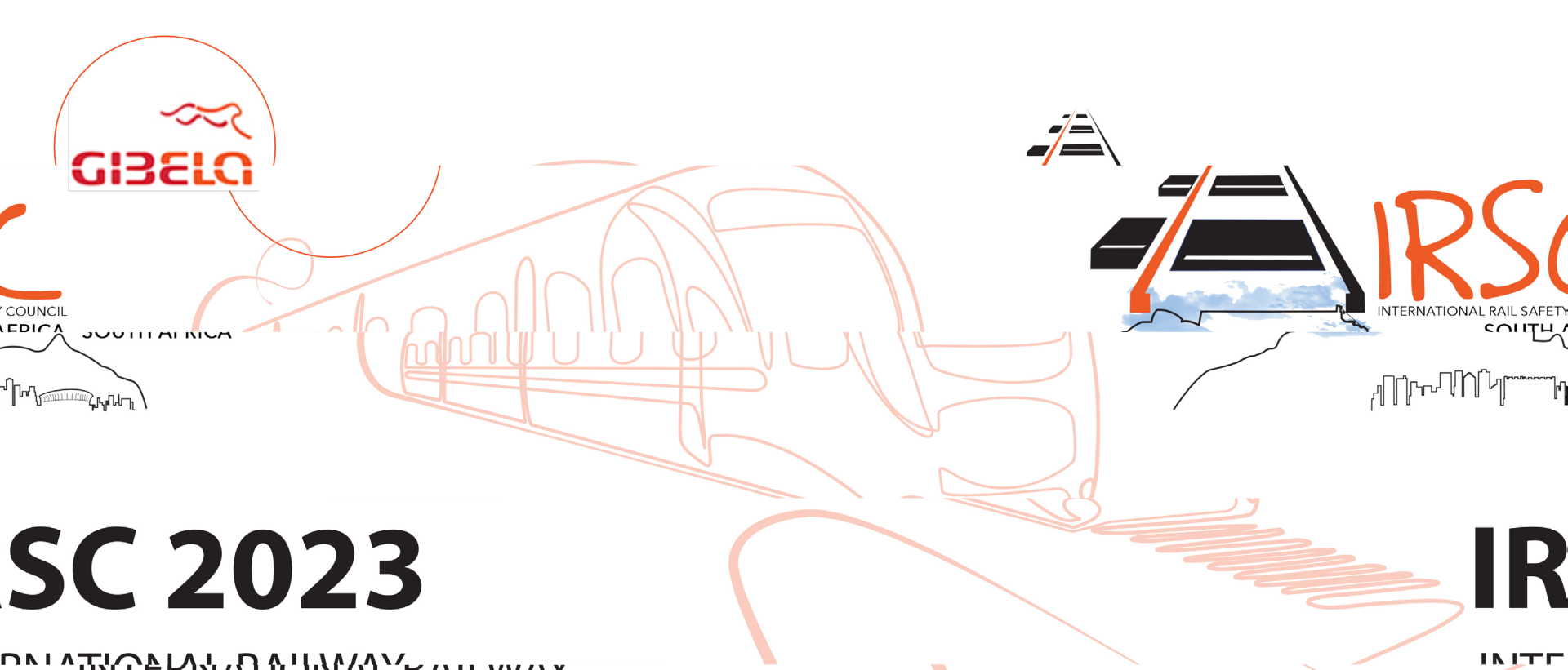


SC 2023

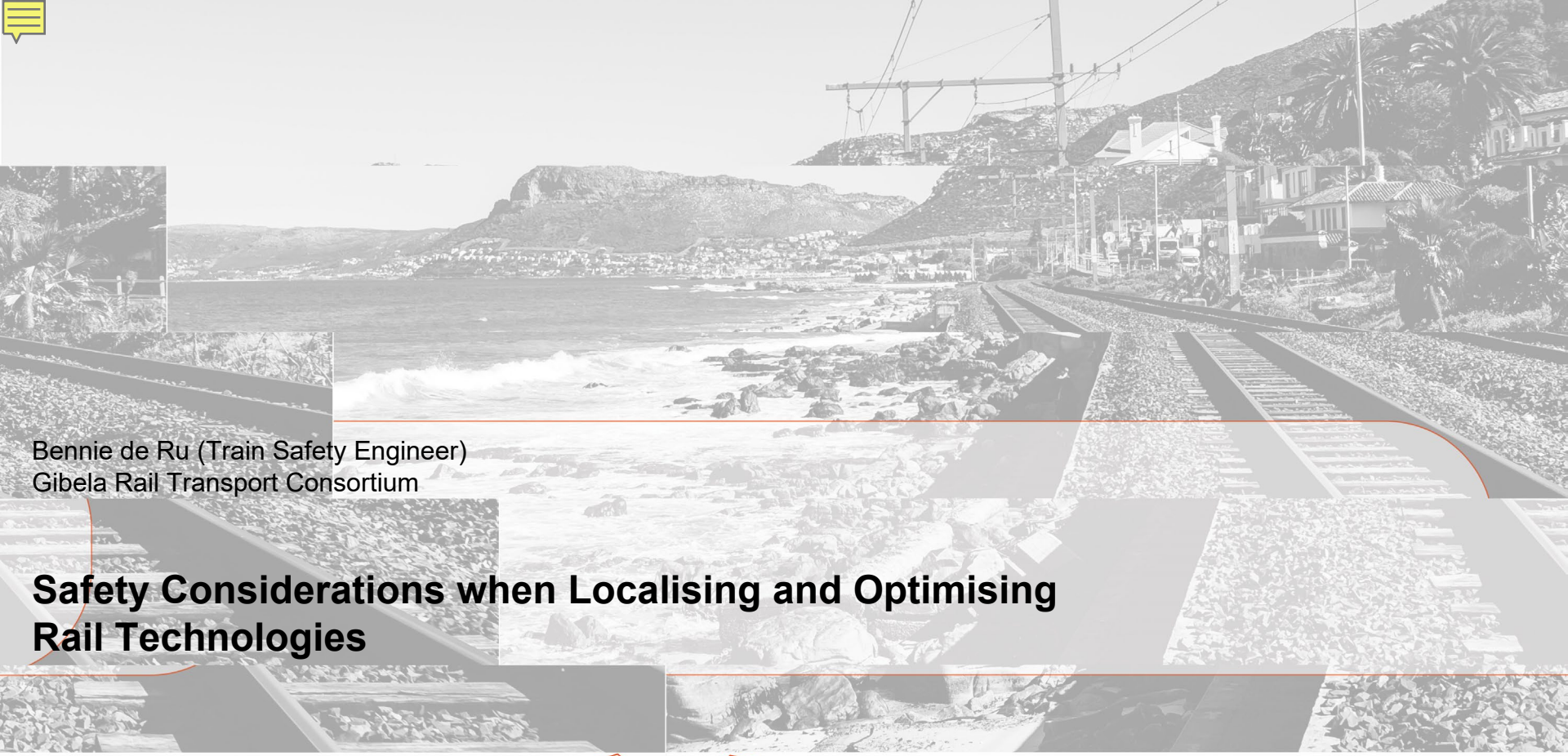
IR

INTERNATIONAL RAILWAY
SAFETY COUNCIL

"Reshaping Railways in an Uncertain World"

