



# Hardox in Concrete & Cement applications

Ad Wientjes

Segment Manager Raw Material Handling

**SSAB**

# Wear

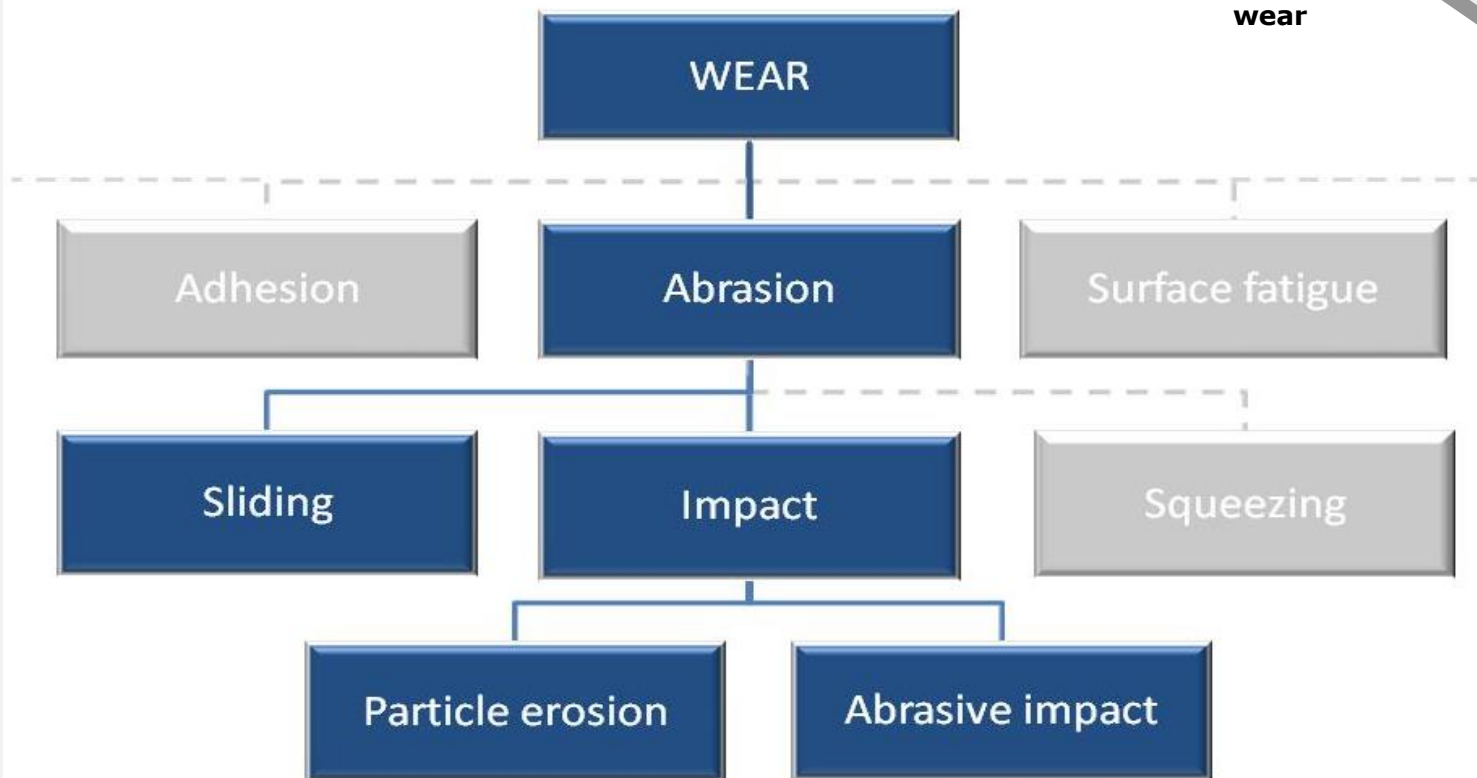
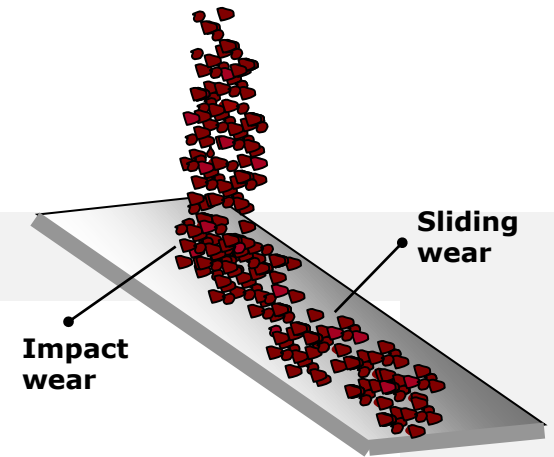
# What is wear

Unwanted loss of material subjected to mechanical contact causing **surface damages**



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# The different types of wear

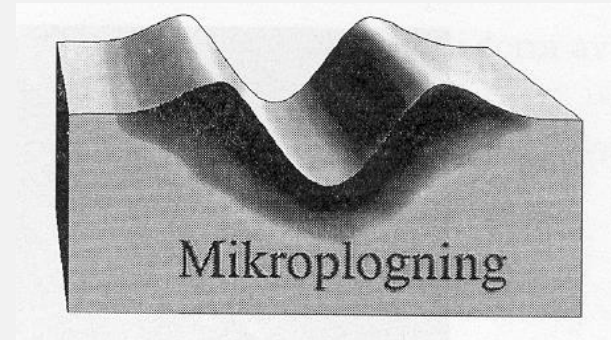


# Surface damages

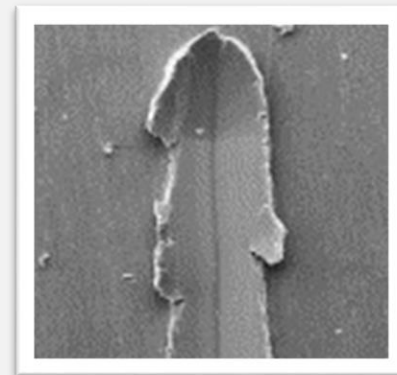
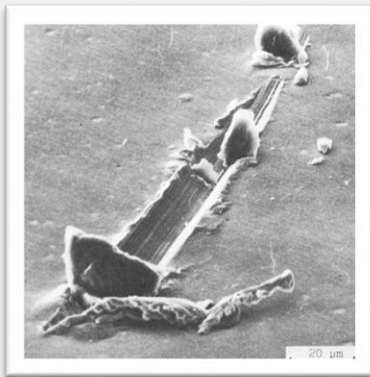
**Cutting**



**Ploughing**

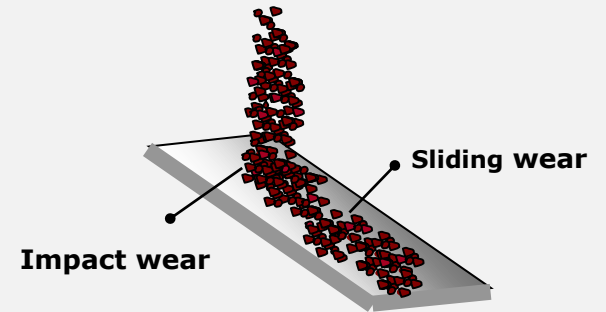


*Higher material loss*

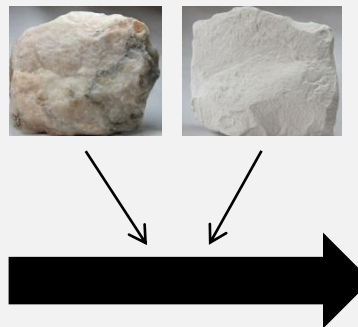


# How to increase service life of applications

- What kind of wear situation do we have?
- What kind of abrasives do we handle?
- What kind of working environment do we have?



