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New constructional solutions crossover double cross on prestressed concrete sleepers

Abstract: The paper presents a brief characterization of construction of prototype railway double cross turnouts mounted on the station "Swidnik" on line 007. The switches produced by three Polish manufacturers, are built for the purpose of carrying out field tests and issue the relevant certificates of release to service speed of 120 km / h.

Keywords: Crossover cross; Crossover railway

Introduction

Currently in Poland there is no standard cross turnouts and crossings of tracks built on a full selection of prestressed concrete sleepers. This creates certain difficulties in the course of investment in the case in the main tracks main essential to use this type of structures. When installing the remaining turnouts of railway sleepers prestressed concrete, we encounter on the turnout head lane heterogeneous surface because of the need for standard switches and crossings cross-track wooden sleepers. In order to eliminate this discontinuity, as well as to provide greater compactness and stability of the structure, it was decided in 2015, as part of the Company's investments PKP Polish Railway Lines SA, to build a new training ground research. Beside the above mentioned. basic goals within the training ground started the procedure for certification of new constructions for the full choices prestressed concrete sleepers using the full variety of welded which is generally extend the life of the structure and allow to increase the operating speed of 120 km / h on the routes. Originally we expected to agree on technical documentation to the four manufacturers, but ultimately, participation in the project maintained three companies:

1. KZN „Biezanów” Sp. z o.o. ,
2. Track Tec KolTram Sp. z o.o.,
3. Vossloh Cogifer Polska Sp. z o.o..

The company voestalpine Railway Systems Poland Sp.z o.o. was the supplier for locks for switches Vossloh Cogifer Poland Sp. o.o.

All producers, turned a lot of attention to improve their existing constructions especially considering provide improved ride comfort, higher reliability and durability crossovers. In work documentation includes new requirements of the European Union identified in the introduced EN standards [3], [4], [5], [6], [7], [8] as well as the requirements of the directives and technical specifications for interoperability relating to the 'infrastructure' rail system [1], [10].

The new switches were used, among other things.:

- a better grade of steel rails and profiles of spike; 350 HT (all producers)
- crossing of the cast bainitic (KZN "Biezanow")
- strengthened structures crossings double (all producers)
- Rolls underspike (all manufacturers)
- new means of locking (WKV- TrackTec, Spherolock- Vossloh Cogifer, the SNB - KZN "Biezanow").

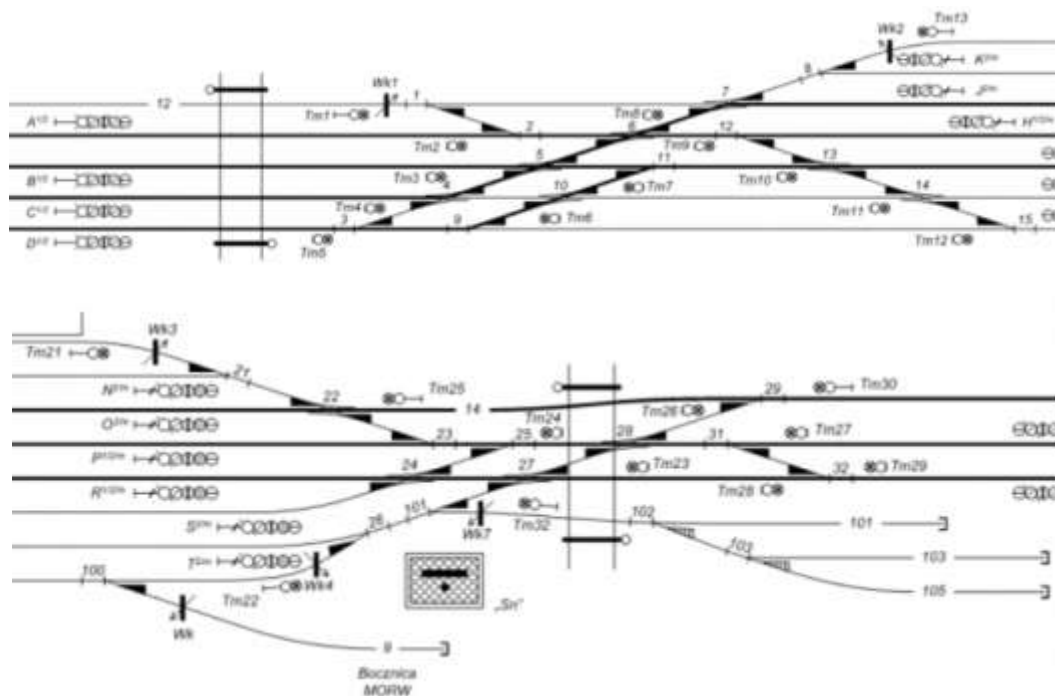
Experimental station

Upon completion of the analysis of many schemes station and the operating conditions (speed, load), among others station: Swidnik - Line No. 007, Tarnow - Line No. 091, Koscian - Line No. 271, Lowicz Main - Line No. 003, Leszczyny - Line No. 140, Lublin - Line 007, it was decided on the location of the polygon at the station Swidnik (Line No. 007).

