





In mining and quarrying industries, both people and machines have to face some of the toughest environments, combined with pressure from the production deadlines and costs.



Working conditions

- Harsh environment
- Severe weather conditions and extreme temperatures
- Quality of maintenance
- Quality of the sealing system
- Quality of lubricants and lubrication process

Areas of bearing applications

- Excavating/Loading Equipment
- Hauling Equipment
- Conveying Equipment
- Primary Processing Equipment

Customer requirements

- Long service life and high reliability
- Maintain full operability even under extreme environmental conditions
- Low maintenance costs
- Easy installation and removal
- Maximum productivity
- Power Density
- Highly engineered products and customized bearing design

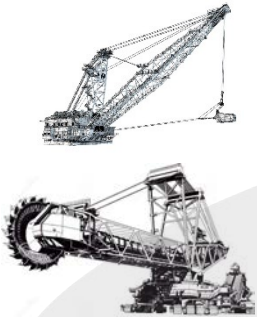
Challenges

- Severe working conditions
 - Heavy loads, unbalanced
 - Shock loads
- Low speeds
- Misalignment
- Debris / Contamination
- Temperature
- Problematic lubrication
- Water and Humidity

Excavation / Loading Equipment

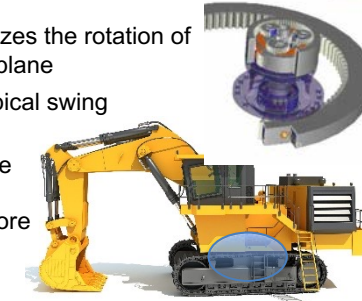
Draglines and Rope Shovels – Hoist / Drag machineries

- Hoist / Drag machineries in draglines and shovels are combined mechanical systems consisting of a large drum, and several geardrives powered by electric motors
- **Drag / Hoist Drums:** Usually supported by large size SRB
- **Drag / Hoist Gearboxes:** TRB, SRB, CRB, up to 300 mm bore



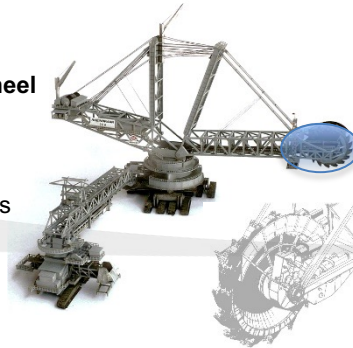
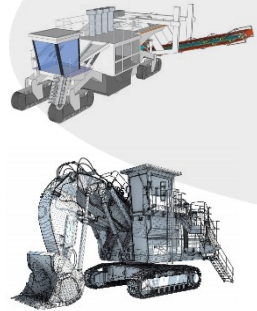
Draglines, Backhoe Excavators, Shovels – Swing machineries

- The swing machinery realizes the rotation of the machine in horizontal plane
- 3 to 6 swing drives in a typical swing machinery
- Each swing drive – multiple TRB, SRB, and CRB positions, up to 500 mm bore



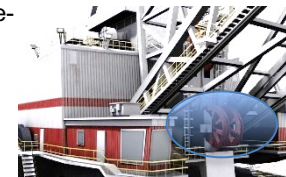
Bucketwheel Excavators - Cutting wheel

- **Cutting wheel shaft support:** Large SRBs, with brass cages
- **Cutting wheel geardrive:** typically combined bevel / planetary gearboxes using all types of rolling bearings, depending on builder and design preferences



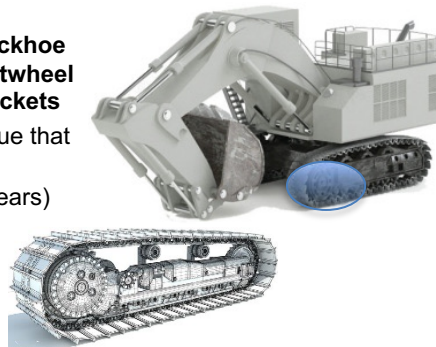
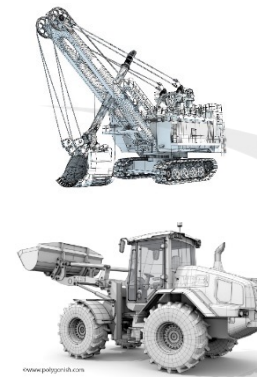
Draglines and Rope Shovels - Sheave applications

