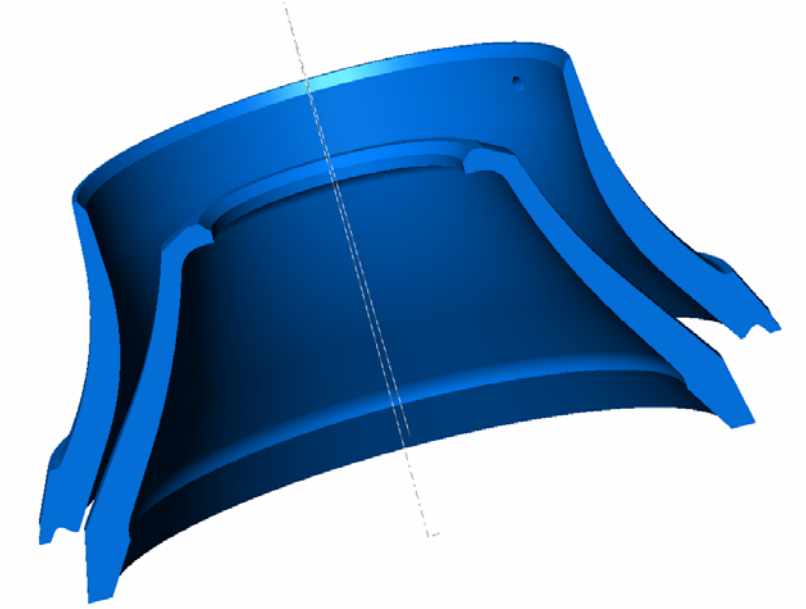
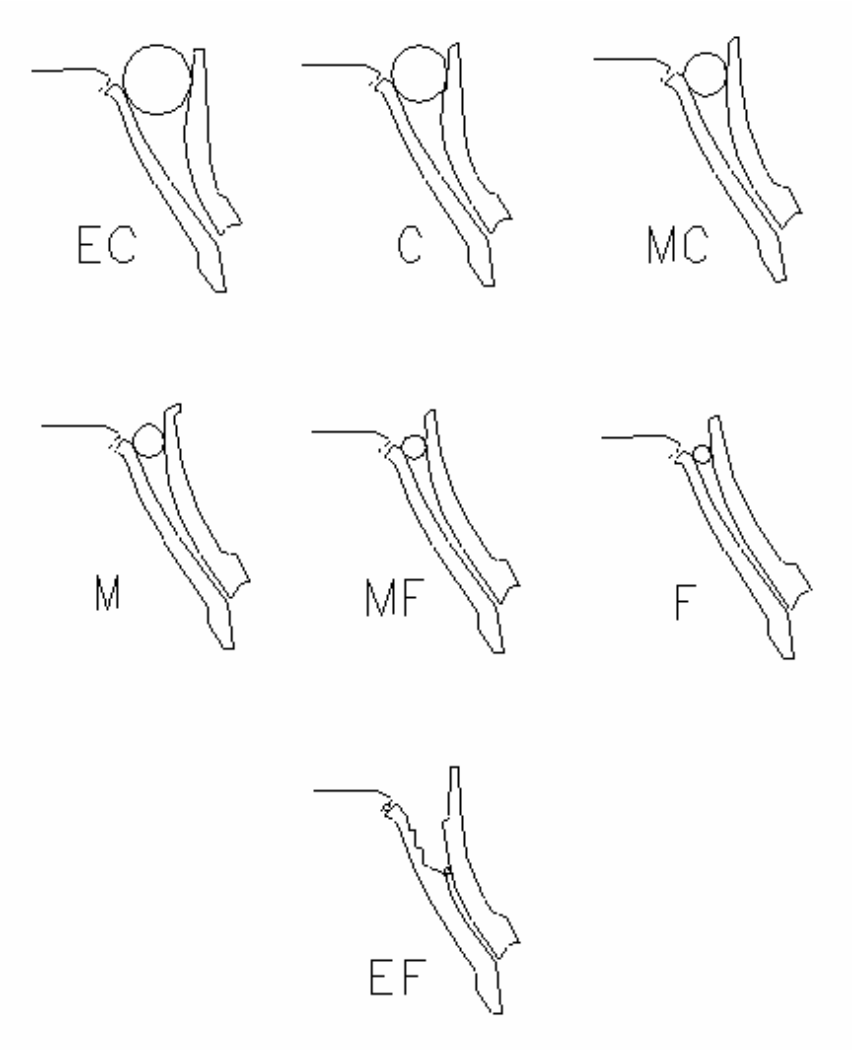
Wear Parts for Cone and Jaw Crushers

How to choose wear parts?

