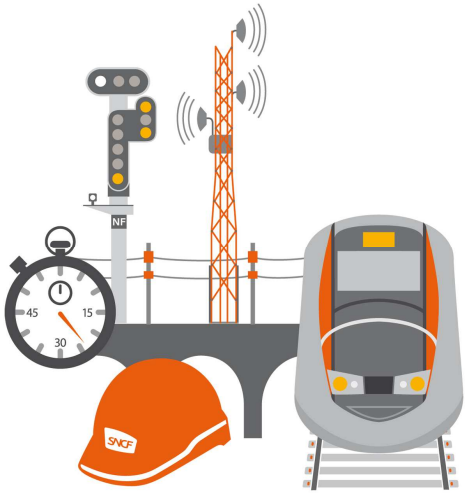
Ingénierie & Projets
Direction Technique
Département Système Ferroviaire

NOTE IRSC 2017

SHUNTING SYSTEM PROJECT



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1. CONTEXT

For trains to move safely on the French rail network (RFN) they need to be safety detected.

Trains are detected by means of the following technical equipment:

- Track circuits: used in switching zones (usually an HVIT) and on open track (UM71 and HVIT)
- Axle counter (CE)

The shunting function only concerns the track-circuit device itself.

The track circuit is operated when the presence of a train in the zone trips the track relay associated with the track circuit receiver. This “shunting” of the signal supplied by the track circuit transmitter by the train’s wheels means that the track circuit receiver no longer receives sufficient energy and so drops the track relay.
By causing this “shunting” between the two wires of the rail with its wheels, the train indicates its presence on the track circuit zone and the signalling installations detect the presence of a train on a track circuit zone.

The “train present on a zone” is a primary safety function which feeds into more complex signalling functions with combined logic (e.g. headway function) or sequential logic (e.g. route locking).

The danger with regard to the “train present on a zone” function is that the technical system comprising the track circuit does not detect the presence of a train movement when it is physically present on the zone.

This undesired event can occur in the following cases:

- Failure of the receiver and associated track relay
- Failure of the train to shunt the track circuit on the zone

It is this problem of “shunt failure” that is the subject of the “Shunting System” project headed by the Direction Technique du métier Ingénierie et Projets.

2. SCOPE

The aim of this document is to describe the missions of the "Shunting Systems" project that had its origins in the accident at Saint-Pazanne on 12 October 2015.

SNCF has always monitored hazardous events involving shunt failure on track circuits since these devices were introduced on the French rail network.

Shunting is a **system theme** which involves various interacting factors.

The project focusing on this theme has three aims:

- To coordinate the implementation of actions decided following the conclusions of risk analyses, within time limits and with the aim of reducing the risks concerned.
- To conduct further risk analyses on certain system functions to assess and/or re-assess the impact of a shunt failure on the level of safety of these functions and, where applicable, to define measures to be introduced to reduce the risks.
- To define and document the processes to be introduced to ensure the control of the shunting system and associated organisations beyond of the project context.

The shunting system project is thus one that brings together the various parts of SNCF (SNCF, SNCF RESEAU, SNCF MOBILITES), as well as external organisations such as the EPSF, BEA TT, Transport Ministry, UIC, research bodies such as RAILENIUM, rolling stock manufacturers and railway signalling manufacturers.

As with any project, it primarily involves teamwork with the aim of improving the level of safety and controlling processes for guaranteeing the required safety level, or indeed improving it in accordance with Chapter 30 of the SNCF RESEAU's Safety Management System.

3. DESCRIPTION OF THE PROJECT

The main aim of the shunting system project is the control of risks related to the undesired event of shunt failure.

The approach adopted by the project is based on managing the risks related to this undesired event and takes the form of the "bowtie" method described in Appendix 3.

The project is divided into 3 actions:

1) Preventive measures
2) Corrective measures
3) Prospective measures

Preventive measures

These measures are take the form of actions aimed at preventing a shunt failure occurring.

