



Niobium's contribution
to road safety

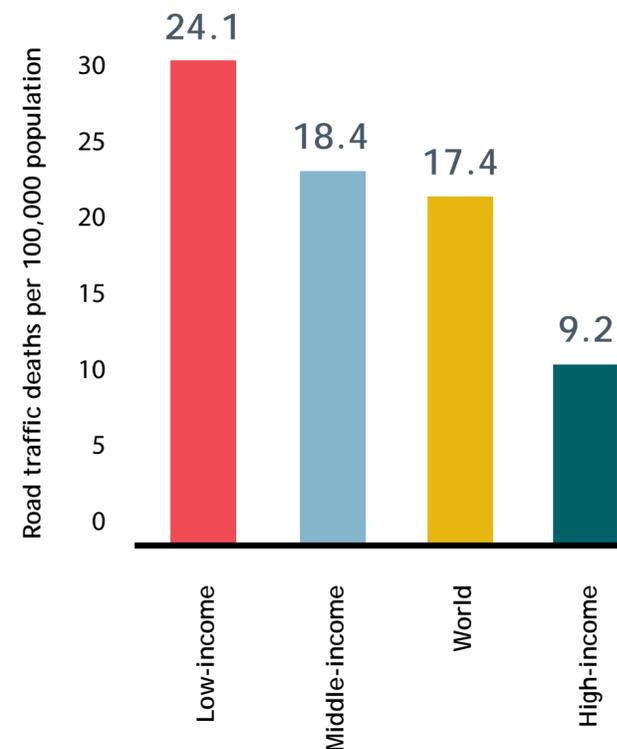
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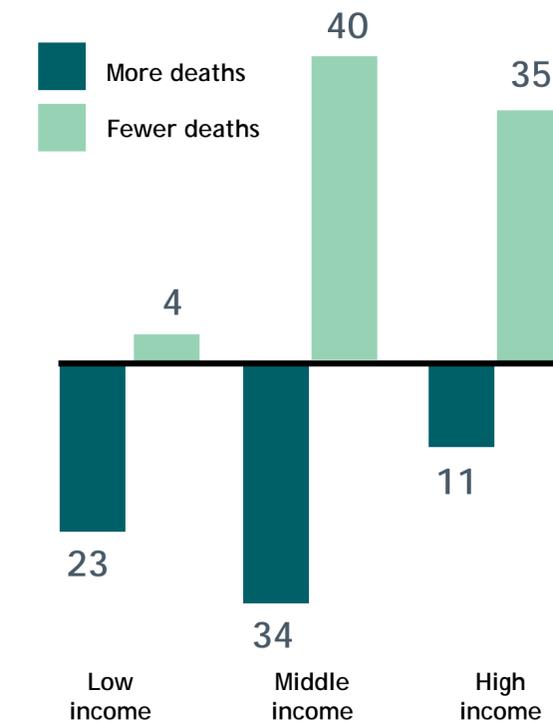
Road Safety is critically important

- Road traffic accidents kill 1.25m people per year globally
- >90% of deaths occur in emerging market countries
- Road traffic injuries:
 - Leading cause of death among people aged between 15 & 29
 - Cost governments 3% of GDP per annum
- Fatalities are rising in many countries
- Niobium usage can **significantly** improve safety performance

Road traffic deaths per 100,000 population, by country income status*



Countries showing changes in the number of road traffic deaths, 2010-2013, by country income status*



