

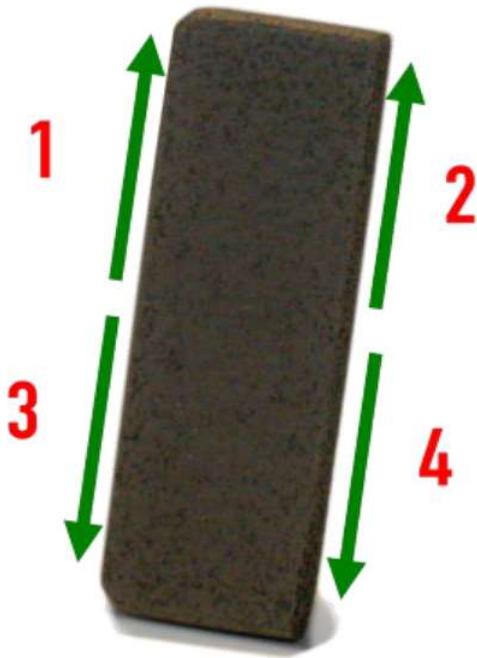
FEROBIDE

Key Benefits



- ▶ World's hardest weldable material
- ▶ Easy to apply through welding
- ▶ Comparable to tungsten carbide in sliding wear applications
- ▶ Higher abrasion resistance than any other weldable material
- ▶ Increases process reliability
- ▶ Increases application flexibility

Welding

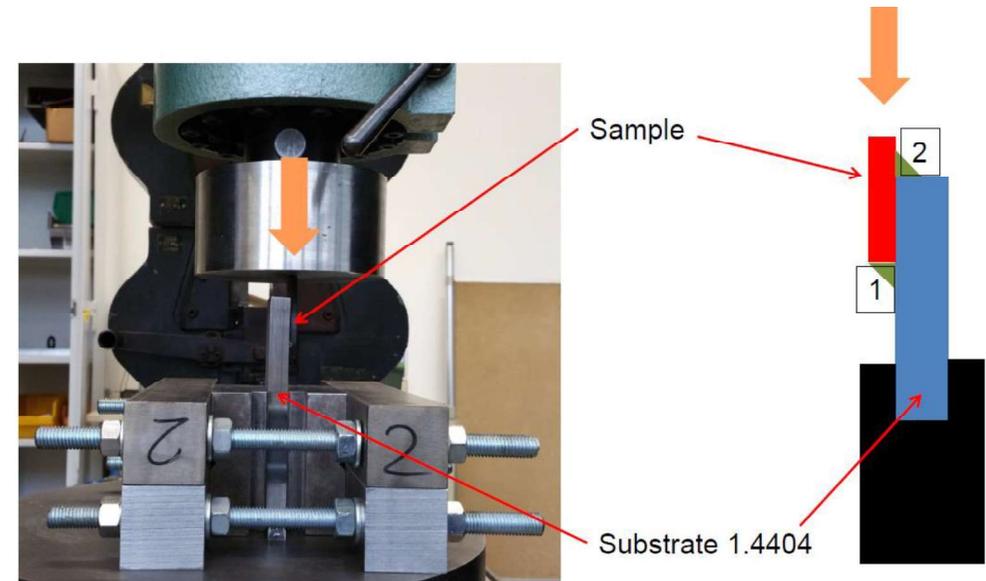


- ▶ MMA and MIG for best results
- ▶ Any electrode will do but dissimilar metal yields strongest joint
- ▶ Keep heat input to a minimum
- ▶ Clamp tile before welding, any gaps to substrate can cause cracking
- ▶ Weld in passes from middle of the longest side

Typical weld strength

Sample	Welded surface		
1591513A	1	2,2x2,2x41,4mm	Force 70kN
	2	2,4x2,4x41,4mm	368MPa
1591515B	1	2,4x2,4x41,4mm	Force 78kN
	2	2,6x2,6x41,4mm	377MPa

