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TECHNICAL CONDITIONS FOR HUMPING OF LONG WAGON IN MARSHALLING YARDS

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Introduction

Project VEL-Wagon was solved in years 2011 and 2012 by consortium of four institutions – Technische Universität Berlin, Kungliga Tekniska högskolan Stockholm, Žilinská univerzita v Žiline and Tatravagónka Poprad, within the European Commission´s 7th Framework Program [6]. The basic idea of the project was that in the future, longer loading surfaces without interruptions, as well as more capable platforms with higher axle loads and with lower loading heights will be necessary in freight wagon design to increase the capacity of the freight railway transportation. Proposed design of new VEL-Wagon was introduced in September 2012 during Innotrans 2012 trade fair in Berlin.

Different technical challenges were studied in frame of the project. Since marshalling yards are a necessary facility to perform single wagonload transportation efficiently for large traffic volumes, an important part of the infrastructure analysis in frame of the VEL-Wagon project was to assess the ability to pass over the hump in marshalling yards. Results of survey for this topic are described in this paper.

Important marshalling yards in Europe

There are hundreds of active marshalling yards in the Europe. To focus on the most important of these, two criteria were defined for what marshalling yards to include in the survey:

- marshalling yards designated as national yards or yards used to make up long-distance freight trains;
- marshalling yards located along the Rail Net Europe (RNE) corridors (Table 1):

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There are several definitions of important European railway corridors:

1. Pan-European corridors (sometimes referred to as the Crete or Helsinki corridors),
2. Rail Net Europe (RNE) corridors
3. European Rail Traffic Management System (ERTMS) corridors
4. Trans-European Transport Network (TEN-T) corridors
5. European Agreement on Main International Railway Lines (AGC) corridors.

Corridors defined by 2, 3. and 5. have defined lists of important terminals and marshalling yards.

Table 1. Rail Net Europe corridors

C01	Oslo/Turku – Malmö – Padborg/Rostock – Hamburg
C02	Antwerpen/Rotterdam – Köln – Mannheim – Basel – Genova
C03	Rotterdam/Antwerpen – Ruhr Area – Warszawa/Katowice
C04	Hamburg/Bremerhaven – Würzburg – München/Passau – Wien/Salzburg – Verona
C05	Rotterdam/Antwerpen – Luxembourg/Paris – Lyon/Basel
C06	Mannheim/Gremberg – Nîmes – Perpignan – Barcelona – Valencia/Paris – Madrid – Lisboa
C07	Gdynia – Ponętów/Warszawa – Katowice – Wien/Bratislava – Trieste/Koper
C08	Lyon/Dijon – Torino – Ljubljana/Koper – Budapest
C09	Wien – Budapest – Bucureşti – Constanța/Kulata/Svilengrad/Varna/Burgas
C10	Hamburg – Dresden – Praha – Bratislava – Budapest
C11	München – Salzburg – Ljubljana – Zagreb – Beograd – Sofia - Istanbul

Basic information about the number, locations and names of major shunting yards was taken from the documents about RNE corridors. Descriptions in pdf-leaflet are available on the official websites of the RNE [4]. Some marshalling yard listed in Appendix II of the

2009/561/EC [1] were added so as not to omit any important terminal or yard that is not listed in the RNE corridors leaflets.

Our research was concentrated only on those shunting yards that use humps for wagon sorting process (marshalling yards). In some cases a list of the marshalling yards in the AGC Network [5] was used to exclude shunting yards without a hump from our list. Shunting yards in countries with broad gauge (Spain, Portugal and Finland) were not included.

Requirements under TSI WAG

The main information that has to be taken into account is specified in the TSI rolling stock – freight wagon (WAG) [3] To be able to assess the impact on the VEL Wagon design if it is to be able be "shunted without restriction", all conditions declared in Annex C of TSI rolling stock – freight wagon were reviewed.

„These vehicles, when they can be gravity shunted, must be capable of passing over activated rail brakes and other shunting or stopping devices located on non-vertically curved track and reaching the 115 and 125 mm dimensions above the running surface, up to 3 m from the end of convex transition curves of radius R_v = 250 m. They must also be able to pass over such devices located inside or near concave transitions curves of radius R_v = 300 m."

The meaning of this text is described by Fig. C10 in the TSI rolling stock – freight wagon (Figure 1).

Survey concerning hump crest vertical radius

Next, information on hump crest vertical radius was requested from the One Stop Shops (OSS) of each country participating in the RNE corridors. In some cases personal contacts with responsible persons at infrastructure managers from our previous research studies were used.

