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RECONSTRUCTION OF WOODEN SLEEPERS BY FITTING IN PLASTIC SCREW DOWELS

SUMMARY

Over three million wooden sleepers are built into the Croatian railway tracks. The durability of these sleepers depends very much on the fastening between the sleepers and the rails provided by the sleeper screws. The author suggests various systems for the fastening of the sleepers and the rails, especially in case of the old ones, and particularly using the plastic replacing dowels.

1. INTRODUCTION

The Croatian railway tracks have more than 3 million wooden sleepers built in. The sleepers have been impregnated insuring thus a life-time of 30 and even more years.

However, the life-time of a sleeper built into the tracks very often depends on the loosening of the sleeper screw.

The greater the rigidity in the fastening of tracks and sleepers, the shorter the time in which the vibrations cause its loosening. The loosening of the fastening points results in the change of distance between rails and at the same time, it changes the height levels between rails causing asymmetric bendings which are impossible to repair even by machine tamping of the rail.

The case may be that the wooden sleepers are still in a very good condition, and yet the sleeper screws may be easily taken out by hand (Figure 1).

In Croatia, the attempts to solve such problems used to consist in "re-nailing" (by drilling new holes for sleeper screws, and plugging the previous ones by wooden dowels). This procedure is both complex and expensive, and it requires moving the sleeper in the ballast bed to the left or to the right from the centre of the track, in order to maintain the required rail space.

In Europe, various hole repair systems have been applied over the last 50 years. At the beginning of the 50s wooden dowels were used, but it provided only short-term improvement in the fastening of sleeper screws.

2. THE FITTING OF PLASTIC DOWELS

Later, specific plug was designed, made of textile fibres and asbestos, and the use of wooden dowels was discontinued. However, asbestos belongs to the group of materials which are harmful for health, since it is cancerogenic and causes asbestosis, a form of lung disease.

In 1975, after the production of asbestos plugs was discontinued, the Austrian "Neumann" system was analysed. This system is based on the synthetic mortar reinforced by wire fabric. This mass is used to fill the sleeper screw holes which need to be repaired. The system had no harmful impact on health, but it proved to be too expensive, in addition to other disadvantages. (it depended on weather conditions, so that it was impossible to plan the time of repairs).

Somehow at the same time, the plastic dowel Hdu 1" was tested, and then introduced in 1977. This dowel was much cheaper than the "Neumann" system, but the disadvantage was the level of friction in the sleeper, depending on the condition of wood.

In 1976, SNCF applied a new repair system. It is a plastic dowel, cut longitudinally and conically wider towards the bottom end. The system is called "BICOQ". The sleeper screw hole is conically enlarged towards the bottom by a special drilling machine. The expected tightening is achieved in relatively healthy wood.

The system was implemented in 1978. For continuous repairs of the screw holes in the rails, plastic dowel Hdu 2 is used, and for the holes in the turnout sleepers, plastic dowel Hdu 3 is used. It has been decided to use the plastic dowel Hdu 1 only exceptionally when repairing the rails and turnouts. However, this restriction regarding Hdu 1 has not been complied with, so that more than 50% of all hole repairs have been done precisely with Hdu 1 (in the first place because it is a much simpler method).

The French system Hdu 2 and Hdu 3, usually require a group of six workers and three machines, one of which is a special drilling machine for enlarging the

bottom of the screw hole (in order to obtain a conical enlargement). The system is very expensive and demanding with regard to the workers and equipment.

A completely new system for sleeper hole repair has been presented by "MULTICLIP", an English company. Its name is VORTOK. Basically, a spiral made of aluminium is inserted into the existing screw hole using a special tool (twister), without any drilling or scraping of the damaged thread winding in the hole. The screw is then twisted into a spiral. The technology of the system is based on the fact that the spiral has a smaller inner diameter than the screw body diameter. While twisting the screw into a spiral, the threads lie between the spiral threads. By twisting the screw, the spiral expands and thus cuts into the wood sideways.

The repair system of worn out screw holes in wooden sleepers is applied to those sleepers that are sufficiently healthy, but in which the screws cannot be tightened well enough due to the decayed or mechanically damaged hole.

The repair is carried out through the hole in the baseplate, i.e. the baseplate remains on the sleeper. If all the four holes at the sleeper fastening point need to be repaired, then the diagonally opposite screw holes are repaired first, before the other two screws are taken out, in order to maintain the track measure.

The disadvantage of the VORTOK system is that the procedure as well as the equipment itself are highly demanding.

- The spiral is fitted by a special device with four types of twisters.
- Special attention should be paid to the type of spiral that is to be fitted, depending on the type of sleeper screw.
- Also, special attention is needed regarding the exact indentation of the spiral, otherwise the spiral may break and then that spot in the sleeper is practically destroyed.
- By tightening of the screw, a torque wrench (max force of 200 Nm) must be used.
- With sleepers which are in bad condition, the required tightening cannot be achieved by one spiral, and in that case one more needs to be fitted, and then a screw driven into it.
- The spiral should not be fitted if there is even the tiniest part of the sleeper screw still in the hole.
- Fitting of new sleeper screws is recommended for the holes repaired in this way.

