Retrofitting makes track maintenance machines more cost-efficient

When crunching the numbers, many machine operating companies ask themselves whether they should either modernise a track maintenance machine that is 20-30 years old or procure a new one. In recent years, however, the trend has clearly been pointing towards retrofitting. This cost-efficient form of modernisation buys companies time, increases the performance of the machine, and makes machine operation significantly more attractive for existing staff.

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It is hard to part with a machine that has worked well for decades. One knows what it is capable of and appreciates the operating experience gained by the staff whilst working with it. Also, one is aware of the time and effort that are associated with switching to a new machine. Apart from that, technologies change over the years, of course; this can reduce the cost efficiency of the machine or even lead to problems with carrying out certain contracts.

Retrofitting allows machine service companies and manufacturers to provide a solution tailored specifically to these situations. A retrofit modernisation retains the intact basic machine; the customer specifies which parts are to be reconditioned and upgraded. In doing so, the focus is on exchanging only those components whereby the use of new technologies leads to an increase in productivity. Typical examples are the DRP data recording processor, the SmartALC machine guiding computer, or the rotating-speed modulator for tamping units. Following such a modernisation, the machine will be available for many more years of operation.

SUCCESSFUL RETROFIT PROJECTS

Deutsche Plasser, now merged into Plasser Robel Services GmbH (PRS), has already successfully performed several machine retrofits. In the following, three examples of retrofit projects are addressed, which demonstrate what a machine retrofit can entail in practice.

Example 1: a Unimat 08-475/4S turnout tamping machine (Fig. 1)

Since 1995, the Unimat 08-475/4S turnout tamping machine has been successfully used by a track maintenance company for maintaining and constructing track infrastructure of German Rail (DB AG).

At the beginning of 2018, the company decided to have the machine fully modernised, exactly because it was still pleased with its performance.

The Unimat 08-475/4S is an important factor in the machine fleet of this track maintenance company, and has been in operation for many years, tamping turnouts and short track sections with a great deal of success. However, after 23 years, signs of wear appeared owing to its age. In addition, important parts of the equipment were no longer state-of-the-art. For that reason, the machine operating company contacted PRS (formerly Deutsche Plasser) at the beginning of 2018 to discuss whether a retrofit would be possible and worthwhile. At that time, the machine was still fully in operation.

In August 2018, the Unimat 08-475/4S arrived at the Leverkusen-Opladen maintenance workshop of PRS for a thorough inspection. Around the same time, Plasser & Theurer in Linz identified potential retrofitting measures that could be performed without jeopardising machine approval. This information was used to define the scope of the contract and the timeline of the project.

In January 2019, the machine was fully disassembled at the maintenance workshop, in that the hydraulics, the measuring equipment, the cabs, the work and drive units were all removed in their entirety. The machine frame was virtually all that remained. Then the machine was rebuilt successively, starting with grinding the machine frame, which was to be painted according to the new machine design.

The modernised Unimat 08-475/4S left the maintenance workshop in August 2019, following extensive operational testing. It drove directly to the next worksite and, since that time, the machine has been continuously in operation.

Fig. 1: The Unimat 08-475/4S before (left) and after (right) its retrofit – the extent of modernisation is clearly visible

Example 2: a Unimat 09-16/4S universal tamping machine (Fig. 2)
In the summer of 2018, a freight train collided with a parked Unimat 09-16/4S tamping machine belonging to a track construction company. The machine was seriously damaged. After the accident, the machine operating company was certain that the 21-year old Unimat 09-16/4S would either have to be sold as quickly as possible or scrapped.

In the end, however, a different decision was made, as there was a new option available: retrofitting. Following successful negotiations with the insurance company, it was agreed that PRS would repair and retrofit the machine. Shortly after the accident, the machine arrived at the maintenance workshop in Leverkusen-Opladen, where it was to be brought into a top condition again. The insurance company covered the cost of the repair work, while the machine owner assumed the cost of retrofitting.

After the contract had been awarded, talks took place with Plasser & Theurer in Linz to determine what measures could be taken while still retaining machine approval. This was not an easy task as, in this case, the retrofit also included an updating of the machine control system.

Fig. 2: The Unimat 09-16/4S with trailer. At the time this picture was taken, the progress made in maintaining and modernising the machine that was involved in a collision was very obvious

Retrofitting the Unimat 09-16/4S started in June 2020 and is scheduled to be completed in May 2022, when it will be available for many more years of operation.