- Serves to guide the ropes which control and operate the bucket or dipper
- Supported by two X-mounted single-row TRB or TDOs, between 300 to 1100 mm bore depending on machine size and sheave position (boom point, fairleads, dump block, etc).
- Dedicated double-row CRB for sheaves



All Tracked Machines: Shovels, Backhoe Excavators, Surface Miners, Bucketwheel Excavators – Final drives and Sprockets

- Provides the horsepower and torque that turns the tracks
- TRB (Sprocket support & planet gears)
- CRB / NRB (Planet gears)

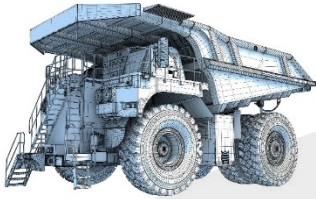


Front Loaders – Final drives and Wheel bearings

- **Wheel support :** TRB
- **Planet gears support:** RN, RNN integrated CRB or NRB

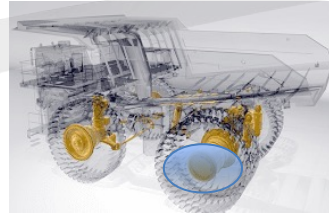


Hauling Equipment



Haul mining trucks – Final Drives (Planetary wheel ends)

- The 1- or 2-stage planetary group provides the final speed reduction and torque increase to the wheel
- Planet support bearing solutions vary based on technical or commercial preference of OEMs
- TRB, SRB, CRB 50-300 mm OD



Haul mining trucks – Hydraulic cylinder articulations: Front struts, Steering cylinders, Rear struts, Dump cylinder

- Spherical plain bearings



Haul mining trucks – Wheel Bearings

- Two large single-row TRB in O-arrangement, preloaded
- Dissimilar sizes for front wheel, similar sizes for rear wheel

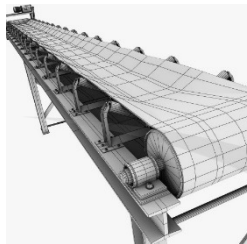


Articulated mining trucks – Articulation hitches

- Opportunity for small TRB
- Bearings subject to small angular oscillations not full rotation

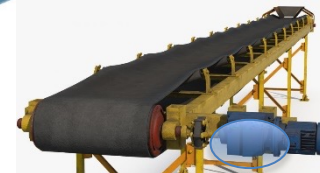
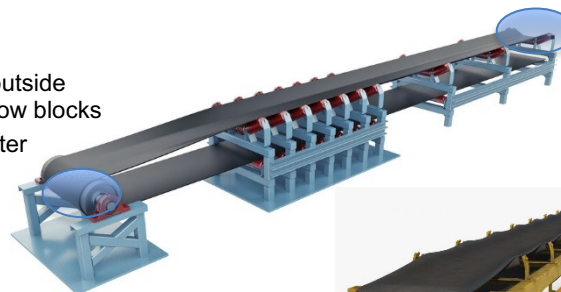


Conveying Equipment



Belt conveyors – Pulleys

- **Live shaft pulleys:** Rotating shaft applications, with bearings located outside the pulley, commonly mounted in pillow blocks
- Typically SRB 222, 231 K / C3, adapter sleeve mounted
- **Dead shaft pulleys:** Stationary shaft applications suitable for limited space situations as bearings are located inside the pulley
- SRB 222, 231 series, typically within bore size range 45-300 mm, DGBB sometimes used
- Opportunity for sealed SRB



Belt conveyors – Idlers

- Typically supported by DGBB, commonly in 62, 63 series, C3, sealed preferred
- For mine duty conveyors, SRB and TRB also used

Belt conveyors – Gearboxes

- Parallel shafts or bevel constructions, pedestal or shaft-mounted
- Multiple bearing arrangements and combinations, including SRB, TRB, CRB, ACBB