# How to increase service life



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# Aggregates in concrete

## Aggregates example\*

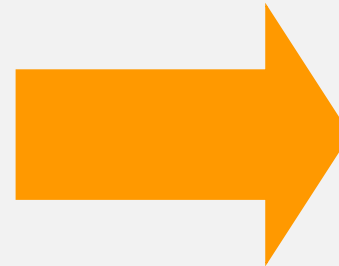
Basalt (780 HV), Granite (713 HV), Trachyte (677 HV), Diabase (780 HV), Limestone (725 HV), Slagg (600-600 HV), Diorite (753 HV). Sandstone (quartz bearing).

\*) Hardness according to WearCalc



# The wear from concrete

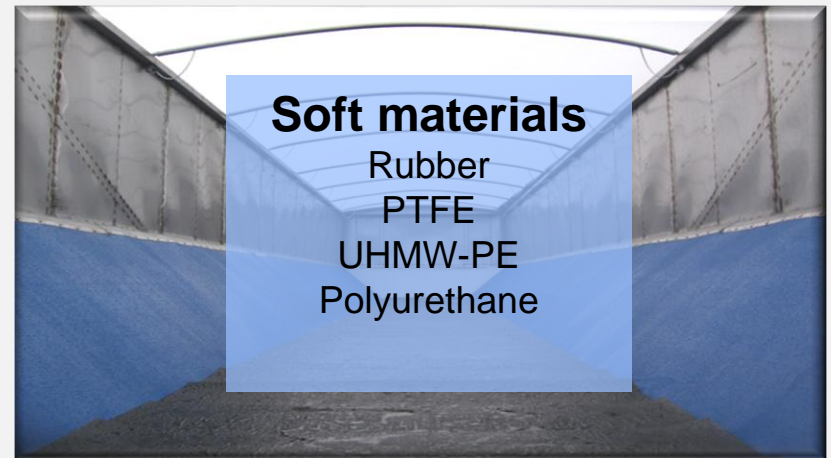
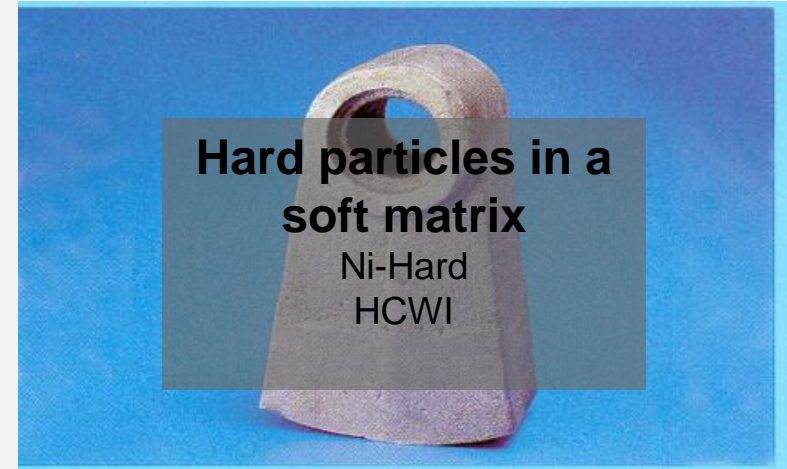
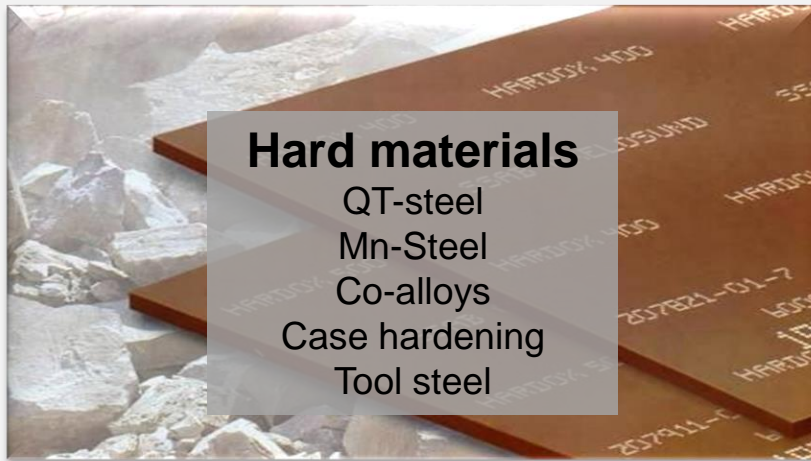
- ❑ Different aggregates
  - Hardness, size and shape
- ❑ Different proportions
  - Water / binder / aggregates
- ❑ The water influence
  - Lubricating substance, hardness
- ❑ Way of production
  - Hydration time
- ❑ Stop time
  - Corrosion and cleaning



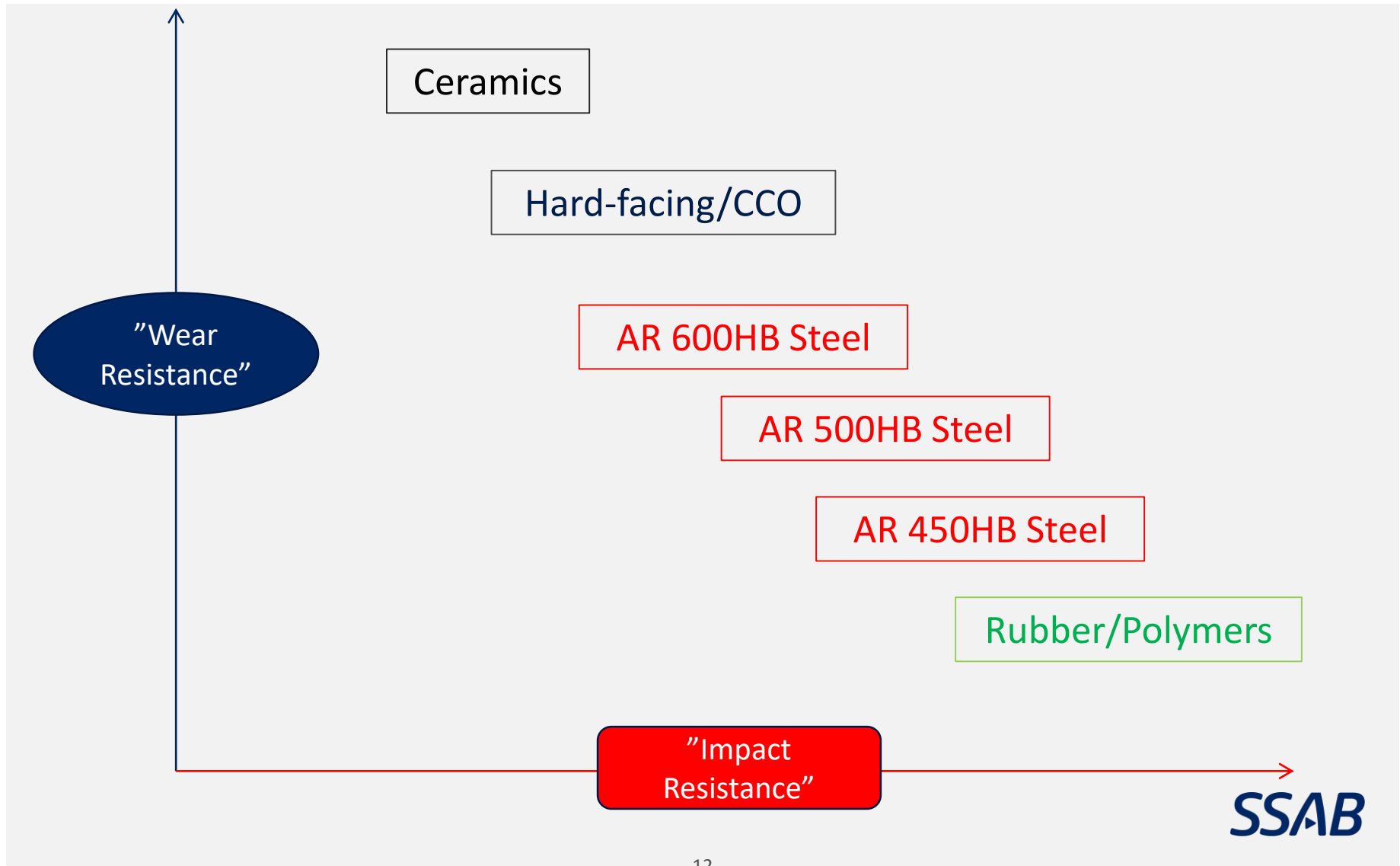
Very difficult to estimate the concrete wear rate.