CAPE TOWN, OCTOBER 1 - 6, 2023

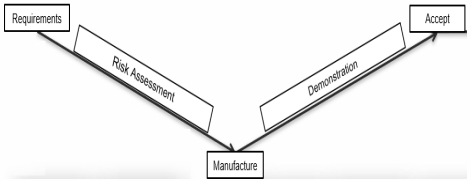
HOSTED BY



Bennie de Ru (Train Safety Engineer)
Gibela Rail Transport Consortium

Safety Considerations when Localising and Optimising Rail Technologies

Contents



Project Introduction – 600 Trainsets to be supplied to PRASA

Following the original design by Alstom and the subsequent manufacturing of the first 20 trainsets in Brazil, the manufacturing of the rest of the 580 trainsets moved to Dunnottar, South Africa.

The production of these trainsets are done by Gibela Rail Transport Consortium thought the Main Supply Agreement (MSA) with PRASA (Passenger Rail Agency of South Africa).

A contract of this size and local content target necessitates re-design due to several factors including localisation and design optimisation.

Safety of passengers remains our top priority

For any re-design,

Product Safety will not be compromised.

This dedication to safety is in line with the train name 'The People's Train'.

Sub-theme 8: Local and International collaborative efforts

The People's Train Safety Features

Design per EN50126 : Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

High Performance Emergency Brake (EB)

Traction Interlock (/Authorise) (TA)

Passenger door operation with high level of safety integrity

Breakable window for emergency egress (1 per car)

Automatic Train Protection (ATP) (ETCS* Level 2)

Fire hazard mitigation

Critical safety information for the driver (via hardwire)

SIL 2 Speed indication

SIL 2 Deadman function

Emergency ventilation

Effective Crash Protection Design

ETCS: European Train Control System

When things Go Wrong!

24

≈ 240

One of the worst railway fatalities in South Africa in recent times

Hennenman-Kroonstad Accident

24 fatalities and over 240 injuries[1/2].

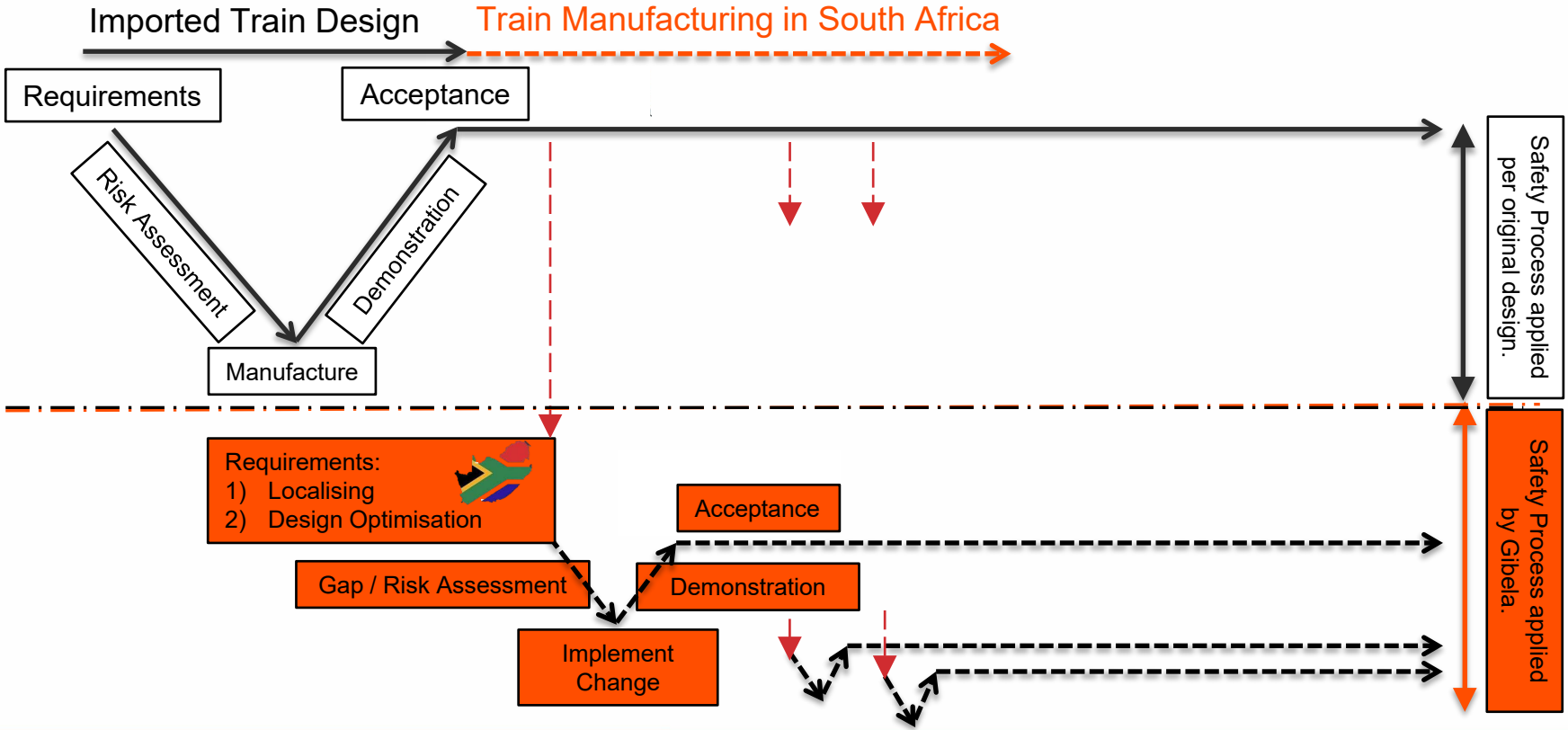
Contributing Design Factors[2]:

Coaches involved did not have adequate emergency exits and passengers were unable to exit through the windows.

