



Photo: SNCF

BONAXLE® | product specification

BONAXLE® is our innovative solution to the requirements of increased safety and reliability. It also brings significant decrease of life-cycle costs (LCC). **BONAXLE®** is likely to bring paradigmatic change in railways across Europe and beyond. GHH-BONATRANS achieved to improve the technology already well established in Japan by adapting it to the conventional European geometry and steel grades. Innovative technology improves the strength of all types of axles without modification of the axle's geometry or steel grade.

Key features

- Higher safety and lower LCC
- Allows older platforms to comply with current safety requirements
- Increased NDT intervals thanks to no crack initiation
- No damage of axle shaft in operation, thus no repair of damaged paint, in fact no need for any coating
- No seizure during maintenance



GHH-BONATRANS
Pioneers of wheelset solutions

Damage prevention

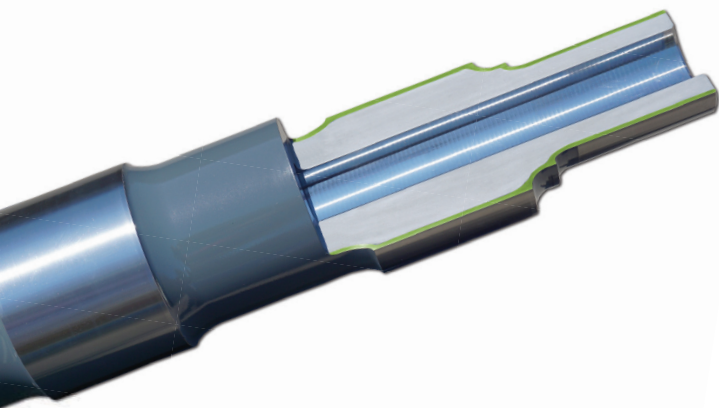
Due to the high hardness, the high yield and tensile strength the wheel seat cannot be seized during wheel dis/assembly (analogically for axle journal with bearing systems). The depth of homogenous hardened layer with hardness of approx. 490 HV 30 reaches up to approx. 6 mm below the axle surface, which enables re-profiling of axle without compromising the hardened layer. The axle shank is resistant to impact from track ballast (proved by impact test with energy 90 J).

Endurance against crack propagation

Crack propagation tests demonstrated it is impossible for cracks to propagate. The cracks grow commonly at stress 100 MPa, however, **BONAXLE** is resistant even at 300 MPa. Even with an artificial notch in critical position, the fatigue strength of **BONAXLE** is higher than required level by EN 13261 without notch.

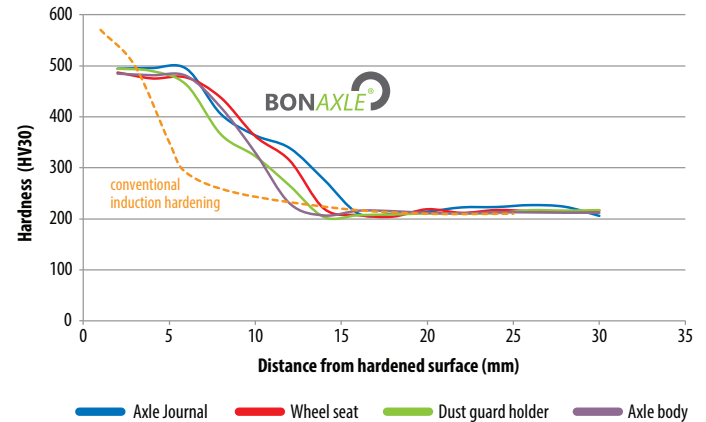
LCC reduction

Thanks to high safety margins the service intervals in particular NDT for crack detection can be prolonged and synchronized with intervals for other wheelset and bogie parts. Therefore, life-cycle costs (LCC) can be reduced significantly. Initial cost as well as maintenance of high-thickness coating is just another important saving.



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BONAXLE is produced in compliance with EN 13261 and additionally treated by surface indication hardening along the entire length and at all diameters and transitional sections of the axle. It has been fully validated for steel grade EA4T.



Fatigue and tensile test

With significantly increased fatigue limit sensitivity to notch (q-factor) remains below the level of standard EA4T.

| EN 13261 (grade EA4T) | R_{FL} [MPa] | R_{FE} [MPa] | $q=R_{FL}/R_{FE}$ [-] | R_e [MPa] | R_m [MPa] |
|--------------------------|-------------------|-------------------|--------------------------|----------------|----------------|
| Standard axle | 350 | 215 | 1,630 | >420 | 650-800 |
| BONAXLE | 660 | 420 | 1,571 | 852 | 1,563 |

The fatigue strength of **BONAXLE** is 450+ MPa, compared to 240 MPa of standard EA4T axle.

| EN 13261 | Local stress [MPa] | Nominal stress [MPa] | Stress in pressfit area [MPa] | Number of cycles |
|----------------|-----------------------|-------------------------|----------------------------------|------------------|
| Required | - | 240 | 145 | 10,000,000 |
| BONAXLE | 450 | 419 | 274 | 10,000,000 |
| | 500 | 465 | 305 | n/a |