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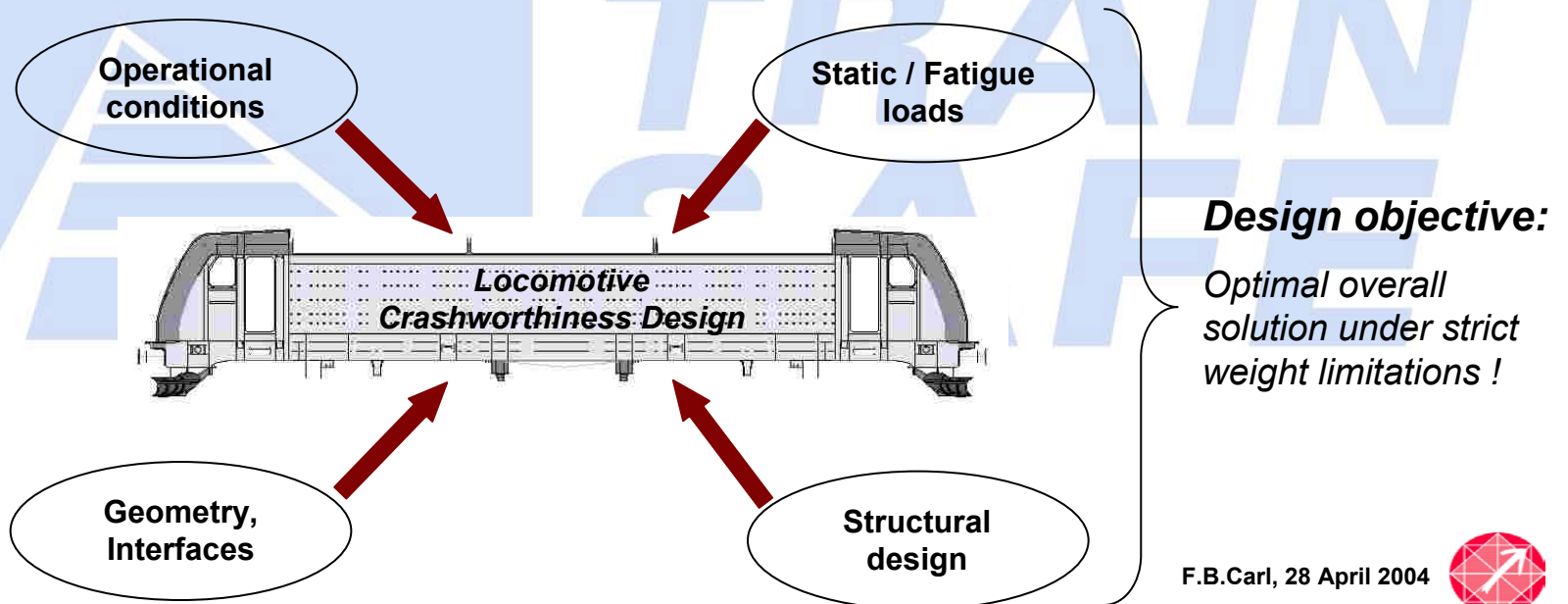


# Safe Vehicle Structures - Locomotive Energy Absorption (1)

- **State of the art of locomotive crashworthiness**

- External energy absorbers
- Stiff cab structure
- Obstacle deflector

- **Locomotive specific aspects of crashworthiness**



F.B.Carl, 28 April 2004





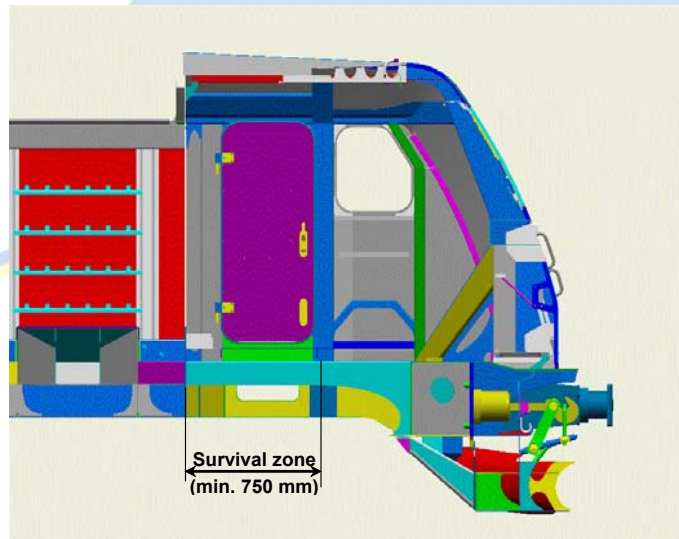
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## Safe Vehicle Structures - Locomotive Energy Absorption (2)

- **Crashworthiness design of new Bombardier TRAXX locomotives**



- Crashworthiness design based on TSI-HS (2002)
- Crashworthy reference train considered
- High external energy absorption (TSI-1, TSI-2)
- Improved protection for the driver (heavy obstacle)
- Survival zones in driver's cab and machine comp.
- SAFETRAIN compliant anti-climber

- **Fields for further research work**

- Protection of driver in case of collision with heavy obstacle
- Equipment attachments: Collision shock loads vs. static design against yield
- Compatible solutions for anti-climbers of rail-vehicles with side buffers



F.B.Carl, 28 April 2004