* All data from WHO

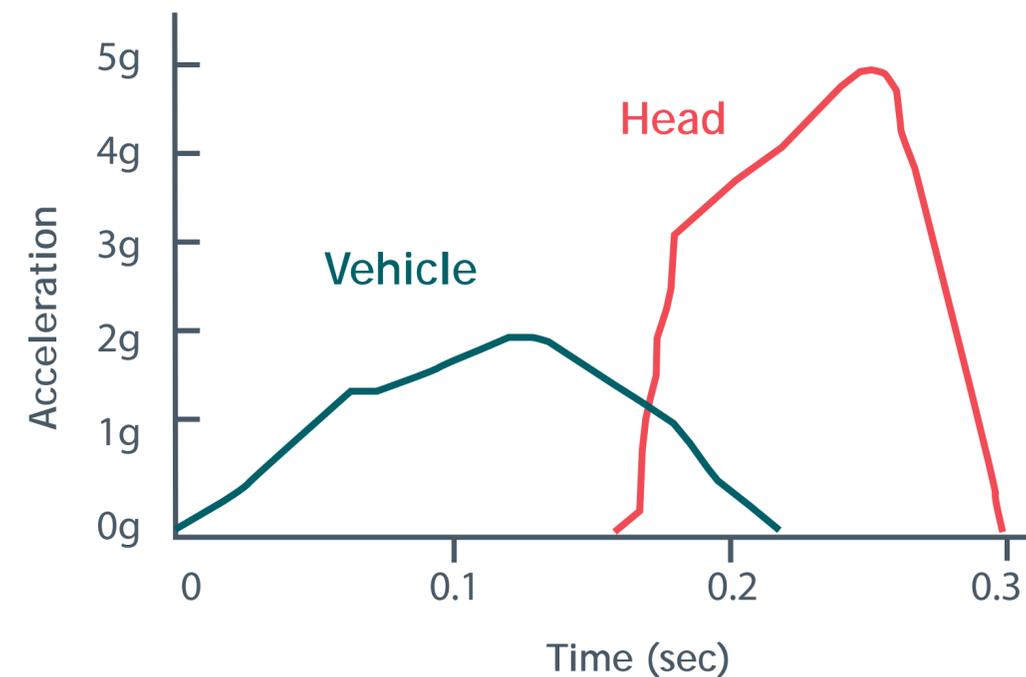
Crash testing and improving standards

- Introduction of crash tests significantly increased safety in developed markets over last 20 years
- Driven by tighter regulation and NCAP movement
 - Euro NCAP calculate safer cars have saved 78,000 lives in Europe since 1997
- Improvements achieved through
 - Active safety measures (e.g. air bags)
 - Passive safety measures (e.g. vehicle structure)
- Some cars in developing markets have not benefited fully from improving standards
- Niobium steels provide a well understood, cost effective method for improving crash performance

Principles of crash protection

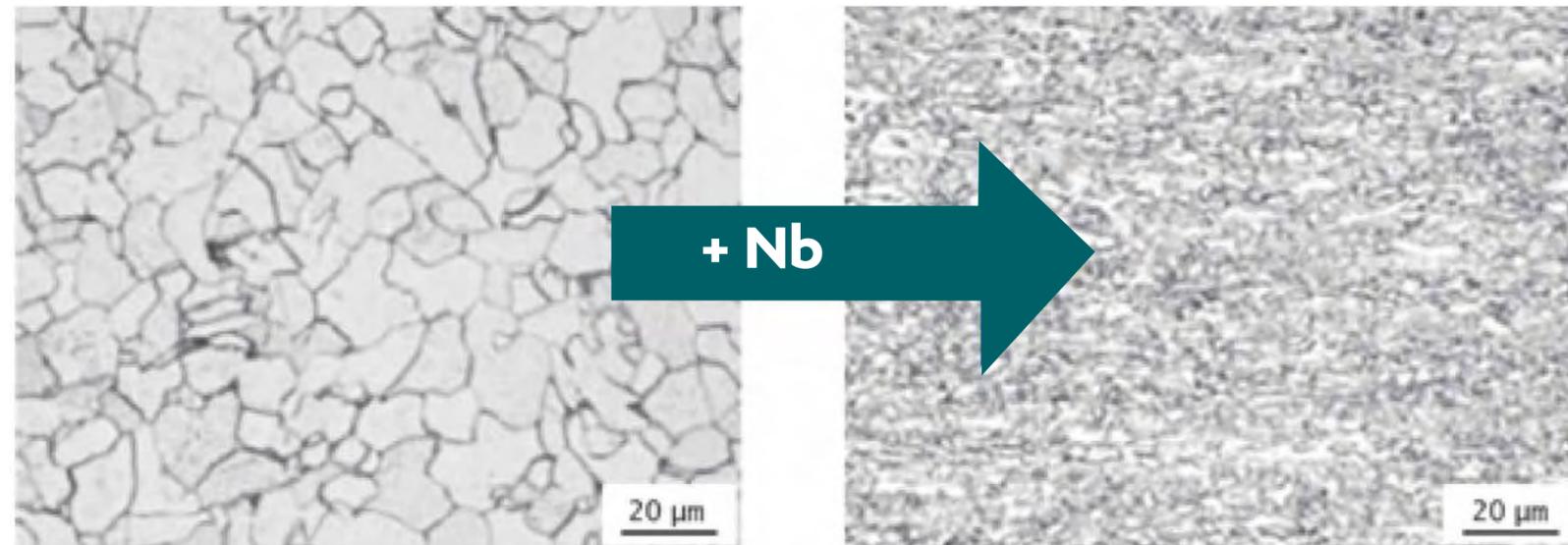
- Major causes of injury during crashes are related to
 - Acceleration-deceleration
 - Intrusion into passenger compartment/cab
- Vehicle structure plays vital role in minimising injuries through combination of
 - Gradual energy absorption - e.g. controlled deformation of parts of a vehicle to reduce acceleration
 - Reduced deformation - car body must be strong enough to resist deformation and compression (side and vertical impacts)
- Stronger grades of steel and better design help OEMs to meet these demands

