THE OPERATION OF THE GAUGE CHANGING FACILITY OF THE NEW RAILWAY LINE RAIL BALTICA

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This article describes the operation mode for the trains gauge changing facilities. These facilities enables the trains specially constructed or adapted for the gauge changing to run on the two gauge systems that will coexist in Lithuania, namely European Standard (UIC) gauge 1435mm and Wide (Russian) gauge 1520mm.
Several gauge-changing systems are available in the international market. The description below is based on the Talgo system. This system is state of the art and well proven. It operates on the Spanish – French Border (Irún/Hendaye) as well as on the connections of the Madrid – Seville Highs Speed Line (1435 mm gauge) and Spanish conventional rail network (1668mm) in Cordoba and Seville.

Keywords: *gauge changing facility, auxiliary locomotives, draggers*

1. INTRODUCTION

The railway line of Rail Baltica can be divided in two sub-sections:

1. Polish / Lithuanian border – Mauručiai Subsection (68 km). The Government of the Republic of Lithuania already approves the alignment of this sub-section;
2. Mauručiai – Kėdainiai Subsection (by-pass of Kaunas). Following three alignment alternatives were considered for this subsection:
   1. Eastern by-pass 1 (75.5). Crossing the river Nemunas over the Kaunas Sea dam and continuing northwards through Neveronys. Construction of a new interchange station in Palemonas;
   2. Eastern by-pass 2 (73.9 km). Crossing the river Nemunas over the Kaunas Sea dam and continuing northwards through Karmėlava. Construction of a new station close to Taikos Avenue (the station will serve only the new line, no interchange will be available);
   3. Western by-pass (62 km); construction of a new 2.024 km long viaduct to cross of the river Nemunas; construction of a new interchange station in Mauručiai.

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2. LOCATION AND FACILITIES

The gauge changing facility will be located on the special track close to the Logistic Node. It will be installed between two turnouts separated by 167 m (point to point distance).

The facility itself will be installed in a pit 15.5x5x1.45m inside specially built building 22x9m and 8m headroom.

Two inspection pits will be located on the two accesses outside of the building. The inspection pits will be 6x4m and 1.45 m deep. The main objective of the pits will be to provide the possibility of axle inspection before entering in the gauge changing facility.

Two stub tracks will be located in the two sides of the gauge changing facility. The goal of these stub tracks will be to provide the possibility for the moving away of the locomotive in case that it is not suited for gauge changing.

3. OPERATION

The gauge changing will be done automatically in the following way (see figures on the next page):

1. The train enters into the gauge changing facility from the wider gauge track (Figure 1).
2. After the train has entered into the changing facility, the track rails descend and lose the contact with the train wheels; the vehicle is supported on the special guides (the axle does not support any load) (Figure 2).
3. The locks, which fix the wheel axle, are removed by means of another special guide located on the gauge changing facility frame (Figure 3).
4. At this moment the wheels are free for lateral movement. Either the guides push the wheel outside or a hydraulic piston pushes them inside (according the direction of train movement through the facility) until the wheel is in the position that corresponds to the new gauge (Figure 4).
5. The locks are activated and the new wheel positions are fixed (Figure 5).
6. Finally, the train is gradually placed on the rising track rails and the wheels start supporting the train.

The vehicle is than prepared to run on the new gauge (Figure 6).

4. ALTERNATIVES

This system permits two different modes of coach traction through the changing facility.

The movement of the train through the changing facility is done without a locomotive. This implies that the front locomotive should be uncoupled and moved away. Alternative traction is needed to move the train through the facility.

The following two possibilities are available:

1. Auxiliary locomotives that push the train until its head have passed through the changing facility.
2. A dragger to pull the train until its head has passed through the facility.

On both cases, after the train head has passed through it is coupled to the locomotive, which waits on the other side of the changing facility.

Either two auxiliary locomotives or two draggers are required in order for the system to be two way operative. A mixed system (one auxiliary locomotive and one dragger) is also possible.

The following sections describe the main characteristics of the two systems.

4.1. Auxiliary Locomotives

The auxiliary locomotive will push the train until its head has passed through the changing facility and can be coupled to the locomotive, which will be waiting on the other side.

In order to make the system more agile it would be convenient to construct an additional stub track which would be used by the auxiliary locomotive between the passing of two trains.

The stub tracks both for the auxiliary and for the main locomotive will be necessary on each side of the changing facility.

4.2. Draggers

The dragger will pull and pull the train until its head has passed through the changing facility and can be coupled to the locomotive which be waiting on the other side.

The dragger can be operated via remote control.

The dragger runs on the rail base and cannot be passed through the turnouts. Due to this fact the minimum length required for the train should be approximately 100m. Thus, when the dragger reaches the turnout point the first vehicle of the train will be already through the gauge changing facility and so can be coupled to the locomotive. In case of Talgo coaches the train should consist of at least 8 coaches.

Besides the dragger itself, its functioning implies the installation of four electrical motors, four reducers, control panel, power and control cabling and ducts. This system also implies substantial civil works, namely concrete slab track along the whole dragger course.

The system is prepared for outdoor operation and there are no lengths limitations.

Investment cost for two draggers of 120m lengths is approximately 190,000 Euro (VAT excluded). The cost of associated civil works is approximately 120,000 Euro (VAT excluded).

