Joint Network Secretariat Urgent Procedure Task Force “Extreme effects of thermal overload in special cases of freight operation

Final report –
Part 3: Detailed information on the work of the JNS task force

02.February 2022

Version 1.0

5. Detailed information on the work of the taskforce

The short-term risk control measures are based on the following:

- 5.1 Assessment requirements of composite brake blocks,
- 5.2 Homologation of the IB 116*
- 5.3 Analysis of fixed brakes
- 5.4 Fire protection evaluation of composite brake blocks for use in freight wagons
- 5.5 General case evaluation
- 5.6 Identification of the relevant cases to be treated in the urgent procedure
- 5.7 Risk analysis for brake block and wheel regarding sparkling/ flaming brake block and exceeding brake energy input

The work is documented in the following slides.

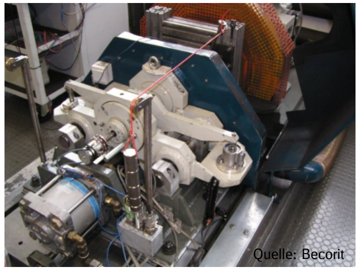
Requirements on CBB

UIC 541-4 / EN 16452

28.11.2021 | Minden

5.1 The Safety Requirements in Europe are manifold

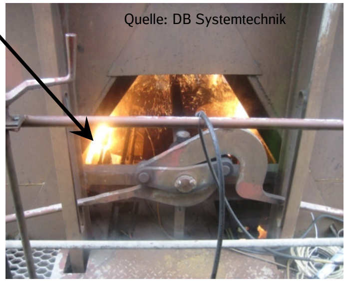
Example: Composite brake blocks on Freight Wagons

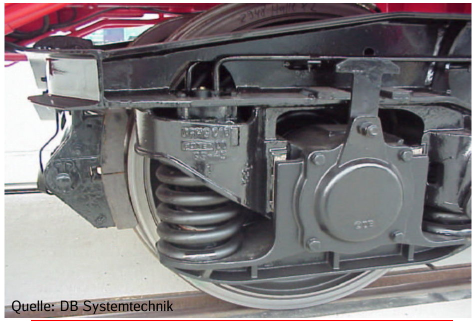


Compatibility with track circuit detection Systems (shunting)

Braking Performance Under Severe Winter Conditions

Cast iron blocks!





And more: cof dry/wet, static cof, cof hot/cold …

Locked brake testing

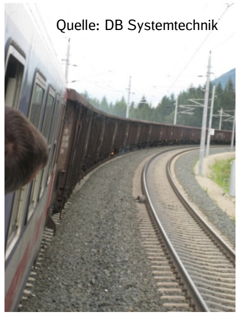
Travelling on Steep Slopes

5.1 The Safety Requirements in Europe are manifold

UIC-leaflet 541-4 / EN 16542 test programs and requirements for blocks - Extensive Pre-approval testing of composite brake blocks necessary

Full scale rig-based testing

- Friction testing - brake performance programme, brake assessment programme (friction testing to be performed for each configuration e.g. 2 x Bg, 2 x Bgu, ….)
  - test programs in annex A2_a and A2_b of 541-4 for standard freight wagon configurations, friction level LL
  - Checked with these test programs:
    - friction level in general (stop brakings)
    - Reaction on hot braking and wet braking as well as downhill braking
- Testing to determine propensity for metallic inclusions
  - Test program defined in annex A4



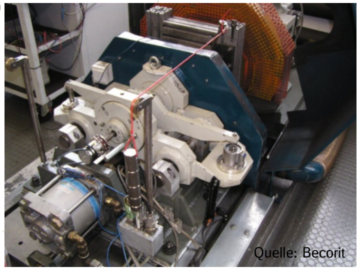
content of UIC-leaflet and EN standard concerning rig-based testing in general identical

5.1 The Safety Requirements in Europe are manifold

UIC-leaflet 541-4 / EN 16542 test programs and requirements for blocks - Extensive Pre-approval testing of composite brake blocks necessary

Full scale rig-based testing

- Proof of braking performance in winter condition
  - Test program defined in annex A5 (alternative: test on track, defined in Annex G)
- Extreme load testing (locked brake)
  - Test program defined in annex A6
- Testing shunt suitability (track side signalling systems)
  - Test program defined in annex A7 (on a small scale test bench) (alternative: test on track)
- Testing coefficient of static friction
  - Test program definined in annex A12



content of UIC-leaflet and EN standard concerning rig-based testing in general identical

5.1 The Safety Requirements in Europe are manifold

UIC-leaflet 541-4 / EN 16542 test programmes and requirements for blocks - Extensive Pre-approval testing of composite brake blocks necessary

Slip tests[1]	■ To be performed and analysed in accordance with UIC-leaflet 544-1 (Brakes – BRAKING PERFORMANCE), corresponding EN 16834 ■ Rules for determining the exchangeability of LL-blocks with cast iron actually established (at least three slip brake tests necessary)
In-service tests[1]	■ Duration at least one year on 5 wagons with each 60.000 km ■ Conditions and measurements described in UIC-leaflet

1 to be performed for each configuration

5.1 The Safety Requirements in Europe are manifold

Locked brake testing
test program A6 of UIC leaflet 541-4

- Procedure was elaborated in the years 2005 and 2006 in a combined working group wheelset / brake

- Work is described in report B169 / RP 23 (available from UIC: https://www.shop-etf.com/en/wheels-definition-of-the-extraordinary-thermomechanical-stresses-on-wheels-due-to-composite-brake-blocks)

- The thermal load of a locked brake event might be so high, that there will be damages of the blocks and sign of thermal overload on the wheel (burned paint) after a locked brake and flames event. But integrity of the wheel is given, if a block fulfils the requirements of program A6

5.1 The Safety Requirements in Europe are manifold

Locked brake testing
test program A6 of UIC leaflet 541-4

1.2.2.2.7 - The effect of friction material under unusual thermal stresses on the wheels (e.g. locked brake) is tested as per Test Programme A6 (point A.6 - page 86).

The following acceptance criteria apply for suitable behaviour.

Table 4 : acceptance criteria for test program A6

Wheel temperature [°C] [1]		
< 600	**> 600**	**> 700 and ≤ 850**
OK	not OK [2]	not OK [3]

1. measured 9 mm below the tread, the upper envelope of the 3 individual measurements applies to the assessment.
2. if the cumulative duration of excess is more than 25 min
3. If the cumulative duration of excessive temperature in the range 700 to 850°C is more than 5 min. Under no circumstances may the upper limit of 850°C be exceeded..

After reaching the defined wear level (see Test Programme A6 - point A.6 - page 86), the application force has to be stopped. The duration in this cooling phase has to be taken into account for remarks b. and c. in the table above as well.

The acceptance criteria apply to the 2 x Bgu, 2 x Bg, 1 x Bgu and 1 x Bg configurations combined with nominal wheel diameters of 920 to 680 mm.

A validation for the 2 x Bg configuration according to the conditions of A.6 (point A.6) also validates the various 2 x Bgu, 2 x Bg, 1 x Bgu and 1 x Bg configurations combined with nominal wheel diameters of 920 to 680 mm.

If a validation is performed in another configuration, only the tested configuration is considered valid. In this instance, the test must be performed as per Test Programme A6 (point A.6).