# Materials

# Wear resistant materials



# Wear resistant materials



# Wear resistant materials

Material	Sliding wear	Impact wear	Toughness	Welding	Bending	Machining	Cutting
Qt-Steel	Very Good	Very Good	Very Good	Good	Poor /Good	Medium / Good	Good
Ceramics	Excellent	Poor	Poor	----	----	----	----
Mn-Steel	Medium	Very Good	Excellent	Medium	Possible	Medium	Poor / Medium
HCWI	Excellent	Good/Medium	Poor	Casting - Poor Hardfacing – Good	Overlay-Medium	Not Possible	Poor/Medium
Ni-Hard	Very Good	Medium	Poor	Not Possible	Not Possible	Not Possible	Not Possible
Rubber	Poor	Good	----	Gluing	----	----	----

# High temperature wear



- ❑ Elevated working temperature



- ❑ Friction heat



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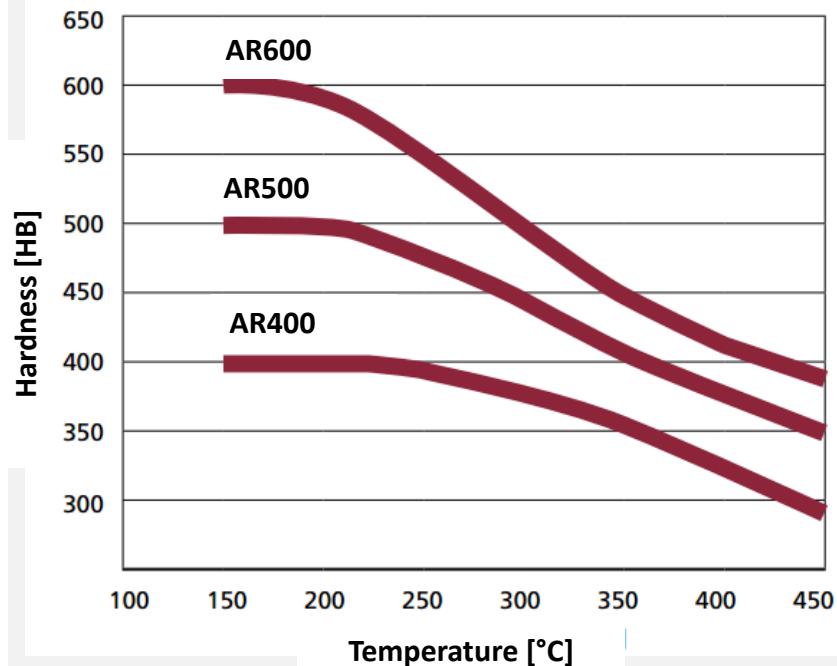
# High temperature wear