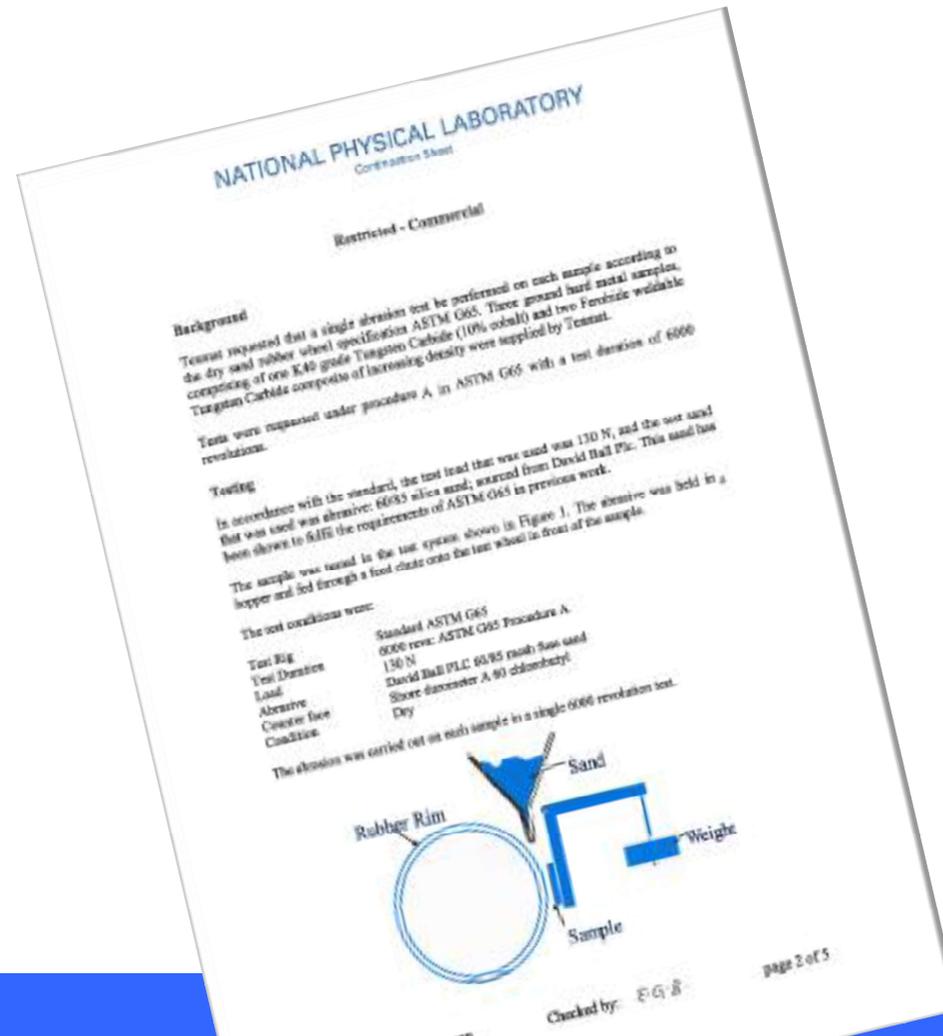
Sample	Welded surface	Force	Distance
1591513A	2,2x2,2x41,4mm	70kN	1.35mm
1591515B	2,4x2,4x41,4mm	78kN	1.45mm



Welding Ferobide will yield a stronger bond, 370 MPa, than brazing conventional WC

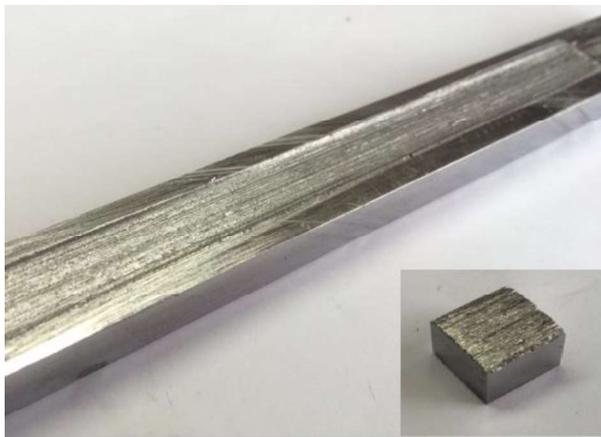
Wear performance

Typical results in ASTM G65 tests is 3mm³ of wear, comparable to that of high cobalt content tungsten carbide.