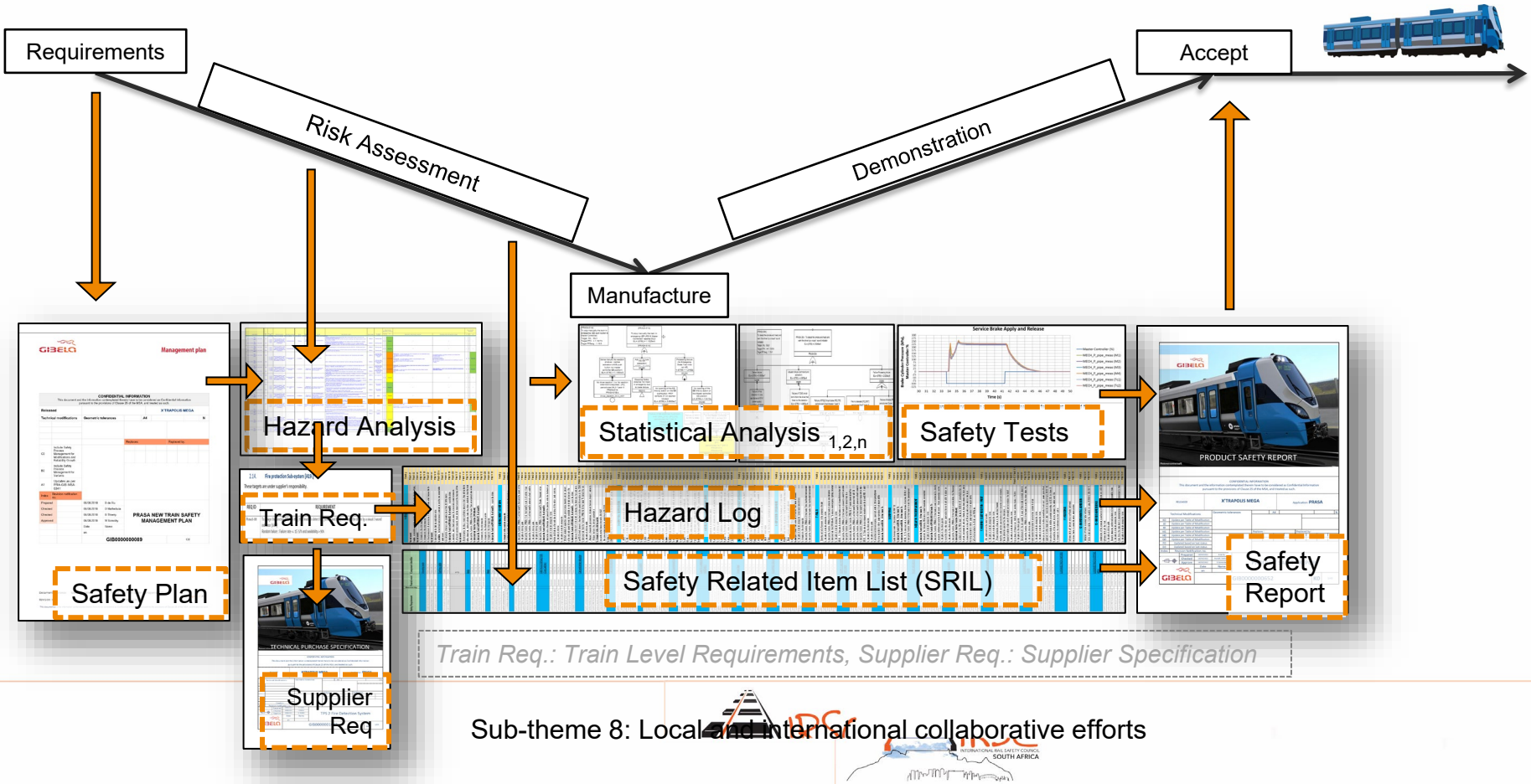
The material covering the coaches is not fire resistant or retardant.

1. Ndileka Lujabe. (2018, January 10). News24.com. Retrieved from News24: https://www.news24.com/citypress/news/inquiry-to-look-into-kroonstad-train-crash-20180110
2. RSR/20180104/002. (4 January 2018). GENEVA STATION LEVEL CROSSING COLLISION BOARD OF INQUIRY REPORT. Johannesburg: Railway Safety Regulator.

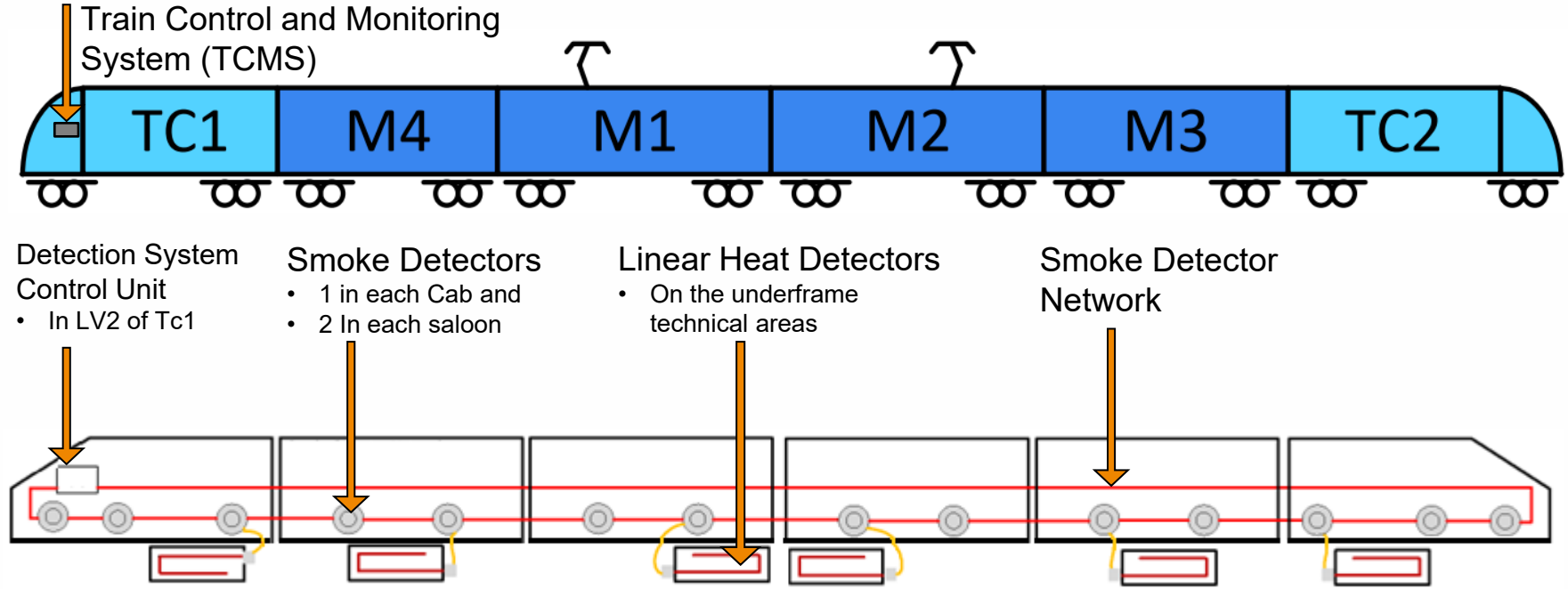
Safety Process overview (EN50126): When Localising and Optimising Design



