RISK MANAGEMENT APPLIED TO CIRCUIT SHUNTING

OCTOBER 2017

PRESENTATION CONTENTS

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- **The undesired event: de-shunting**
- **The four main causes of de-shunting**
- **Incident analysis**
- **Detecting de-shunting**
- **The Sainte-Pazanne accident: a trigger event for efforts to eradicate de-shunting**
- **Introduction of a project mode based on a risk assessment process**
- **The three types of actions implemented**

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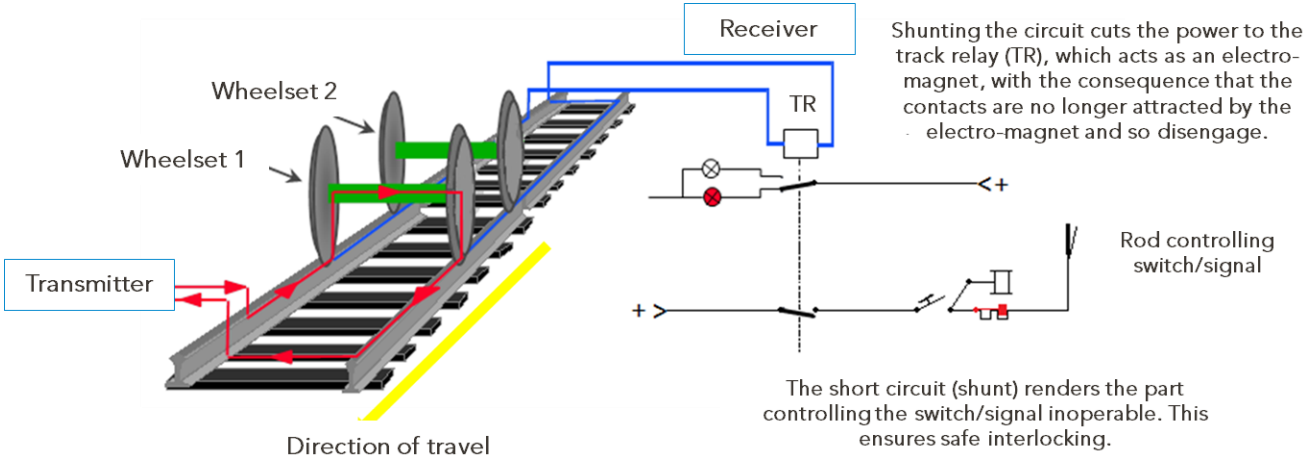
SHUNTING - THE BASICS

The ***TRACK CIRCUIT***: a train detection device.

The train's axles ***SHUNT*** the track circuit running between the two rails.

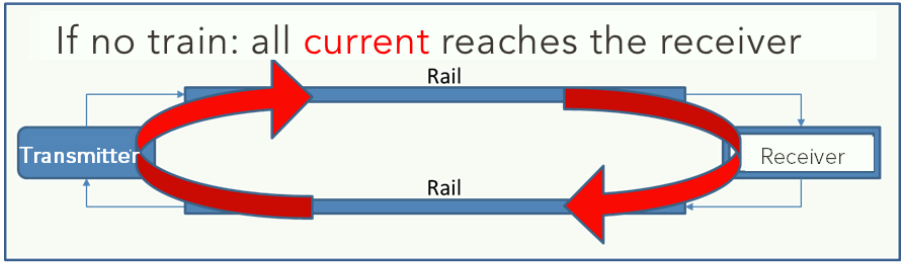
The functions performed by the ***TRACK CIRCUIT*** and by ***SHUNTING*** of traffic on the track facilitate the signalling functions that prevent rear-end and head-on collisions, derailments and collisions at level crossings.

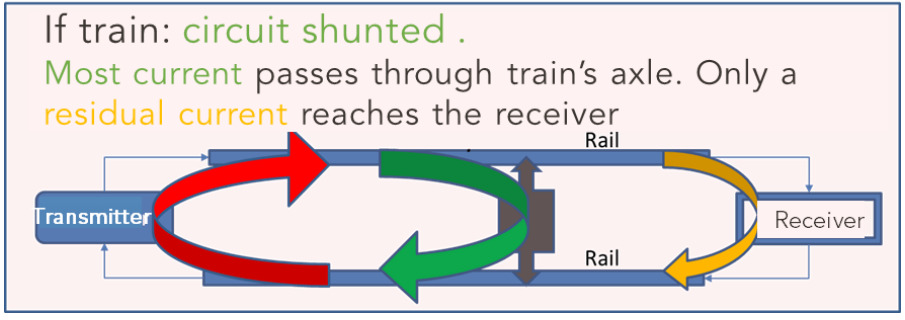
Countries using such devices for traffic detection include: France, Germany, Belgium, the Netherlands and Japan.



