Rail Accident and Incident Investigation Unit

Summary
Safety Investigation Report
Events during automatic shunting operations at the Antwerpen-Noord marshalling yard
Antwerpen-Noord - 30 April 2022

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REPORT VERSION TABLE

Version number	Subject of revision	Date
1.0	First version	21/08/2023

Any use of this report with a different aim than of accident prevention - for example in order to attribute liability - individual or collective blame in particular - would be a complete distortion of the aims of this report, the methods used to assemble it, the selection of facts collected, the nature of questions posed and the ideas organising it, to which the notion of liability is unknown. The conclusions which could be deduced from this would therefore be abusive in the literal sense of the term.
In case of contradiction between certain words and terms, it is necessary to refer to the Dutch version.

SUMMARY

From the reports sent to the RAIIU by the infrastructure manager and railway undertakings, the RAIIU was able to detect an increase in the number of events of collisions, runaway vehicles, and derailments during humping operations in fans of sidings B and C in Antwerpen-Noord. These events are secondary track events, and their consequences do not meet the criteria of a serious or significant accident. The RAIIU initiated a safety investigation with the aim of gathering information on these events and using this information to identify railway safety elements and bring them to the attention of the railway sector in order to prevent future events during the process of automatic shunting at the marshalling yard or to mitigate their consequences.

At the same time, the infrastructure manager and railway undertaking have also seen an increase in the number of events during hump shunting, and have started an analysis and improvement process in parallel.

The Antwerpen-Noord marshalling yard is characterised by freight wagons being sorted using a humping process that makes use of gravity: the freight wagons to be shunted are pushed over the hump by a marshalling locomotive, after which gravity causes them to roll down the hump as a group of wagons (also known as cuts). Via brake controls, the cuts are slowed down, and via switches they are taken to the respective destination track where they are formed with other cuts to form a new train set (hence the name formation yard is also used).

In hump shunting, first of all, single wagon loads arrive on the reception tracks. The wagons of a train have a different destination (unlike homogeneous transport where all wagons of a train have the same destination).

In these reception fans of sidings, the preparations for shunting are then carried out by railway undertaking staff. Preparing a wagon group for shunting includes:

- screw couplings are adequately loosened from the wagons to be separated,
- brake hoses are uncoupled and hung in the hooks provided,
- the train composition is checked (e.g. wagon number as well as repair, RID, hazard and shunting labels, …),
- brakes are vented,
- a limited inspection is carried out (e.g. no encroachment on the clearance gauge, interlocks, visible wagon damage, ...),
- a transitional immobilisation is applied to prevent wagons from breaking away while waiting to be hump shunted.

At the administrative level, wagon data are entered/adjusted/confirmed in the wagon management system, and a shunting bulletin is delivered to the infrastructure manager.

Then a train driver from the railway undertaking drives the marshalling locomotive behind the train on the reception track, and he couples his locomotive with the set to be sorted. The applied transitional immobilisation is lifted by the train driver. After carrying out the tensile test (checking coupling), the train driver reports to the infrastructure manager that he is ready for hump shunting. When ordered to do so, the train driver switches the marshalling locomotive into 'automatic regime'. The automatic shunting system then further controls the speed of the locomotive via radio control, pushing the train to the hump fully automatically. Control and any correction are based on values measured by sensors.

Since 2017, apart from a sharp fall in 2020, the number of events during humping operations have been on the rise:

- In absolute numbers, there is an increase from 9 events in 2017 to 33 events in 2022.
- The ratio of the number of events to the number of hump shunted wagons rises from 0.0045% in 2018 to 0.0093% in 2022.

In 2022, there were 33 events, which is the highest number since 2017. The events can be categorised as:

- 16 runaway vehicles (4 of which followed by a collision and/or derailment) = 48%
- 12 collisions (8 of which followed by a derailment) = 36%
- 5 derailments (excluding incidents preceded by another event) = 16%

18 of the 33 events took place in the B bundle, while 15 occurred in the C bundle.

Most of the events (30) occurred in the first three quarters of 2022. Only three events took place in the last quarter of 2022.

The involvement of dangerous goods in events was highest in 2022, with 14 events, where in previous years there were no more than six events each time.

The direct cause in the most common events is inadequate brake control, i.e. a cut that is slowed down too much or too little.
If, on the one hand, the brakes of a wagon are insufficiently released, the wagon or cut may come to a stop too early while rolling down the hump, allowing it to be hit by other cuts.

On the other hand, if the hump braking of the shunting system is inadequate, a cut will roll down too fast and may hit another cut on the destination track.

The different contributing factors are:

1. **failure to lift or inadequate lifting of the immobilisation of wagons during the preparations for shunting of a set.**

If a wagon was not or inadequately vented or if the screw brake of a wagon was not or inadequately loosened (resulting in the brakes being inadequately released), the cut may come to a stop between the master retarder and the group retarders, with the risk of a subsequent cut rolling down on the same route or on the common part of both routes colliding with the stationary cut.

2. **the weight data entered for setting the brake control in the automatic shunting system do not correspond to the actual weights of the cuts**

If the wagon data contain incorrect weight data, lighter wagons may be slowed down too strongly and heavier wagons too weakly (with weight measurement switched off or malfunctioning). In the first situation, a cut may come to a stop too early while rolling down and be hit by a subsequent cut rolling down on the same route or on the common part of both routes. In the second situation, a cut on the destination track may run too far than anticipated and collide with a stationary cut there.

3. **incorrect assessment of released brakes by staff during the push-up movement**

The hump foreman's listening to see if there are still any unreleased brakes is an unreliable habit to overcome inadequate venting of brakes or inadequate loosening of a screw brake during the preparations for shunting. The check must be carried out before the push-up movement.

4. **failure to place or inadequate placing of a scotch block on the destination track**

If the railway undertaking staff do not place the scotch block on the destination track at the designated location, cuts with an excessive coasting speed are not slowed down, and any runaway wagons can reach a subsequent crossing.

5. **the proper functioning of the automatic shunting system depends on the continuity of set parameters**

A reset of the shunting system causes manually changed parameters of reduced set coasting speeds, for example, to be reset to factory settings. As a result, cuts may roll down too fast and collide with another cut on the destination track.

The different systemic factors are:

1. **the infrastructure manager has not planned any risk mitigation measures in case of malfunctioning of the weighing installation, and this despite the increased risk as shown in its risk analysis**

The humps each contain a weighing installation that carries out a weight measurement of the cut and thus performs a check between the (transmitted) weight known by the marshalling yard versus the actual weight of the cut. If a difference is found, regardless of its cause, the shunting system applies the braking force based on the weight measured by the weighing installation.

2. **the railway undertaking does not obtain sufficient data to generate comprehensive statistics concerning the number of incorrectly entered wagon weight data into the system**

Brake control adjustments that did not result in an event are unknown and lack feedback to the railway undertaking. This makes the railway undertaking less able to sensitise shippers. It also means that anomalous weight data will be maintained throughout the route of the wagon.

Despite the various measures taken by the parties involved, the risk of runaway vehicles, derailments and collisions remains very real, with the consequences, although not significant to date, being potentially serious.

The RAIIU recommends the DRSI to ensure that the parties involved work together to verify the effectiveness of the measures already taken, evaluate the (residual) risks, and take measures to mitigate the identified risks.


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