Quenched steel vs. Heat resistant tool steel

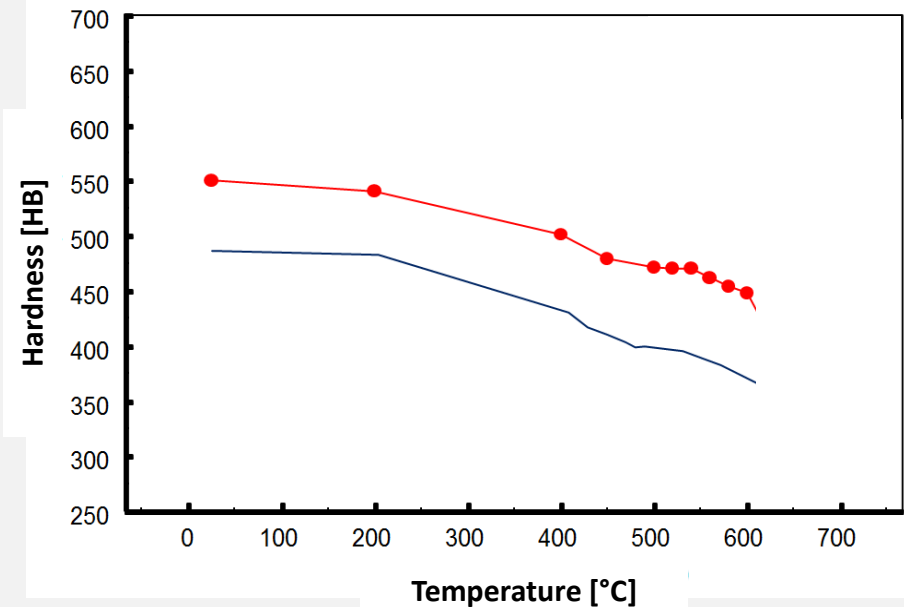


*The steel remember how it was created*

Quenched steel

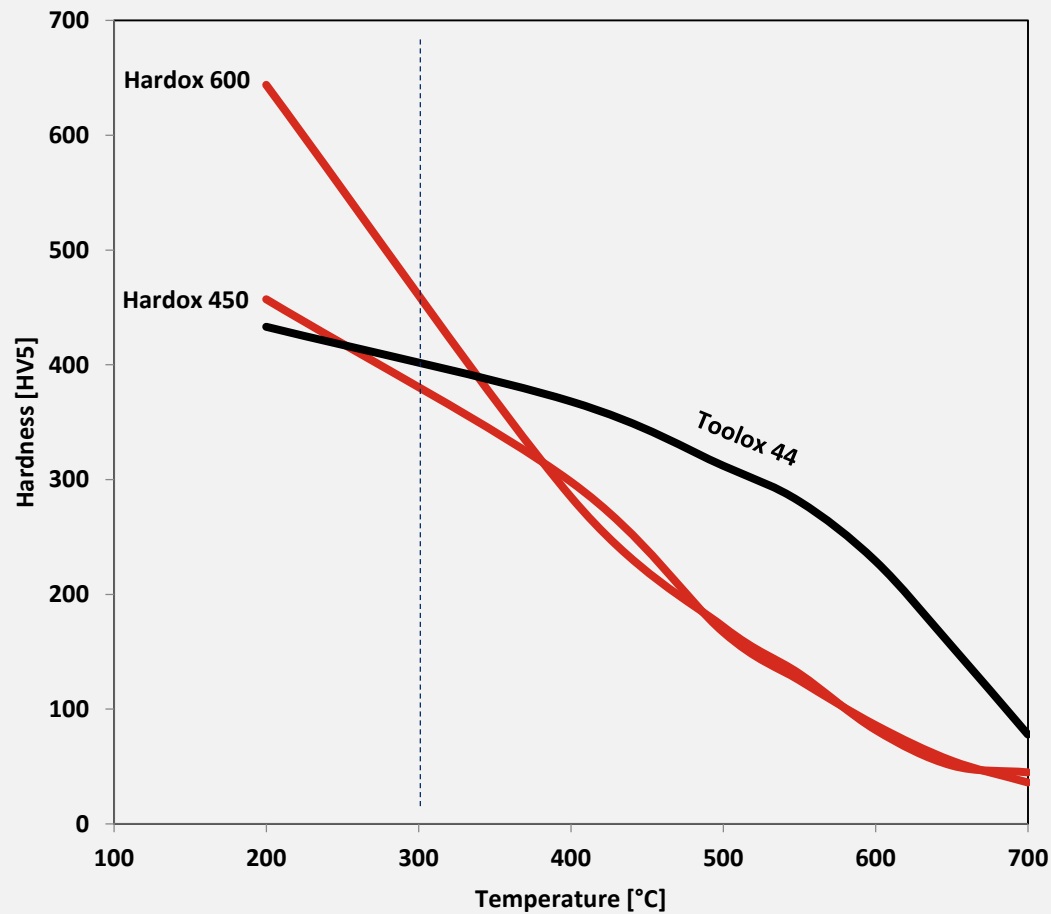


Heat resistant tool steel



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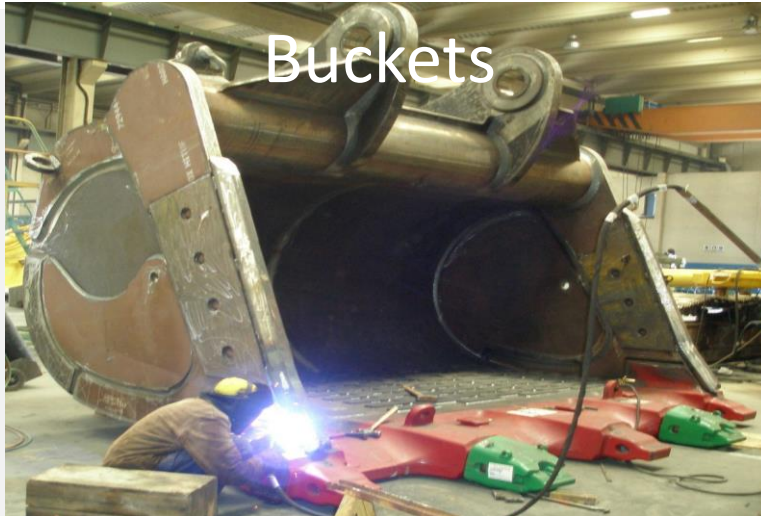
# High temperature hardness test



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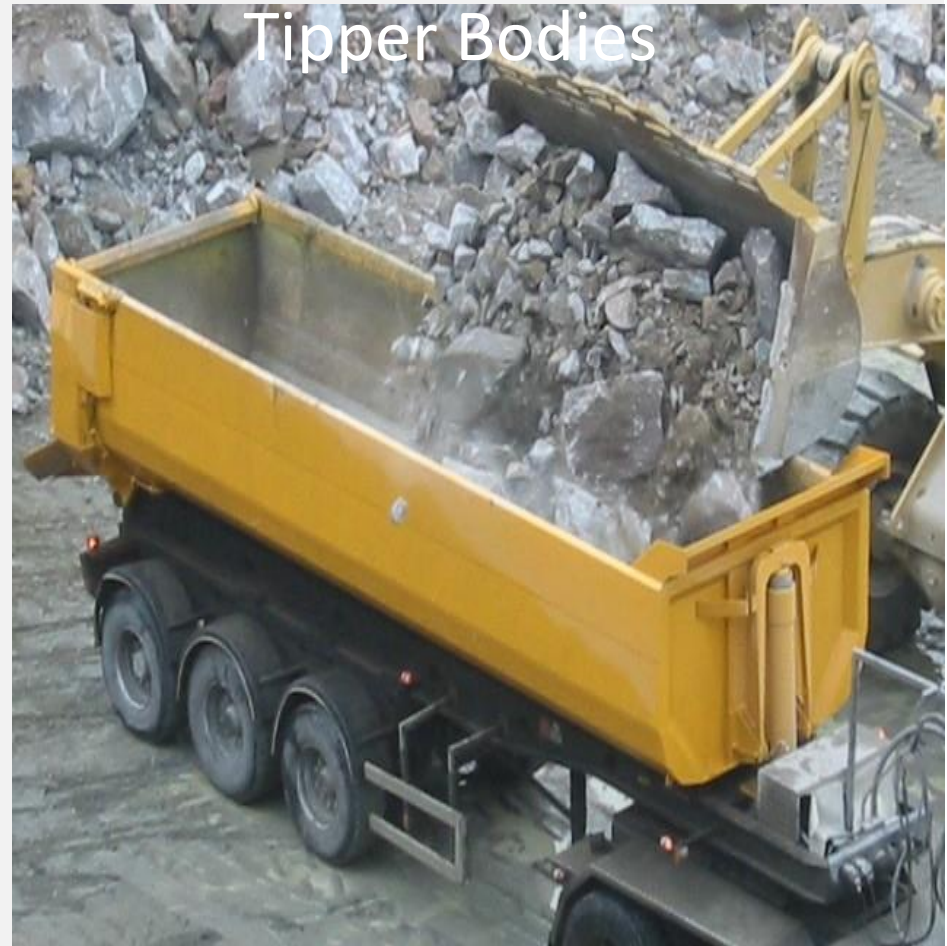
# Applications

# Hardox material - Where is it used ?



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# Hardox material - Where is it used ?