When taking the above mentioned. decisions takes into account the following aspects:

- All experimental crossovers built-in track No. 1, operated under the same conditions of speed and load,
- All experimental crossovers built on one station in one of the investment task,
- Other identified ordinary turnouts and crossovers doublecrossed in track No. 1, are in very good condition due to the fact that it has been listed among under the "700 turnouts." This aspect will allow the execution of experimental ride at a speed of 135 km / h.

Different locations for specific crossovers illustrated in picture 1. The prestressed concrete sleepers were produced by TrackTec WPS "Kolbet" in Suwalki, STRUNBET Bogumilowice Mirosław and WPS Mirosław Ujski and made in one mutually agreed coordination dowel holes based on the modified plan for the overall turnout Rkpd Austrian producer of railway turnouts - VAE GmbH (with the consent of company). Development turnouts at the station Swidnik ended 31/11/2015. It is planned that the study will be completed in 2017. Construction works were carried out by the Pomeranian Mechanical Track Company Sp. z o.o Gdansk.



1. Schematic heads turnout station Swidnik

Crossover 13 - producer KZN "Biezanow" Sp. z o.o

Crossover 24 - producer Vossloh Cogifer Poland Sp. z o.o

Crossover 27 - producer Track Tec KolTram Sp. z o.o.

Used common solutions on station Świdnik

The "Rkpd on concrete sleepers in a variety of welded" is a common project of all producers supplying crossovers on the network of PKP PLK SA. In coordination meetings always tried to work out a common consensus and adopted the following key assumptions:

- assumed operational speed of the truck basic 120 km / h,
- speed in the direction of turning a crossover $v \leq 40$ km / h,
- maximum axle weight of the vehicle: 221 kN
- radius of curvature of the track feedback: 190 m,
- slant 1: 9,
- track width 1435 mm with the necessary expansion of curved track track feedback,
- variety welded clearances welding 8 mm -2; 0 mm
- the total length of construction and design: 33230 mm \pm 10 mm,
- screws that secure the sleepers: 42R,
- tilting cross level 1: ∞ ,
- spiers of the section 60E1A1,
- resilient system attaching rails Sk112,
- resilient system attaching resistances: DF2,
- closing not sensitive to crawling spike in steel sleepers integrated complex,
- process of adjustment switches supported by roller systems,
- crossovers built on Polish sleepers prestressed have a common coordination dowel holes,
- spiers and rheostat with sections of steel grade 350 HT
- other elements of the rail grade Steel 350 HT
- strip devices blades of ordinary sections 33C1 species Steel 320 Cr,
- crossovers are designed for electric heating of turnouts,
- crossovers are equipped with locks Universal to make the emergency closing of the crossover.

Crossover turnouts TracTec Koltram company is equipped with a closing type WKV BarathForge not sensitive to crawling spiers in steel composite sleepers own design with a undercoat into the drive (pic.10), crossover turnouts KZN "Biezanow" was equipped with the closure of their own design vertical action of the SZN, crossover turnouts Vossloh COGIFER (pic. 12) is equipped with a closing type Spherolock.

Specific solutions individual producers

A crossover KZN "Biezanow" was built over as a crossover No. 13, delivered a new technology block using new Polish wagons type "Switcher" to transport assembled at the manufacturer teams turnout. To Build over used crane Gottwald GS150.14.TR with a capacity of 153 tons. Figures 2, 3, 4, 5, showing selected steps of the installation and assembly of the teams finished Rkpd turnout. Figures 6, 7 illustrate double frog with a crossover and a team of ordinary frog after finished building.



2. Installation the steering of crossover Rkpd using a crane Gottwald GS150.14.TR



3. Installation of crossover switch Rkpd using crane Gottwald GS150.14.TR

Two blocks single crossings came to Swidnik in a specialized a wagon-platform equipped with cranes (Switcher +) enabling self-loading and unloading, the middle part and on the wagon with extended platforms (Switcher). Currently in Poland standard rail transport block such a large and heavy crossover is only possible using technology patented by KZN. With this technology producer obtains the highest possible quality corresponding to the initial position of the load in the factory, and the user receives a crossover assembled and ready to be laid in the track, which hortens the time eliminating errors and inaccuracies during buildover.



