Optimized deployment of track-maintenance machines thanks to the use of high-quality wearing parts

Maintenance work on railway tracks constitutes an important factor in upholding the high quality of the network. It ensures the availability of the track and a high quality standard. Achieving these targets for the lowest possible cost is the challenge facing the network operators [1].

Searching for further potential for improvements is still high on the agenda for the network operators, even after developing and implementing various maintenance strategies to achieve the highest possible standards of track quality whilst, at the same time, reducing costs.

One essential element of a successful maintenance strategy is the use of modern track-maintenance machines (Fig. 1), harmonized in size and output, deployed in all-in maintenance systems so as to achieve the best possible quality of work and thus lasting cost savings. Servicing and regular maintenance of these machines, as well as timely exchange and replacement of those parts that are subject to high wear, make it possible to achieve the goals set for availability, output, savings and better quality.

In addition to all this, the consistent incorporation of further developments and new wearing materials as they become available makes it possible to leverage considerable savings potential along with a higher output and a better quality of work. The following examples serve to illustrate these latest developments:

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Fig. 1: The 09-3X Dynamic Tamping Express track-maintenance machine

- higher-quality tamping machines, thanks to the use of tungsten-carbide-plated tamping tines and conversion to centre-tool tamping units,
- versatile use of tamping machines, thanks to the application of the CAL laser system in curves,
- better use of existing resources, thanks to the addition of the automatic belt control for MFS material conveyor and hopper units,
- increased work output of track-maintenance machines, thanks to the use of new wear-resistant materials, such as tungsten-carbide edges for the roller runways of conveyor belts, and flexible machine operation, thanks to the use of exchangeable units, such as interchangeable ploughs for ballast-distribution and profiling machines.

Tamping machines with tungsten-carbide-plated tines and centre-tool units

The new Plasser tungsten-carbide-plated tamping tine (Fig. 2) is used as a “year-long tine”. In other words, tines last for a whole construction season, without additional time being necessary to exchange them. Using these new tamping tines (outer tines) on the 09-3X Tamping Express in Germany, it has been possible to achieve more than 890 000 tine insertions up until now. The tungsten-carbide-plated tamping tines for point tamping machines have also proven their reliability in terms of durability and longevity.

These longer and much-improved life cycles are possible thanks to a special design: all-round armour plating with tungsten-carbide plates over the entire area of the tamping tine, which is mainly subject to wear in the ballast bed. The underside of the tine separates the ballast bed as it penetrates it, the tine plate transmits the squeeze forces to compact the sleeper bed, and the rear side of the tine is subject to heavy wear from the ballast when the tines penetrate it and when they are opened again after the squeeze action. For this reason, all the following parts are armour-plated with brazed tungsten-carbide plates:

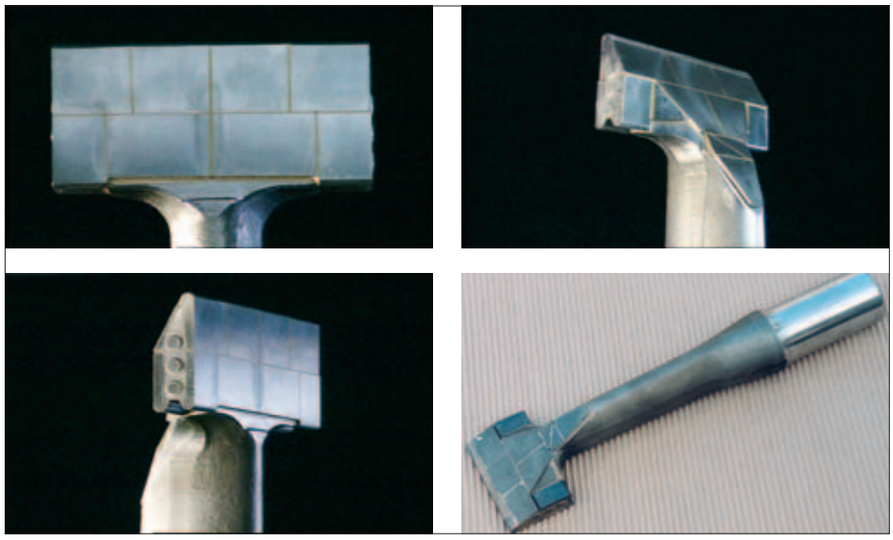

Fig. 2: Plasser tungsten-carbide tamping tine. Top left: tine plate, top right: conical-shape rear side of tine. Bottom left: penetration edge and side surfaces with brazed tungsten-carbide inserts, bottom right: tungsten-carbide tamping tine

- ▷ the penetration edge
- ▷ the tine plate
- ▷ the conical-shape rear side of the tine, and
- ▷ the side surfaces (with brazed, tungsten-carbide inserts).