5.1 The Safety Requirements in Europe are manifold

Locked brake testing
test program A6 of UIC leaflet 541-4

A.6 - Test Programme A6 - "Locked brake" simulation

A.6.1 - Test Programme A6

Friction material	organic or sintered
Brake block configuration	2 x Bg (2 Blocks x (320 x 80 $\binom{}{-2}$ mm)) or 2 x Bgu (4 Blocks x (250 x 80 $\binom{}{-2}$ mm))
Wheel type	Compliant with *UIC Leaflet 510-5*, wheel rim volume according to point A.14 - page 115
Nominal wheel diameter	920 mm, diameter of test wheel according to point A.14. The precise diameter must be given in the test report.

Brake application No.	V	F_B	θ_0	Comments
	[km/h]	[kN]	[°C]	
ES (bedding in)	70	-	20-80	Bedding-in Drag brake application with a power of 26 kW to min. 80% of the contact pattern (in cycles of 45 min)
BS (brake fault)	100	9 kN (K) 24 kN (LL)	20-60	Drag brake application with constant application force for 60 min.

Wear

The blocks are weighed and measured before and after the tests. During the tests, the block wear is monitored continuously.

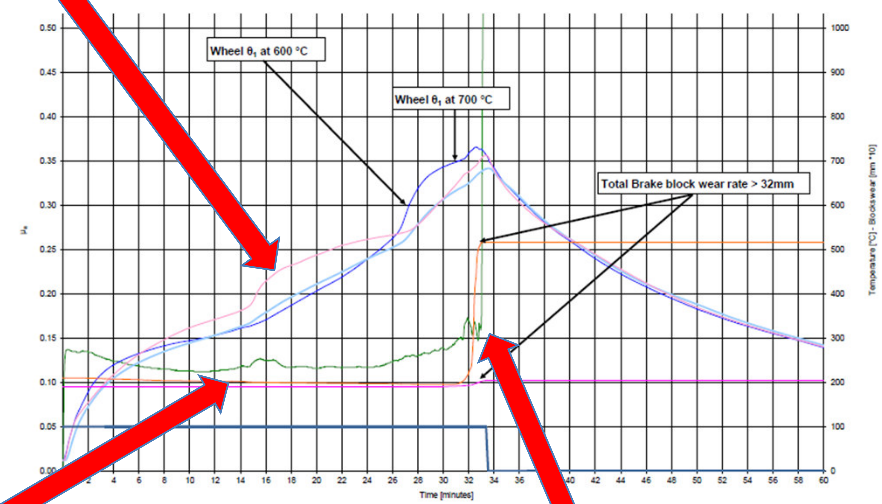
In double sided configuration the sum of wear of both blocks is limited to 32 mm. This wear is to be achieved by limiting the brake cylinder piston stroke or by releasing the block(s).

5.1 The Safety Requirements in Europe are manifold

Locked brake testing

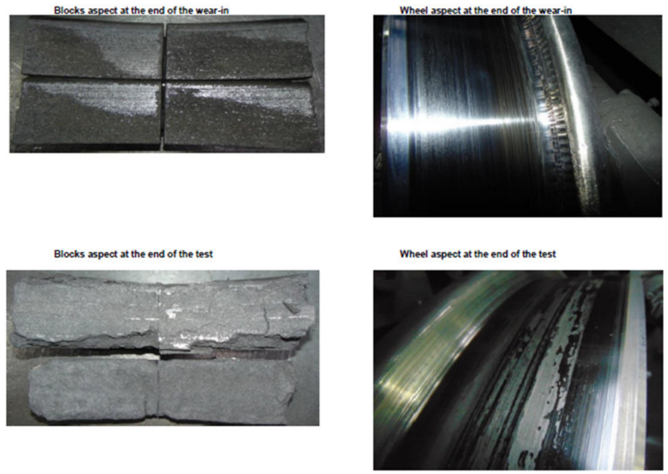
test program A6 of UIC leaflet 541-4 – example test result LL-block - type A

Temperature



Coefficient of friction (green)

Wear (orange)

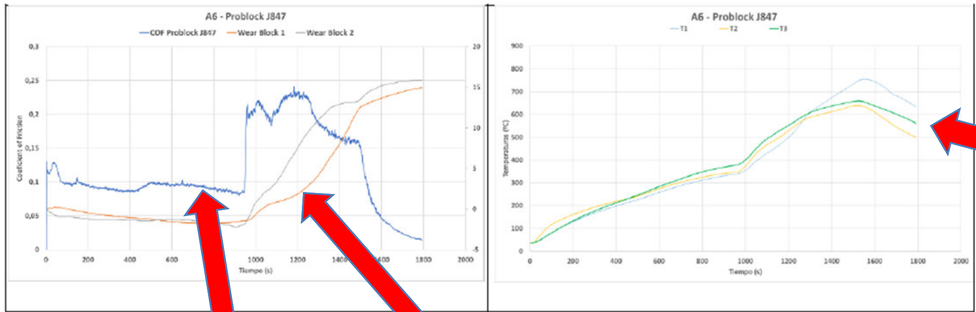


At temperature of approximately 700°C, significant increasing wear (self destroying) and in parallel decreasing temperature of the wheel

5.1 The Safety Requirements in Europe are manifold

Locked brake testing
test program A6 of UIC leaflet 541-4 – example test result LL-block - type B

At temperature of appr 400°C, significant increasing wear up to max value of 16 mm, at that time the average wheel temperature is approximately 700°C



Temperature

Coefficient of friction (blue)

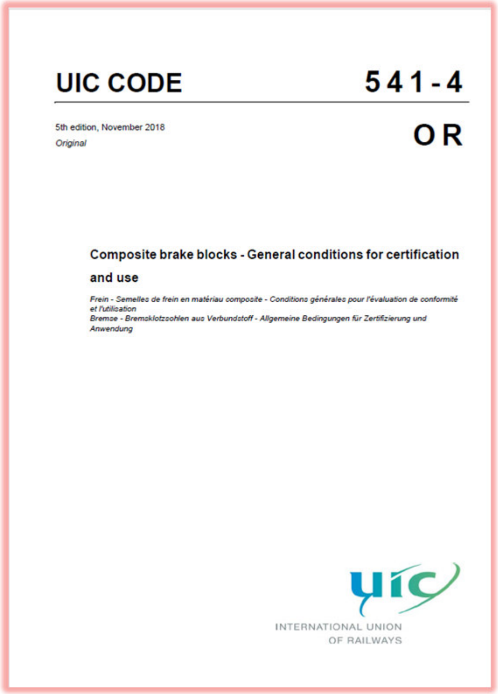
Wear (orange, grey)

5.2 Homologation of the IB 116*,

WHO IS "IT"?