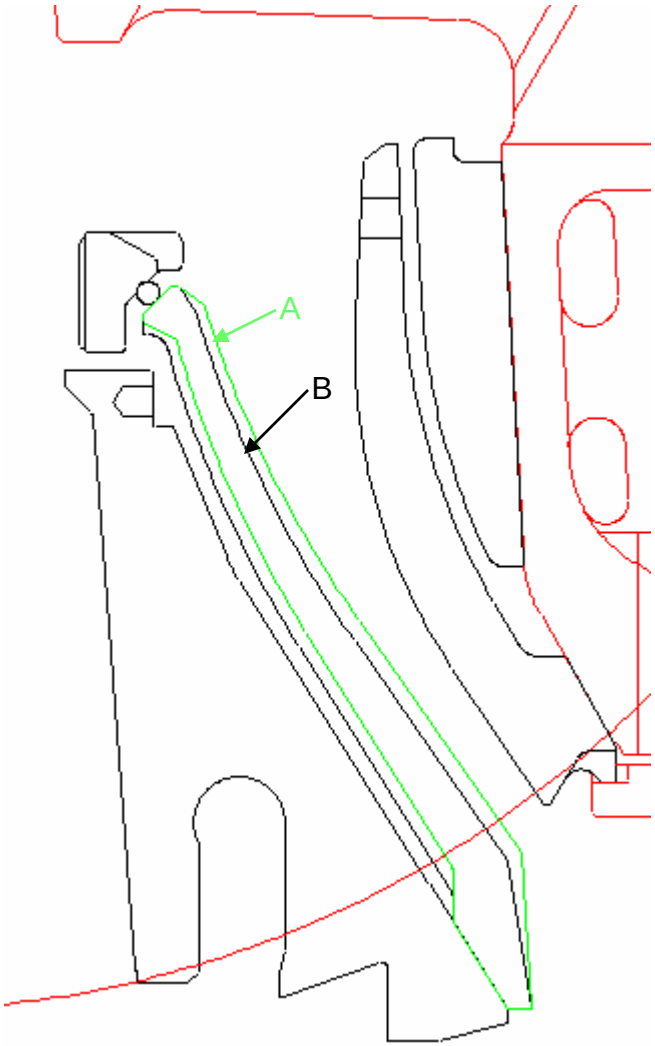
- Castability of wear part?
- Abrasiveness of rock material (AI)?
- Risk of high impact loads during service?
- Work index (WI) of incoming material?
- What degree of expansion during work can be accepted (and expected)?
- Type of crusher?
- Type of crushing (coarse / fine)?
- Size of incoming rock material?
- Operational parameters for the crusher?
- Any tests made on other wear materials?

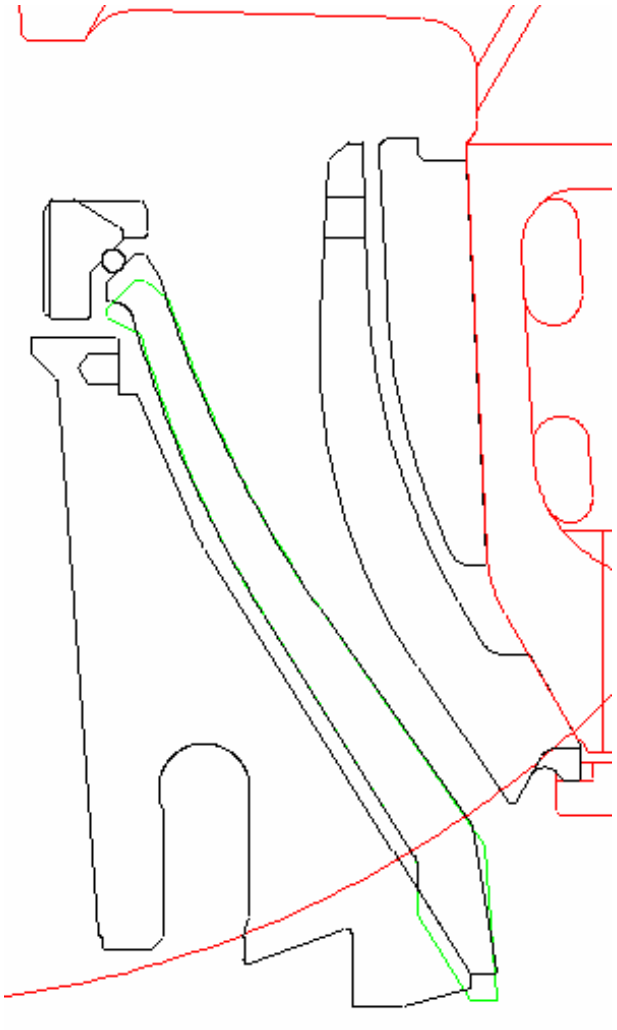
Crushing chambers for Hydrocones





Mantle – Difference between A and B





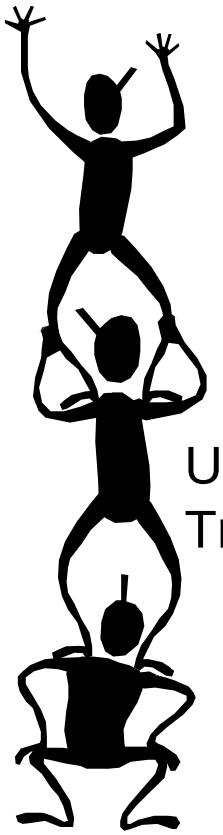
Mantle – A or B

A-Mantle:

- **Used with small setting and small throws.**
- **Used wrongly means that large enough setting can not be obtained. Piston in bottom position.**

B-Mantle:

- **Used with large setting and large throws.**
- **Used wrongly means poor utilization at the end of the A-dimension.**



Utilize the Travel length!