SHUNTING - THE BASICS

HOW A TRACK CIRCUIT WORKS





THE UNDESIRED EVENT: DE-SHUNTING

- ***DE-SHUNTING*** **is the undesired event associated with operating a** ***TRACK CIRCUIT.***

- ***DE-SHUNTING*** **is the term used to describe a high level of impedance in the contact between rail and wheel, which generates electrical behaviour in the** ***TRACK CIRCUIT*** **so that the circuit believes that there is no contact between the rail and the wheel when traffic is in fact physically present in the area.**

- **Hence,** ***DE-SHUNTING*** **can cause safety-critical incidents if its** ***CAUSES*** **and** ***CONSEQUENCES*** **are not managed.**

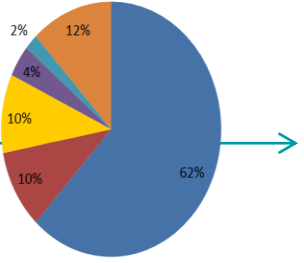
THE FOUR MAIN CAUSES OF DE-SHUNTING

- *OXIDATION OF RAIL/WHEEL CONTACT*

- *EXCESSIVE SANDING*

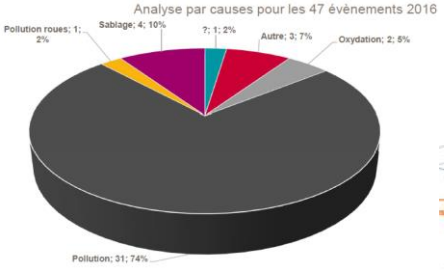
- *AUTUMNAL CONTAMINATION*

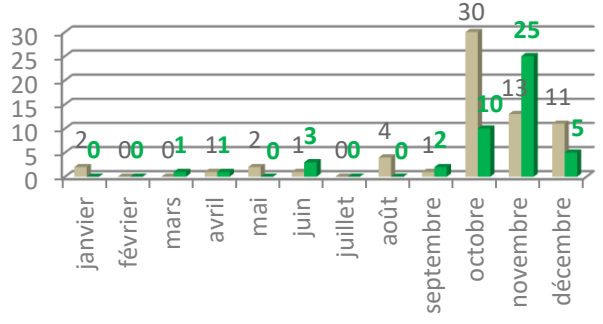
- *INADEQUATE VEHICLE RESPONSE*



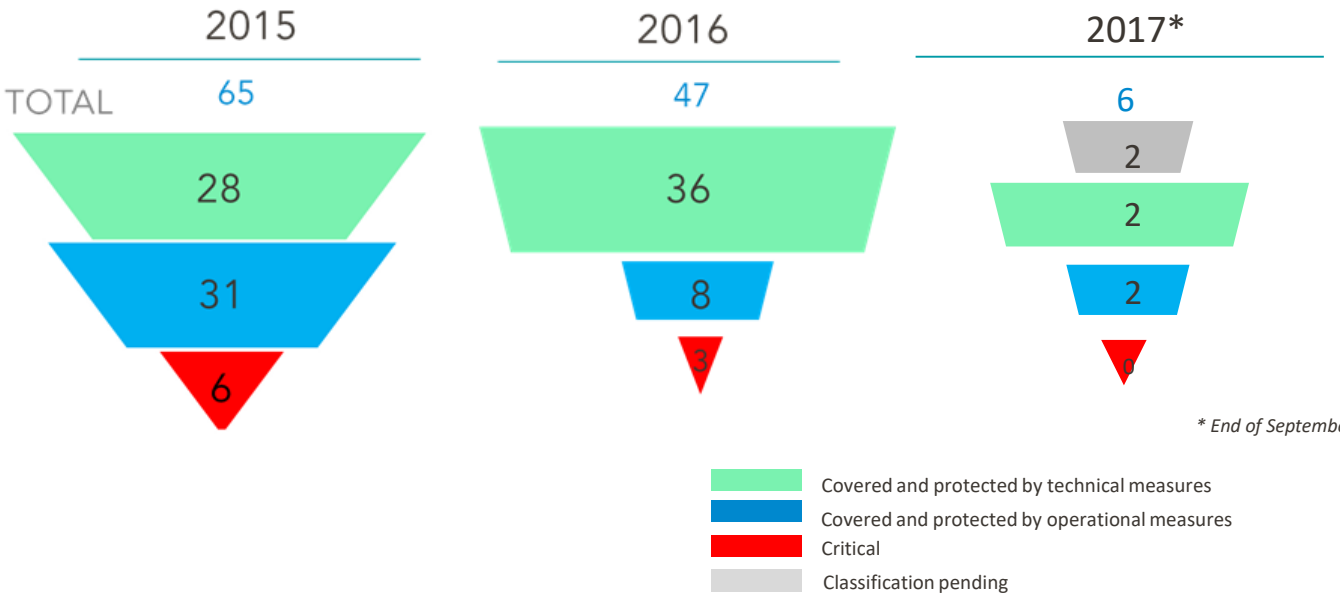
INCIDENT ANALYSIS

- **45 de-shunting incidents on average each year**
- **80% of de-shunting incidents occur in the autumn**
- **3 critical de-shunting incidents in 2016**





DE-SHUNTING TRENDS 2015-2017



DETECTING DE-SHUNTING

The following are involved in the detection of de-shunting or suspected de-shunting:

- **operators:**
  - **the train dispatcher (e.g. failure to release route, distance indicator light turning off or turning to white, etc.)**
  - **the controller**
  - **the driver (e.g. signalling interval)**
  - **electrical service or other staff (e.g. seeing a barrier at a level crossing being raised too early)**
- **the maintenance support computer system (remote monitoring)**
- **recordings from computerised switching stations**
- **the recorders put in place by Infrastructure Management to monitor signalling systems**
- **the track circuits' residual voltage recorders**

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THE SAINTE-PAZANNE ACCIDENT: A TRIGGER EVENT FOR EFFORTS TO ERADICATE DE-SHUNTING

- **Track spread following de-shunting on a switching zone**
- **Highlighted the impact of autumnal contamination**
- **Two immediate measures:**
- **Introduction of a shunting safety protocol**
  - **Circulation of X73500 trains forbidden in interlockings with route recording if operating as single units; verification of a minimum of 2 trains on the route**
  - **Verification of cleanliness of the tyre treads of certain stock**
- **Introduction of a shunting system taskforce (project mode)**