They fall into three categories:

- Improving the rail/wheel contact, as regards infrastructure
  - Cleaning the rails is one of the main preventive actions, with plans in 2017 for improved cleaning of susceptible zones and defining strategies to be employed if the cleaning campaigns cannot take place for whatever reason. This also involves updating the associated reference document (IN3188)
  - Grinding of rails in zones where the rail profile no longer provides correct electrical contract between the rail and the wheel in order to restore it.
- Improving the rail/wheel contact as regards rolling stock
  - Periodically checking the fouling of the wheel tread helps to control the build-up of dirt forming an insulating layer within the wheel/rail contact.
  - Modifying the scrubber control of certain traction units
  - Fitting induction loops to assist with shunting on certain traction units and maintenance/works units
- Optimising the adjustment of the track circuits
  - Track circuits have been installed with long lengths making them susceptible to shunt failures. Action for reducing the lengths of these track circuits is in progress on certain identified sections of the national rail network.

Corrective measures

These measures take the form of actions aimed at mitigating the consequences of a shunt failure

They fall into three categories:

- Reduction in collision risks at level crossings
  - Treadles are fitted to level crossings with track circuit signalling to assist with shunting, with the aim of short-circuiting the rails when a train passes over the treadle. SNCF

RESEAU has already fitted treadles to the most susceptible level crossings and will continue to fit them to all level crossings with track circuit signalling over the coming five years.

- Reduction in risk of head-on collisions
  - On track on intervals between signal boxes carrying less than 15,000 tonnes/day and presenting a risk of head-on collision (two-way track, track equipped for wrong-track working) have a 45-second time-delay has been installed on release of direction interlocking.
- Reduction in risk of points spread derailment and sideswipe
  - In November 2015, SNCF RESEAU introduced a shunting safety protocol to put regulatory measures in place so that routes could no longer be pre-set in certain signal boxes considered to be at risk. This protocol is permanently applied.
  - Studies are currently looking into applying technical measures in safety installations to mitigate this risk, where the application of regulatory measures is itself a source of risk.

Prospective measures

These measures take the form of actions aimed at devising, developing, testing and validating solutions leading to actions that will feed into the preventive and corrective measures.

These fall into six categories:

- Admission of rolling stock with respect to track circuit shunting
  - The reference for admission with respect to shunting is SAM 004 (EPSF). Work aimed at defining an advanced admission method has led to SNCF RESEAU participating in the EVAST project led by RAILENIUM.
  - Tests currently underway for understanding the phenomenon of the formation and transport of autumn pollution by units with disc brakes only, in addition to defining the rolling stock design constraints aim to develop a test protocol for resistance to pollution to complement the one already described in SAM004
- Controlling contributing factors
  - The knowledge and control of the tonnage of lines is being defined with the development of the DINAMIC tool for gathering train tonnage data corresponding to the physical reality.
- Devices for reducing the risk of shunt failure
  - The development in 2016/2017 and full-scale testing (2017) of an inductive loop to assist with shunting should make it possible to gauge the value of this development for effective shunting.
  - The development and testing of a scrubber for X73500 is in progress.
- Devices for understanding the phenomenon of shunt failure
  - The development of a residual voltage measuring device for observing the occurrence of shunt failures led to an initial deployment in 2016, which will be followed up in 2017. As there has been little feedback so far, it is not yet possible to determine whether this measure is effective.
- Regulations for limiting the consequences of a shunt failure

- The upgrading the shunting safety protocol in place since the end of 2015 has a dual purpose:
  - To improve safety
  - To improve operation by reducing the constraints linked to the application of regulatory measures

  The principles for the upgrade have been validated. Trial implementation on pilot sites will take place in 2018.

- Evaluation of zones with risk of shunt failure
  - A risk study conducted in 2016 by SNCF RESEAU's Direction Technique Ingénierie & Projets highlighted the zones on the national network that were susceptible to shunt failure. As a result of this analysis, concrete measures have been put in place, such as improved cleaning of susceptible zones from autumn 2017.
  - A methodology allowing local operators to assess the criticality of their line with regard to shunt failure has been established. It will provide a lever over the coming months for assessing the risk of shunt failure and incorporating this into changes to the shunting safety protocol.