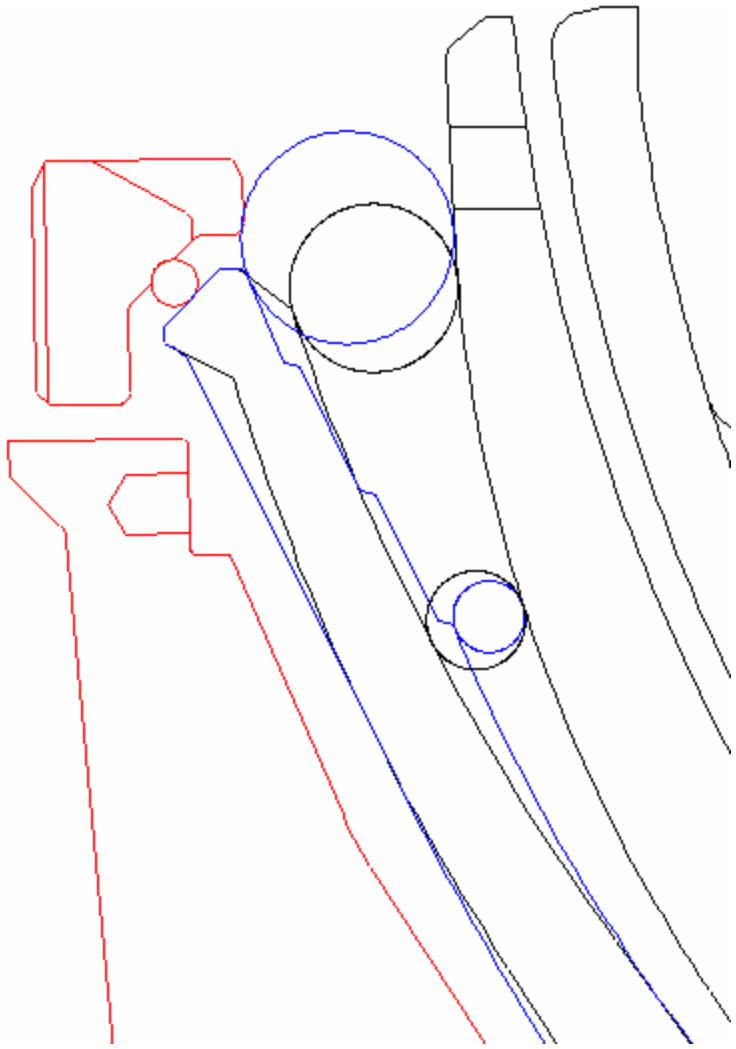
Heavy Choke (HC) - Mantle

Advantages:

- **Enable smaller settings – More reduction means less circulating load and better shape in small fractions (5-8).**
- **Larger feed opening – Marginal stones enter.**

Disadvantages:

- **Lower throughput – Especially with new liners.**



Wear problems

- **Crushing chamber selection - Concave and mantle**
- **Feed distribution**

Preventive maintenance

- **Wrong feed arrangement**
  - ✓ **Higher power usage = higher load on bearing**
  - ✓ **Lower capacity**
  - ✓ **Higher wear in the crushing chamber**
  - ✓ **Less reduction**
  - ✓ **Worse shape of final product**
  - ✓ **Higher cost**

Special Liners – 3C

3C includes:

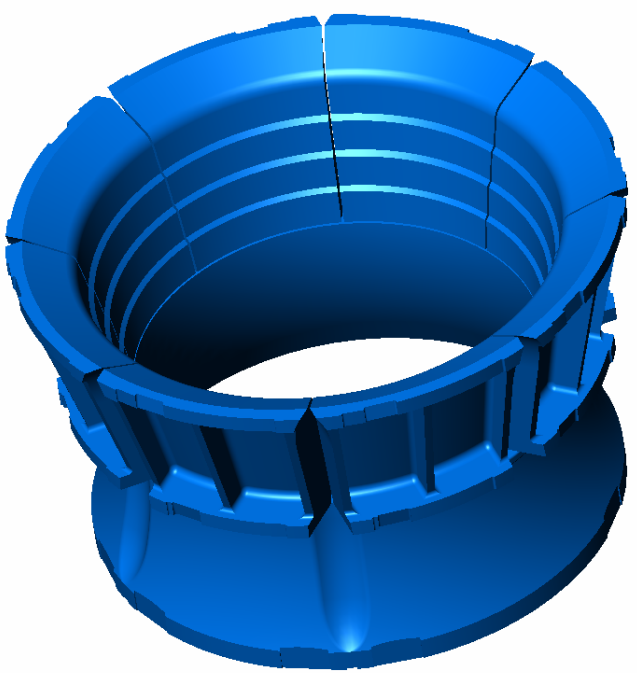
- **Crushing Technology – Solution**
- **After market – Business**
- **Production – Time**