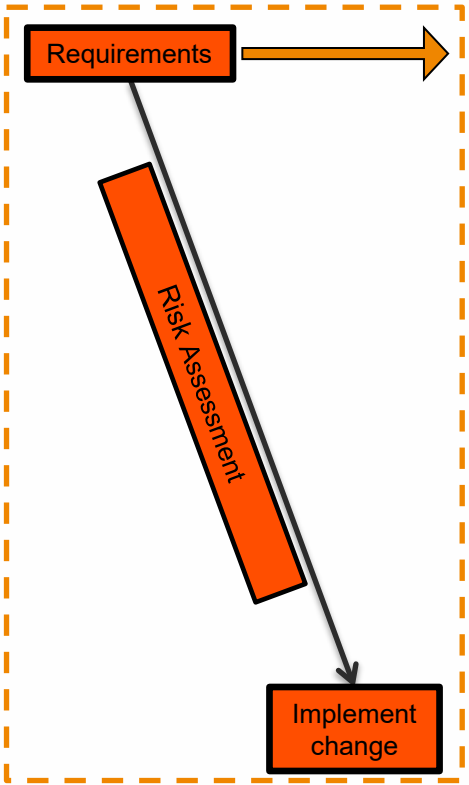
Imported Train Safety Documents (Per EN 50126)



Example 1: South African Supply of the Fire Detection System

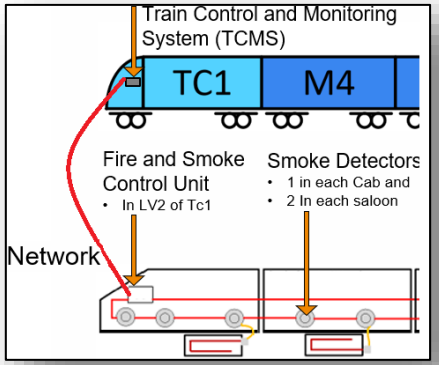


Example 1: Fire Detection System – Safety Process Application (Step 1/5)

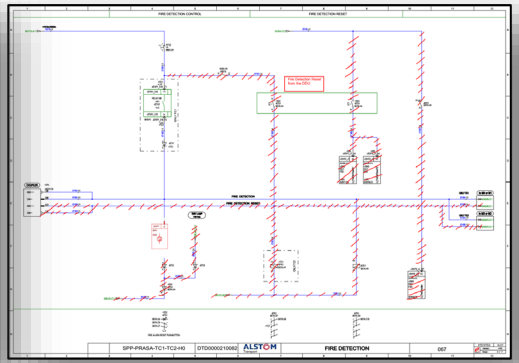


New requirements of the localised system

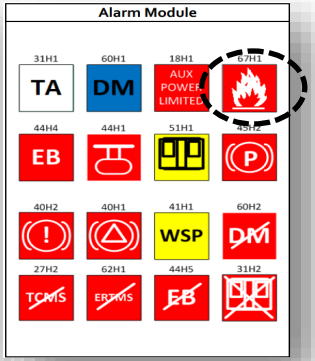
1. New network interface.
2. Optimise electrical wiring.
3. Add lamp to the central alarm module.



Network Interface

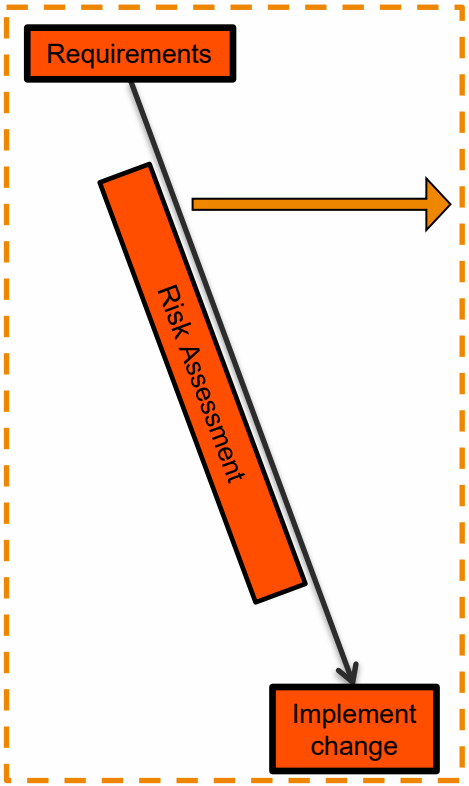


Optimise electrical wiring



Add Fire Alarm on the Alarm Module

Example 1: Fire Detection System – Safety Process Application (Step 2/5)



Identifying and Understanding the Gap

1. Identify and understand the Safety properties of the design.
2. Impact on the Hazard Analysis, Hazard Log and SRIL.
3. Identify new hazards if such hazards are introduced.

Example 1: Fire Detection System – Safety Process Application (Step 3/5)

Requirements

Risk Assessment

Implement change

Apportionment of system requirements

- A fire hazard: primarily mitigated by selection of correct materials.
- The Hazard Situation "**Toxic smoke emission due to a fire**" identified as "Undesirable", in the Hazard Analysis
  - ❑ Hence a safety function: "To detect a fire and warn the driver by a visual or sound indicator." was specified. **[Function P-38A]**
  - ❑ In addition, safety function: "To cut off ventilation in the car where fire is detected." was specified. **[Function P-38B]**
  - ❑ Using the Risk Graph these functions were evaluated to be implemented at SIL0.

Hazard Analysis

Train Req.

Hazard Log

[Function P-38A]
[Function P-38B]

Functions tracked at train level.

Supplier Req

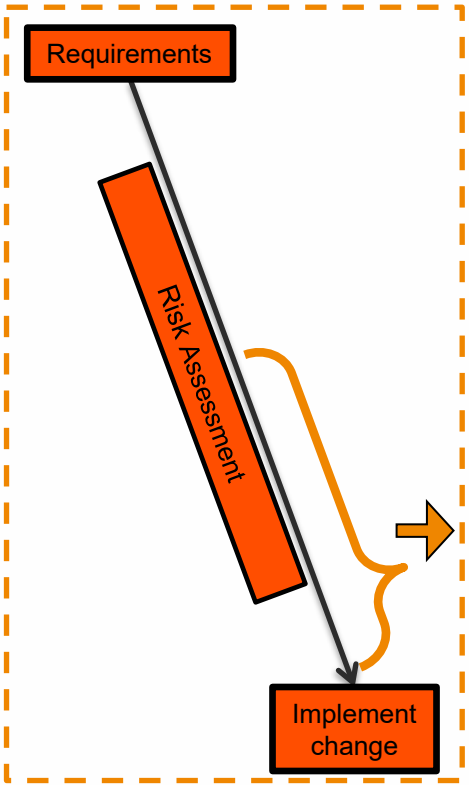
	RAMS	
[REF15]	EN 50126 : Railways applications – The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)	2000, January

ERS	Designation	Target
ERS1	No detection of a fire	1,00E-06
ERS2	Untimely fire detection system	1,00E-05

Collaborate closely with suppliers to ensure that requirements are understood, factored in and managed.