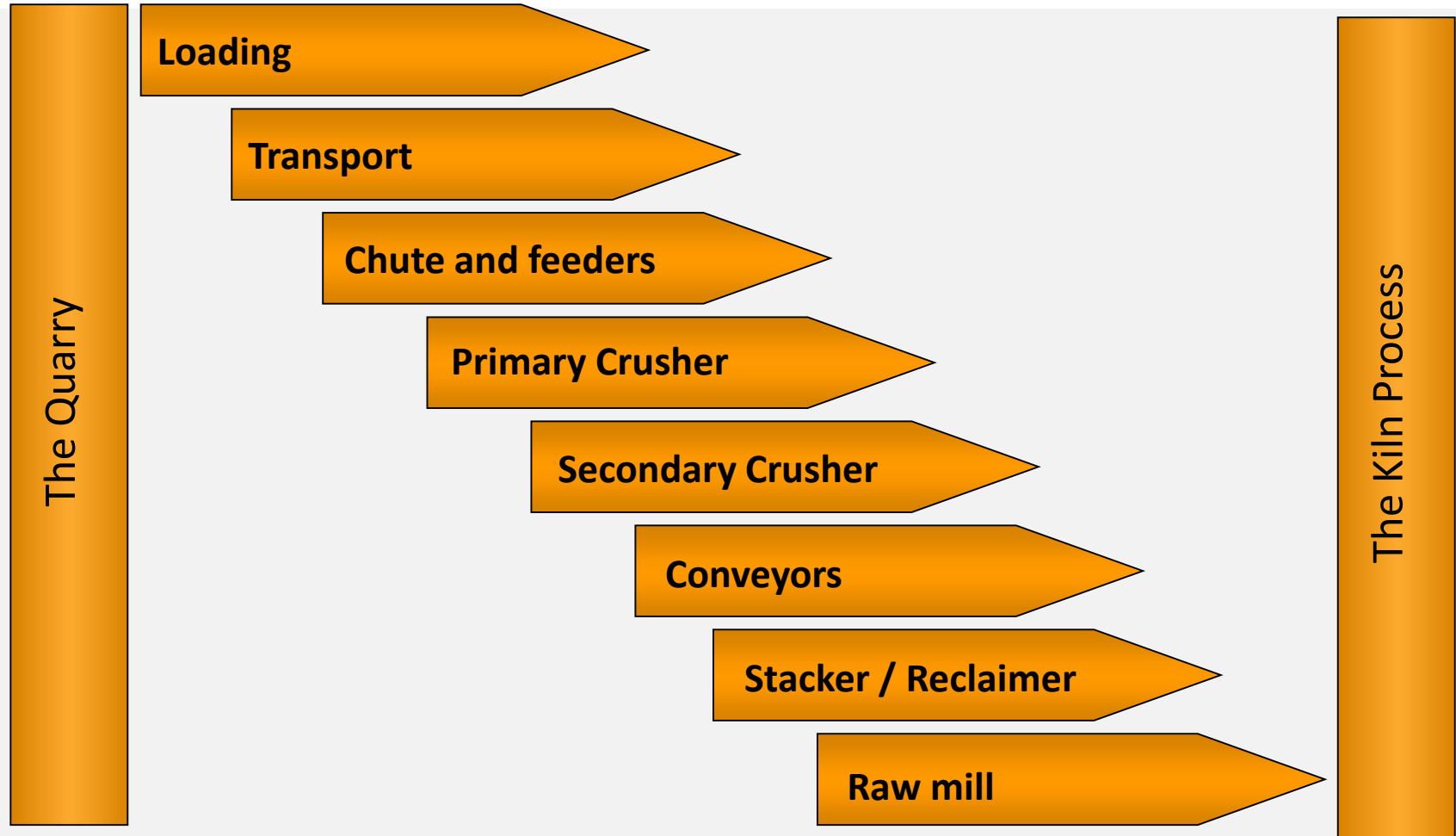
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# Hardox material - Where is it used ?



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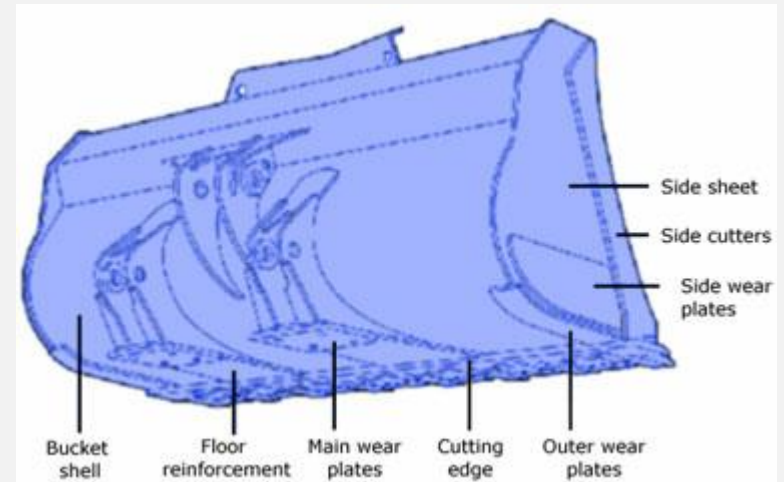
# Raw material handling



# At the Quarry



Part	Steel grade
Cutting edge	HARDOX 500
Bucket Shell	HARDOX 400
Side sheets	HARDOX 400
Side cutters	HARDOX 500
Main wear plates	HARDOX 500
Outer wear plate	HARDOX 400
Floor reinforcement	HARDOX 400



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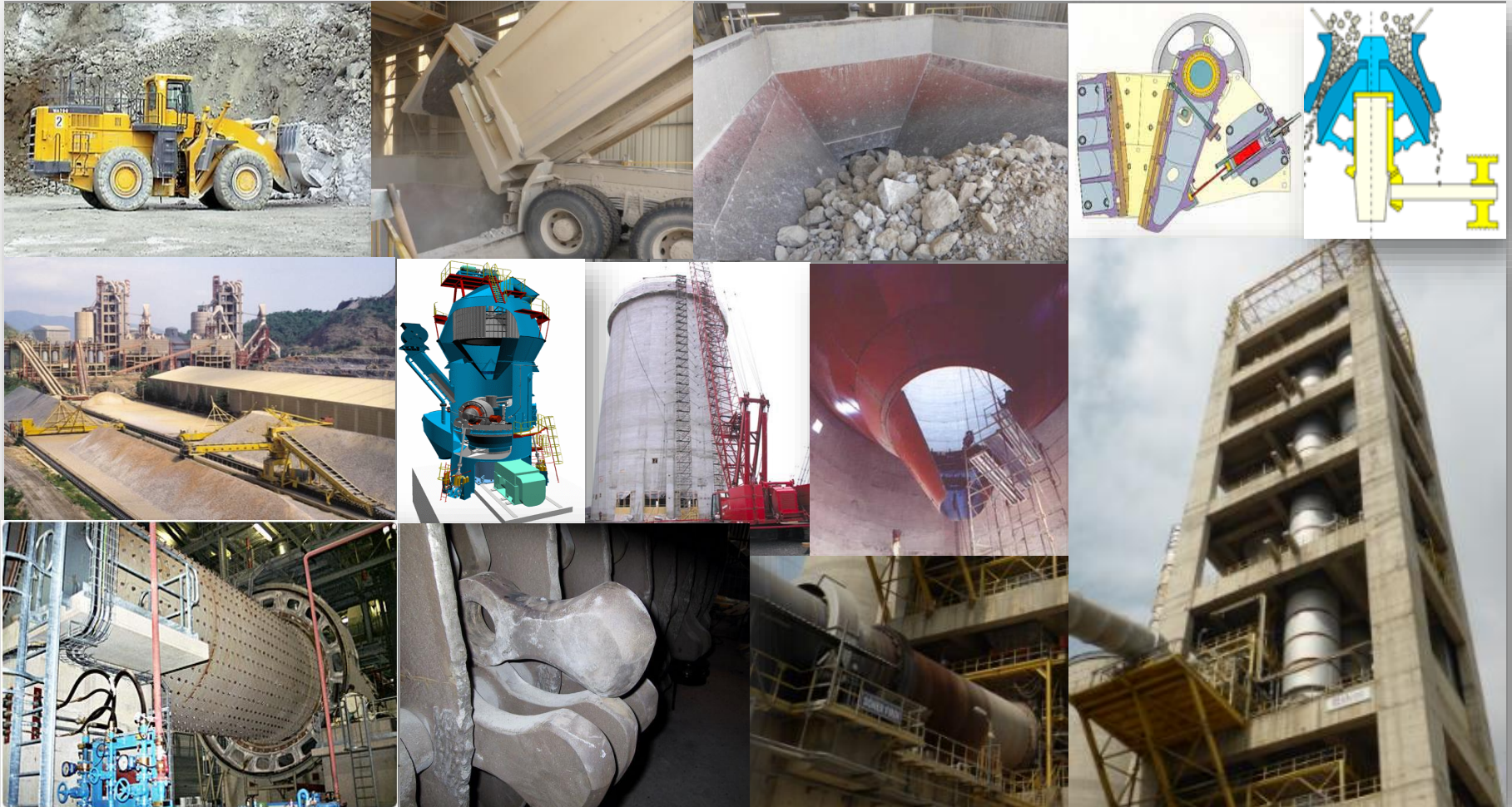
# Transportation