Acceleration of vehicle after rear impact from a vehicle



Niobium's role in road safety

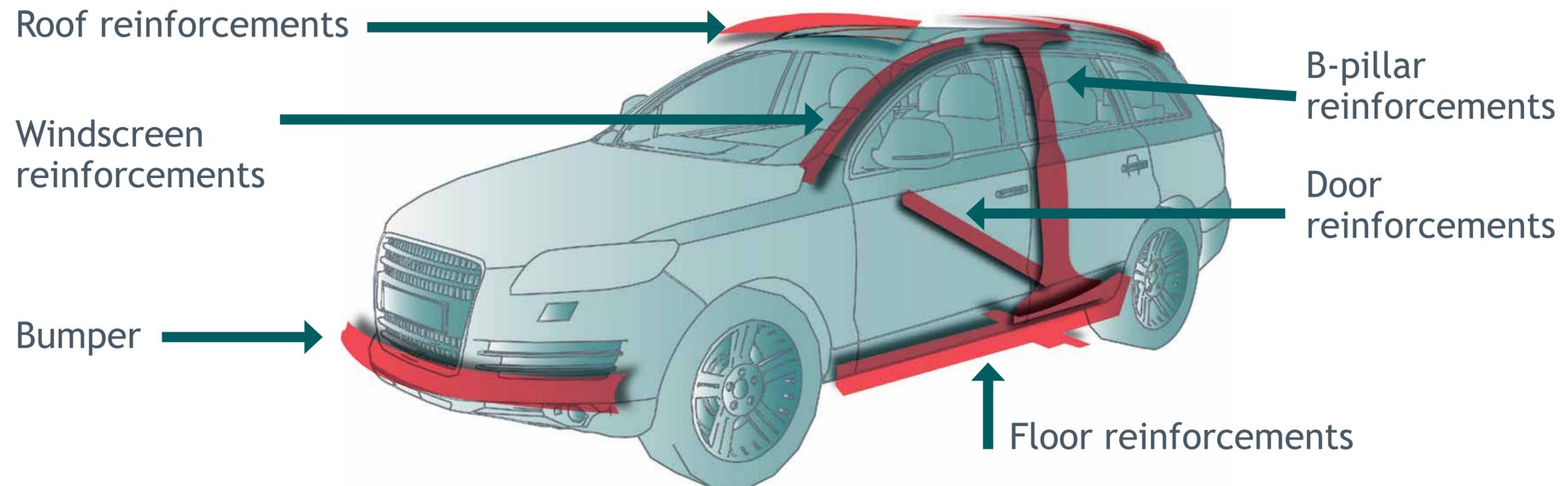
- Niobium refines structure of steel to dramatically change its attributes
- Niobium containing high strength steels provide
 - Increased strength to resist crash impact
 - Enhanced control over deformation to absorb crash impacts
 - Greater formability to enable more complex parts