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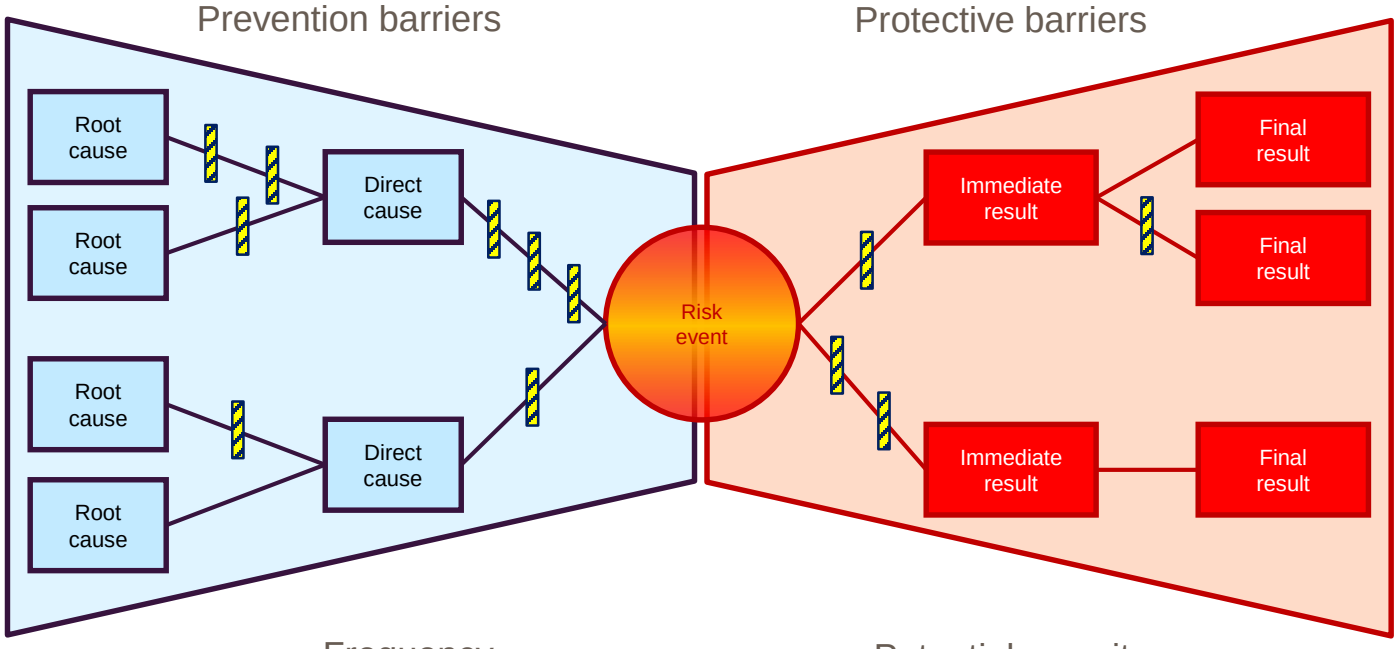
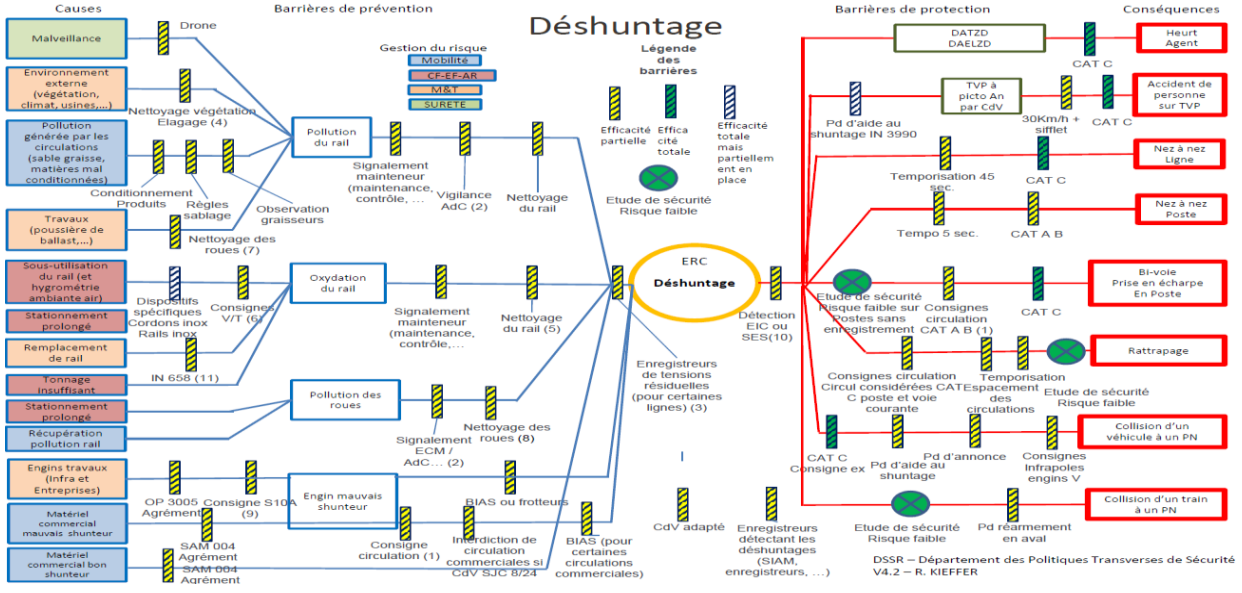
A PROJECT MODE BASED ON A RISK ASSESSMENT PROCESS (1/2)



A PROJECT MODE BASED ON A RISK ASSESSMENT PROCESS (2/2)