Service life has a fundamental influence on the rate of return on investment. Economic-efficiency calculations are influenced decisively by high output per metre. The long service life of the tungsten-carbide-plated tine assures a consistent quality of tamping with reduced costs for material and the labour required for replacing tines.

The two-sleeper tamping machine with centre-tool units makes a further contribution to the durable tamping of sleepers. This machine features a new configuration of tamping tines (Fig. 3). As already tested on the three-sleeper tamping machines, only straight tines are installed. Together with the slim design, it has proved possible to reduce the penetration area and to extend the squeeze path at the same time. The tine compacting surfaces and thus the sleeper seat have been enlarged by about 15%. This considerably improves the durability of the sleeper seat. The lower penetration resistance means that penetration time is shorter, and this increases the working speed (Fig. 4). The higher service life of the tamping tines on centre-tool units has a visible impact on reducing regular maintenance costs. It is thus recommended to convert to centre-tool technology when the tamping units are in the workshop for a scheduled overhaul anyway. In addition to this, the specialists in the repair technology department of Deutsche Plasser, Munich, are able to offer fast and accurate conversion of Duomatic tamping units at any time.

Versatile options thanks to the use of the CAL laser system in curves

Since 1995, a combined longitudinal level and alignment laser for straight track has been used to guide Plasser & Theurer tamping machines. This enables simultaneous measurement of longitudinal level and alignment faults using a dot-shaped laser beam, which is aimed at a laser receiver camera. Using this combined system, the machine can either be guided directly according to the laser beam or it can perform a measuring run prior to maintenance work and calculate correction values from this. The Win-ALC automatic guiding computer is used to record the measured data. The correction data calculated by the Win-ALC can then be used to guide the tamping machine. A measuring run using the combined longitudinal level and alignment laser has produced good results particularly on points and crossings.

All the functions of lasers used on straight track are now available for work in curves too. Work can be performed on all known types of track geometry using the CAL curve laser system (Fig. 5). The laser receiver camera is located on the tamping machine's front tensioning trolley. It tracks the laser beam vertically and horizontally. The correction values for longitudinal level and alignment are calculated from the difference between the measured position and the target position, which is established by Win-ALC. These correction values are used for the automatic guidance of the tamping machine's lifting unit to keep it aligned with the target track geometry.

The curve laser is used primarily in track renewal for the first tamping passes and

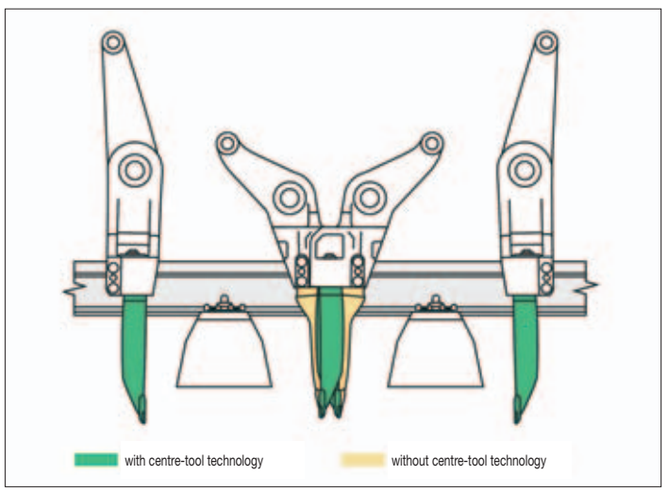

Fig. 3: Reduced penetration resistance thanks to centre-tool technology

Fig. 4: Centre-tool two-sleeper tamping unit on an operating 09-32 CSM

Fig. 5: CAL curve laser system

Fig. 6: Belt control for MFS material conveyor and hopper unit

for secondary lines. Another option is to use the curve laser, as before, in points and crossings. Now the laser can also be used for the turnout track and for curved points.

Retrofitting the CAL curve laser system onto tamping machines can be done by Technical Customer Service personnel on the customer's premises or at one of Deutsche Plasser's repair bases (Leverkusen, Hanau, Leipzig, Freilassing) and will substantially extend the range of application of the machines.

Automatic belt control for MFS units

Material and machine logistics are becoming an increasing challenge, particularly on large-scale worksites. If the entire transport of material to and from the site is to use only the track under repair, with the work being perfomed by high-capacity ballast-cleaning machines or machines for formation rehabilitation, it is necessary to deploy a large number of MFS material conveyor and hopper units in support. To be able to make even more efficient use of these units in future, an automatic belt control has been developed for the fast and controlled loading and unloading of the hoppers. Laser sensors are positioned in the front and rear area of the hopper and monitor and control the filling process. This ensures that the hopper unit is filled evenly. When the loading limit is reached, the laser control switches the transfer to the next MFS unit. The automatic belt control makes it possible for the operating personnel to concentrate on other tasks. Moreover, the available storage capacities are fully used, and this reduces the need for additional units. Retrofitting existing MFS units is possible at any time, but the Technical Customer Service at Deutsche Plasser ought to be consulted first.