Increased customer value:

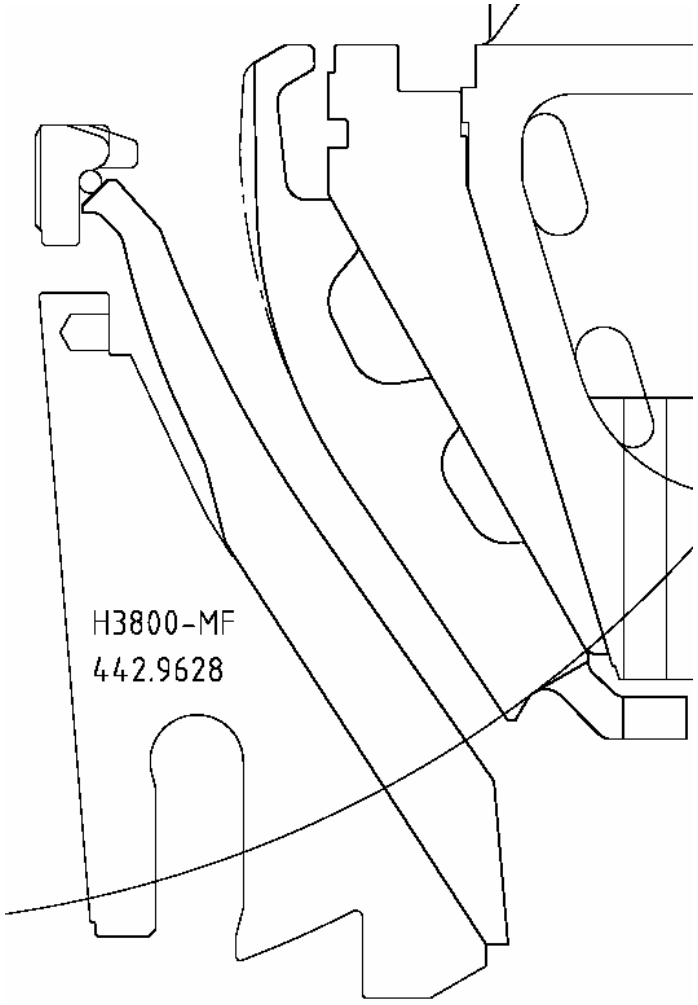
- **Longer liner life**
- **More reduction**
- **Correct setting**

Report results to

Crushing Technology Group



Special Liners



Problem:

- **Low capacity in the end of liner life.**

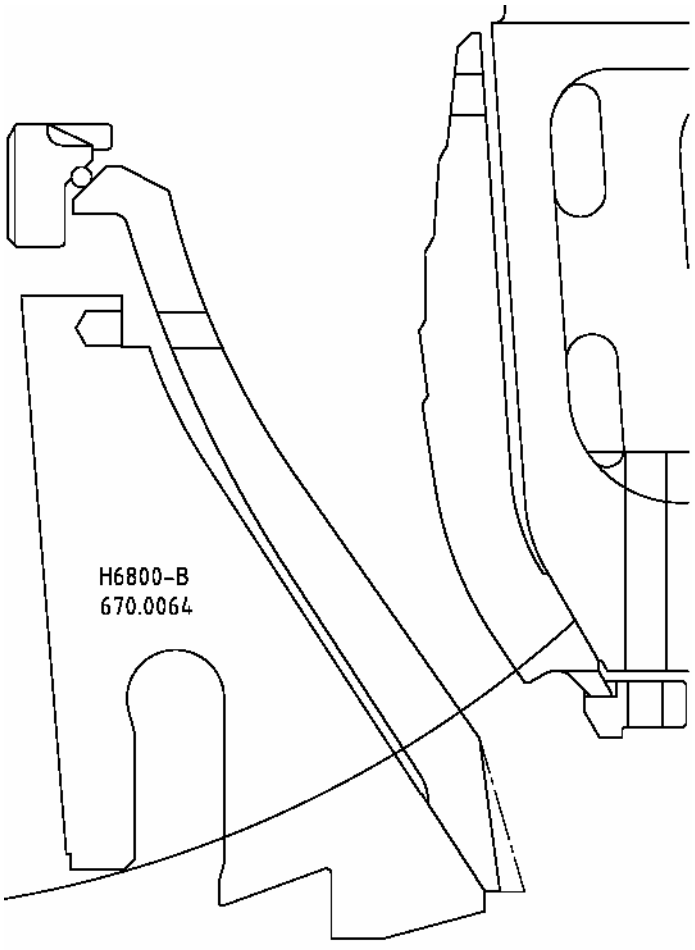
Action:

- **More vertical in the top section by machining**

Result:

- **No premature liner change – 50% increase in liner life.**
- **Full capacity all through the liner life.**

Special Liners



Problem:

- **Wear on support ring when running at large settings**

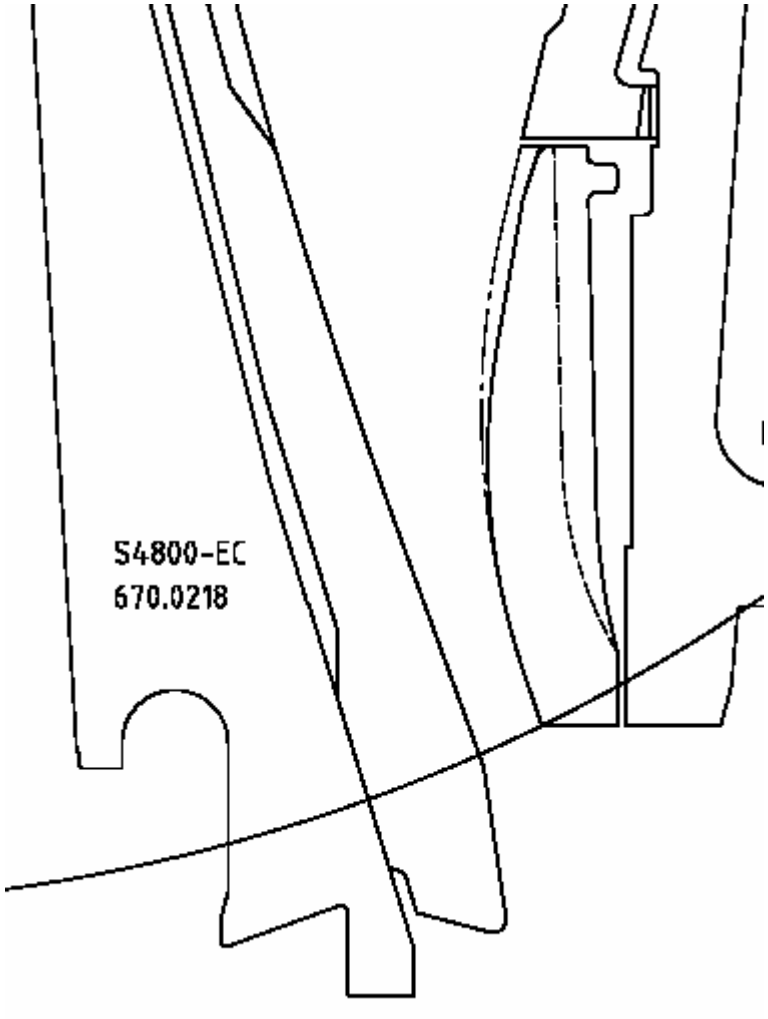
Action:

- **Machining in the bottom section to make more space from the support ring**

Result

- **No wear on support ring**

Special Liners



Problem:

- When changing only concave ring the edge creates low capacity

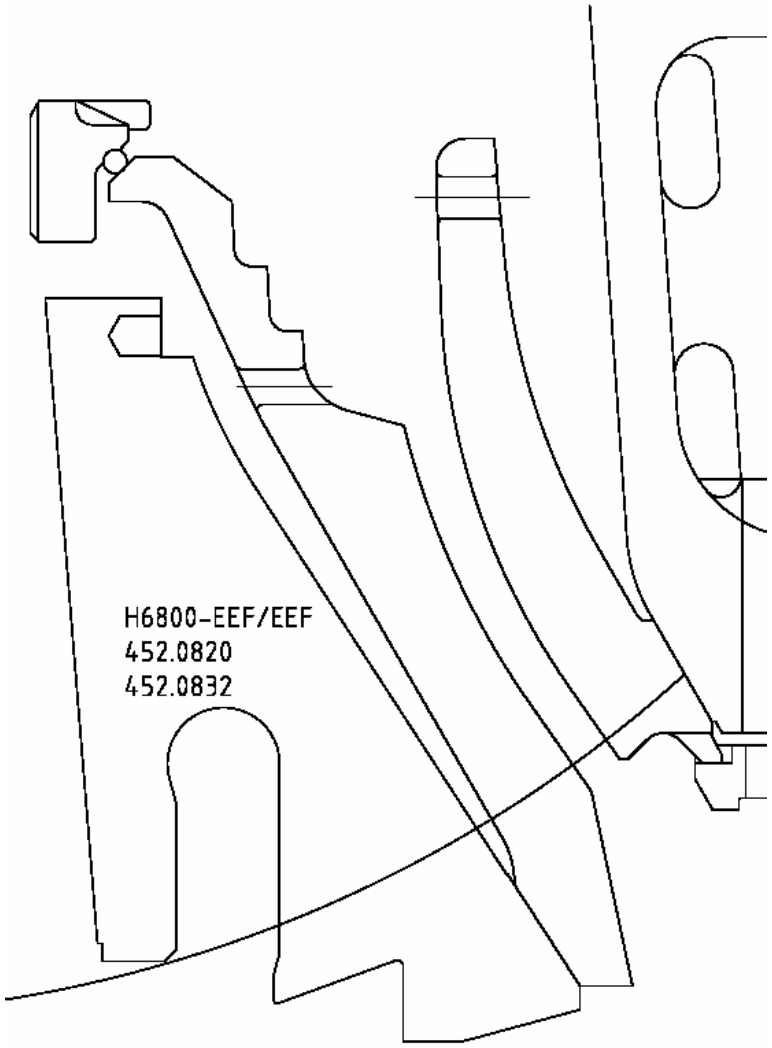
Action:

- Remove the edge by machining - maintaining nip angle

Result:

- No capacity problem
- No need for cutting

Special Liners



Problem:

- **High wear and not enough reduction**

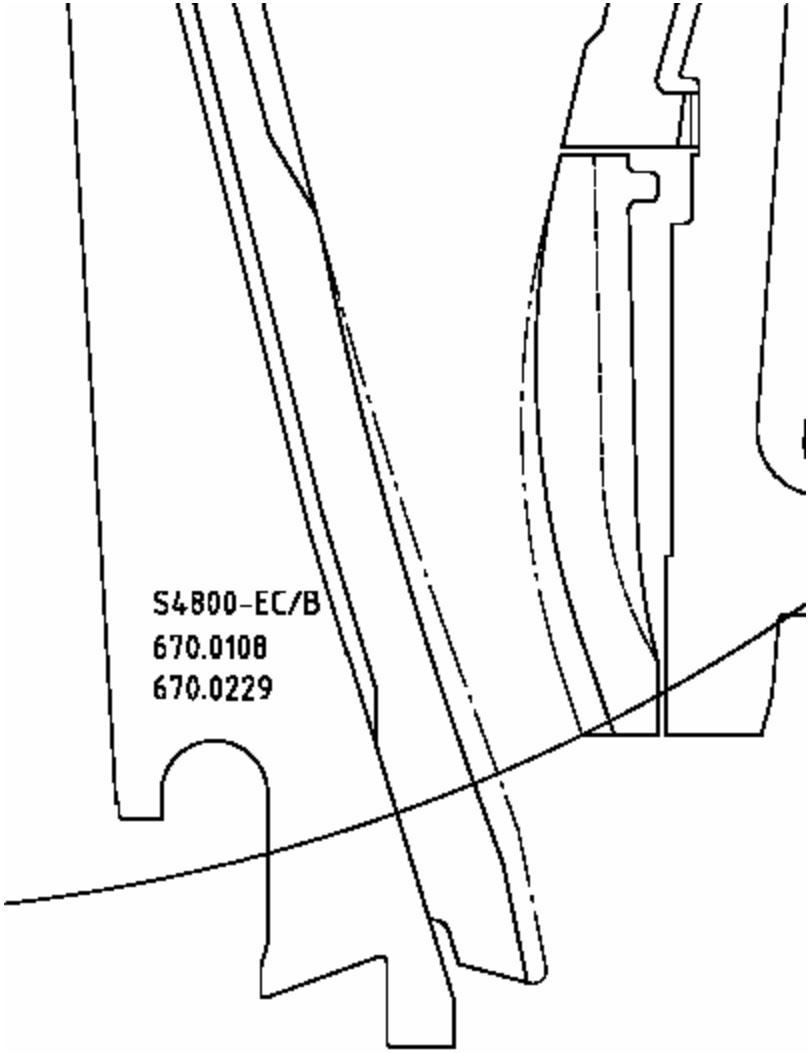
Action:

- **New patterns for both mantle and concave optimizing feed opening and thickness**

Result:

- **More reduction, %<1/4”**
- **Liner life increase with 40%**

Special Liners



Problem:

- **Customer wanted to run at 90mm setting**

Action:

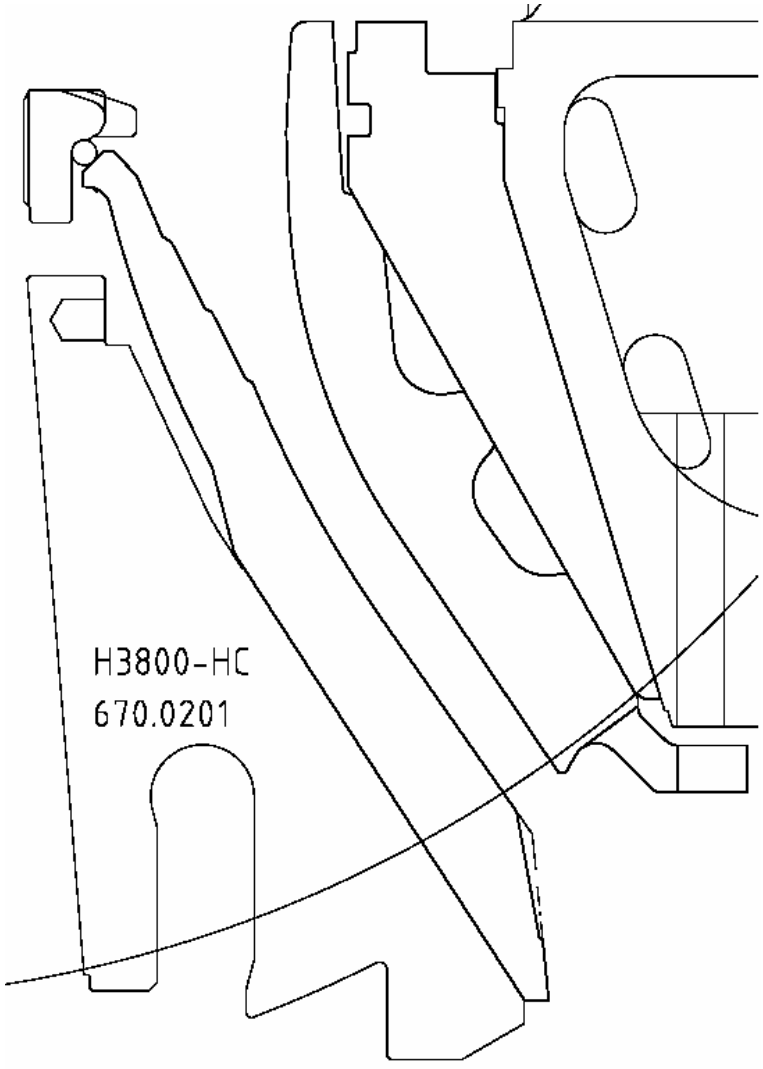
- **Machine off material to allow larger setting with new liners**