4. Delivery to the construction site ordinary crossings using the platform of "Switcher"



5. Building over element ordinary frog with a crane platform of "Switcher"



6. View group of ordinary crossings and double-steering crossover Rkpd 60E1-190-1 :9 by KZN "Biezanow" (pic. KZN "Biezanow")



7. View group of ordinary frog of crossover Rkpd 60E1-190-1:9 by KZN "Biezanow" (pic. KZN "Biezanow")

Specific characteristics of crossover KZN "Biezanow" [2]:

closure of its own design SZN60 / Rk vertical action - in steel podrozjazdniczy composite insulated, ensuring the cover slide adjustment and control. Closure works in analogy with the classic closure that cooperation between the slide rod - opórka buckle lock latch is held in a vertical plane. Vertical integration of these elements, with suitable design of the handle bar

clamp fixing position of the slide allows for insensitivity to relative movement relative to spiers resistances within +/- 30 mm.

- ◆ a single crossings of type "Insert" with inserts from bainitic steel. Track sections wingers 60E1 of steel 350 HT are profiled and matched to the casting of the stem,
- ◆ trestle double consists of two parts (blocks cast from bainitic steel) bow (left and right), welded with resistors simplesteel. The steering wheel is properly processed shaper 48C1 (RL1-54) in the genre R320 Crsteel. Sill rail is part of the double rail simple steel spiers. Frog is bolted together with double curved spiers and vaulted double resistors using inserts with screws M27 classsteel. 10.9. This way of connection elements provides compactness and insensitivity to crawl structure underspire double- and singlerolls own construction

A switch by Track Tec KolTram Sp. z o.o was built over as a switch No. 27 delivered to the construction site in the traditional technology (after receiving disassembled and transported in arts - assembled again on site). Fragment of the built switch is illustrated in Figure 8. A double-ordinary crossings is shown in Figure 9. bearers complex with the closure of adjusting illustrated in Figure 10.

Specific characteristics of switch [12]:

- ◆ closing WKV of CDP BHARAT FORGE,
- ◆ Rolls underspires "Austrollor" from Buntmetall Amstetten Ges.m.b.H.,
- ◆ crossings ordinary - traditional - forged and welded,
- ◆ crossings double _ made of bow rails 60E1 welded from the sectional 60E1F1 with a beak made of wrought block. Rails for beak
- ◆ and knee rail made of a material grade R350 HT. The steering wheel is made of structural type 48C1 (R1-54) in the genre R320 Cr. Crossings screwed with inserts with screws M27 class. 10.9.



8. The crossover switch of Track Tec KolTram Sp. z o.o visible rolls underspires "Austrollor"



9. View group of double crossings and steering switch of Track Tec KolTram Sp. z o.o.



10. complex bearer with the closure of adjusting in the switch of Track Tec KolTram Sp. z o.o.

A switch by Vossloh Cogifer Poland Sp. z o.o was built over as a switch No. 24 delivered to the construction site as well as switch 27, in the traditional technology (after receiving disassembled and transported in parts - assembled again on site).

View of the overbuilt switch is illustrated in Figure 11. The portion clamping the closure of setting Spherolock in the switcher complex is shown in Figure 12. Figure 13 visible reel underspire roll integrated with the plate rib design Vossloh Cogifer Poland Sp. z o.o

Specific characteristics of switch [13]:

- ◆ closing Spherolock voestalpine SIGNALING GmbH,

- ◆ rolls underspires integrated with plates rib structure Vossloh Cogifer Poland Sp. z o.o,
- ◆ crossings ordinary - with extended stem block,
- ◆ a double crossings made of two stem block of steel grade R260.welded with straight resistors and steering wheel from structural 48C1 (RL 1-54) genre R260. Stem improved thermally to a hardness of 340-390 HB. Crossing of twisted double spiers (internal and external) using inserts with screws M27 class. 10.9 and flange nuts M27.

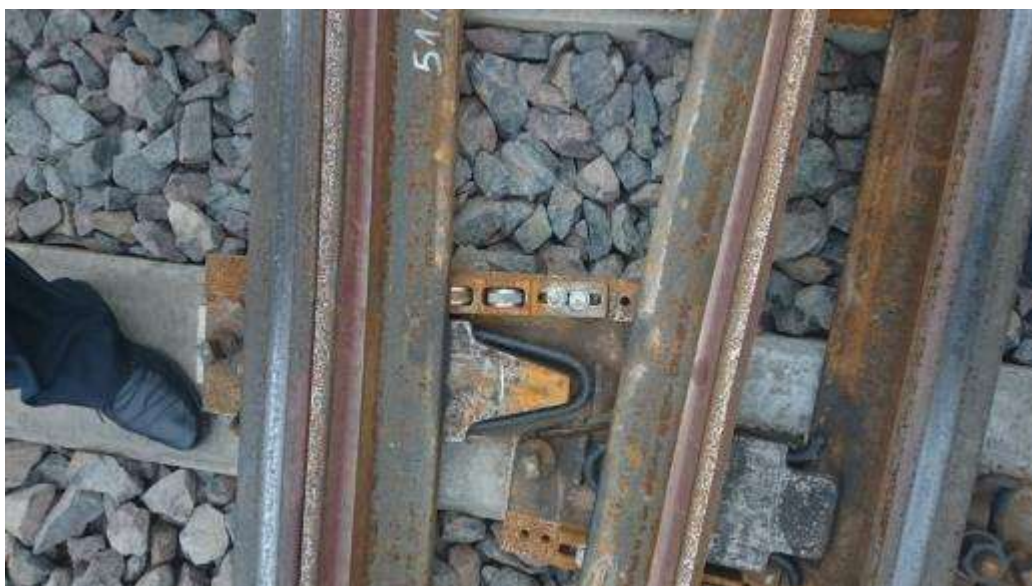
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11. View of of the overbuilt switch Rkpd 60E1-190-1 :9 from Vossloh Cogifer Poland Sp. z o.o on Swidnik station as a switch 24