- Sliding Wear = 3 times longer service life with HARDOX 500 compared to S235.
- A 25 mm plate of S235 = 8 mm HARDOX 500
- Load increased by 7 %



# Wear in cement

# Wear in cement plants



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# Primary crusher anvil and hammers



Anvil Hardox 500 or 550

Hammers Hardox 550 or 600

A lamellar structure works good

Liners Hardox 600

Toolox in the axels



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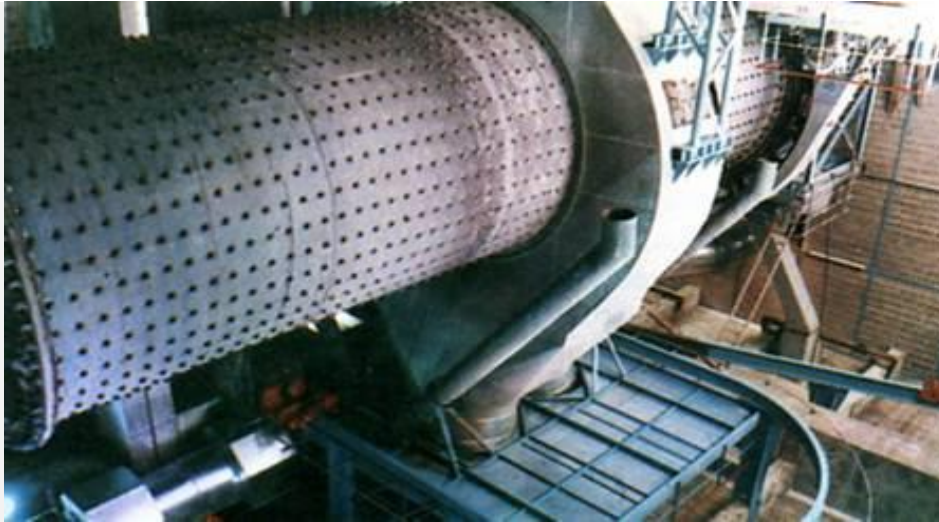
# Crusher screen



Hardox 450/500

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# Grinding raw material



Raw material grinder (double rotator)  
Inlet and outlet Hardox 500 and 550. In  
In this example 12 mm

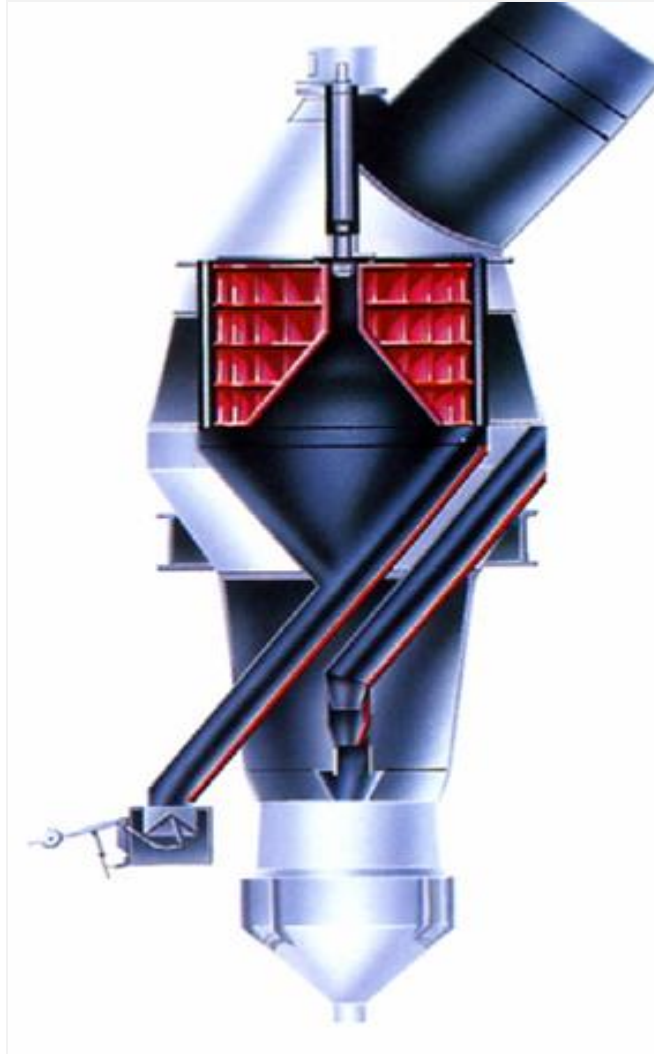
# Elevator bucket



Body Hardox 450. Front edge in Hardox 500



# Separator (air classifier)



Ceramic is mainly used. Also hardfaced material 6+4 mm  
Hardox 500 works for the parts in red