- Organic LL composite block
- TSI Wag compliant, listed in Appendix G
- Fully **UIC 541-4** validated (**locked brake simulation included)**

  As mentioned during meeting 1
- Required a lot of research (IB…116 * !)
- Long time tested on Europetrain project over 2 years, more information: https://europetrain.uic.org/
- In service since 2013
- **Most used all over Europe (90% of LL equipped freight wagons)**



UIC CODE 541-4

5th edition, November 2018

Original

OR

Composite brake blocks - General conditions for certification and use

Frein - Semelles de frein en matériau composite - Conditions générales pour l'évaluation de conformité et l'utilisation

Bremse - Bremsklotzsohlen aus Verbundstoff - Allgemeine Bedingungen für Zertifizierung und Anwendung

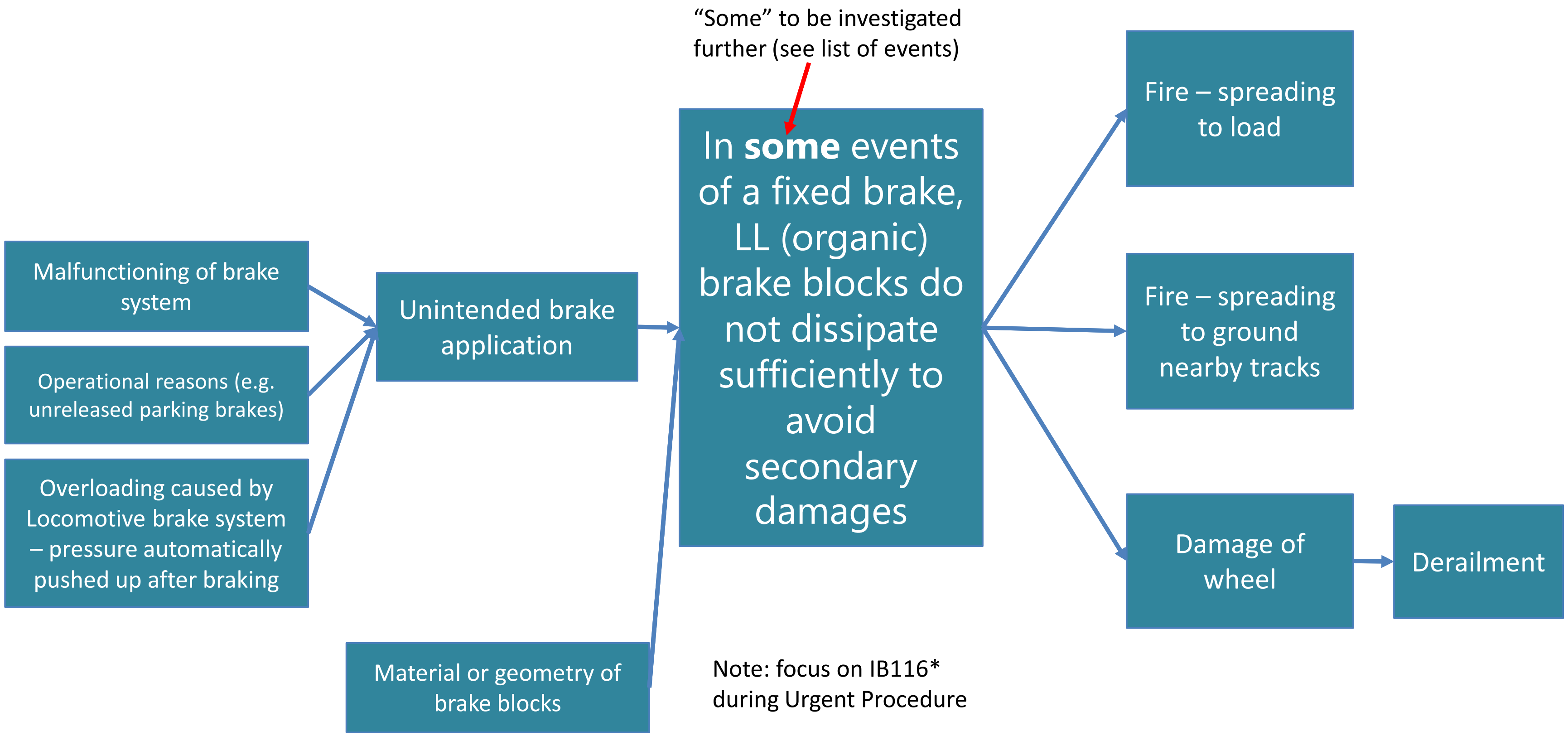
INTERNATIONAL UNION OF RAILWAYS

Manufactured by Knorr-Bremse and Becorit

Full regulatory and technical validation

5. 3 Analysis of “Fixed brakes”

INTERMEDIATE RESULT

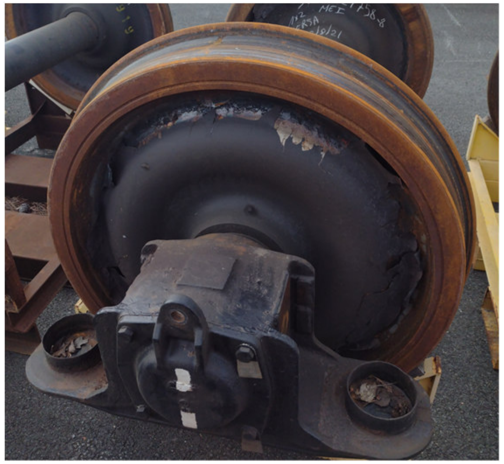


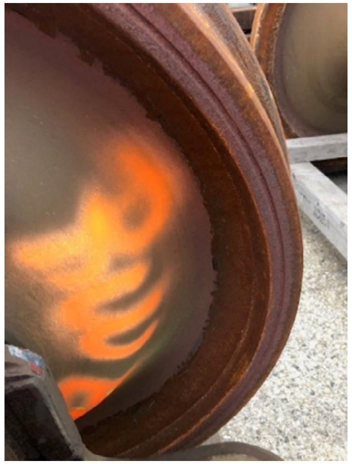
Note: focus on IB116* during Urgent Procedure

5.3 Analysis of “Fixed brakes”

NOT AN EXCEPTIONAL EVENT

- In Operation, locked brakes are to be avoided since they generate wagon immobilization, wheelsets replacements, multiple costs, etc.
- Locked brakes situations are not normal BUT are NOT exceptional either.
- Locked brakes can be caused by malfunctions to the braking system in particularly by applied handbrake, air leakage on the Brake Pipe, air leakage due to bad air supply filtration, problem of overload of the brake system, problem on the distributor, brake control issues, etc.





Ordinary fixed brakes

- Have an impact on the blocks and the wheels
- Not safety relevant
- No critical damage of the wheels

In extraordinary cases critical impacts possible.

GCU Bureau
General Contract of Use for wagons
Contrat Uniforme d'Utilisation des wagons
Allgemeiner Vertrag für die Verwendung von Güterwagen

Annex 9

5.3 Analysis of “fixed brakes”

EXAMPLE: CAST-IRON #1

Cast Iron

- Significant thermal overload
- Impact on the blocks
- Impact on the wheels (web and treads)

This incident has generated **sparkling + smoke + fire along the track**

5.3 Analysis of “fixed brakes”

PARTICULAR BEHAVIOR OF IB 116*

All IB116* after unintended brake applications

Singular behavior noticed

- Behavior was analyzed
- To be kept in mind that the block has to destroy itself during the fixed brake
- Seems unusual (does not “only” wear)
- Damages on the brake block and signs of thermal overload on the wheel

Needs to be further investigated (normal procedure)

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– DETAILED INFORMATION ABOUT THE PERFORMED TESTS I

- Tests performed at the beginning of 2020 on the test bench in Minden
- Four Tests performed on full-scale brake test bench and experiments performed in the fire laboratory
- LL-block IB 116* and K-block J816 M
- Load on the brake test bench according to locked brake testing on the test bench (program A6 of UIC leaflet)
- Evaluation was performed by the specialists of the fire protection department of DB Systemtechnik

- Results assessed concerning
  - Fire severity due to open flames or radiant heat
  - Fire severity due to flying sparks
  - Fire severity due to emission of broken out block material