Operation of the Gauge Changing Facility

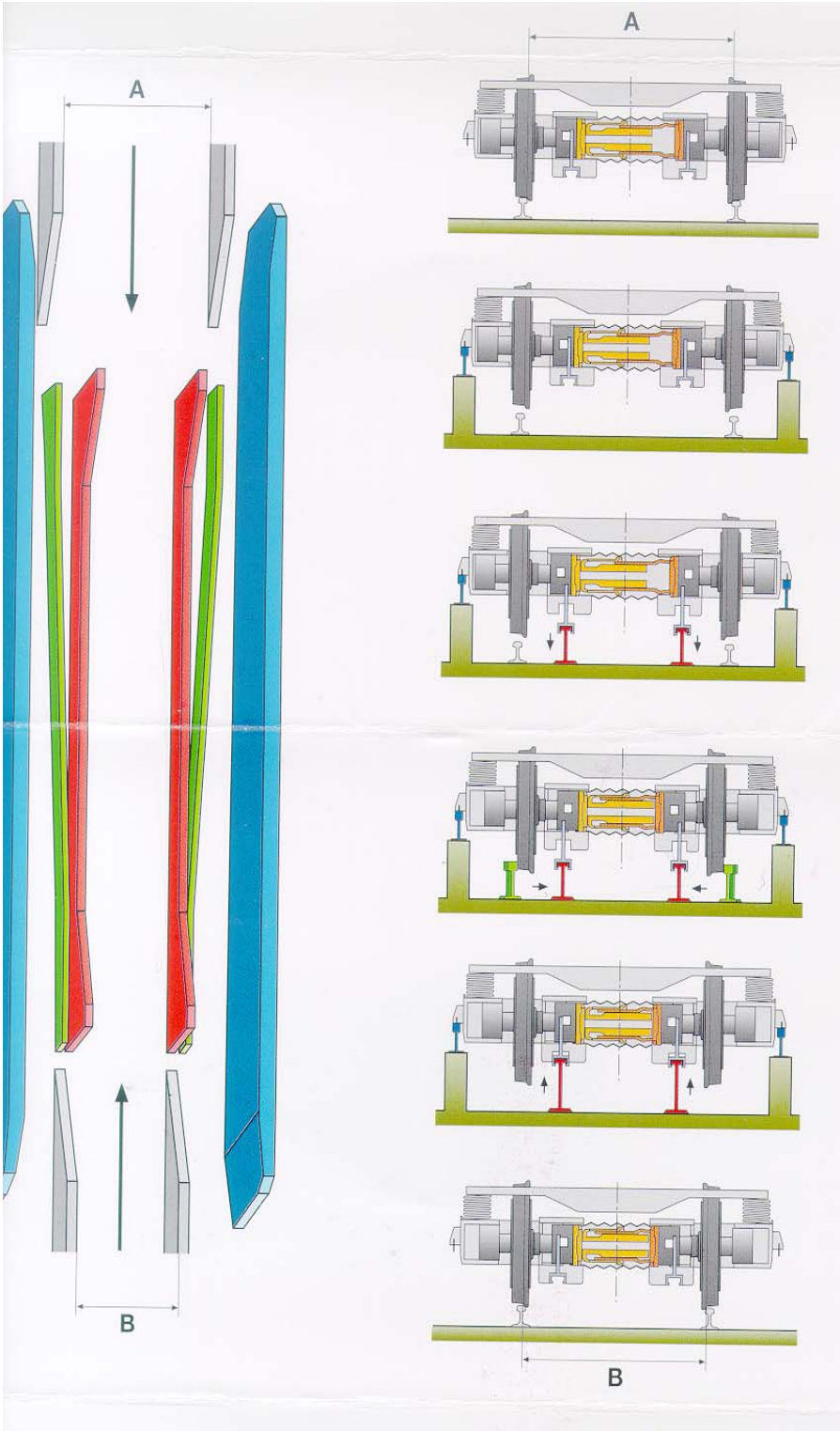

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

5. CONCLUSIONS

1. The trains gauge changing facilities enables the trains specially constructed or adapted for the gauge changing to run on the two gauge systems that will coexist in Lithuania, namely European Standard (UIC) gauge 1435mm and Wide (Russian) gauge 1520mm.
2. Connection of the new "Rail Baltica" line to the existing wide gauge line Kaunas - Kybartai by means of implementation of the Gauge Changing Facility in Mauručiai Area.
3. Talgo system permits two different modes of coach traction through the changing facility.
4. The auxiliary locomotive will push the train until its head has passed through the changing facility and can be coupled to the locomotive, which will be waiting on the other side.
5. The dragger will pull and pull the train until its head has passed through the changing facility and can be coupled to the locomotive which be waiting on the other side.

References

[1] Pre-feasibility studies for the European Gauge Railway Link from the Polish Border to Kaunas: GOPA–Consultants (Status Report, September 2000) and AB Kelprojektas and TRRI (Assessment Report, January 2003).
[2] Logistic and Multimodality, Intelligent Transport Systems and Inter-Operability Development Concept for the Kaunas Logistic Node, Phare Programme Nº. LI 9702, November 2000, HPC/UNICONSULT/Spiekermann/ EDI Management.
[3] European standard railway line PL/LT border – Kaunas. Construction justification. Transport Road Research Institute (Lithuania), 1998.
[4] European standard railway line Polish/Lithuanian border – Kaunas. Special Plan. Transport Road Research Institute (Lithuania), 1999.
[5] European Union directive 96/48/EB, defining trans-European high-speed railways system interaction.
[6] Traffic Forecast on the TEN Pan-European Transport Corridors of Helsinki, NEA Company, Netherlands.
[7] "Building Construction Justification. Summary" Transport Ministry of Lithuania State. Enterprise "Transport and Road Research Institute", Kaunas 1998.
[8] "Obligatory Documents for Technical Design. Special Plan. Summary." Ministry of Transport and Communications of the Republic of Lithuania Transport Investment Directorate, Kaunas 1999.