is now possible – for the first time – to fully work through a turnout in a single pass without having to reverse the machine.

In fact, the URM 700-2 can work through turnouts from both sides – a clear advantage if several turnouts have to be cleaned one after another. Also, if the clearance gauge of the track under repair allows, the straight track between two turnouts can even be worked by using the shoulder ballast excavation units on either side of the machine (all work units are doubly configured);



Fig. 3: The ballast excavation chain can easily be inserted underneath the track panel following removal of the shoulder ballast – no track panel dismantling or access hole digging is required



Fig. 4: Soiled ballast that has been removed from underneath the track panel onto the shoulder area is continuously picked up by the scraper conveyor system and transferred to the ballast screening unit for cleaning

— *a new scraper conveyor system*: by making use of a new scraper conveyor system, located in the shoulder area next to the ballast excavation chain, the pick-up of soiled ballast material has been optimised, in that it picks up and conveys it to the ballast screening unit in a continuous manner, instead of with interruptions as was previously the case. Thus, no material heap-ups occur that could jeopardise the delivery geometry of the turnout following work;

— *an improved sleeper handling*: in order to provide a better distribution of the lifting forces and, thus, further optimise the handling of heavy concrete-sleepered turnouts, three lifting units are adopted to lift the through track of the turnout and a number of additional ones to lift the diverging track, all featuring telescopic beams (similar to the three-rail lifting principle adopted by the Plasser & Theurer turnout tamping machines);

— *an improved re-ballasting process*: the re-ballasting of the turnout track panel with cleaned ballast has been improved, in that it now takes place directly behind the main ballast excavation unit, using two slewable conveyor belts, thus achieving a more even re-ballasting and, thus, delivery geometry of the turnout;

— *a larger ballast storage hopper*: the URM 700-2 features a larger (now 15 m³, previously only 2 m³) on-board ballast storage hopper that can hold a large amount of cleaned ballast before it is returned to the track – interim storage of cleaned ballast in a MFS unit has thus become obsolete;

— *an improved machine drive*: the tractive effort of the machine has been improved, as it now features a more powerful drive system, as well as four powered axles. As the URM 700-2 has its own drive unit (two diesel engines with a total output of 1,100 kW), it can travel over short distances at a maximum speed of 19 km/h without having to be hauled by a locomotive. Further, the ballast screening car features its own drive unit for operating the screens. Thus, if needed, it can be separated from the machine and be used independently for cleaning ballast;

— *a dust arresting atomiser*: by using this water-spraying system, the spreading of dust is suppressed, which reduces environmental pollution;

— *an improved work crew safety*: with safety of the work crew during track maintenance being of paramount importance, the provision of safe work spaces is a must. The URM 700-2 features cabins and secure work spaces in the shoulder excavation area, as well as the main excavation area (the latter featuring, amongst others, the lifting units with clamps and hooks, the ballast excavation chain, as well as the two slewable conveyor belts that are used for re-ballasting), thus providing a safe working environment for the work crew.

The optimised features of the URM 700-2 allow it to operate in a safe and efficient manner, which enhances the cost efficiency of ballast bed cleaning of both plain track and turnouts.

Operating principle of the URM 700-2

Ballast bed cleaning of turnouts, using the URM 700-2, is performed according to the assembly-line working principle. Firstly, the shoulder ballast excavation unit towards the front of the machine excavates the shoulder ballast on the free side of the track and transfers it to the ballast screening unit. The free space thus created allows the slewable ballast excavation chain to be easily inserted underneath the track panel (Fig. 3). The ballast excavation chain moves the soiled ballast material from underneath the track panel to the shoulder area, where the scraper conveyor system noted earlier continuously picks it up and transfers it to the ballast screening unit for cleaning (Fig. 4).



Fig. 5: Efficiency of the URM 700-2 in action: whilst the soiled ballast material is being removed, the cleaned or new ballast is already deposited directly behind the ballast excavation unit – a high-quality delivery geometry of the turnout is thus achieved

The cleaned ballast is returned to the sleeper area via two slewable conveyor belts and then deposited – as noted earlier, this now takes place directly behind the main ballast excavation unit, in order to ensure a high-quality delivery geometry of the turnout (Fig. 5). Any spoil material is transferred to the MFS material conveyor & hopper units at the front of the machine. If required, new ballast can be supplied from the MFS units that are coupled to the rear of the machine.

During the entire ballast bed cleaning process, the turnout is held in place by means of the lifting units noted earlier, either using roller clamps or lifting hooks, depending on prevailing work-site conditions.

Benefits of continuous-action ballast bed cleaning of turnouts

The machine operating concept of the URM 700-2 allows a highly efficient ballast bed cleaning of turnouts, in that the machine:

- allows non-stop ballast bed cleaning, as no dismantling of the turnout or digging of an access hole is needed, let alone any cutting of the rails at the beginning or welding at the end of the work;
- can fully work through a turnout in a single pass without having to reverse the machine, due to its shoulder ballast excavation unit being positioned towards the front of the machine;
- requires only short set-up times which, together with shorter time windows needed for ballast bed cleaning, leads to significant time and, thus, cost savings;
- allows a large proportion of cleaned ballast to be returned to the track, due to the high-quality cleaning of the soiled ballast material by the high-capacity ballast screening unit and, thus, less new ballast is needed – this results in cost savings, as well as a reduced environmental impact;

- can operate without infringing the clearance gauge of the adjacent track, as the supply and transfer of all the ballast material solely takes place on the track under repair – traffic on the adjacent track can continue without disruption;
- features a safe working environment for the work crew.

In addition to the above, the URM 700-2 ballast bed cleaning machine for plain track and turnouts, due to its allowing of a fast and independent insertion and removal of the ballast excavation chain, can also perform ballast bed cleaning of track shoulders and short sections of track where only short track possessions are available (spot maintenance); this further enhances the benefits offered by this multi-talented machine.

Final remarks

The enhanced machine operating concept offered by the Plasser & Theurer URM 700-2 allows non-stop ballast bed cleaning of turnouts and plain track in a safe, efficient, cost-effective, as well as environmentally-friendly manner – it can fully work through a turnout in a single pass without having to reverse the machine, due to its re-positioned shoulder ballast excavation unit.

As the ballast excavation chain can be inserted (and removed) underneath the track panel without any dismantling of the turnout or digging of an access hole, let alone any cutting of the rails at the beginning or welding at the end of the work, the machine can also cost-efficiently be used for spot cleaning.

Using the URM 700-2, total track closures are no longer necessary, and time windows required for ballast bed cleaning of turnouts are very much reduced – this is precisely what railway administrations want: speedy, safe and high-quality ballast bed cleaning of turnouts without any lengthy traffic disruptions.