- Comparison of cast iron brake blocks and composite brake blocks

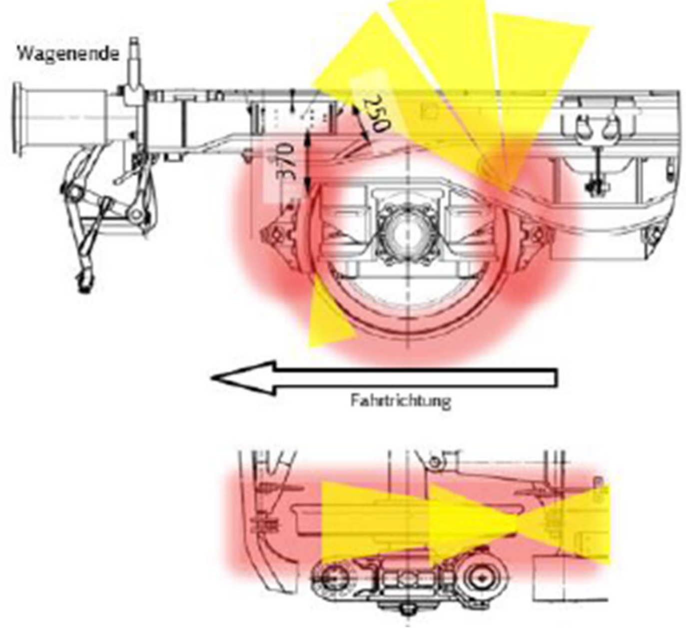
5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– DETAILED INFORMATION ABOUT THE PERFORMED TESTS II

- To assess the severity of thermal damage and the influence of radiant heat, the following parameters were recorded in test rig trials
  - Determination of the average tread temperature
  - maximum temperature of the tread to derive the heat influence zones
  - Determination of the block after-burning time and maximum flame height to evaluate the direct heat influence of open flames on surrounding components
  - Detection of erupted and emitted block material to determine the ignitable mass fraction of erupted material
- Tests in the fire laboratory
  - To evaluate the ignition potential of spalled block material, the cooling rate of test specimens and their ability to ignite dry grass were investigated in subsequent tests.

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– FIRE SEVERITY DUE TO OPEN FLAMES OR RADIANT HEAT



Two heat affected Zones

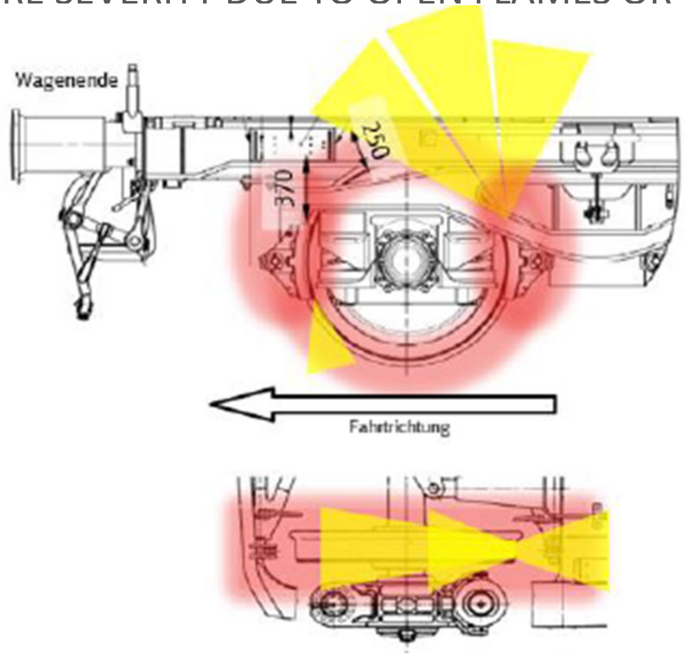
- One is created by the brake blocks through radiant heat and open flames (yellow)
- Second due to the heating of the wheel tread (red)

LL-Block
at max. fire state

K-Block
at max. fire state

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– FIRE SEVERITY DUE TO OPEN FLAMES OR RADIANT HEAT



Two heat affected Zones

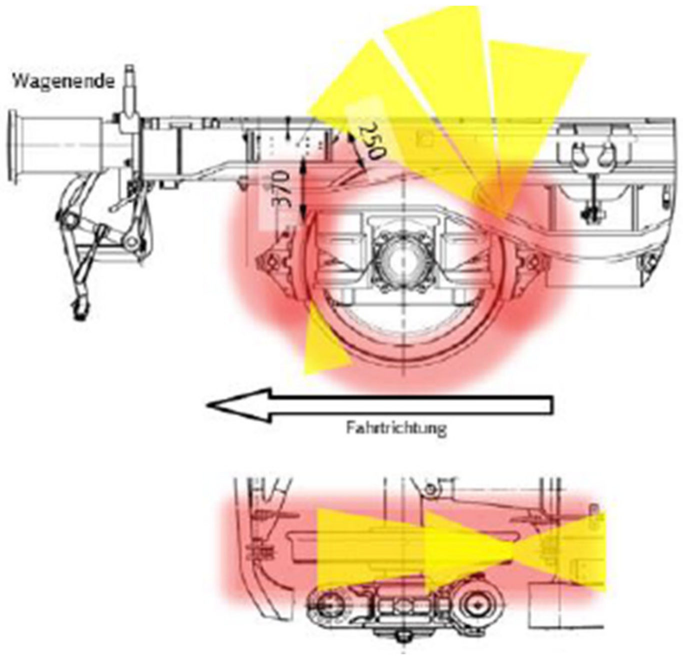
- One is created by the brake blocks through radiant heat and open flames (yellow)
- Second due to the heating of the wheel tread (red)

Conclusions

- At its greatest extent, the heat-affected zone of the brake block by open flames was 370 mm over the brake block. In the border area of this zone, temperatures of max. 115 °C were determined.
- At standstill, with the brake released and the ventilation inactive, a flame developed with a flame of the brake block. height of approx. 20 cm above the upper edge
- The max. afterburning time in this test runs was 327 s.
- The heat-affected zone of the wheel bodies by radiant heat has been estimated and concerns an area of approx. 250 mm around the wheel circumference, measured from the tread.
- An ignition of combustible materials by radiant heat from a distance of 250 mm from the wheel tread surface is unlikely.

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– FIRE SEVERITY DUE TO FLYING SPARKS



Effects on the cargo when using CBB

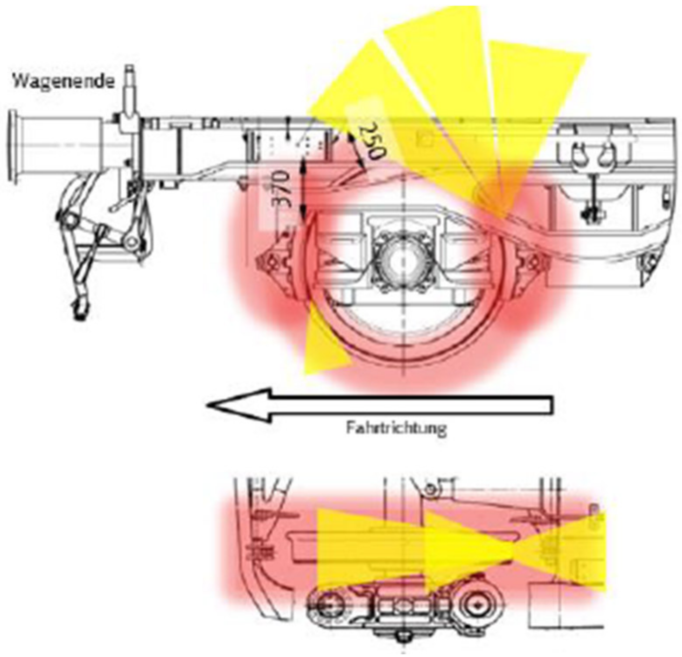
- The sparking of the rear brake direction of travel represents the main source for sparks. The sparks produced can occur at a distance of < 1 m from the point of spark formation in direct contact with the brake block.
- Possible burning materials may act as an ignition initiator. It is estimated that, in addition, the ignition effect of the sparks decreases considerably.