Most common bearing types & damage modes



Spherical Roller Bearing (SRB)

Tapered Roller Bearing (TRB)

Cylindrical Roller Bearing (CRB)

Cylindrical Roller Bearings for planetary support (type RN, RNN)

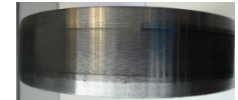
Spherical Plain Bearing (SPB)

Equipment

Bucketwheel excavators	●	●	●	
Draglines & Electric rope shovels	●	●	●	
Hydraulic shovels & Backhoe excavators	●	●	●	●
Front Loaders	●	●	●	●
Haul Mining Trucks	●	●	●	●
Belt conveyors	●	●		
Gearboxes & geardrives	●	●	●	●

Frequent bearing damage modes seen in mining applications

Wear from foreign material



Etching / corrosion



Inadequate lubrication



Overloading



Fretting corrosion



NBI combines experience in designing and producing bearings with the latest technology in material research and manufacturing technology to create a new bearing line in order of prolong bearing life.

Premium steel and improved heat treatment

Achieving an optimized microstructure and hardness uniformity on the functional section by:

- Selecting of through hardening steel type according to the rings' and rollers' thickness
- Restricting chemical composition to closely control inclusions size and quantity
- Narrowing carbides threshold
- Optimizing heat treatment

Surface coating standards according to each specific application requirements

- Zinc coating: to protect from corrosion
- Black oxide: for running-in and under poor lubrication
- Hard chromium: to resist corrosion, wear and friction
- PTFE: for starting up and to reduce stick-slip phenomenon
- DLC: for high mechanical strength, reduced wear and optimal friction properties
- Nitriding / Nitrocarburizing: increases the resistance against fatigue, wear and corrosion



- Improved dynamic load capacity and consequently, longer operating time
- Reduced friction and lower operating temperature
- Downsizing possibility
- Lower overall costs

SRB improved internal design

- Maximum capacity design (No. of rollers, length and diameter)
- Optimized geometry between rollers and raceways (osculation ratio)
- Improved rolling contact surface finishes
- Optimized steel and brass cage design
- Higher dimensional and running accuracy
- Customized CE12 SRB for vibrating screens
- Sealed SRB

CRB improved internal design

- Maximum capacity design (No. of rollers, length and diameter)
- Optimized contact surface geometry.
- Improved rolling contact surface finishes
- Optimized polyamide & brass cage design
- Higher dimensional and running accuracy
- Pin-type or solid finger-type machined cage
- Multi row

TRB improved internal design

- Maximum capacity design (No. of rollers, length and diameter)
- Improved rolling contact surface finishes
- Improved geometry (outside surface, end faces, side of rollers, raceway, IR rib)
- Higher dimensional and running accuracy
- Optimized metal sheet cage design
- Multi-row
- Metric or inch design
- Sealed TRB

SPB improved internal design

- Better fabric characteristics: cover factor, thickness, yarn characteristics.
- Gluing process improvement: optimal OR steel roughness, better cleanliness of OR ultrasound baths and appropriate quantity of the glue evenly spread and curing.

NBI's design capacity has been backed by market feedback regarding the CRB Enhanced+ bearing line. The last milestone achieved by NBI has been E+ SRB.

Manufacturing tighter internal tolerances

Reduced and controlled internal geometry tolerances optimize the components' guidance and reduce friction and wear.

Benefits: run cooler, reduced noise and vibrations.



Heavy-duty, maximum capacity design

Optimized internal design (number of rollers, roller length and diameter) increases the contact surface area and improves the capacity to carry loads. **Benefits:** improves bearing performance for high loads.

Different cage designs

Cage constructions from brass or steel, guided on rollers, inner ring or outer ring in order to fulfill different application conditions.



Steel cage **benefits:** lightweight, high stiffness and impact resilience.

Nitriding treatment **benefits:** superior toughness and wear resistance.



Brass cage with optimized pocket design guided by outer ring (CE12 for vibrating screens) **benefits:** better guidance of rollers out of load zone, reduced friction with rollers and improved lubricant flow.