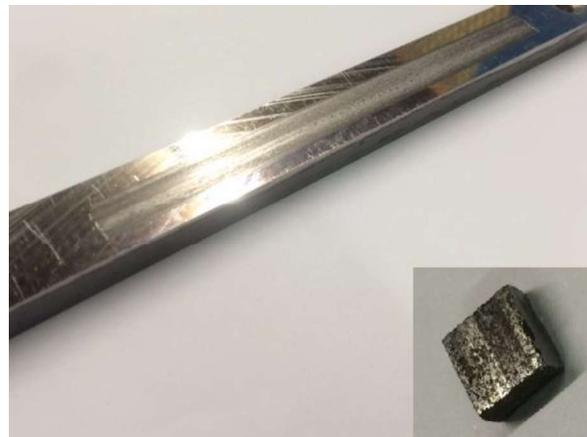


Sliding wear against steel

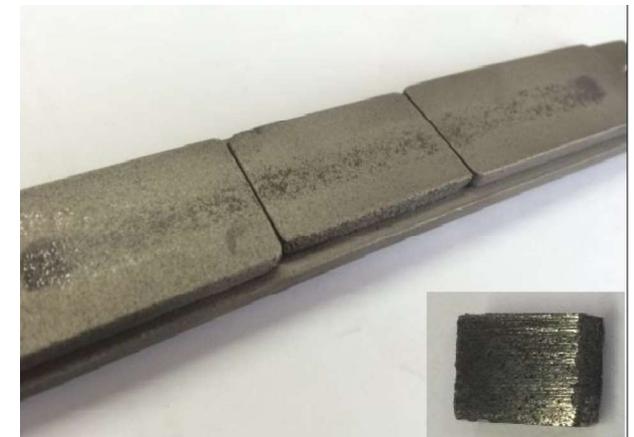
Sliding wear performance	Wear of pad in mm per km	Relative wear performance vs steel on steel	Wear of counterface in mm per km	Relative wear performance vs steel on steel
Hardened steel pad on hardened steel counterface	22.8	-	7.6	-
Ferobide pad on hardened steel counterface	0.03	711 times longer life of pad	0.4	19 times less wear of counterface
Ferobide pad on Ferobide counterface	0.3	79 times longer life of pad	n/a	n/a



Steel on Steel



Ferobide on Steel



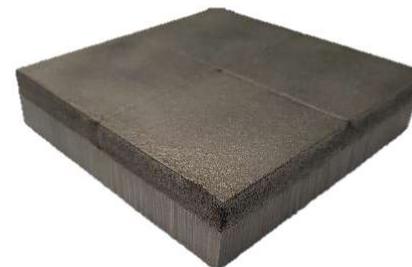
Ferobide on Ferobide

→ Ferobide sliding on steel will last about 700 times longer than conventional hardened steels whilst the counterface will wear 19 times less

Availability

4mm thickness	6mm thickness	8mm thickness	12+mm thickness
8 x 40	-	-	-
15 x 40	15 x 40	15 x 40	-
25 x 60	25 x 60	25 x 60	25 x 60
40 x 40	40 x 40	40 x 40	40 x 40
200 x 40	200 x 40	200 x 40	200 x 40
200 x 200	200 x 200	200 x 200	200 x 200

2D shapes possible with tooling:



Applications

Ferobide gives tungsten carbide-like performance in sliding wear applications such as:

- Scrolls
Decanter centrifuges, screw presses, screw transporters, augers
- Skids
Cold planers, road sweepers, mowers, ski-doo's, etc.
- Ground engaging tools
Agriculture and construction, scrapers, legs (rippers), TBM cutterhead, etc.
- Conveyors
Flights, chain guides, etc
- Others
Cement deflectors
Pipe bends
Excavator Buckets
Crawler width adjustment sliding bearings
Rails for ceramic tiles and bricks
Metal on metal sliding wear