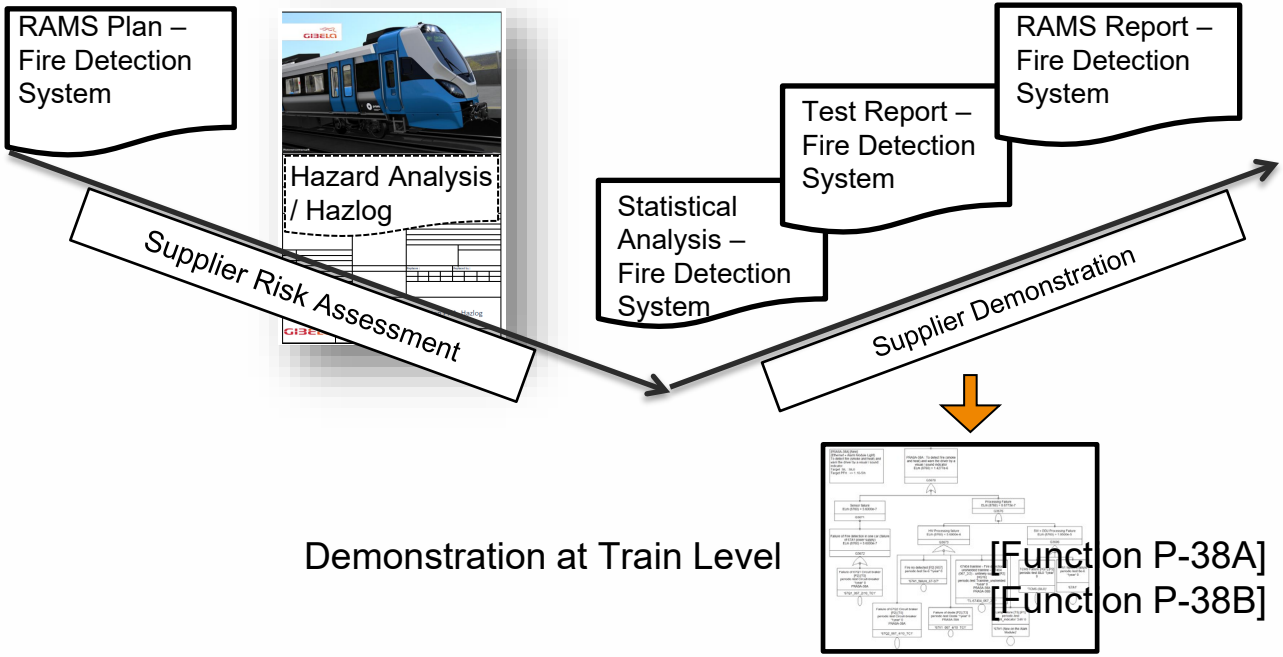
Req.: Requirements

Example 1: Fire Detection System – Safety Process Application (Step 4/5)

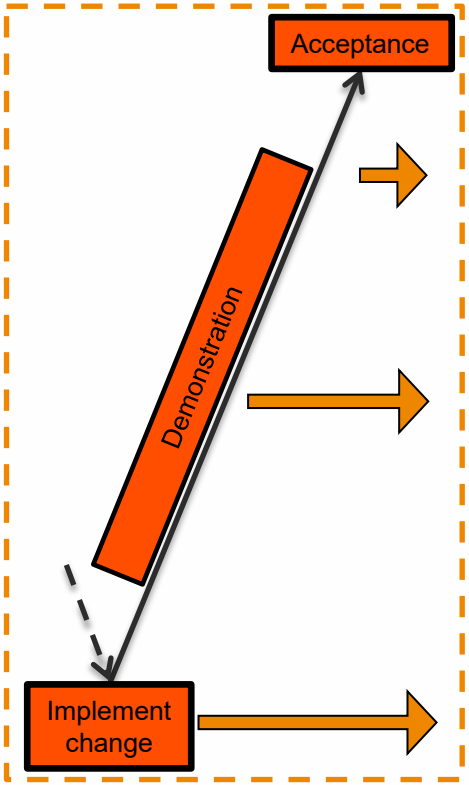


Risk Assessment with the Supplier : Teamwork

The Supplier Safety management process was a collaboration between supplier and Gibela.



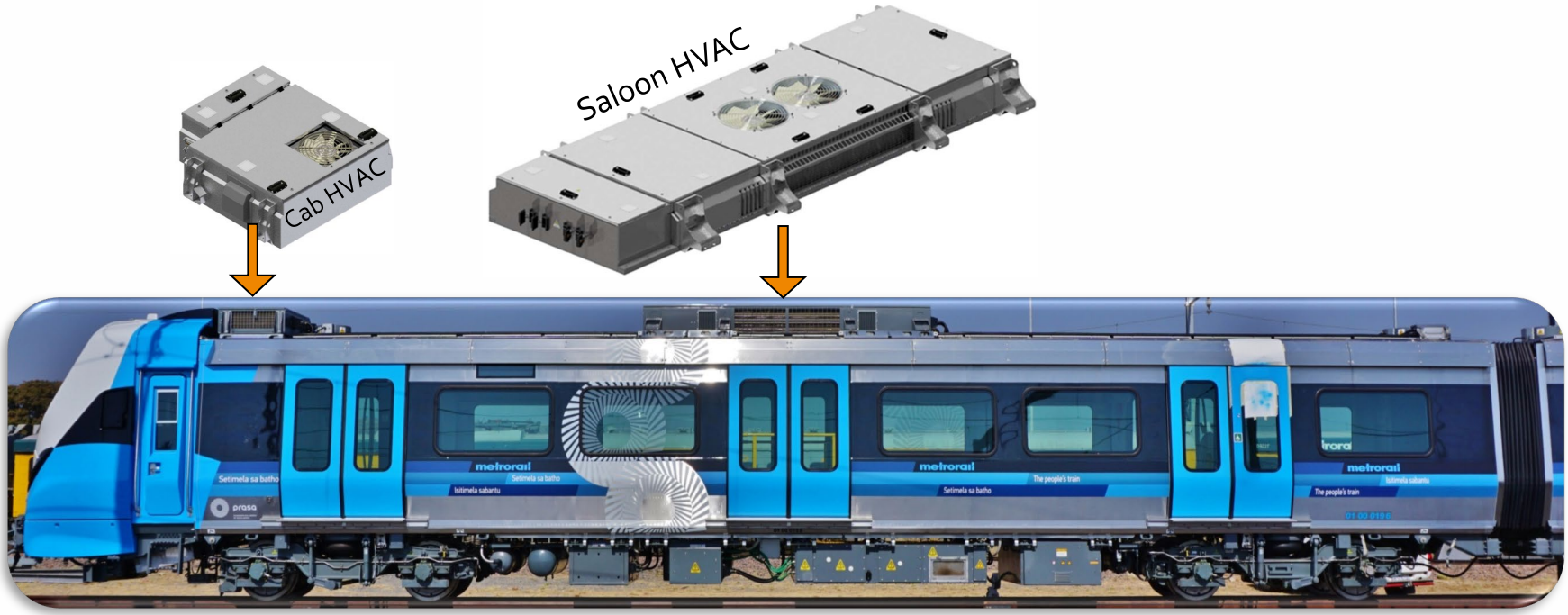
Example 1: Fire Detection System – Safety Process Application (Step 5/5)