Improved surface finishes

Superfinishing of the rollers and inner race generates constant surface features, favorable lubricant distribution and lube film. The enhanced grinding of the outer race optimizes the rollers' traction and reduces the rollers' skewing tendency in intense dynamic application conditions.

Benefits: reduces friction and prolongs bearing life.

Optimized osculation ratios

Improved contact lowers the torque, assures an optimal load distribution, reduces stress concentrations and the rollers' skewing tendency.

Benefits: minimizes wear, improves bearing performance for high loads and prolongs bearing life.

Special focus: Sealed SRB for intensely contaminated environment

- Sealed NBI spherical roller bearings are designed to strengthen the bearing protection against contamination under demanding environmental conditions.
- Internal design same as the open bearings
- Contact-type seals on both sides, sheet steel-reinforced, especially developed for spherical roller bearings
- Factory pre-greased

Note: Multiple seal materials are available, however the final selection must be made carefully, considering the operating temperature.



Special focus: SRB to CE12 specification for vibratory applications

- Available as machined brass and stamped steel cage variant
 - Two-piece cage construction
 - Both cage types are guided on outer ring for enhanced stability
 - Steel cages and guiding rings are nitrocarburized
- Restricted bore tolerance - approx. the upper half of the normal tolerance range
- Restricted OD tolerance – centre half of the normal tolerance range
- Standard C4 clearance (not shown in the bearing symbol)



SRB in plummer blocks

- Heavy-duty bearings enclosed in rugged housings, provided as complete ready-to-mount units that deliver performance in toughest environments
- Factory pre-lubricated with NLGI 2, extended temperature range grease
- Separable housing construction for ease of access
 - Choice of seals
 - Fixed or floating positions
 - Comprehensive dimensional range



CRB Enhanced+ bearing line

- One or multi rows bearings
- Non-locating, semi-locating or locating bearings
- Full complement or cage construction
- Compact design, easily handled for mounting/dismounting
- Maximum radial load ratings in given radial section
- Suitable axial load capacity for semi-locating and locating designs
- Pre-set solutions, manufactured for right radial internal clearance
- Sealed and pre-greased solution which facilitates simplified equipment design and easy maintenance



Special focus: CRB without outer ring for planetary applications

- One or multi rows bearings
- Full complement or cage construction
- High radial load carrying capacity and high rigidity on full complement versions
- Available in sets of matched units for multiple rows



RN



RN-V



RNN-V

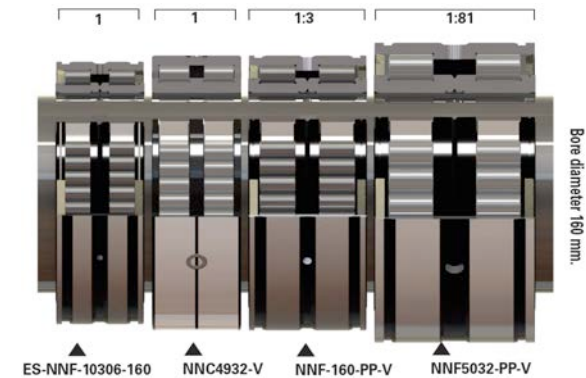
TRB Enhanced+ bearing line

- One row or two rows in different arrangements



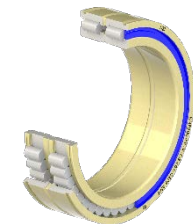
Special focus: Dedicated CRB bearings for sheaves

- A world of possibilities in those standardized designs (NNF, NNC)
- Customized solutions with the same bore diameter but outer diameter and width adapted to your system.
- Flexibility in modifications to adapt the bearings solutions to the specific requirements of each project, such as:
- Anti-corrosion protection coating CE05
- Special grease for specific requirements (under water operation)
- Special seals made of selected materials for extreme operational conditions