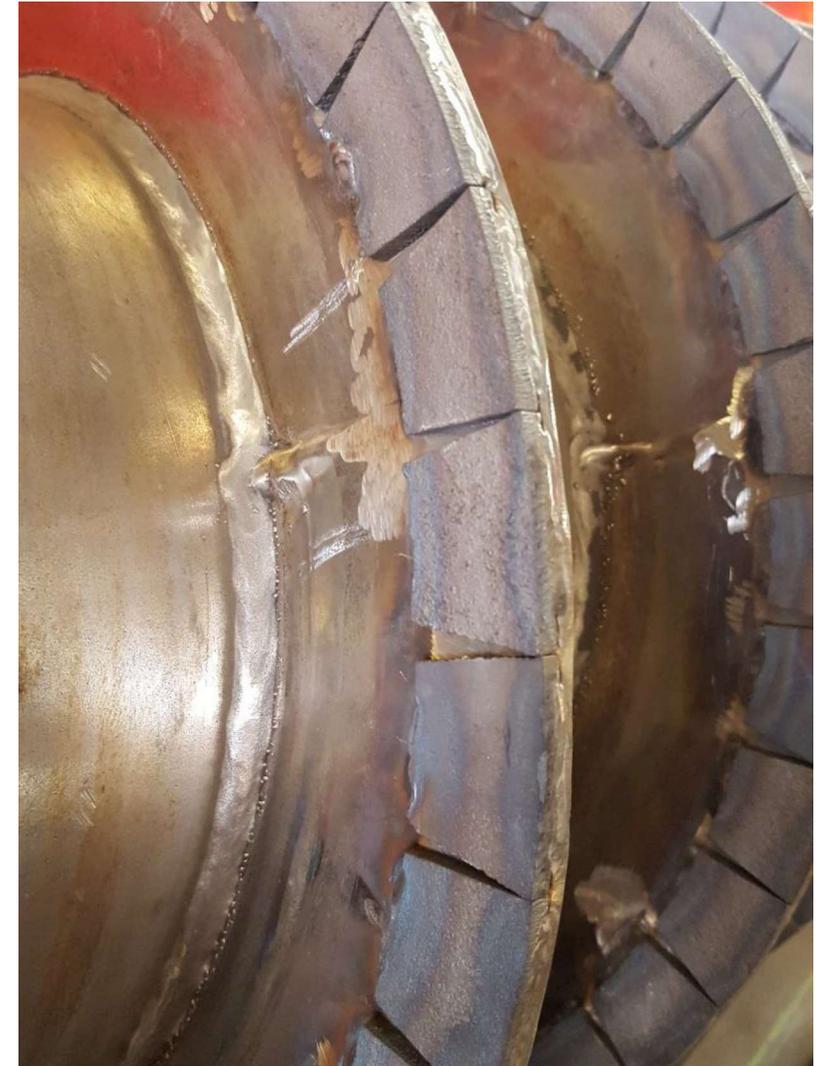
Decanter centrifuge scroll

Brief

- ▶ **Customer:** OEM
- ▶ **Competition:** Tungsten carbide
- ▶ **Location:** UK
- ▶ **Result:** No chipping, no tile delamination. The machine ran for 4 years before retiling.