Example 3: a 08-16/90 tamping machine (Fig. 3)
Many track construction companies hold tamping machines like the 08-16/90 in very high esteem. One of these machine operating companies has four of these compact machines, and has been using them very successfully for projects in its home country for decades. However, one of these machines was severely damaged in a rear-end collision in 2018. At first glance, it looked as if the extent of the damage would leave no other option than to scrap the machine. However, when the company contacted PRS for a damage appraisal, the sequence of events completely changed.

The machine operating company had not realised that it was possible to repair the machine and upgrade it at the same time. The first discussion concerning this matter took place at the InnoTrans 2018 trade fair, during which it became clear that the machine operating company had actually considered buying a new machine. However, one deciding point in favour of retrofitting was that the 08-16/90 has ideal prerequisites for certain uses in the company's home country and that structurally identical machines are no longer manufactured. Repairing and retrofitting opened up the opportunity to keep this time-tested machine, which dates from 1993, in operation.

The greatest challenge posed by this retrofit project was the customer's specification to install a Caterpillar engine of the latest generation. It concerned an extremely powerful small engine that has sufficient power to drive the machine and also meets all current environmental requirements. Further, the old tamping unit was to be replaced, a lifting and lining unit was to be installed, and the hydraulic system was to be modified in such a manner that the conveyor belt on the trailer could be operated in accordance with the request of the customer.

In April 2019, the complete requirements specification went to Plasser & Theurer in Linz, where just in the same year a separate design department specifically for retrofit projects was founded.

By June 2019, all the technical documentation for the modification of the 08-16/90 tamping machine had been prepared. This was achieved within a very short time, taking into consideration that around 85% of the machine had to be re-designed, and that, because of the new engine and the new tamping equipment, the issue of weight distribution had to be solved.

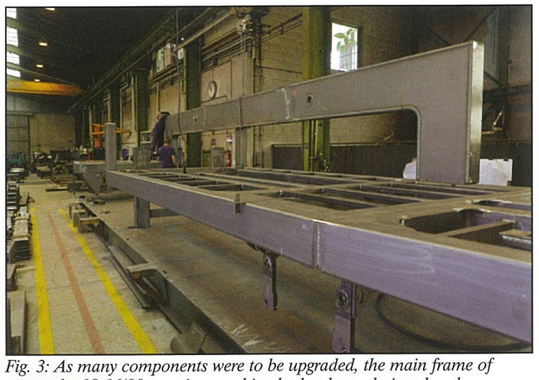

Fig. 3: As many components were to be upgraded, the main frame of the 08-16/90 tamping machine had to be re-designed and re-built, which took place at Plasser & Theurer in Linz, Austria – this highlights the importance of a close collaboration between machine service company and manufacturer

In January 2020, PRS submitted the final proposal. The retrofit of the tamping machine, which was carried out at the Leverkusen-Opladen maintenance workshop, started in April 2020 and was completed in January 2022. The machine operating company is very happy that, thanks to the retrofit, it can continue to operate its own machine for many more years to come.

BENEFITS OF RETROFITTING

The three retrofit projects described in this article have shown that a retrofit can take on different forms in practice, depending on the particular situation at the start of the project and the requirements of the respective machine operating company. A retrofit is not always the ideal solution – a demand for new, high-performance machines will continue to exist. Nevertheless, retrofitting has many benefits that ought to be considered before coming to a decision. A number of these benefits are alluded to in the following.

The machine retains its approval
In the retrofit projects described above, all three modernised machines retained their approval and could start working again immediately following the retrofit. This is always the case with retrofitting and, therefore, one of its main advantages.

The requirement that the machine retains its approval places high demands on the company performing the retrofit, as all modernisations must comply with the existing approval. If, for example, a heavier engine is fitted during the retrofit, other components have to be moved and larger wheels fitted, in order to meet the axle load specifications. This is a challenge. However, it is one that can easily be met when there is a good collaboration with the machine manufacturer.

It is generally important for machine service companies to have access to the master data of a machine, and a good collaboration makes this possible. Having access to the master data makes it possible to determine exactly which measures may be performed without compromising the existing machine approval. When machine maintenance workshops offering services similar to retrofitting cannot access this data, this may cause problems with the machine approval afterwards, leading to an exponential increase in time involved.