12. Fragment of fastening elements closing adjustment Spherolock in the switcher complex switch Rkpd 60E1-190-1 :9 from Vossloh Cogifer Poland Sp. z o.o



13. The underspire roll integrated with the plate rib design Vossloh Cogifer Poland Sp. z o.o used in the switch Rkpd 60E1-190-1 :9

Conclusion

The increase in demand for high-speed trains in the Member States of the European Union, high investment costs for this purpose have become a technical challenge and the organizational for manufacturers of all its components, as well as for operators and infrastructure managers. Still constantly increasing requirements pose new tasks exploiters provide improved ride comfort, higher reliability and durability of all railway surface elements. PKP Polish Railway Lines S.A. on the occasion of carrying out modernization of their line trying to modernize the installation work construction using new proven solutions in other countries. Progress in this area has also been forced through continuous improvement and changes in other areas, such as:

- improving technology of metallurgy and methods of improving steel using modern heat treatment or implementation of better grades of steel rail, for example grade 350 HT
- production of individual elements of the new structural materials, eg. bainitic steel,
- emergence of new environmental requirements relating to the protection of the environment that necessitated the widespread transition from wooden sleepers on the pre-stressed concrete and replacing lubricants and oils other technical solutions, for example. underspires rollers,
- continuous development of technology of installation and construction.

Of course, should be aware that new solutions may slightly increase the cost of investment, but through its increased reliability and low operating costs can turn many times during the life of the entire product. However, to be able to fully apply the described solution, must first perform a full procedure for product certification in the field of placing it on the market in accordance with the applicable law [11] For this is used, among others, new training ground research of modern cross turnouts at the station Swidnik.

Source materials

- [1] Dyrektywa Parlamentu Europejskiego I Rady 2008/57/WE z dnia 17 czerwca 2008 r. w sprawie interoperacyjności systemu kolei we Wspólnocie.
- [2] KZN „Bieżanów” Sp. z o.o. - Warunki techniczne Wykonania i Odbioru Nr WTWiO-TB-03/14.1
- [3] PN-EN 13232 – 1: Kolejnictwo – Tor – Rozjazdy i skrzyżowania - Definicje

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- [4] PN-EN 13232 – 2: Kolejnictwo – Tor – Rozjazdy i skrzyżowania – Wymagania dotyczące projektowania geometrii
 - [5] PN-EN 13232 – 3: Kolejnictwo – Tor – Rozjazdy i skrzyżowania – Wymagania dotyczące oddziaływania koło/szyna
 - [6] PN-EN 13232 – 4: Kolejnictwo – Tor – Rozjazdy i skrzyżowania – Przewodzenie zamykanie i kontrola
 - [7] PN-EN 13232 – 5: Kolejnictwo – Tor – Rozjazdy i skrzyżowania – Zwrotnice
 - [8] PN-EN 13232 – 6: Kolejnictwo – Tor – Rozjazdy i skrzyżowania – Krzyżownice pojedyncze i podwójne ze stałymi dziobami
 - [9] PN-EN 13232 – 9: Kolejnictwo – Tor – Rozjazdy i skrzyżowania - Układy
 - [10] Rozporządzenie Komisji (UE) Nr 1299/2014 z dnia 18 listopada 2014 roku dotyczące technicznych specyfikacji interoperacyjności podsystemu „Infrastruktura” systemu kolei w Unii Europejskiej
 - [11] Rozporządzenie Ministra Infrastruktury i Rozwoju z dnia 13 maja 2014 r. w sprawie dopuszczania do eksploatacji określonych rodzajów budowli, urządzeń i pojazdów kolejowych
 - [12] Track Tec KolTram Sp. z o.o. - Warunki techniczne Wykonania i Odbioru Nr WTWiOT-15/KT-59
 - [13] Vossloh Cogifer Polska Sp. z o.o. - Warunki techniczne Wykonania i Odbioru Nr WTWiO-15/COGIFER/01