HARDOX
TechSupport

Information from
SSAB Oxelösund

#62

SPECIAL VERSION
Wear Technology Group™

DEAD BED CONCEPT

Design against wear is one very efficient way to increase the cost performance in applications exposed to severe wear. Redesign with the dead bed concept leads to lighter applications and the possibility to increase load capacity. In most cases, the service life of the wear part will also increase. Without the dead bed openings, rocks slide over a plate causing scratches along the entire plate.

"The dead bed concept basically allows the material to wear on itself"

How does the dead bed concept work?

Bars attached to a plate perpendicular to the material sliding direction create the dead bed function, Fig 1. Abrasive materials such as sand, small stones or similar fine particles will be trapped in the boxes as seen in Fig 2. In the area between the bars the abrasive particles wear on themselves. The wear is located only on the top of the bars and the edge because the sand slides on the steel bar. The result is that wear rate per steel volume is much reduced compared to a flat plate.

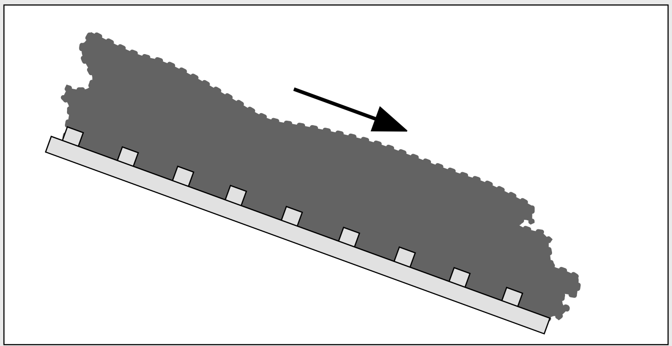

Figure 1

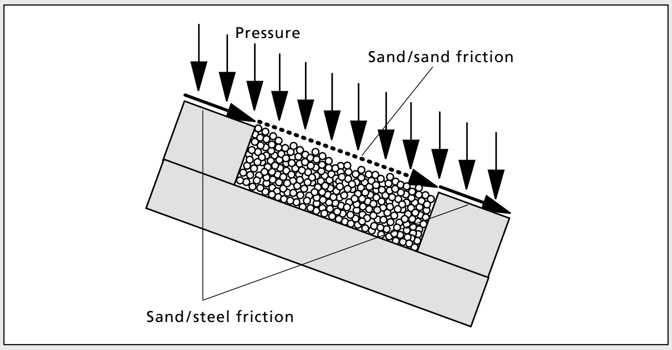

Figure 2

If the rocks are of baseball size as seen in Fig 3, the shear flow line is located a bit above the bars. Beneath the shear flow line, the material doesn't move, but wiggle when layers of rocks slide above. Most wear takes place on the top of the bars but the rocks carry a high load and the wiggling may cause indents in the box floor. In comparison, sand or dust material cause almost no wear on the box floor.

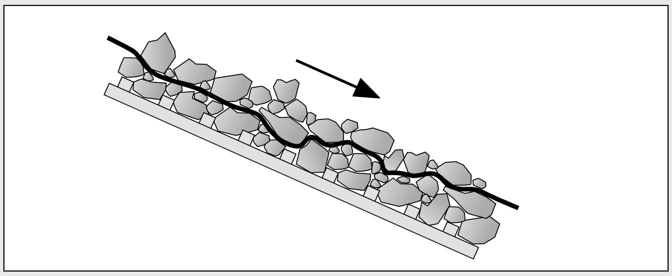

Figure 3

If the rocks are too big to fit in into the boxes, the rocks can start to rotate. A rotating rock normally leaves less indent than a sliding rock. The rotating speed should be as constant as possible. If the bars are mounted in a way that influences the rocks momentum too much, the rocks will leave dents in the bars. If the material is a mix of different sizes of rocks and sand or just larger rocks, the best practice is to use low bars and a narrow gap between the bars.