FB tiles tack welded into position



Tiles fully welded

Decanter centrifuge scroll



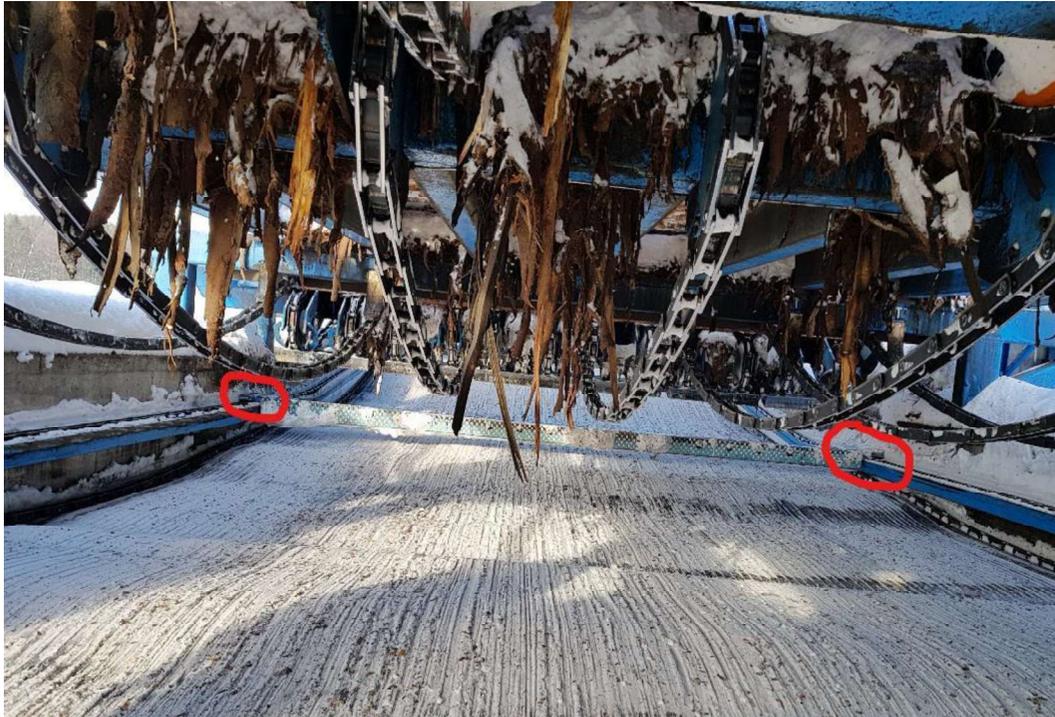
Decanter centrifuge scroll



Log deck scraper chain pads

Brief

- ▶ **Customer:** Sawmill in Norway
- ▶ **Competition:** -
- ▶ **Result:** No measureable wear after 6 months



Position of Ferobide



Ferobide welded to link on chain – after 6 months

Roller scrapers

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** 500 HB Boron Steel
- ▶ **Location:** UK
- ▶ **Result:** 100x longer life compared to steel scrapers.



Machine with Ferobide scrapers

Ferobide scrapers: £225 plus one hours welding.
Saving: £1500 in scrapers and 60 hours in scraper adjustment time, as well as increased tractor working time by 60 hours, after 1 season.



Ferobide scrapers after 3000 acres. Operator currently at 30x longer life and thinks he can get 100x longer life compared to steel scrapers.

Roller scrapers

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** 500 HB Boron Steel
- ▶ **Location:** UK
- ▶ **Result:** No wear seen after 180 acres when steel scrapers worn out.



Top view after 180 acres

Bottom view after 180 acres



Scraper with Ferobide maintains clearance to the roller, keeping soil removal efficiency high



Steel scraper worn to a point where it needs replacement, clearance to roller too large

Subsoiler leg shins

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** Brazed WC
- ▶ **Location:** UK
- ▶ **Result:** An expected improvement of 15 times longer life.

Ferobide has been run for 400 hectares at the time of the picture and is expected to last 1200 hectares.

Conventional tungsten carbide lasts 80 hectares due to chipping and that the steel becomes soft during brazing.



Lime and mill scale spreaders

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** Boron steel
- ▶ **Location:** UK
- ▶ **Result:** Approx 5-6 years of life, from 1 day of life



Spreader blade after 1 day of working, fitted with 1 row of Ferobide tiles. Steel worn through.



Spreader blade with 3 rows of Ferobide after 1 year in operation, throwing 10,000 tons of lime and 300 tons of steel mill scale. Approx life another 5 years.

Subsoiler leg shins

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** Boron steel
- ▶ **Location:** UK
- ▶ **Result:** 2.5 times less wear by weight of components after 123 ha



Subsoiler machine, working depth is 375mm
Land is dry and very abrasive.