LL-Block

K-Block

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– FIRE SEVERITY DUE TO FLYING SPARKS



Conclusion

- Due to the low spark formation, the severity that sparks as an ignition initial lead to the ignition of cargo is classified as low.
- The use of flame-retardant materials that meet the fire protection requirements for freight wagons according to Regulation (EU) No 321/2013 effectively limits the spread of fire to the vehicle.
- Influence on infrastructure: due to the small particle size of the sparks and the low heat capacity of the block material, the sparking material quickly loses its ignition effect at an ejection distance of > 1 m.
- This weakening can be enhanced by spark deflection (spark deflectors, frame construction).
- **The severity that sparks from CBB as an ignition initial lead to the ignition of embankments is classified as low.**

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– FIRE SEVERITY DUE TO EMISSION OF BROKEN OUT BRAKE BLOCK MATERIAL

Effects

- The largely flaky material spalling from the burning brake blocks was examined. The fragments of the blocks had a maximum volume of 1 cm^3. The fragments of CBB that were produced during the test were collected by the collection tray under the test stand.
- A spreading of the fragments beyond this was not detected. The ejection distance is therefore limited to the immediate vicinity of the braked wheel.

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– FIRE SEVERITY DUE TO EMISSION OF BROKEN OUT BRAKE BLOCK MATERIAL

Conclusions

- The influence on the load is strongly dependent on the respective constructive vehicle solution.
- A fire protection severity exists here in the case of existing installation spaces on the vehicle or load that offer suitable storage areas for material accumulations.
- The briefly glowing broken block material can then act as an ignition initiator.
- The use of flame-retardant materials that meet the fire protection requirements for freight wagons according to Regulation (EU) No 321/2013 effectively limits the spread of fire to the vehicle.
- Infrastructure: in tests carried out, safe ignition of the dry tufts of grass was observed in a temperature range of over 600 °C. In the temperature range between 400 °C - 600 °C, an increased severity of ignition must be expected. It must therefore be assumed that the erupted block material reaches areas adjacent to the ballast bed and can act as an ignition initiator there. (comparison with CI)

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– CONCLUSIONS CONCERNING OPEN FLAMES

- **only the massive and sustained input of frictional energy into the brake block material kept the heat development and thus the combustion process of the CBB at a high level**. The max. afterburning time is limited after standstill.
- **The fire phenomena of an open flame on the blocks, even after the brake has been released and the vehicle has come to a standstill, do not lead to any significant increase in severity**. It was assumed that there are no flammable vehicle components in the immediate vicinity of the burning blocks, 370 mm above the brake blocks and approx. 250 mm around the wheel circumference.

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

–COMPARISON WITH CAST IRON – NO HIGHER FIRE SEVERITY WITH CBB

Conclusions concerning **sparks**

- The intensity of spark formation and spark propagation with composite brake blocks is significantly lower than from cast iron.
- **A higher fire severity outside the track bed than with grey cast iron blocks is not seen.**

Conclusions **broken out material**

- Broken out block material of composite brake blocks has a significant ignition potential for slope fires and cargo.
- But comparing the technological and physical properties of CBB and CI material, it becomes clear that the heat capacity of fused beads made of cast iron material is far higher than that of the CBB material.
- **Due to the difference in heat capacity, the ignition potential of broken-out CBB is lower than that of beads from molten cast iron blocks.**

CI-block

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– SUMMARY OF THE PERFORMED TESTS

All test performed and assessed by fire protection department of DB Systemtechnik GmbH, detailed information: 19-57772-TT.TVI3-DO-001 published 01.04.2020

- Full-scale brake tests on test bench in Minden according to locked brake testing on the test bench (program A6 of UIC leaflet)
- Tests in the fire laboratory to evaluate the ignition material potential of spalled block on dry gras
- LL-block IB 116* and K-block J816 M

- Results assessed concerning
  - Fire severity due to open flames or radiant heat
  - Fire severity due to flying sparks
  - Fire severity due to emission of broken out block material

  for vehicle and infrastructure

- Objective: Severity comparison of cast iron brake blocks and composite brake blocks regarding the above-mentioned topics

5.4 Fire protection evaluation of composite brake blocks for use in freight wagons

– CONCLUSION OF RESULTS

- Fire severity due to open flames or radiant heat
  - Only the massive and sustained input of frictional energy into the brake block material kept the heat development and thus the combustion process of the CBB at a high level. The max. afterburning time is limited after standstill.
  - An ignition of combustible materials by radiant heat from a distance of 250 mm from the wheel tread surface is unlikely due to the fast-decreasing spatial temperature gradient.
- Fire severity due to flying sparks
  - The intensity of spark formation and spark propagation with composite brake blocks is significantly lower than from cast iron.
  - The severity that sparks from CBB as an ignition initial lead to the ignition of embankments is classified as low.
  - The use of flame-retardant materials that meet the fire protection requirements for freight wagons according to Regulation (EU) No 321/2013 effectively limits the spread of fire to the vehicle caused by flying sparks.
- Fire severity due to emission of broken out block material
  - Due to the difference in heat capacity, the ignition potential of broken-out CBB is lower than that of beads from molten cast iron blocks.

In summary, the investigated CBB do not show a higher fire severity for vehicles and infrastructure than cast iron blocks within the scope of the tests.

5.5 General case evaluation

JNS URGENT PROCEDURE MEETING 3 DISCUSSION

Fixed brake situations have an **impact** :

- On the **blocks**
- On the **wheels**

They are **to be avoided** in operation but are **not exceptional**

They must **not generate critical damages of wheels**

Need to identify "critical" incidents versus "usual" ones in order to concentrate the analysis on the cases potentially triggering safety

1. ***Set the criteria to evaluate safety-triggered cases.***
2. **Select**, from the ANSFISA list, the **incidents to be further analyzed during the urgent procedure**

Scope of work of the breakout group

5.5 General case evaluation

ATTENDANCE AND ORGANIZATION

When ?

5 meetings

- 17 December 2021
- 4 January 2022
- 13 January 2022
- 18 January 2022
- 31 January 2022

Who ?