Result:

- **Crusher sold –**

  Customer satisfied

Special Liners



Problem:

- **Ski slope on mantle creating high pressure, large setting and low capacity**

Action:

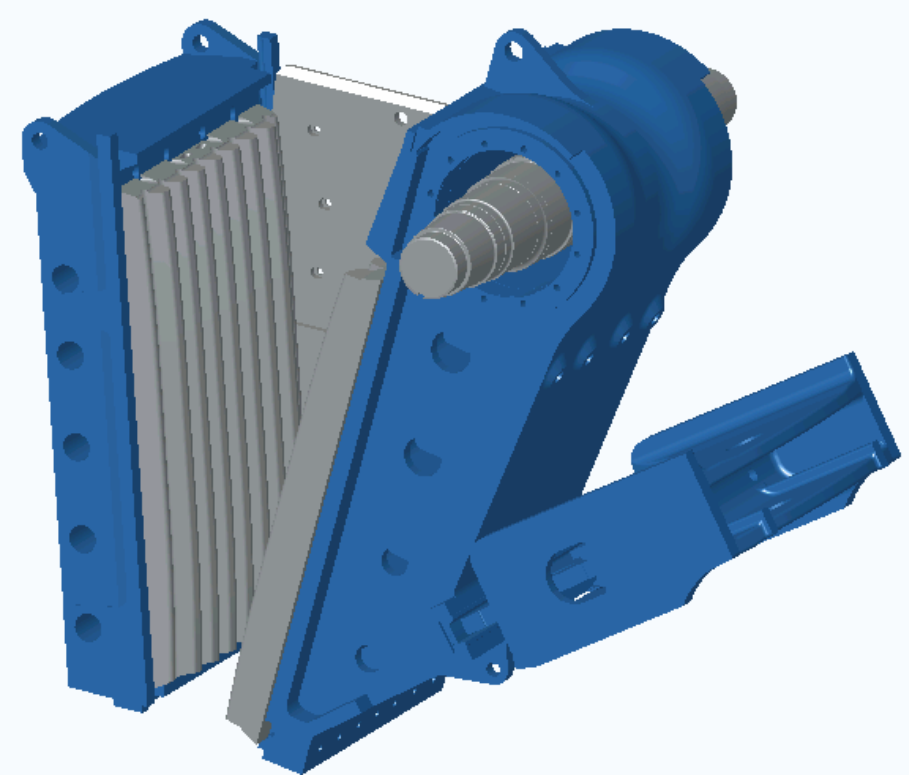
- **Optimizing crushing point by machining**

Result:

- **Full capacity and maintained setting, all through the liner life**
- **Increase in life up to 100% depending on application**

Jaw Plates for the Jawmaster

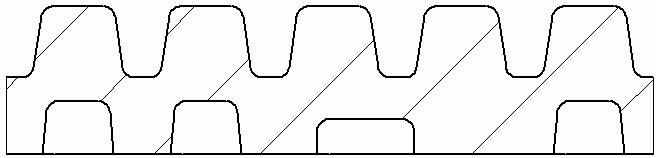
	Wide Teeth (WT), Z	Corrugated (C)	Coarse Corrugated (CC)	Sharp Tooth (ST)	Heavy Duty (HD)	Wide Wave (WW)
JM 806	1	1				
JM 907	1	1				
JM 1206	1	1		1		
JM 1108	1	1	1			
JM 1208	1	1	1	1	1	
JM 1211			1	1	3	3
JM 1312	1	1	1			
JM 1511			1	1	3	
JM 1513			2	1	6	6