New wear-resistant materials – tungsten-carbide edges for the roller runways of conveyor belts

The economic use of track-maintenance machines and vehicles depends on their availability at the required time. This means continuous monitoring of the servicing and repair of all components, especially those subject to high wear during working operation. Research into new wear-resistant materials and testing under operating conditions are opening up new fields of application. Precision manufacturing according to original Plasser & Theurer drawings ensures fast and easy installation in situ. Additionally, the flexible production method makes it possible to implement engineering requirements with precision.

The use of new tungsten-carbide edges for the roller runways of conveyor belts (Fig. 7), like those used on material

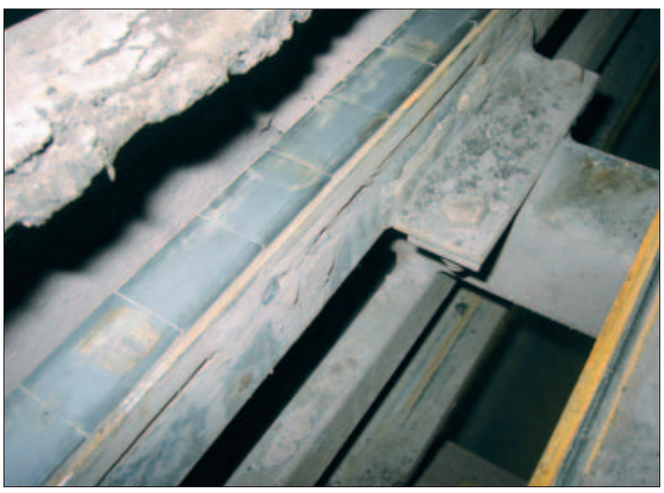

Fig. 7: Tungsten-carbide edges for roller runway of conveyor belts

Fig. 8: Comparison between edges made of tungsten carbide and Hardox 500

Fig. 9: Profiling and shoulder plough on the SSP 110 SW ballast-distribution and profiling machines

conveyor and hopper units, ballast cleaning machines und formation-rehabilitation machines, brings about a clear increase in the durability of these components. This results in enormous savings as regards maintenance and replacement as well as a higher availability of the machine. During the winter overhaul, the wearing parts can be checked thoroughly and accurately and replaced as necessary. The long service periods of the new tungsten-carbide edges for roller runways already in operation have surpassed those of the material previously used. The comparison in Fig. 8 shows that, after operating over a distance of 112 km, the tungsten-carbide edge of conveyor belt A1 on a cleaning machine owned by H.F. Wiebe has a depression of 0.1 mm. The connecting roller edge on this conveyor belt made of the material normally used, Hardox 500, has a depression of 2.3 mm after this same operating period (upper part of the photo, Fig. 8).

Other experiences confirm this trend and draw attention to the necessity to use the best available wearing materials for the economic operation of track-maintenance machines.

Use of replacement units

On the profiling and shoulder ploughs (Fig. 9) of ballast-distribution and profiling machines, the movement of ballast causes high material wear. To increase the service life of these machine parts, wear-resistant tungsten-carbide edges are now being used in the area of the profiling plough and on the edge of the movable front plate. The special quality of the tungsten carbide, the size of which is chosen according to its operating position, results in a tenfold increase in service life compared with conventional wearing materials.

In many cases, it is not even necessary to dismantle a component for repair, thanks to the easily exchangeable tungsten-carbide elements. In this way, these new tungsten-carbide wearing edges reduce the amount of maintenance work needed on the machines and bring considerable savings in costs. In addition to conversion to these modern wearing materials in the ballast plough sector, Deutsche Plasser offers the use of leased or replacement equipment. Not only complete shoulder ploughs but also centre ploughs are available for ballast ploughs. While the units are being reconditioned or retrofitted, work can continue using the replacement ploughs. This service provides a cost-efficient option to avoid wasted working shifts.

Apart from all this, Deutsche Plasser is able supply a tamping unit, recording unit, ALC automatic guiding computer, longitudinal level and alignment laser and the like, at any time.

Concluding summary

Quality of work and output as well as the labour costs related to them are decisive factors for maintenance strategies. Thanks to the use of modern machine systems, the best way to meet these requirements is through retrofitting and optimizing the existing machine fleet as well as the far-sighted use of high-quality original spare parts and wearing parts. This ensures a high availability of the machines required and, consequently, shorter total track possessions. This contributes to the success of the individual construction projects and also to the success of the railway system as a whole.

Reference

[1] Scherz, W.; Kabisch, J.: Instandhaltungsstrategie der DB Netz AG, Effizienzsteigerung durch gesamtheitliche Prozessbetrachtung in der Instandhaltung; EIK Eisenbahn Ingenieur Kalender 2004, p.61