

PROJECT FUTURA

The main objective of the proposed action is to improve the quality and safety of life of over 55 million EU citizens who live or work near train tracks

The FUTURA action will improve the quality and safety of life of over 55 millions of EU citizens, who live or work near train tracks. The main objective of the action is to provide last development steps for market launch of Divided Rail Freight Brake Disc (DRFB disc). DRFB disc is a revolutionary solution, influencing 3 key elements in the rail freight transport: 1) safety and security, 2) health and environment and 3) cost-effectiveness with strong horizontal and vertical "spill-over" effects and crucial social, economic and technical impacts.

Today there are two competitive solutions: K-block and non-divided brake disc (the current state-of-the-art). Although non-divided brake disc is a superior solution (as it ensures higher safety, lower noise levels and less vibrations), it is used in practice in less than 10%, because it is too expensive. That is the problem that FUTURA action is solving.

Our ambitious solution, DRFB disc, was developed by 4 high impact companies in the field of development, production and testing components for freight rail vehicles. The specific objectives of FUTURA action are: 10-15 dB lower noise, 11% shorter braking distance, 14% less vibrations, 21% lower mass, 7% less accidents, 12% less damage of freight, 50% longer life cycle of wheels, 13% lower LCC of the disc. For an operator with 1,000 6-axle wagons, the savings within a life-cycle would amount to 5,838,000 € in comparison with K-block and 9,840,000 € in comparison with non-divided brake disc.

DRFB disc will contribute considerably toward increasing the transported freight volumes via rail, which is environmentally friendlier than alternative modes (by road and air). Total available market size for our innovation is around 12 billion € per year. Our key target markets are EU, USA, Canada, Russia, China, India and Brazil. The aim of commercialising the innovation is to capture 7% of the market share in the production of brakes for rail freight wagons on the global market.



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Consortium

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Members of the consortium :

The consortium consists of 4 partners from 3 different countries. The partners are leaders and the highest-impact companies in the EU in the following fields:

- **KOVIS** – development and production of brake discs, axle boxes, brake pad and brake shoe holders in rail freight transport,
- **OMNIA** – production of steel forging parts and hubs for railways,
- **ZX-B** – development, production, servicing and lease of freight wagons,
- **VUD** – development, lab research and testing on all modes of transport.

= COORDINATOR  <i>good ideas create future</i>	= PARTNER 1 
= PARTNER 2 	= PARTNER 3  Výskumný ústav dopravný

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FUTURA project results

During the FUTURA project, two final prototypes were developed and produced. The first one with brake plate width of 170mm, and latter one with 110mm. Both of them went through demanding dynamometer bench tests according to UIC 541-3 and TSI standards, as well as a real environment test on the wagon.

With final prototypes of DRFB disc, the focus was on safety, thermal performance, lowering vibrations (due to accurate connection of crown and hub), as well as further reduction of mass of DRFB disc.

A new patented brake plate to hub mounting design, which enhanced torque transfer capability and reduced the possibility of vibrations was introduced. Stresses induced in the brake disc, caused by thermal expansion were reduced (as this design allows expansion in a radial direction), thus increasing safety and decreasing stopping distance.

Connection of DRFB disc crown and hub was simplified with use of six bolts and self-centering fits with the special shape of connecting ears in between. More low drag cooling fins were used to reduce ventilation losses. As this design has larger air intakes, the air mass flow through the disc is higher, as well as thermal power dissipation.

With the final design of the 170mm wide DRFB disc, mass was lowered by 22.7%, air resistance was decreased by 21%, and thermal dissipation efficiency was increased by 17.3% in comparison with the initial DRFB disc.

Tests performed on dynamometer test bench:

- Test program B.1 (Freight wagons, Energy class A1, UIC 541-3, 8th Edition)
- Tests according to TSI for freight wagons (COMMISSION REGULATION (EU) No 321/2013)

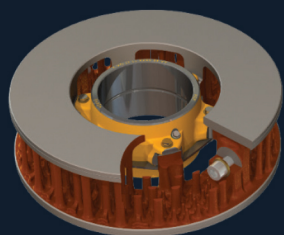
Main characteristics of the 170mm wide DRFB disc

Outer diameter	590mm (610 optional)
Inner diameter	325mm
Width	170mm
Mass	112kg
Ventilation losses	372W at 165km/h
Connection crown/hub	Special patented shape
Connection hub/axle	Shrunken/Pressed
Material	Cast iron
Imbalance value	max 16gm
Wear limit	10mm



Operational characteristics of the 170mm wide DRFB disc

Maximum velocity	160km/h
Wheel diameter new/worn	920/840mm
Maximum axle load	25 t
Average life time of brake disc	1,800 000 – 2,600,000km



DRFB disc final prototype (590x110mm)

From market analysis, face-to-face dialogues with potential buyers and producers of freight wagons, as well as from received information while attending international fairs, the finding was that great interest exists for the narrower DRFB disc. Based on this research data, the decision was made to design a narrower, 110mm wide disc.

With the final prototype of a 110mm wide DRFB disc, the focus was on further reduction of the mass of the DRFB disc, while maintaining same level of safety and thermal performance.

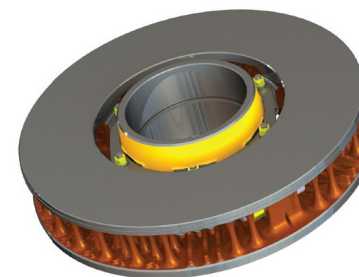
The design of the 110mm wide prototype followed a similar structure for both DRFB disc crown and the hub- as for the 170mm wide prototype. The design was proven by numerous FEM thermal and structural analysis tests, as well as laboratory tests performed on a dynamometer test bench. With this prototype, mass was lowered by 34.5%, -air resistance was decreased by 34%, and thermal dissipation efficiency was increased by 32.7% in comparison with initial DRFB disc.

Tests performed on dynamometer test bench:

- Test program B.1 (Freight wagons, Energy class A1, UIC 541-3, 8th Edition)
- Tests according to TSI for freight wagons (COMMISSION REGULATION (EU) No 321/2013)

Main characteristics of 110mm wide DRFB disc

Outer diameter	590mm (610 optional)
Inner diameter	325mm
Width	110mm
Mass	95kg
Ventilation losses	311W at 165km/h
Connection crown/hub	Special patented shape
Connection hub/axle	Shrunken/Pressed
Material	Cast iron
Imbalance value	max 16gm
Wear limit	10mm



Operational characteristics of 110mm wide DRFB disc

Maximum velocity	160 km/h
Wheel diameter new/worn	920/840mm
Maximum axle load	25t
Average life time of brake disc	1,800 000 – 2,600,000km