ANSFISA

UIP

CER

UIC

EUROPEAN UNION AGENCY FOR RAILWAYS

5.5 General case evaluation

2 STEPS

- **<u>Fire</u>**

Regarding fire risk, from the element shared during the JNS meeting, appears that the fire risk with LL IB116* is not higher than with cast-iron (for details see slides before)

→ Fire cases are proposed to be **further analyzed within the normal procedure**

- **<u>Derailment</u>**

JNS urgent procedure should **focus on events potentially generating a derailment risk**

→ It is therefore necessary to identify them efficiently in the list

To do so, a **new criteria regarding wheel damage** is to be integrated in the data-list of event collection

5.5 General case evaluation

WHEEL DAMAGE LEVELS

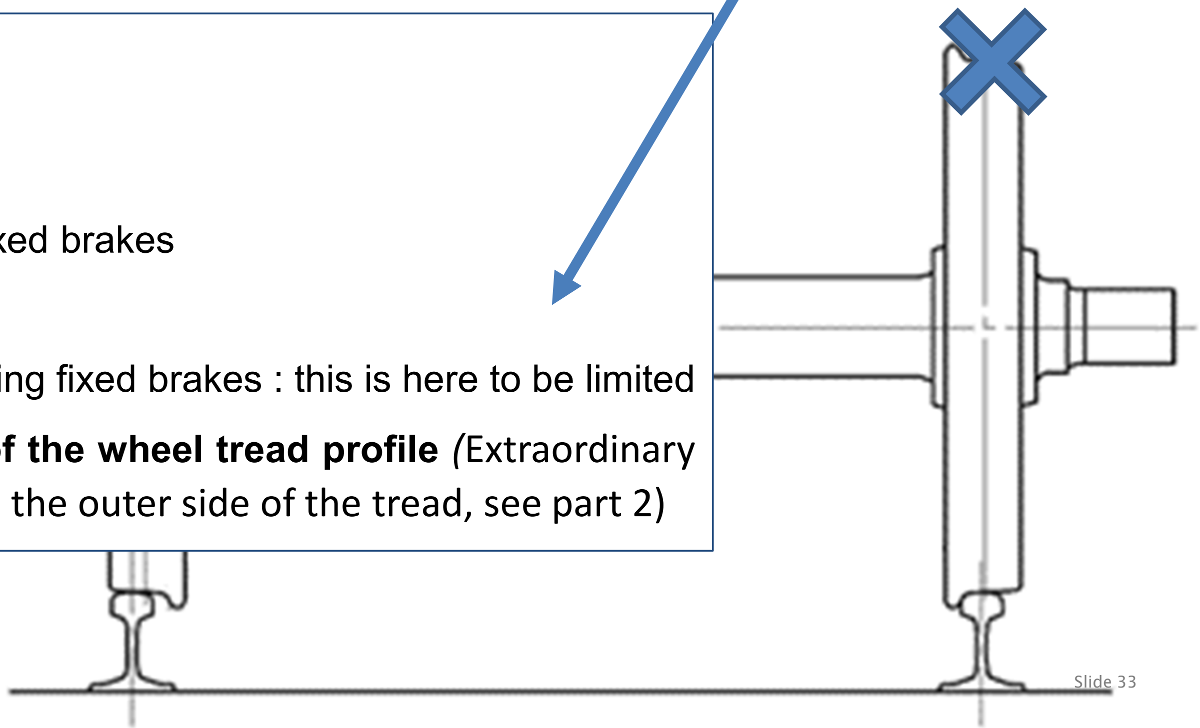
Pictures and/or measurements necessary

New scale established to categorize wheel damage after a fixed brake event

0 : no damage of the wheel tread

1 : usual damage of the wheel tread during fixed brakes

2 : **Unusual damage of the wheel tread** during fixed brakes : this is here to be limited to **damages generating a strong deviation of the wheel tread profile** *(*Extraordinary wheel tread deformation near the flange or on the outer side of the tread, see part 2)



5.5 General case evaluation

SHORT LIST CASES

Update performed by ANSFISA requiring the **new criteria integration in the data-list** of the 41 cases

5 cases

Focus agreed on cases n° 7, 10, 17, 23, 28

First analysis performed with ANSFISA, CER, UIP and UIC (January 7th) :

- Pictures of the wheel damages
- Wagon brake test reports after the incident (if available, investigation reports)
- Brake calculations of the concerned wagons
- Data recorder of the locomotive
- Data recorder of the Hot Axle Box Detection and Hot Wheel Detection

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 7 “2020-05-17_66583_PM PANICALE_DB”

- Keeper : DB Cargo Germany
- Derailment case.
- Yes, to categorize as “2” as the wheel is highly damaged.

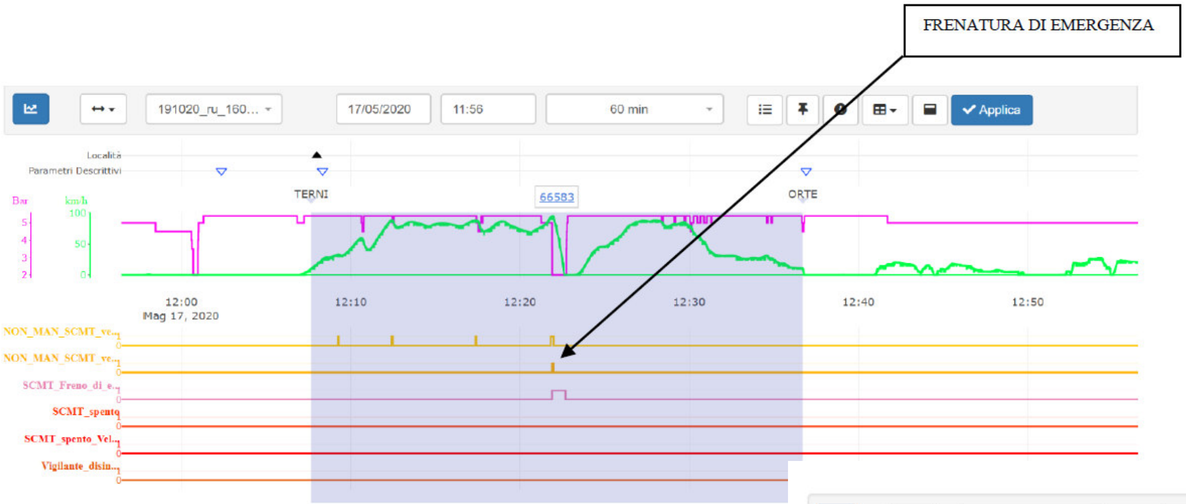
5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 7 “2020-05-17_66583_PM PANICALE_DB”

Data analysed	Evidence collected	Evaluation
Brake system operation	Brake test report available	No abnormalities were found.
Bake system technic	Brake calculation available	No abnormalities were found.
Wheel investigation after incident	Special investigation report of the wheelsets available. 20-61015-TT.TVE33.2-14-001-Entgleisung It.	Thermal overload of the wheel Extraordinary wheel tread deformation with finally derailment
Running of the train	Automatic traction/braking system used for this event. *(the automatic system uses both electric and pneumatic braking).*	Strange behavior for example regarding the BP pressure evolution. Does not correspond to the normal behavior of a loco driver. Chaotic brake application and release orders.
Maintenance History	Maintenance data	No abnormalities were found.
Infrastructure (IS) detection systems	Data of the wheel detector systems	the last hot wheel detector met by the train before the derailment occurred registered a temperature of the wheel between 296° and 318° C. (see short-term risk control measure 2.2.1)

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 7 “2020-05-17_66583_PM PANICALE_DB”



- Further Investigation necessary

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 7 “2020-05-17_66583_PM PANICALE_DB”

- ➔ Interaction Wheel / brake block needs to understand what exactly leads to such a picture of damage.
- ➔ By the elements collected on the event, there is no evidence that the case is directly related to IB116* issue and could occur with different brake blocks.