SHUNTING ACTION PLAN

I. ***Preventive*** actions to prevent shunt failure

II. ***Corrective*** actions of the consequences of shunt failure

III. ***Prospective*** actions for knowledge of the rail/wheel contact system

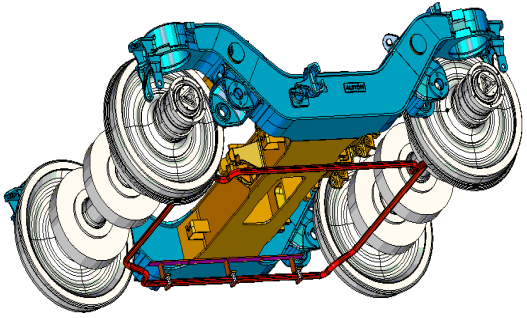
Preventive actions

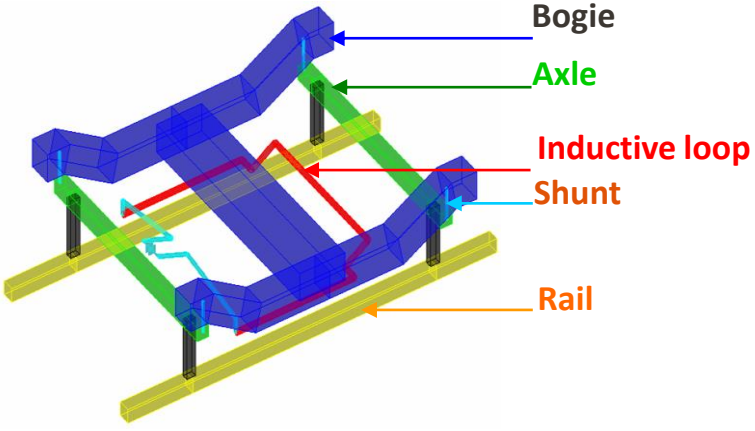
Corrective actions

Prospective actions

PREVENTIVE ACTIONS/INADEQUATE RESPONSE FROM VEHICLE

Inductive loop shunt assisting device

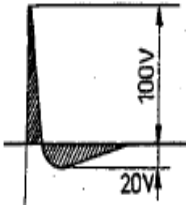




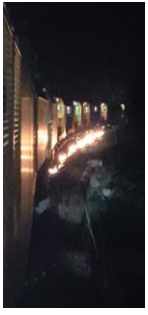
Scrubber

PREVENTIVE ACTIONS/OXIDATION

High voltage impulse track circuit



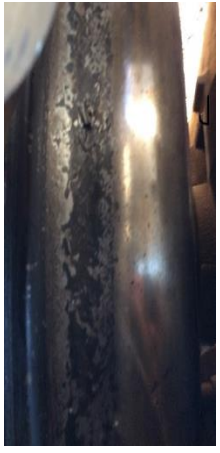
Rail grinding



Rustproof rails

PREVENTIVE ACTIONS/POLLUTION

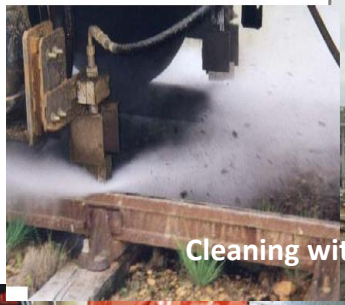
Cleaning of certain vehicles' wheels



PREVENTIVE ACTIONS/SANDING

Cleaning of rails and track

Cleaning with high-pressure water



Cleaning by brushing

MITIGATING ACTIONS/RISK OF COLLISION AT LEVEL CROSSINGS

Treadles for level crossings with track circuit warnings

MITIGATING ACTIONS/RISK OF HEAD-ON COLLISION

Delay of 45 seconds for route release mechanism

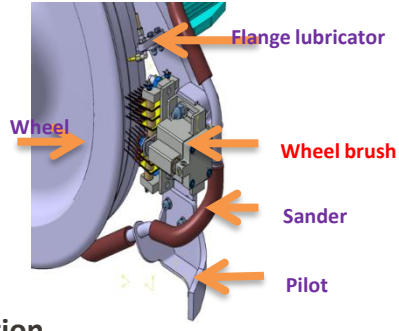
PROSPECTIVE ACTIONS/ANTICIPATING DE-SHUNTING

- **Safety studies: mitigating actions are required for around 30 sections of line identified as critical by safety studies.**
- **Methodology for de-shunting analysis and risk management**
- **Development and testing of a residual voltage measurement instrument**

PROSPECTIVE ACTIONS/PREVENTING DE-SHUNTING

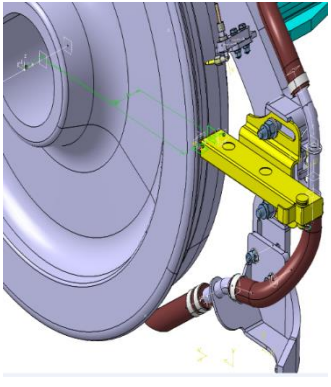
Development and testing of a next generation inductive loop shunt assisting device