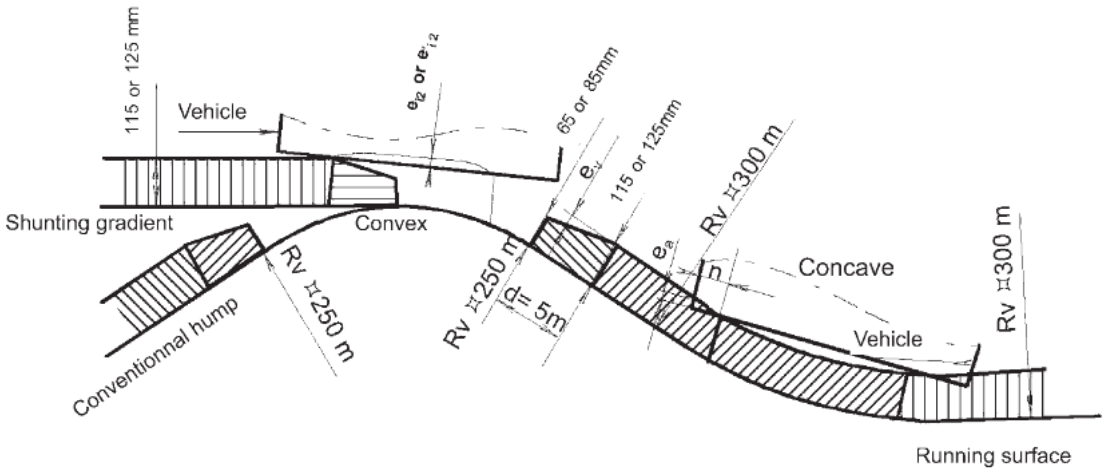
Information from more than half of the contacted persons was received by the end of April 2012. The information received covers more than half of the marshalling yards mentioned in the RNE corridors leaflets, including those of Germany, Austria, Switzerland, Sweden, Poland, Czech Republic, Slovakia, Slovenia, Serbia, Croatia, Denmark and Luxembourg. No information was received from Italy or France, but the infrastructure

manager and operators in these countries are phasing out marshalling yard operation. No information was received from Bulgaria, Romania, the Netherlands, Belgium or Norway, either. We tried to substitute this information by information from Network Statements or other information available on the web.

The information received from infrastructure managers, One-Stop-Shops (OSS) or on the web indicates that in general, in the european countries with 1435 mm track gauge, the vertical radius of hump crests in all except one case is 250 meters or more:

- only one hump has radius of 180 meter (Linz Ost Vbf, Austria),
- only one hump has radius 250 meter (Bettembourg, Luxembourg),
- all other humps have radius at least 300 m.

Figure 1. Transition curves on hump under TSI WAG



(reduced values expressed in metres)

Conclusion

Based on this result, we can confirm, that there is no conflict with conditions defined in the TSI,i.e for the VEL Wagon with 19 000 mm distance between bogie pivots to run over the hump in nearly all marshalling yards (with hump crest vertical radius of 250 m or more). However, if switches are located within the area with vertical curve radius less than 250 m or if track circuits used to control the automatic route setting system are shorter than the distance between adjacent wheelsets i.e. between axle 2 and axle 3 on VEL Wagon, the automatic

hump control system (control of switch alignment) should be off while the VEL Wagon runs over the hump. This is because of technical solution used for free point and track segments detection. Track circuits are use in some countries (for example Poland, Serbia, Croatia) for this purpose. Minimum length of these circuits is 13.8 meters (Poland) or 14 meters (Serbia, Croatia. It can happen in case the VEL-Wagon passes over a track circuit which is then released between the first bogie and the second bogie, which are then interpreted by the hump control system as two separate wagons, possibly resulting in switches being realigned between the first and the second bogie, which will then enter different tracks, causing the wagon to derail.

It can be expected that any hump that not meet the condition of larger than 250 meter hump radius will be either deleted from shunting yard list in corresponding RNE corridor, or reconstructed to the required dimensions. This opinion is based on TSI infrastructure [2]: "The Member State shall specify for TEN lines those elements of the infrastructure subsystem, which are required for interoperable services (e.g. tracks, sidings, stations, marshalling yards) and therefore need to comply with this TSI. In specifying these elements the Member State shall consider the coherence of the system as a whole."

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