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 10 “2020-09-25_47227_GEMONA_MIR”

- Keeper : Rail Cargo Austria
- Fire case.
- Update after Meeting 11th January, categorization 1

5.6 Identification of the relevant cases to be treated in the urgent procedure

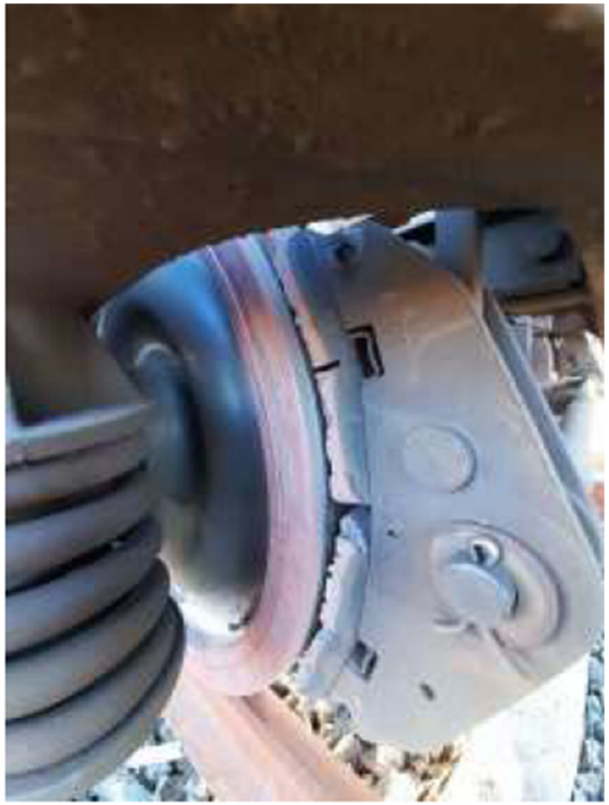
CASE 10 “2020-09-25_47227_GEMONA_MIR”

data analyzed	Evidence collected	Evaluation
Brake system operation	Brake test report available	No abnormalities were found.
Bake system technic	Brake calculation available	Max. braked weight 62 t
Wheel investigation after incidence	Only based on pictures	Categorized „1“
Running of the train	Template LL Analysis	Automatic traction/braking system used for this event.
Maintenance History	n. a.	
IS detection systems	n. a.	

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 17 “2021-04-02_56440_SARZANA_MIR”

- Keeper : VTG Rail Europe
- wheel damage is categorized as “2” after evaluation based on the photos in part 2 about the extraordinary deformations
- Extraordinary wheel tread deformation near the flange



5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 17 “2021-04-02_56440_SARZANA_MIR”

data analyzed	Evidence collected	Evaluation
Brake system operation	Brake test report available	No abnormalities were found.
Bake system technic	Brake calculation available	No abnormalities were found.
Wheel investigation after incidence	Wheelset maintenance report available	Effects of thermal overload: Increased residual stress insight the limits (max 299 MPa) Strong deviation in sd between left/right wheel (30,3 – 36,8 mm)
Running of the train	Template LL Analysis	Automatic traction/braking system used for this event.
Maintenance History	n. a.	
IS detection systems	Data of the wheel detector systems	Case detected by a HABD absolute alarm (temperature of the axle box was 102°C). (See short-term risk control measure 2.2.2)

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 17 “2021-04-02_56440_SARZANA_MIR”

Wheelset without extraordinary wheel tread deformation

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 17 “2021-04-02_56440_SARZANA_MIR”

Wheelset with extraordinary wheel tread deformation

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 23 “2021-06-07_44235_CARNIA_MIR

- Keeper : Železničná spoločnosť Cargo Slovakia, a.s.
- Yes, wheel damage is to be categorized as “2” after evaluation based on the photos in part 2 about the extraordinary deformations
- Extraordinary wheel tread deformation near the flange and on the outer side of the tread

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 23 “2021-06-07_44235_CARNIA_MIR

data analyzed	Evidence collected	Evaluation
Brake system operation	Brake test report available	Abnormalities detected. (A-Chamber, leakage)
Bake system technic	Brake calculation available	Max. braked weight 64 t
Wheel investigation after incidence	Only based on pictures	Categorized „2“
Running of the train	Template LL Analysis	Automatic traction/braking system used for this event.
Maintenance History	n. a.	
IS detection systems	Data of the wheel detector systems	Case detected by a HFB alarm (temperatures of the right wheels: 506 °C, 637 °C, 651 °C, 651 °C). The HABD recorded 85 °C (See short-term risk control measure 2.2.2)

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 28 “2021-0729_63842_SPRESIANO_CAPTRAIN”

- Keeper :Petrociterne (SA)
- Fire case.
- From data available, the wagon was able to run at lower speed without replacement of the wheelsets.
- After meeting 11th January, Categorized “1”

- Picture with changed wheelsets after incident
- Picture with signs of thermal overload on the brake blocks,, see short-term risk control measure 2.1.5

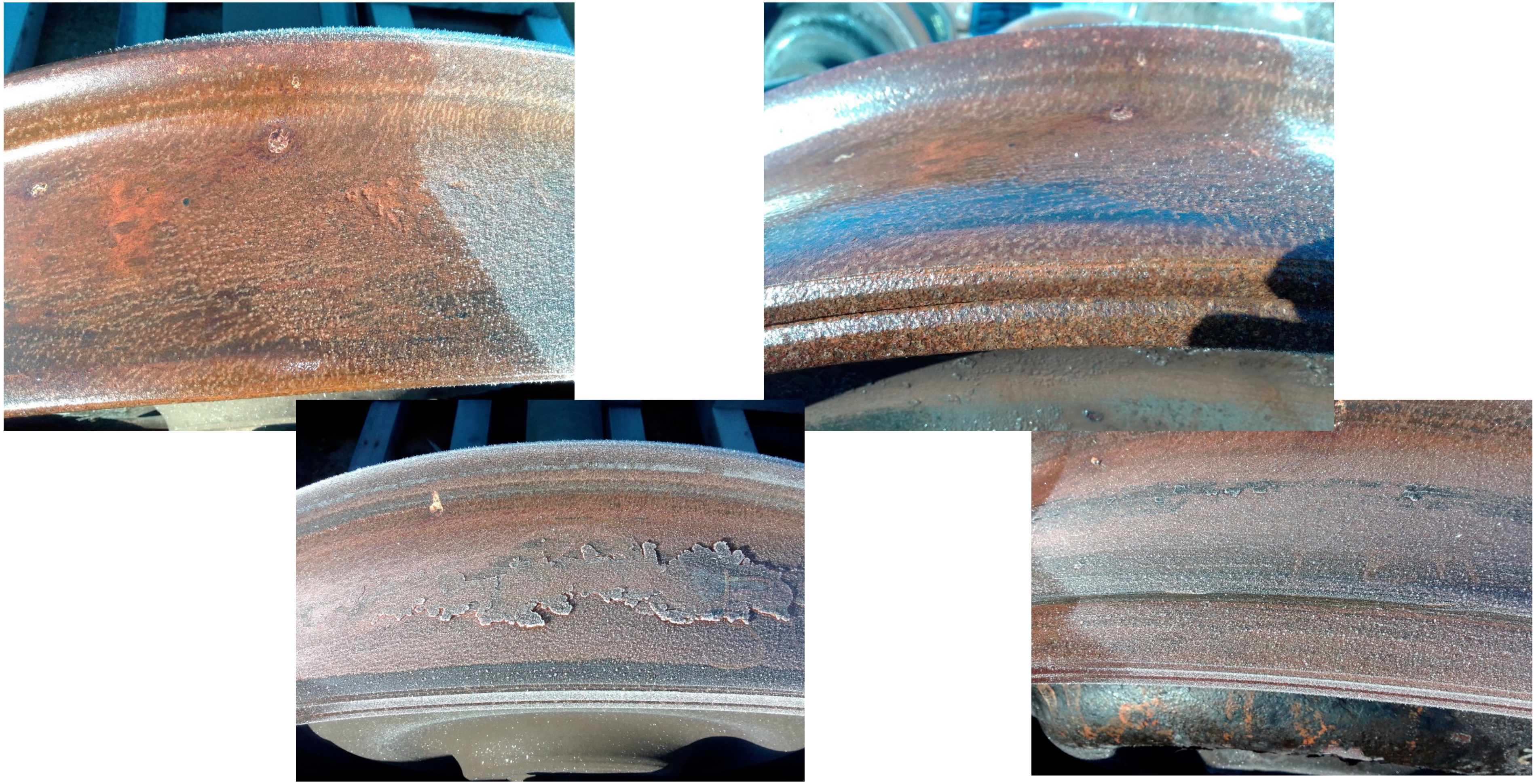
5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 28 “2021-0729_63842_SPRESIANO_CAPTRAIN”