Shin with
Ferobide

Shin without
Ferobide



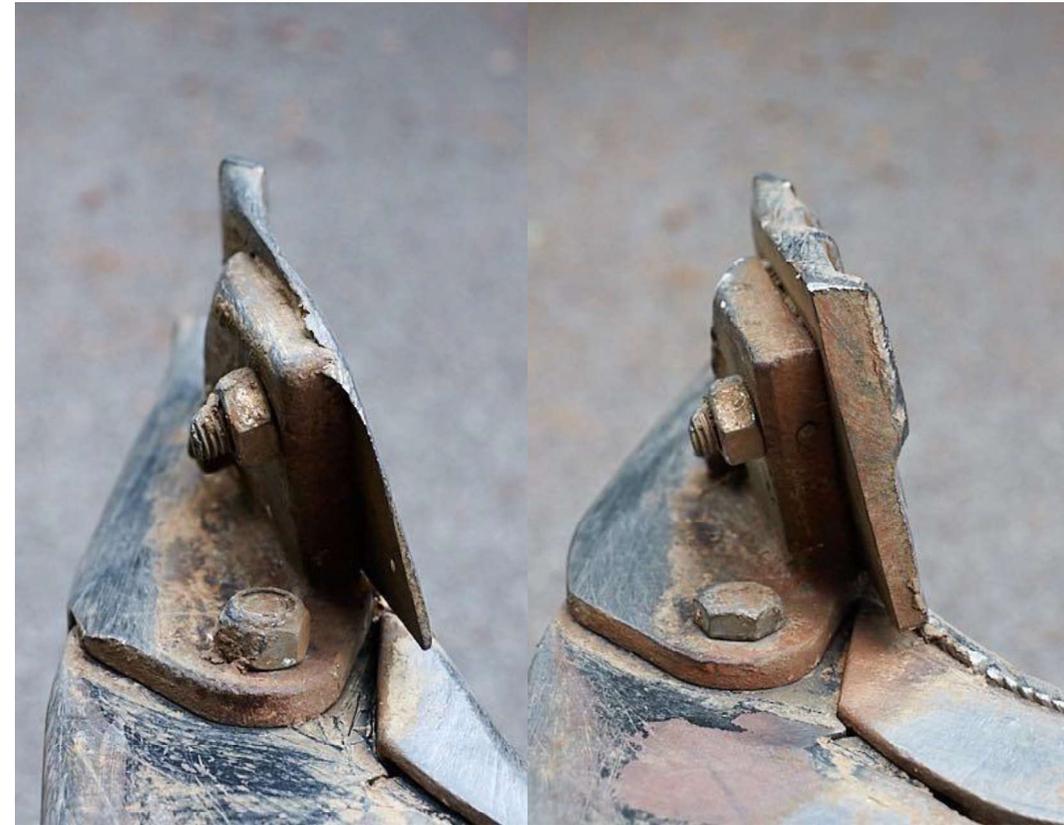
Shin with
Ferobide

Shin without
Ferobide

Subsoiler wings

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** Boron steel
- ▶ **Location:** UK
- ▶ **Result:** 2.4 times less wear by weight of components after 123 ha



Wing without Ferobide
- Worn out

Wing with Ferobide
- Base steel thickness
almost like new

Plough point

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** -
- ▶ **Location:** UK
- ▶ **Result:** 65g weight loss after a few weeks of ploughing with Ferobide versus 1.5kg with no Ferobide



Ferobide welded onto the 450-500 HB steel body

These two plough points completed 180 hectares on the same plough at the same time.

The point on the right had been treated with welded hard facing, the point on the left with Ferobide. The right hand point lost 1.5kg, the left hand point with Ferobide lost 65g.



Pipe reinforcement

Brief

- ▶ **Customer:** Cement manufacturer
- ▶ **Competition:** 450 HB Boron Steel
- ▶ **Location:** Sweden
- ▶ **Result:** Significantly increased life of repairs, 5x and counting.

Ferobide tiles welded



The maintenance manager:

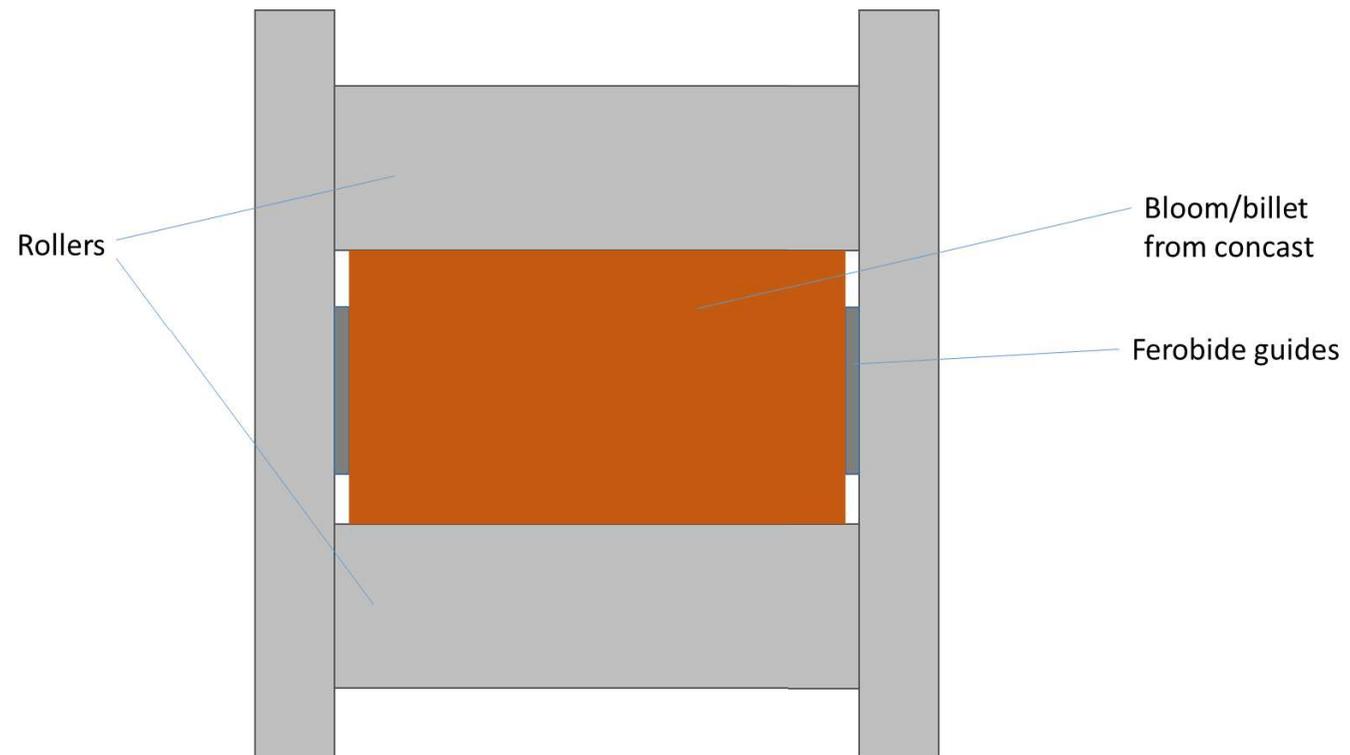
“A good solution for repairing holes due to concentrated wear! In this case the cement grit is only flowing against the area where the Ferobide tiles are welded. These tiles have a good hardness and are ideal as a wear resistant surface.”

(The old repair patches can be seen under the Ferobide tiles and they did not last nearly as long as Ferobide)

Concast guide pads

Brief

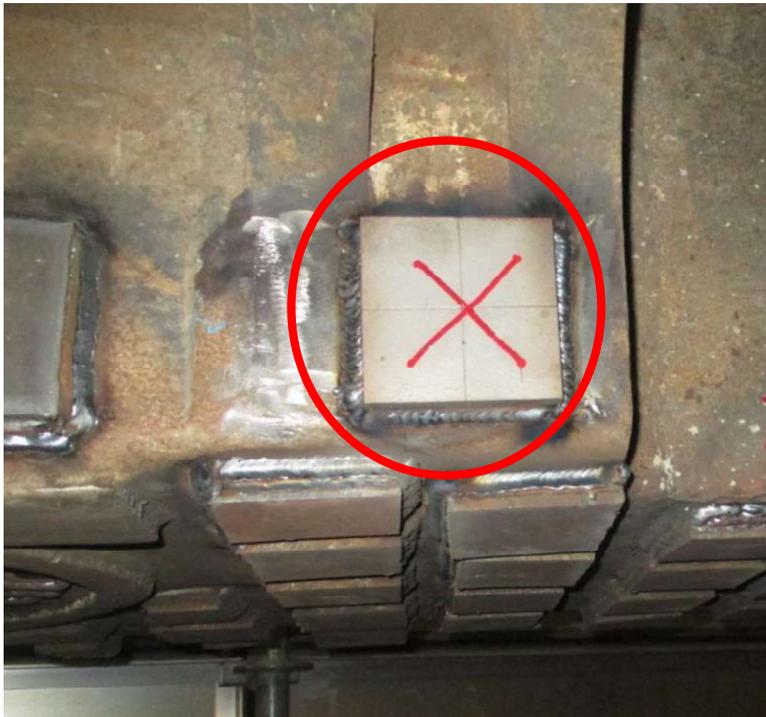
- ▶ **Customer:** Steel mill
- ▶ **Competition:** Stainless steel
- ▶ **Location:** UK
- ▶ **Result:** No gauging after 6 months in operation



Tunneling – TBM cutter head protection

Brief

- ▶ **Customer:** TBM OEM
- ▶ **Competition:** Overlay plates
- ▶ **Result:** 2mm wear after 8km of tunneling, competitor plates needed hardfacing



As welded



After 8 km

Mower skids

Brief

- ▶ **Customer:** Alfalfa Farmer
- ▶ **Competition:** 450 HB steel
- ▶ **Location:** Egypt
- ▶ **Result:** Increased life from having to replace skids every 10h shift to being on a life of 21 days and counting (42 shifts).