Retrofitting saves time and costs
When compared to procuring a new machine, one of the main arguments in favour of retrofitting is that it saves time. The condition of the machine is obviously a determining factor in this. In general, however, a retrofit takes about 8-10 months, depending on the scope of the work involved and the size of the machine. After leaving the maintenance workshop, the machine can start working again straightaway. Furthermore, no extra time is needed for an approval procedure, as the machine is fully functional immediately after the retrofit has been completed.

There are also obvious advantages in terms of costs. The cost of equipping a machine with the latest technology will never exceed the cost of procuring a new machine. It can be assumed that the cost of a retrofit is significantly lower than the procurement price of a new machine.

The performance of the machine increases
Regardless of the specific requirements and the duration of the work involved, the following applies to all retrofits: a systematic installation of new technologies can significantly improve the performance and output of the machine. In this sense, new versions of existing components can significantly expand their functionality to a certain extent. In addition, new solutions can increase cost efficiency, such as the rotating-speed modulator for tamping units. By using these components, a machine that has been operating for years can achieve a performance similar to that of modern types of machine.

Machine operation becomes more attractive
One aspect that is often overlooked is the positive effect a new or an upgraded machine has on the staff operating it. The track maintenance industry suffers from a shortage of skilled staff, and this situation is worsening. This makes it all the more important to offer new incentives to the already experienced staff of a company.

One way for companies to retain its machine operating staff is to offer a more attractive work environment. And retrofitting can do just that. The employees do not have to say goodbye to a machine that they have been operating for years, a machine they are familiar with down to the last detail. Instead, they get a machine that is in a completely new and significantly improved state, one whose performance is noticeably higher.

In addition, as the machine operating team is already completely familiar with the machine, there is no need for any basic training. The only training required concerns the use of the upgraded components. Furthermore, when the staff is already familiar with these components from operating other machines, significantly less time is needed for training. This means that the machine is not only immediately available for operation once the retrofit has been completed, but can also operate with its increased performance from the very beginning.

The basic machine remains unchanged
Another important aspect of retrofitting is that it retains the intact basic machine. Not only does this save time and costs, it is also sustainable; sustainability is becoming increasingly important. With pollution posing increasing challenges and a climate that continues to change, solutions that use resources sparingly are in demand more than ever. Retrofitting allows machine operating companies to make a major contribution in this respect.

During the preparation phase of a retrofit, the condition of the machine is carefully inspected and assessed. All the components that are still in a good condition are retained, and hence fewer resources are consumed. In the spirit of saving money and protecting the environment, existing components are only reconditioned when necessary. For example, if a machine frame is still in a good condition, it can continue to be used.

Time-tested machines can remain in service
As the example of the 08-16/90 tamping machine has shown, certain types of machine have been operating successfully for years, and customers are highly satisfied with them. For various reasons, structurally identical machines are no longer produced these days and would also not obtain approval if they were. Thanks to retrofitting, the service life of such machines can be extended considerably, as well as their performance and reliability improved, while retaining their approval.

Improved supply of spare parts
Last but not least, modernising a machine significantly improves the availability of its spare parts and, hence, its availability. Particularly in the case of older components that are nearing the end of their service life, there may be problems and restrictions when it comes to the supply of spare parts. This can have a major impact on the availability of the machine. However, when components are upgraded or replaced with more modern alternatives during a retrofit, the spare part situation automatically improves. This ensures that the time-tested machine can remain in service.

A MODERN MACHINE CONTINUES TO OPERATE

The retrofit projects presented in this article have clearly demonstrated the benefits that retrofitting can have for machine operating companies. Machines that have operated successfully for a long time can be made fit to operate and have a better performance for several more years to come thanks to a systematic modernisation. Retrofitting is less time-consuming than building a new machine, and also the cost is lower than that of procuring a new machine. In addition, in the case of retrofitting, the machine retains its approval, which means that it can be put into service immediately after the work has been completed. A close collaboration between the machine service company that performs the retrofit and the manufacturer of the machine is particularly valuable. It allows the machine service company to have access to the design data of the machine, which ensures that the retrofit can be performed quickly and successfully.

FINAL REMARKS

Retrofitting makes it possible to modernise a 20-30 year old machine, so that it can remain in operation for a longer period of time. The cost of a retrofit is much lower than that of procuring a new machine, and a retrofit is also less time-consuming. Also, the machine can retain its approval which, for some types of machine, makes it even possible to continue operating them. Retrofitting also has another bonus: staff can continue operating the machine, which they have often worked with for a very long time and become very familiar with over the years. They will appreciate "their" machine all the more when it has been upgraded and become more attractive as a result, which significantly contributes to job satisfaction.