Special Solutions for Dredging operating under water

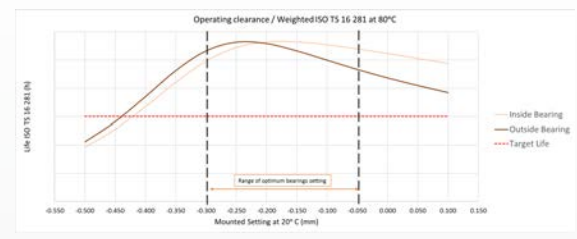
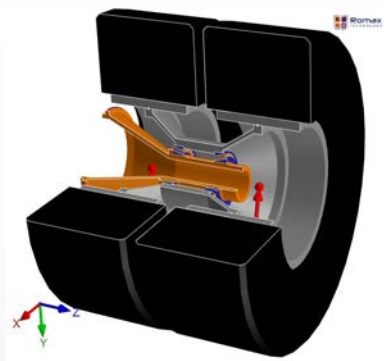
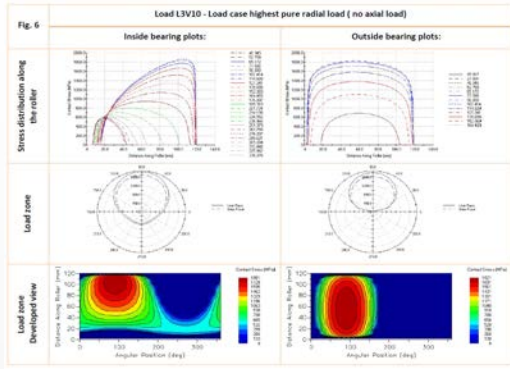
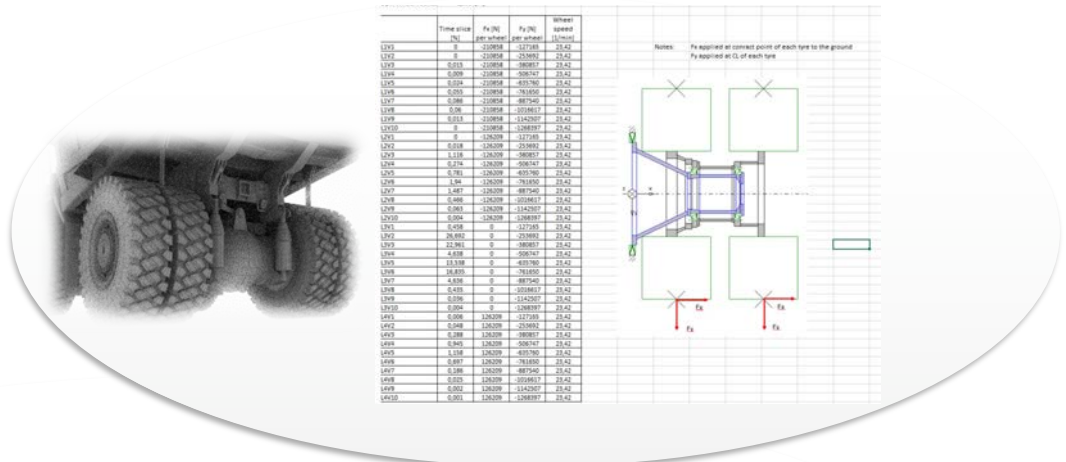
- Special coating CE05
- Special seals
- Special grease



Study case: Mining truck wheel

Case 1

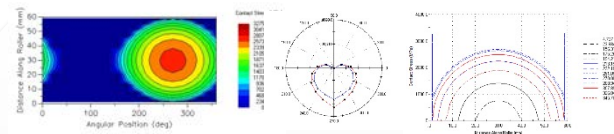
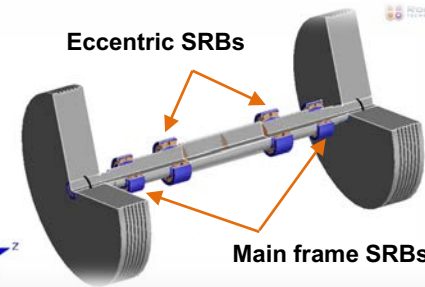
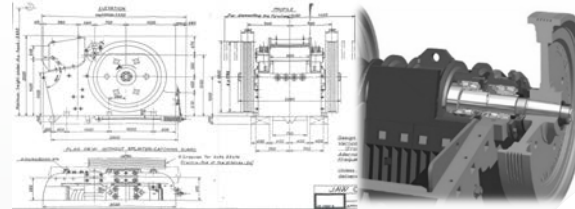
New product development and analysis of the TRB solution performance for mining truck wheel