# Chutes



Hardox 500/600, if not heat affected

15 mm Hardox 600



# Hopper

Lower parts in Hardox 400/450



# Blow bar



Blow bar in limestone quarry. Hardox 500  
30 - 60 mm. Originally MG Magotteaux

# Conveyors

Liners exposed for sliding wear

Relative service life

Mild steel 1.0

Hardox 400 1,8

Hardox 450 2,5

**HARDOX 500 3,4**



# Conveyor sprocket

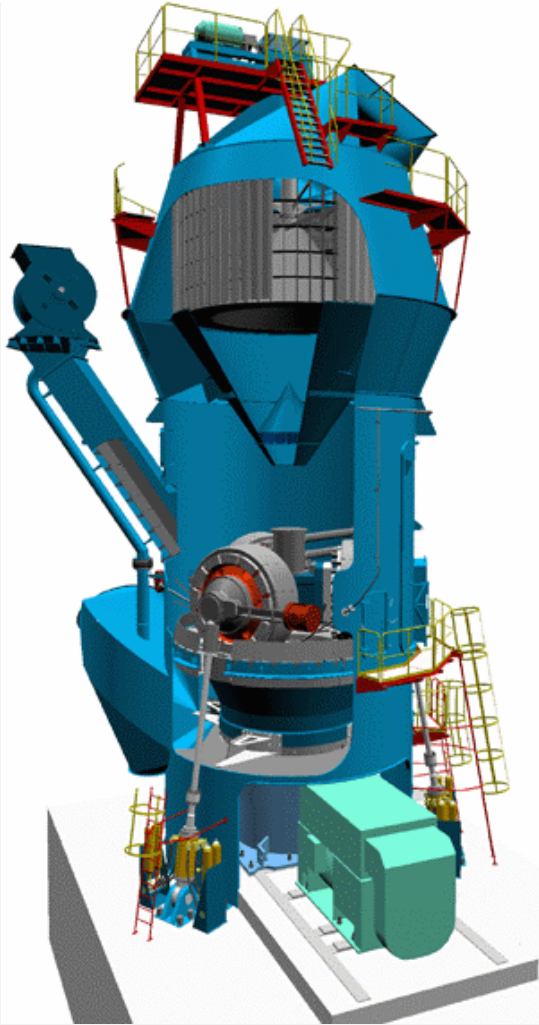


Hardox 500 56 mm



# Louver rings

Hardox 600 outperformed  
CCO plate because of  
uncertain performance



# Screw conveyors for crushed clinker or cement

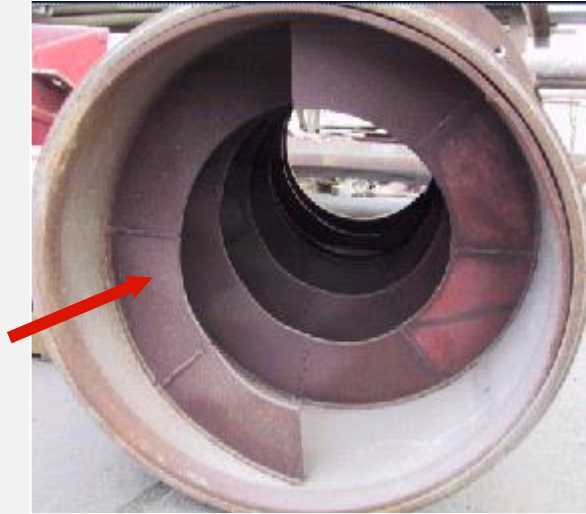
For crushed clinker or cement

Flanges made in

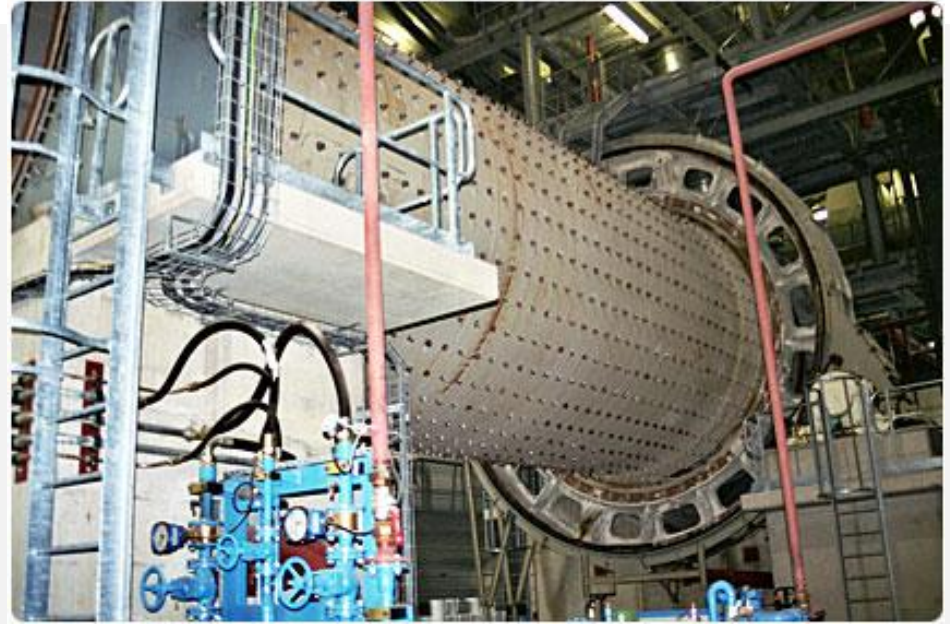
Hardox 400

Hardox 450 gives +30% wear life

Hardox 500 possible



# Ball mill



Wear protection at inlet and outlet chutes  
Hardox 500 and Hardox 550

# Wear in concrete

# Concrete mixer paddles and scrapers



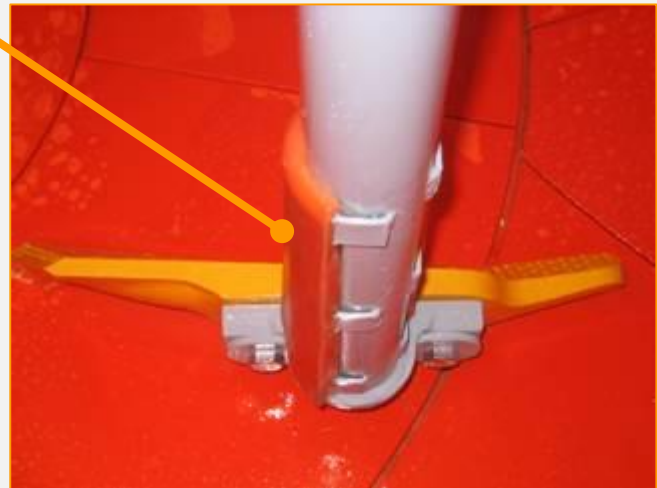
Hardox 500 hardfaced, Hardox 550 or Hardox 600 with sufficient support



# Ready mix arm liners

Less wear compared to the paddles

- HARDOX 400
- HARDOX 500
- HARDOX 550
- HARDOX 600 can be an alternative if the support is good and if they don't need to be bended