Development and testing of a wheel brush

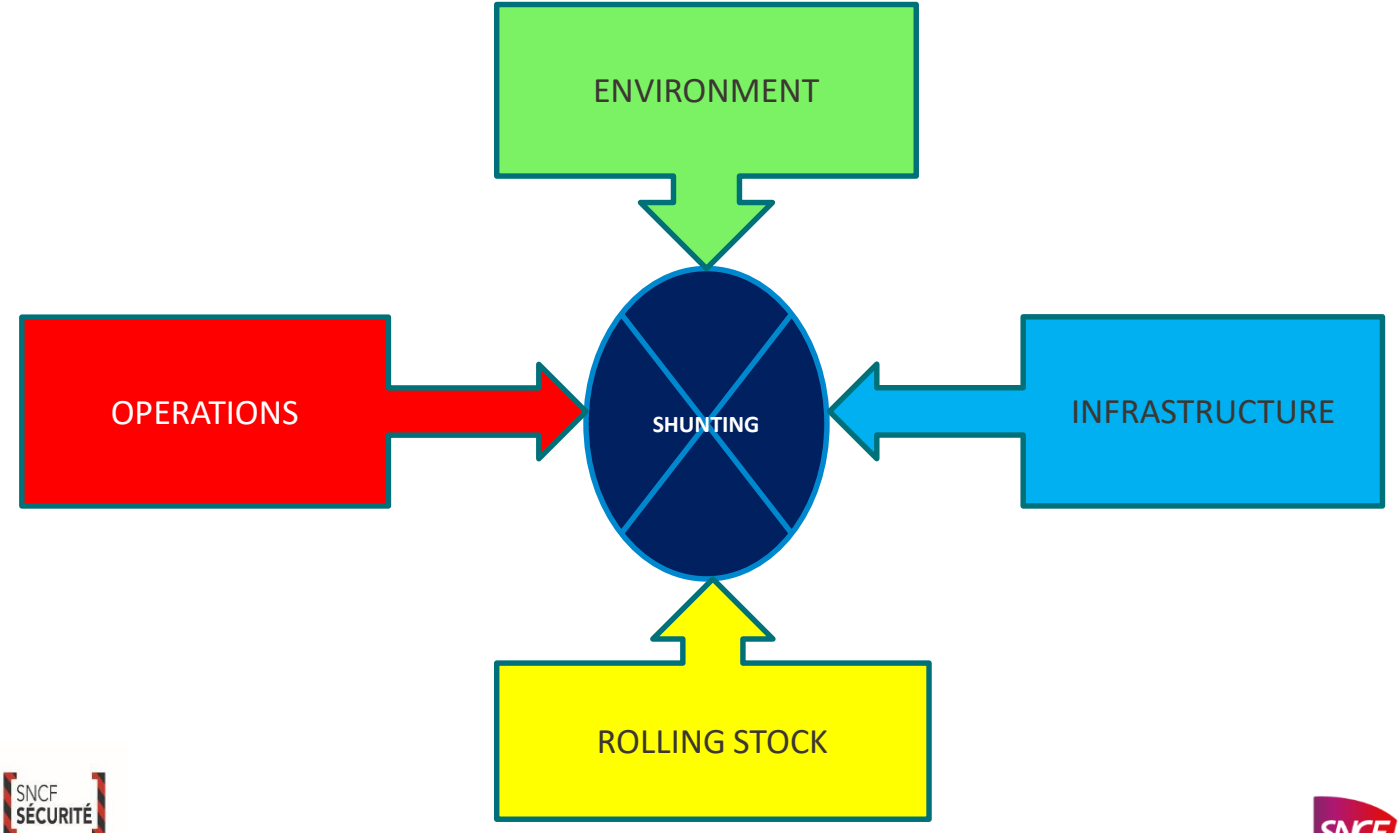


Development and testing of an on-board anti-contamination device

UIC device (Marc Antoni): Research on improving track circuit receivers



SHUNTING AND SYSTEMS



IN ADDITION TO RISK ANALYSES

- A local criticality analysis methodology
- See presentation by Jean-Luc Wybo

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