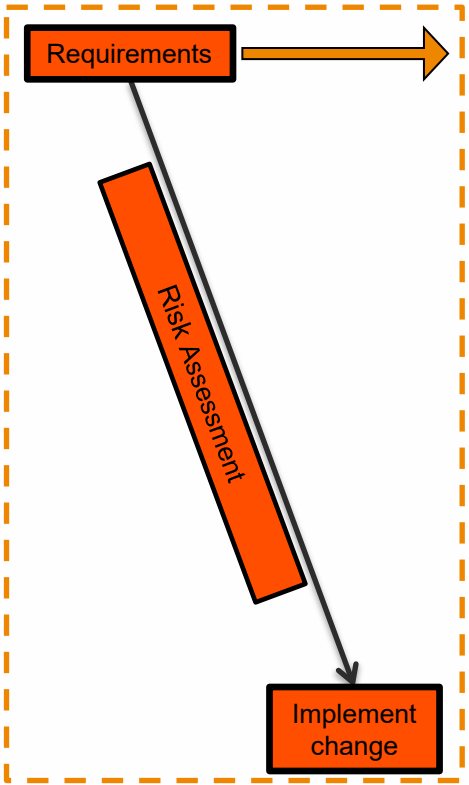
Implementation and Demonstration

- Product Safety Report
- Maintenance Document update considering supplier information.
- Testing at Train Level with the supplier.
- Manage Safety Related Application Conditions (SRAC).
- First Mounting Review

Example 2: South African Supply of Cabin and Saloon HVACs

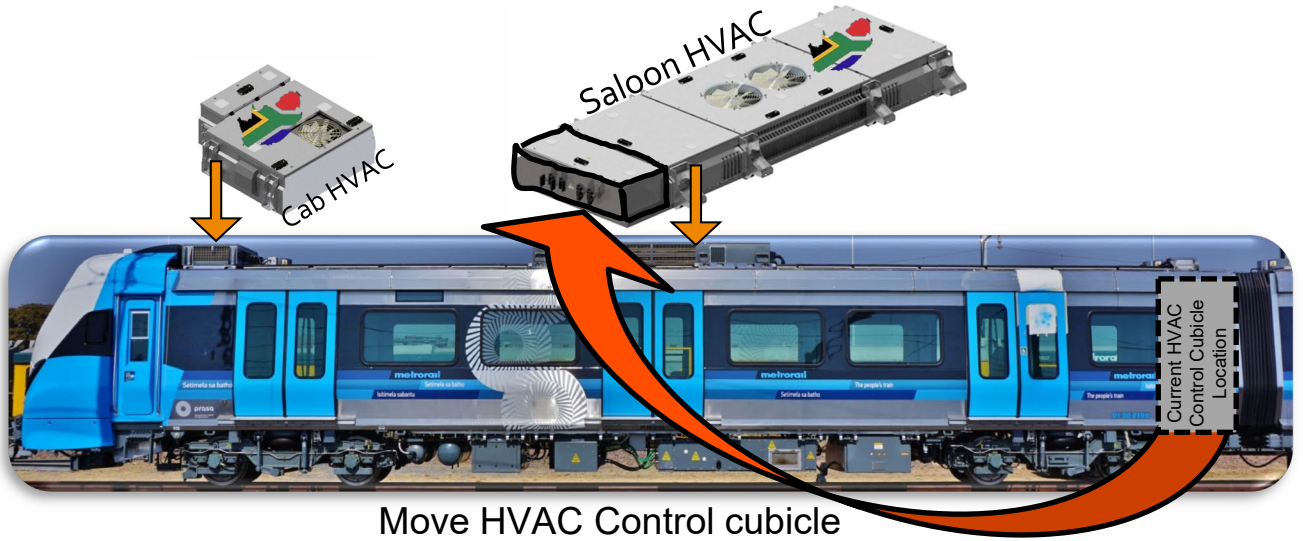


Example 2: South African supplied HVACs – Safety Process Application (Step 1/5)

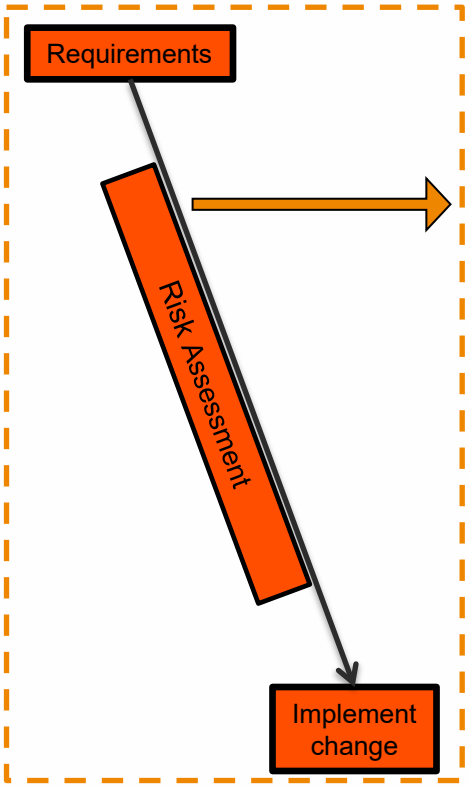


Requirements:

1. Equip the train with South African sourced Cab and Saloon HVAC's.
2. Design optimisation: Relocate the HVAC LV control box (currently in the Saloon of each car) to the HVAC roof unit.