Ferobide creates dirt pockets and protects the steel skids

Asphalt cold milling skids

Brief

- ▶ **Customer:** Asphalt cold milling contractor
- ▶ **Competition:** Boron steel
- ▶ **Location:** UK
- ▶ **Result:** No wear seen after 5 months of use, at which time the steel skids needed replacement.



FEROBIDE on rear of plate

FEROBIDE on front of plate

Asphalt cold milling shoes

Brief

- ▶ **Customer:** Asphalt cold milling contractor
- ▶ **Competition:** 400 Brinell steel or crushed carbides
- ▶ **Location:** UK
- ▶ **Result:** Still in operation after 6 weeks, when steel skids are completely worn out. Crushed carbides lasts 12 weeks. Test ongoing.



Asphalt cold milling shoes



Ferobide in photo welded to AR400 steel, used for 4 months and still in good shape

Tree stump grinder

Brief

- ▶ **Customer:** Tree stump grinder contractor
- ▶ **Competition:** Boron steel
- ▶ **Location:** Belgium
- ▶ **Result:** Easy to apply for repair jobs, little wear after 800h of running.



Before repair, after 200 hours



Repaired with Ferobide



After 800h

Cultivator point

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** -
- ▶ **Location:** UK
- ▶ **Result:** More than doubled the life of the tool

Ferobide as a complement to WC. Ferobide helps protect the life of the steel body and more than doubles the life of the component.

Ferobide welded in rows onto the steel body



Sugar cane harvesters

Brief

- ▶ **Customer:** Wear parts manufacturer
- ▶ **Competition:** Hardfacing rods
- ▶ **Location:** Australia
- ▶ **Result:** Still ongoing. Good wear resistance and fast repair time vs hardfacing if operator hits irrigation pipes, boulders, etc.



Harvester disc



Ferobide fully welded around the disc

Cane harvester tips

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** Hardfacing
- ▶ **Location:** Australia
- ▶ **Result:** Increased life from 1-2 weeks to 4-6 weeks using Ferobide.



Current hardfaced tips



Ferobide tips after 4 weeks



Location of the tips

Cane harvester shoes / skids

Brief

- ▶ **Customer:** Farmer
- ▶ **Competition:** Hardfacing
- ▶ **Location:** Australia
- ▶ **Result:** Very little wear to shoes after one season – capable of 2-3 seasons or more. Skids have remained flat – with hardfacing they would have worn into a curve.



Ferobide after one season



Ferobide after one season

Bucket edge pads

Brief

- ▶ **Customer:** Poultry Farmer
- ▶ **Competition:** Hardened steel
- ▶ **Location:** France
- ▶ **Result:** 250 hours of life with one 40x40x6mm tile in each corner, working on mostly concrete floor, stopped rounding of the steel.



Tile as welded in corner of bucket edge



After 200h

Cement batch mixer scrapers

Brief

- ▶ **Customer:** Manufacturer of cement pipes
- ▶ **Competition:** Hardfacing
- ▶ **Location:** Australia
- ▶ **Result:** 3mm of wear after 16 weeks – capable of outlasting hardfacing by approximately 3-4 times with the added benefit that mixer paddles also last longer.



Ferobide scraper as welded



Hardfaced scraper after
12 weeks – worn out



Ferobide scraper after 16
weeks – can do 50 weeks

Shredding / mulching

Brief

- ▶ **Customer:** Banana farmer
- ▶ **Competition:** Hardfacing
- ▶ **Location:** Australia
- ▶ **Result:** Currently on trial



Full shredder, Ferobide in the red circle



Ferobide tiles welded to the cylinder

Iron Ore – Chute

Brief

- ▶ **Customer:** Wear protection installer
- ▶ **Competition:** Casted carbides
- ▶ **Location:** Germany
- ▶ **Result:** Better erosion wear resistance than casted carbides.

Ferobide was mounted next to casted carbides to protect a chute in an iron ore processing plant. After 4 months, very little wear could be seen on the Ferobide plate, while the competitor casted carbides had worn ~5mm