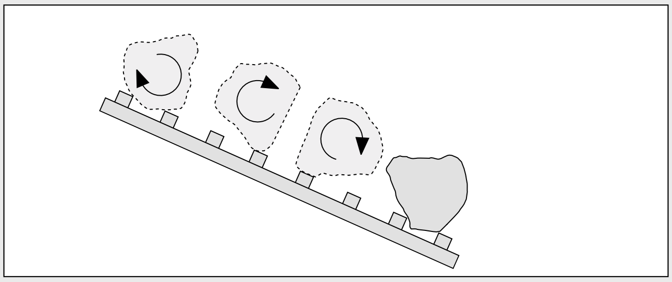

Figure 4

When the material slides against itself the irregular shape will cause a locked structure, which requires increased force to move the material. In practical terms, this means that the speed of the material is reduced, causing a reduction in capacity, for example a chute. If the material is wet there is also a risk of clogging. In tippers or truck boxes the described phenomenon has no effect on the capacity.
In some applications, the material falls down on a plate changing the materials flow path. The materials speed decreases when it hits the plate, and the drop in kinetic energy results in wear on the plate. A dead bed box is created by welding a bar of HARDOX as shown in Fig 6. The wear problem is reduced dramatically but the speed of the material is also reduced which decreases the capacity. The material will accumulate in the dead bed box until equilibrium is attained at a certain slope. Widening the plate is also a possible way to compensate if the capacity is insufficient.

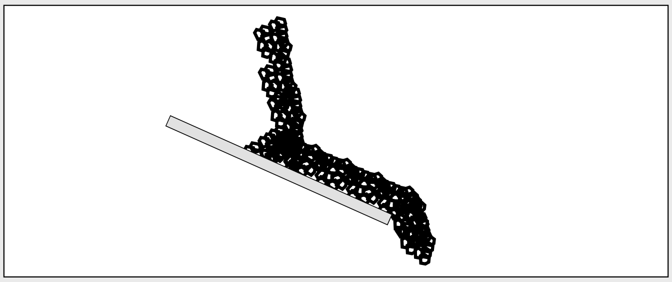

Figure 5

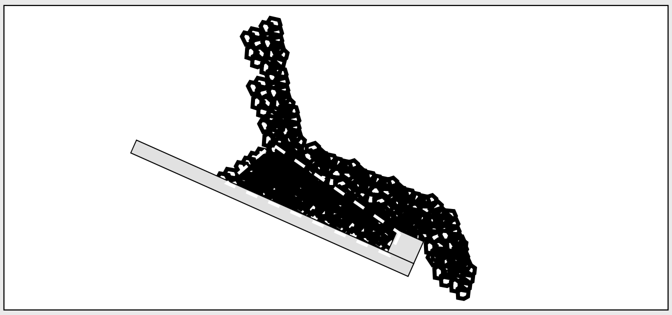

Figure 6

Dead bead liner

The latest design of dead-bed liner plates are made of HARDOX 500 or HARDOX 450 as liners in truck boxes. Also, tests with HARDOX 550 have been carried out with excellent results, but the choice of the right steel grade can best be made by employing the Relative Wear Method and the WearCalc program together with SSAB Oxelösund application engineers. The liner is welded along the outer edges and plug welded at selected locations. It is advisable, if practical, to fit the plate edges tightly together where the edges of the plates are parallel to the material flow direction, and weld only the edges that are transverse to material flow. This will eliminate erosion of welds by abrasion.

A hypothetical calculation

Figure 7

Ordinary liner

A truck box initially has 200 ton capacity. The box is lined with HARDOX 400 20mm thick and the liner is consumed when 70% of the weight is worn off. The average load capacity becomes 188.5 tonnes after lining the box. The liner cost is $40 000. When the box has been lined, the hauling capacity is about 1 995 000 ton/year at a cost of $1 660 600. The cost/ton is calculated to be $0.8324/ton

Dead bed liner

The dead bed liner is made from HARDOX 450 20mm with 53% of the weight cut out as seen in the Fig 7. The liner is consumed when 70% of the weight is worn off and this gives an average load capacity of 194.9 including the trapped abrasive material in the boxes. The liner costs $44 000 plus maintenance of $11 000.

The yearly hauling capacity is increased to 2 063 000ton/year at a cost of $1 675 600. The cost/ton is reduced down to $0.8122/ton

In a case of unchanged mine production capacity the yearly cost is $1 622 410 which is less than the ordinary liner. So the dead bed liner gives, in case of unchanged production, lower yearly cost but there is also an option to increase the production at lower cost per ton according to the calculations. If hauling is a bottle neck, the profit will increase even more because the whole production line will be better optimised.

To summarise, dead bed concept to reduce wear is, in many applications, the perfect solution for long service life or increased capacity.