Example 2: South African supplied HVACs – Safety Process Application (Step 2/5)



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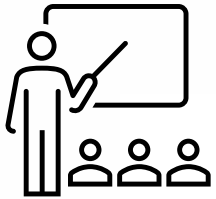
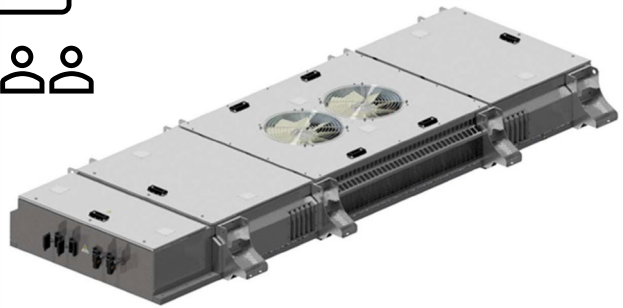
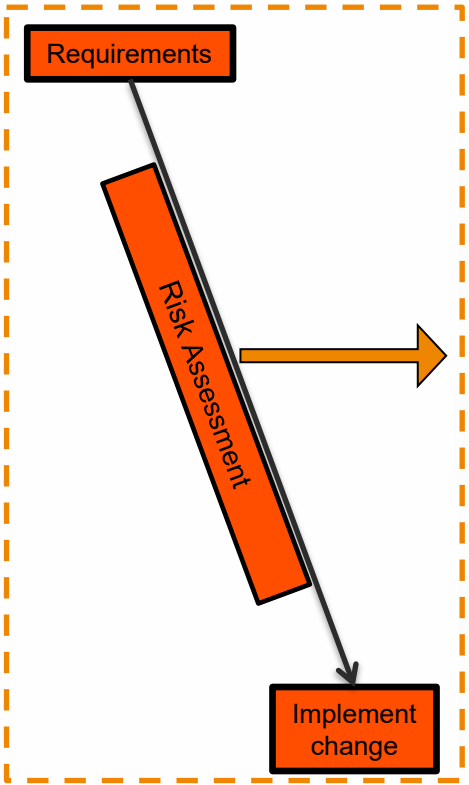




Example 2: South African supplied HVACs – Safety Process Application (Step 3/5)



Apportionment of system requirements

- The Hazard Situation "**No air exchange**" identified as "Negligible", in the Hazard Analysis.
- Thus, no Safety Function was needed.
- However, two items are registered in the Hazard log to be managed:
  1. *HL_3-14*: **Demonstrate** that the CO2 buildup is within limits
  2. *HL_3-19*: **Driver Document** to be updated confirming HVAC OK.

Hazlog requirements to be closed at train level prior acceptance.

RAMS

[REF15] EN 50126 : Railways
specification and de
Availability, Mainta

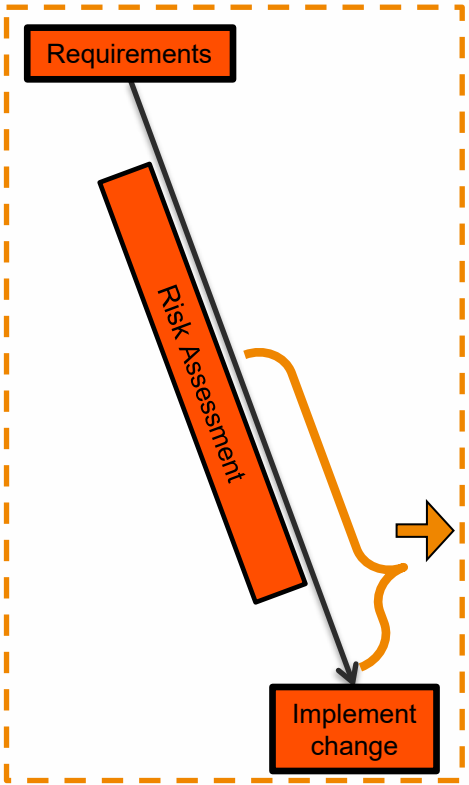
Requirements

ERS	DESIGNATION	TARGET
ERS1	Asphyxia (low level of O2 or high level of CO2....)	1.10E-9 / h
ERS2	Fire start or a smoke release by the air-conditioning	1.10E-9 / h
ERS3	HVAC explosion potential human injury due to projectiles	1.10E-9 / h
ERS4	Failures leading to electrocution (400 V used)	1.10E-9 / h
ERS5	Fluid cooling outflow from air-conditioning unit	1.10E-7 / h
ERS6	Fall of HVAC part	1.10E-9 / h

Collaborate closely with suppliers to ensure that requirements are understood, factored in and managed.

Req.: Requirements

Example 2: South African supplied HVACs – Safety Process Application (Step 4/5)



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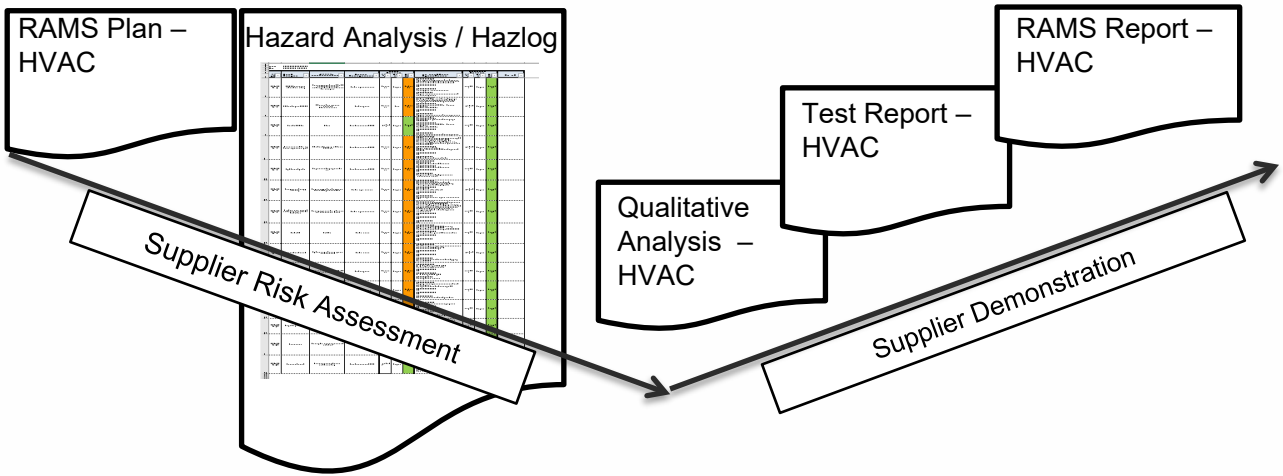
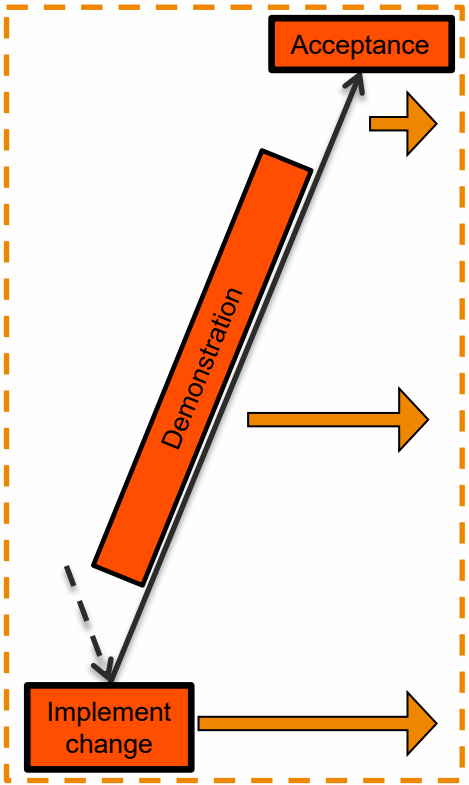
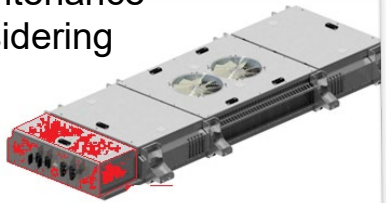