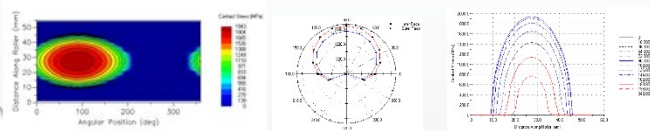
Study case: Jaw crusher

Case 2

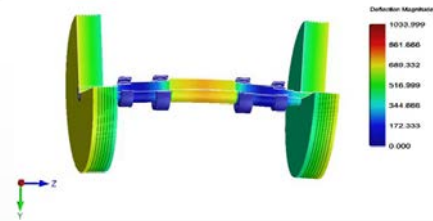
Selection of the appropriate SRB solutions for a Jaw crusher application based on customer operating conditions as an alternative to plain bearings



Eccentric SRBs



Main frame SRBs



System deflections

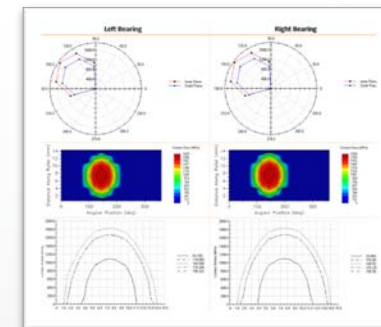
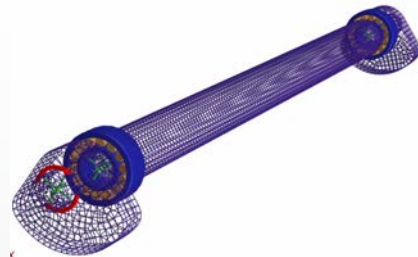
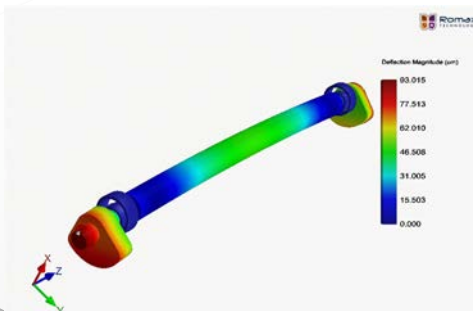
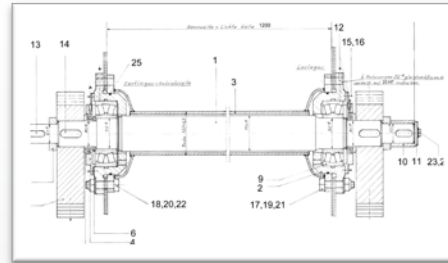


$$p = \sigma_v \left(\frac{u}{2h} + 1 \right) = \sigma_v$$

Study case: Vibrating screen

Case 3

Analysis of the performance and evaluation for the solution with SRB 22310-E-W33-C12-ENH assembled into a vibrating screen



NBI Bearings Europe is a Premium brand serving the market since 2002



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Application engineering and sales office in Bucharest (Romania).

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Manufacturing plant warehouse and sales office in Wujin (China).



Sales office, Brazil



Manufacturing plant, Spain



Application engineering office, Romania



Manufacturing plant, India



Manufacturing plant, China

Equipment

- Equipped with **high precision machinery**:
- Soft machining operation, turning
- Grinding and superfinishing machines highly automatized with integrated robots
- Integrated Aichelin Heat Treatment Line
- Fully equipped labs: dimensional, material and lifetime testing centers
- Ultrasonic washing machines
- Magnetic particle inspection equipments
- Grinding burns & cracks inspection equipments
- Full Traceability
- Research & developement



General view manufacturing plant



Fully equipped labs: dimensional, material and lifetime testing centers



Integrated Aichelin Heat Treatment Line



Wide range available on stock



BEARINGS | **NBI**[®]
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