# Mixers

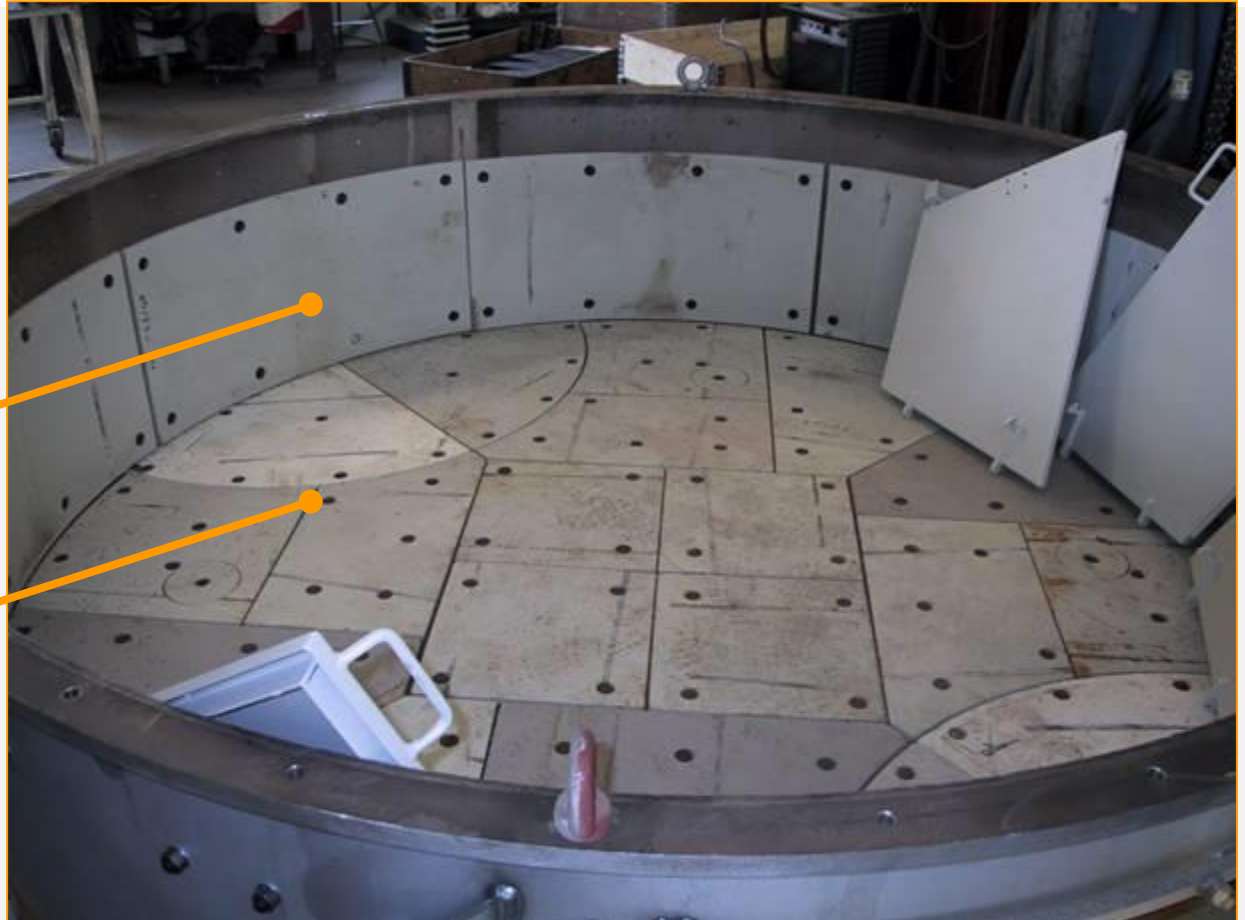
## Side plates

Hardox 400  
Hardox 450  
Hardox 500  
Hardox 550

Bended !!!

## Bottom plates

Hardox 500  
Hardox 550  
Hardox 600



Tests ongoing in Denmark with Hardox Extreme

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# Concrete mixer

**HARDOX®**  
WEAR PLATE

**STRENX®**  
PERFORMANCE STEEL



Hardox 450

Spiral / Fins

Drum / Barrel

Nose Cone

Hopper

Collector

Chute

Strenx 700 MPa

Pedestal

Subframe

Pedestal

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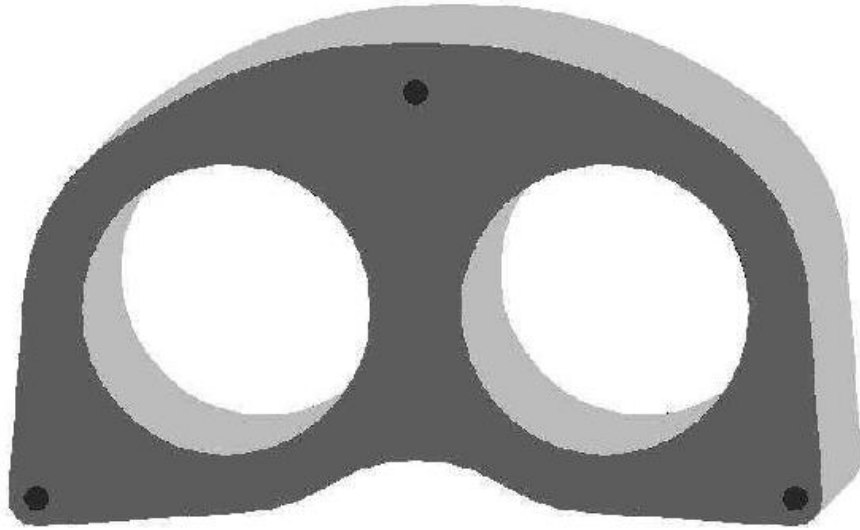
# Concrete pump trucks

## Structural steel

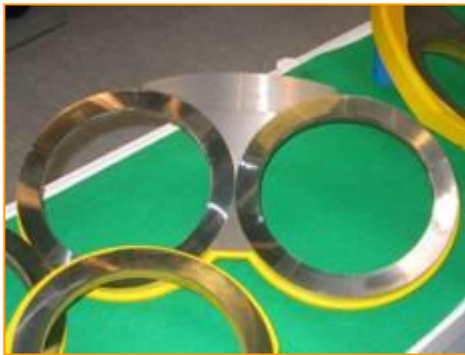
- In some areas Strenx 700, Strenx 900 but even Strenx 960 and 1100
- Hardox tubes



# Valve for pumping element



Hardox 600 35 mm instead of castings



Hardox 500 and 600 instead tungsten carbide

# Drain chute

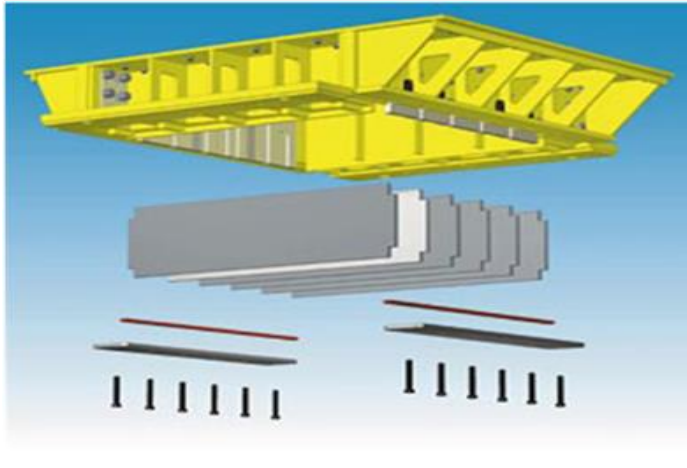


Drain chute to load the trucks. HARDOX 450

# Moulds



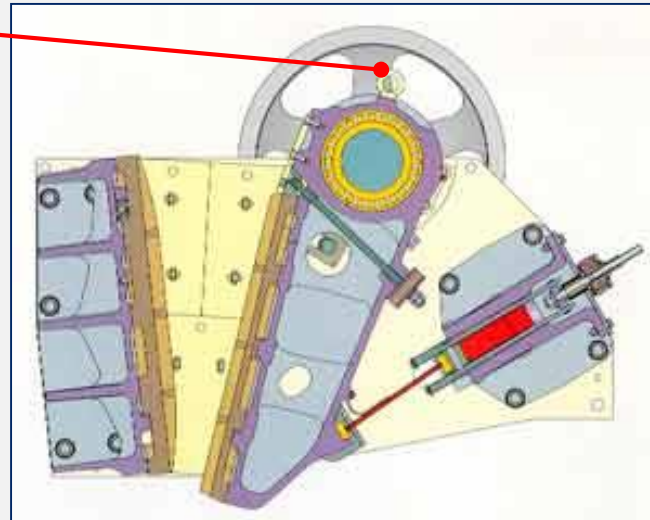
6 mm HARDOX 600  
Liner plates before and after Hardox Extreme



Toolox 33 or 44 nitrided  
65 HRC after nitriding

# Jaw crusher

Liner plates in Hardox 550 or Hardox 600.  
Double lifetime compared to Mn castings  
Cheek plates



# Clinker crusher

Directly after cooling bed temperature  $\sim 100^{\circ}\text{C}$

Liner plates  
HARDOX 450  
HARDOX 500



Grating  
HARDOX 450  
HARDOX 500



# Clinker conveyor

Originally S355

Hardox 450 + 40% wear life



# Clinker chute

Often made in hard faced material  
Hardox 550 or 600



# To keep in mind

- ▶ Understand the material processed and what kind of wear it imposes to the different applications
- ▶ Be aware of areas where temperature over 250 degrees
- ▶ Service life needed → less downtime and repair
- ▶ Weight saving → more payload and less fuel consumption
- ▶ Total wear cost
- ▶ Availability and flexibility
- ▶ What support and service do you need
- ▶ Processing Hardox and other SSAB products

**HARDOX®**  
WEAR PLATE

**HARD  
AND  
TOUGH**

**SSAB**

**SSAB**



*A stronger,  
lighter and more  
sustainable world*