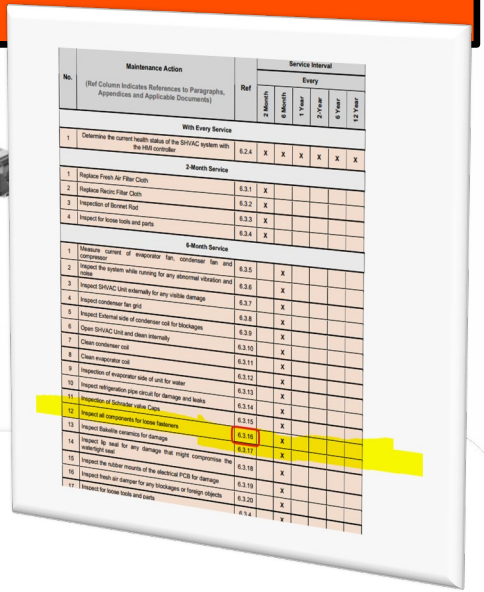
Example 2: South African supplied HVACs – Safety Process Application (Step 5/5)



Implementation and Demonstration

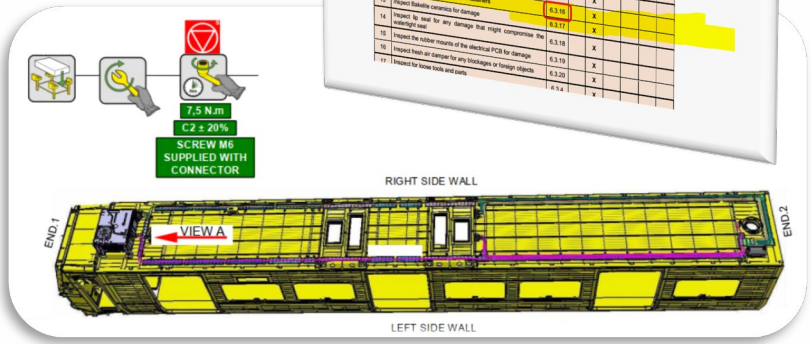
- Current Activities : Maintenance Document update considering supplier information.
- Product Safety Report





- Testing at Train Level with the supplier.

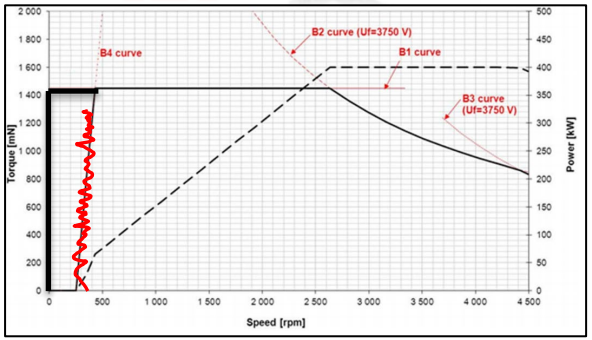
- Safety Related Application Conditions (SRAC) to be added to the Maintenance Manual.



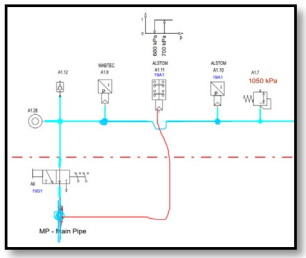
- First Mounting Review

Considerations and challenges when localising and optimising the design

- Both Gibela and our local suppliers were newcomers to the Safety Management Process per EN 50126.
- The nature of localization and design optimisation topics are such that each is unique and necessitates, in addition to application of the Safety Management Process, a technical learning curve.
- Application of the Safety Management Process is seen as critical, but when proposed changes lead to new Safety requirements these new requirements are often challenged.
- Documentation takes up time
  - Hazard Analysis ≈ 150 lines, Hazlog ≈ 500 lines
- Product Safety is generally not well-known in South Africa and is often grouped together with EHS (Environmental Health and Safety).



Changes to the Braking Curve impacting Traction Authorise (TA) Train Line.



Safety Pressure Switch piping change.

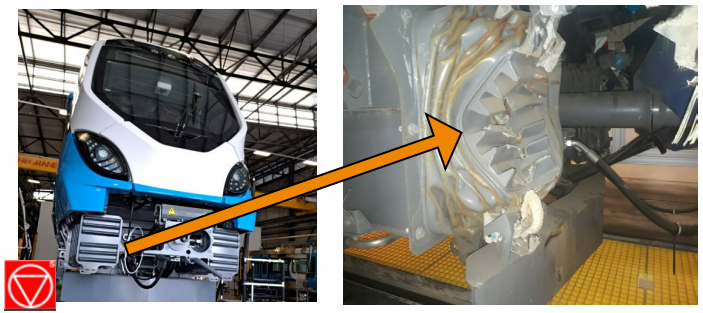
Learnings and Opportunities

- When onboarding new local suppliers, it is crucial to establish the maturity of their Safety Management Process, per EN50126, early in the onboarding process.
  - ✓ This could lead to the need to do workshops or training to develop their Safety Management Process.
  - ✓ (By having worked with local suppliers also resulted in Gibela having to better understand the Safety Management Process.)

- In the execution of the localisation project, two key factors are crucial:
  - ✓ initiating the Safety Process early, and
  - ✓ establishing partnership.

  These elements play a pivotal role in identifying hazards and formulating requirements to effectively mitigate associated risks.

- The Safety Management Process and nature of localisation and design optimisation topics necessitates Safety Engineers in the team to be fully focused on the railway safety.



- It is important that the entire organisation understands and supports the safety function, the long-term benefits and potentially disastrous consequences if the process is not followed.
- Local suppliers who has produced products for *The People's Train* are also in a better position to supply the international market.
- From a technical perspective the Safety Engineer has the challenge, which becomes an opportunity, to learn a wide spectrum of train system.

In Conclusion!

At Gibela, we take Safety Engineering and Product Safety seriously!

Localisation is undertaken to unlock economic growth in the South African rail sector.

The rigorous safety process and use of modern materials and technology ensures that the safety integrity of ‘The people’s train’ is never compromised.

We have deep knowledge of the safety process and will continue to revitalise the rail industry in South Africa!

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