The advantages are the following:

- Very satisfactory speed of repair.
- Relatively high fastening strength is achieved.
- There is no need to remove the baseplate.

Beginning November of this year, the application of plastic dowels of "KEMKON" type has been tried out for the first time in repairing the wooden sleepers on Croatian rails.

The "KEMKON" system is a new construction element of the rail fastening system called replacing wooden sleeper screw dowel (replacing dowel). It is made of synthetic composite of high strength, thus achieving the drawing force (extracting) out of beech wood greater than 40 kN (4.0 tons). It is adapted to all dimensions and by inner thread for sleeper screws Dž-12, Dž-12 a and Dž-13.

The only disadvantage is that it is necessary to remove the steel baseplate.

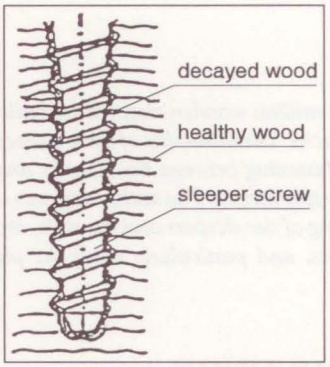

Figure 1

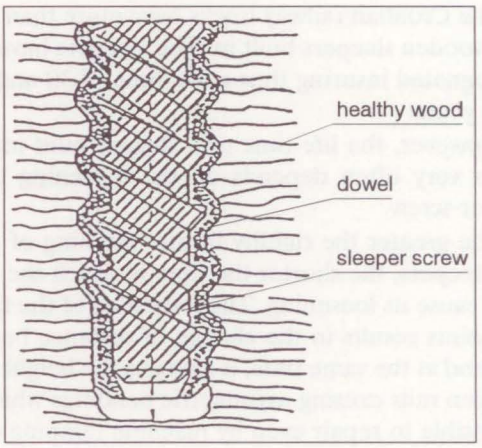

Figure 2

The advantages are:

- high tightening strength is achieved,
- complete repair of wooden sleeper, enabling simultaneous revision i.e. replacement of the worn out fastening equipment (especially the replacement of Grover baseplates),
- the existing old screw is used,
- the system is very suitable for the spots where shorter screws Dž-12 are used, since it allows the fitting of Grover baseplates thus increasing significantly the elasticity of the whole fastening system and also the durability of high-quality connection,
- low repair cost per sleeper screw.

The ecological factor is also important in all this. The old wooden sleepers that must not be destroyed by burning because of the impregnation are taken to waste deposits where they are cut into small parts and left to the activity of a special kind of worms. The sleepers with fitted aluminium dowels cannot be recycled in this way, since the metal element prevents the cutting.

After HŽ-INFRASTRUKTURE (Croatian Railways - Infrastructure) test the plastic dowel according to a special programme, these will start to be regularly fitted, and the repair of wooden sleepers may start.

3. CONCLUSION

The use of replacing dowel allows the tightening force of over 40 kN per screw to be achieved. This means that a force of 320 kN (32 tons) per one sleeper with eight screws ("K" equipment and steel corrugated plate DŽ-6) is attained. This is more than enough for the loading conditions in normal railway tracks. Moreover, the fastening point in the rail is repaired in such a way that it significantly increases the elasticity of the connection, as well as longer service life than the one of the wooden sleeper. All this is achieved along with acceptable costs, and the repair procedure is simple within the regular tracks maintenance. Special benefit is the revision and repair of the whole fastening equipment included in the repair procedure, which is a necessary element in preparing the tracks for machine regulation.

The sleeper repair procedure is especially useful in turnout sleepers, which are expensive and subjected to much higher loads. The traffic safety at turnout points depends much more on the fastening quality, so that the replacing dowel here is of great importance.

According to the experiences of the West-European railway managements, the repair of wooden sleepers using the plastic replacing dowels prolongs the life-time of wooden sleepers by 7 to 10 years. Thus, overhauls of certain tracks sections can be postponed and financial means saved to a great extent. It need not be stressed what this would mean for the Croatian railways at the moment.

SAŽETAK

OBNOVA DRVENIH PRAGOVA UGRADBOM PLASTIČNIH USADNICA (TIPLI)

Na hrvatskim prugama je ugrađeno preko 3 milijuna drvenih pragova. Trajnost drvenih pragova uvjetovana je uvelike vezom drvenog praga s tračnicom (tirfon).

Autor predlaže da se veza praga tračnicom, osobito onih već starijih vrši pomoću niza sustava, a posebno pomoću plastičnih sanacijskih tipli.

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