data analyzed	Evidence collected	Evaluation
Brake system operation	Brake test report available	Abnormalities detected. (Release function)
Bake system technic	Brake calculation available	No abnormalities were found.
Wheel investigation after incidence	Only based on pictures	Categorized „1“
Running of the train	Template LL Analysis	No automatic traction/braking system used for this event.
Maintenance History	n. a.	
IS detection systems	n. a.	

5.6 Identification of the relevant cases to be treated in the urgent procedure

CASE 28 “2021-0729_63842_SPRESIANO_CAPTRAIN”



5.6 Identification of the relevant cases to be treated in the urgent procedure

CONCLUSION

Status:

- *1 derailment case, with very critical wheel damage (7) but without evidence of a connection with IB116* issues; which could have been detected by hot wheel detector with alarm set to 300°C;*
- *2 cases category 1 (10 and 28) but to be evaluated in normal procedure;*
- *2 cases category 2 (17 and 23), detected by the track systems.*

5.7 Risk assessment

- To compare the risks between cast iron brake blocks and composite brake blocks regarding the flaming brake block issue and the impact to the wheel a FMECA is prepared see file:

Microsoft Excel
7-2003-Arbeitsblat

Source:
UIC B169/RP 29, Reliability and safety of axles, wheels and axle bearing, Reliability, availability, maintainability, safety – Implementation of EN 50126 for mechanical components in railways, UIC SET 6, May 2015
IRS 80881., Railway applications, Reliability, availability, maintainability and safety, Guidelines for the implementation of EN 50126 to mechanical components of railway vehicles

Results:

- Direct qualitative comparison between existing system „cast iron“ and new system “Composite Brake Blocks” based on the method from the UIC project B169/RP29 “Implementation of EN 50126 for mechanical components in railways”
- The FMECA refers to the current situation within Europe without taken into account the proposed measures.
- The risk priority number (RPN) was chosen in accordance with the RP 29 with 250, because this value was applied in the UIC project for wheelsets, and also recommended for further applications.
- No higher maximal Risk Priority Number with Composite Brake Blocks compared with Cast Iron, also medium values are at comparable level. In the risk analysis of the JNS a maximum risk priority number of 125 was identified for the cast iron brake blocks and 100 for CBB.
- With the implementation of additional measures, a further decrease of the RPN is expected.
- The risk assessment takes in account all results from the JNS TF UP.
- Consideration of the main failure root causes for brake block and wheel in context of this JNS
- Taking in account of the direct consequences like ignition of components of the wagon, load or infrastructure and failure on the wheel like cracks, strong deformation on the tread, residual stress

Conclusion:
The risk analysis demonstrates that the risk with composite brake blocks is not higher as the risk with cast iron brake blocks.

According to this results the implementation of measures presented in slides 4 and following could be set to reduce the global risk arising from fixed brake.

5.7 Risk assessment

EVALUATION OF THE EFFECTS OF THE PROPOSED MEASURES

Mode of failure	Short-term risk control measure	JNS TF analysis carried out	Expected effect of the short-term risk control measure		
			Severity	**Detectability**	**Frequency**
Malfunction of the brake system	2.1.1 General use of overcharge/assimilation function in accordance with the description in UIC 541-03, 2nd edition August 2015, clauses 2.1.12 and 2.1.13 or EN 14198 .	Most of events analyzed by the JNS TF occurred after few kilometers from the cross-border stations, where therefore the measure is recommended to be applied. The measure could lead to a double result consisting in reducing fixed brake events and increasing the detectability of them.	-	Increase	Decrease
	2.1.2 Start up test for freight trains	The measure is a best practice used in some Member States in the shunting yard in order to avoid fixed brake and detect them just after the train departure.	-	Increase	Decrease
	2.1.3 Start up test performing after emergency braking				
Operational reasons	2.1.4 Appropriate use of overcharge/assimilation function in accordance with the description in UIC 541-03, 2nd edition August 2015, clauses 2.1.12 and 2.1.13 or EN 14198 Appendix E.	The measure is a best practice used in some Member States. The overcharge of the distributor valve should be avoided in system where the assimilation function is not incorporated; in other cases, an appropriate use of overcharge function should be avoided in order to prevent unintentional fixed brake.	-	-	Decrease
	2.1.5 Use the automatic traction and braking system (e. g. AFB) after reaching the regular train speed to get feedback about the behavior of the train	By JNS analysis it has been shown that the use of the automatic traction and braking system provided by both electric and pneumatic braking could be related to fixed brake	-	Increase	Decrease

5.7 Risk assessment

EVALUATION OF THE EFFECTS OF THE PROPOSED MEASURES

Mode of failure	Short term risk control measure	JNS TF analysis carried out	Expected effect of the short-term risk control measure		
			Severity	**Detectability**	**Frequency**
Undetection of a fixed brake	2.2.1 Use of the hot wheel detection systems with appropriate alarm levels (warm and hot) to detect hot wheels or fixed brakes	With regards to the three events classified as relevant cases «2» all of them would have been detected by a hot wheel detector with an appropriate alarm level (<300°C).	-	Increase	-
	2.2.2 Use of the hot axle box detection system, in case of alarm also check of the wheel	Two events classified as relevant cases «2» were detected by a HABD system whose axle box temperature read by the system was higher than 90°C.	-	Increase	-
	2.2.3 Alert the train driver in case of fixed brakes or flaming brake blocks	Several cases of fixed brake blocks occurred were detected by the train driver or other operational staff seeing flaming or smoking arising by the wheel.	-	Increase	-
	2.2.4 Detection of consequences of fixed brakes by indicators on the brake blocks (examples on slide 10 and 11)	Indicators on the brake blocks of thermal overload or extraordinary tread wear and tread deformation are an useful means to detect fixed brake.	-	Increase	-
	2.3.1 Check the wheels for extraordinary tread wear / wheel tread deformation		-	Increase	-