Nb refines the microstructure

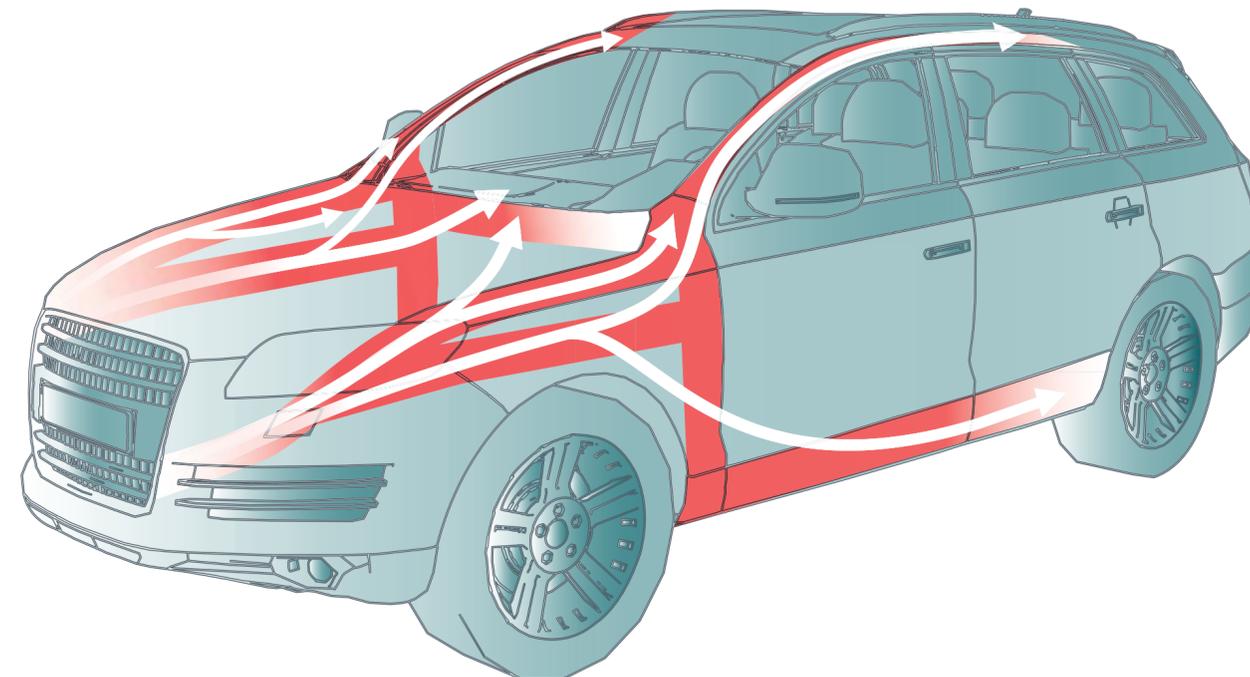
Increased strength

- Ultra high strength steels containing Niobium are much stronger than traditional mild steels - 2,000 vs 300 Mpa
- Protects occupants from impact and compression
- Stronger materials also require fewer reinforcements, reducing welding and materials costs



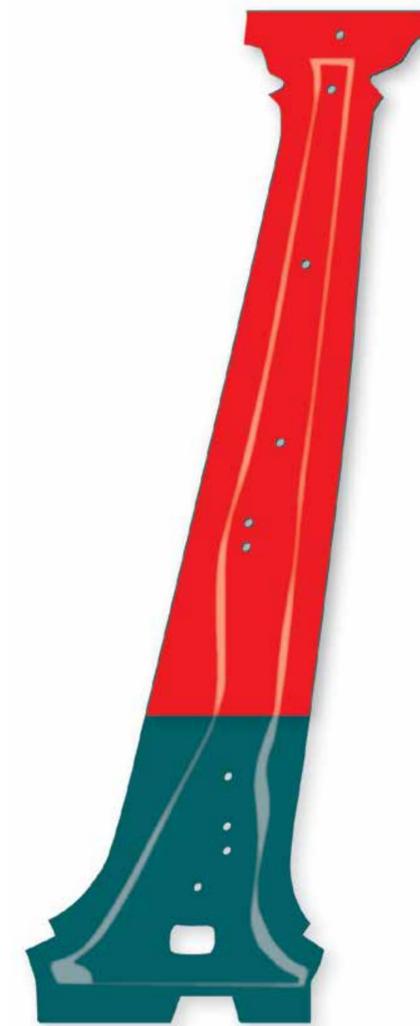
Enhanced deformation control

- Deformation absorbs and dissipates energy from crashes away from vehicle occupants
- Niobium can create a high strength microstructure in certain steels to increase energy absorption
- Limits intrusion into passenger area
- Use crash energy to move vehicle away from impact



Greater formability

- To meet more stringent regulations, vehicle parts becoming more complex
- Niobium can alter the microstructure of steels so they are more ductile and formable into complex shapes
- Parts such as pillars and bumpers can be made in complex shapes, with varying dimensions and strengths to control deformation



High Strength
Intrusion resistance

High Ductility
Energy absorption

Niobium's value proposition

- Niobium enhances existing materials, reducing need to invest in new
 - Tooling
 - Training
 - Assembly processes
 - After sales services/Maintenance
- Improves safety without compromising
 - Design
 - Performance
 - Sustainability