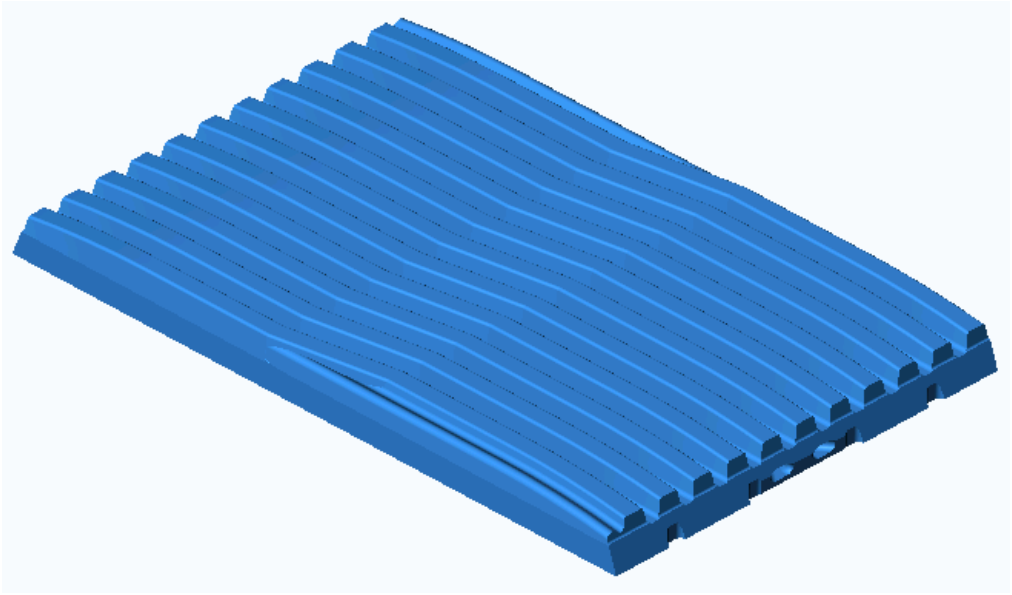


Wide Teeth (WT), Z

- General applications
- Abrasive rock
- Less in stock due to that

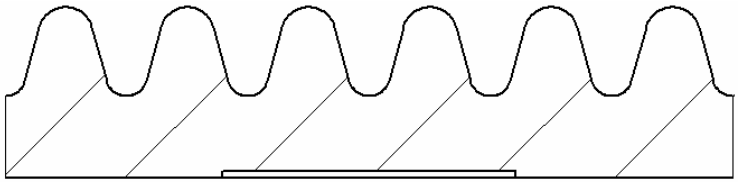
  the Z-plate can be fitted on both sides

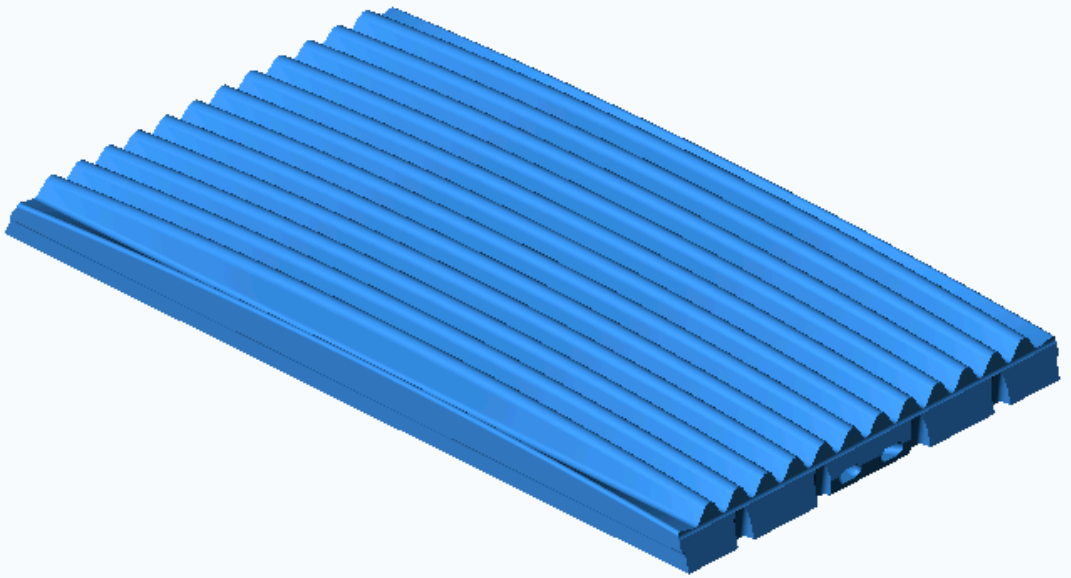




Corrugated (C)

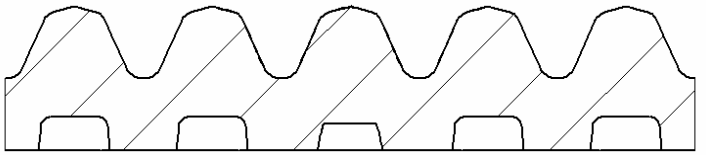
- Laminar material
- High amount of fines
- Small setting
- Cubical product

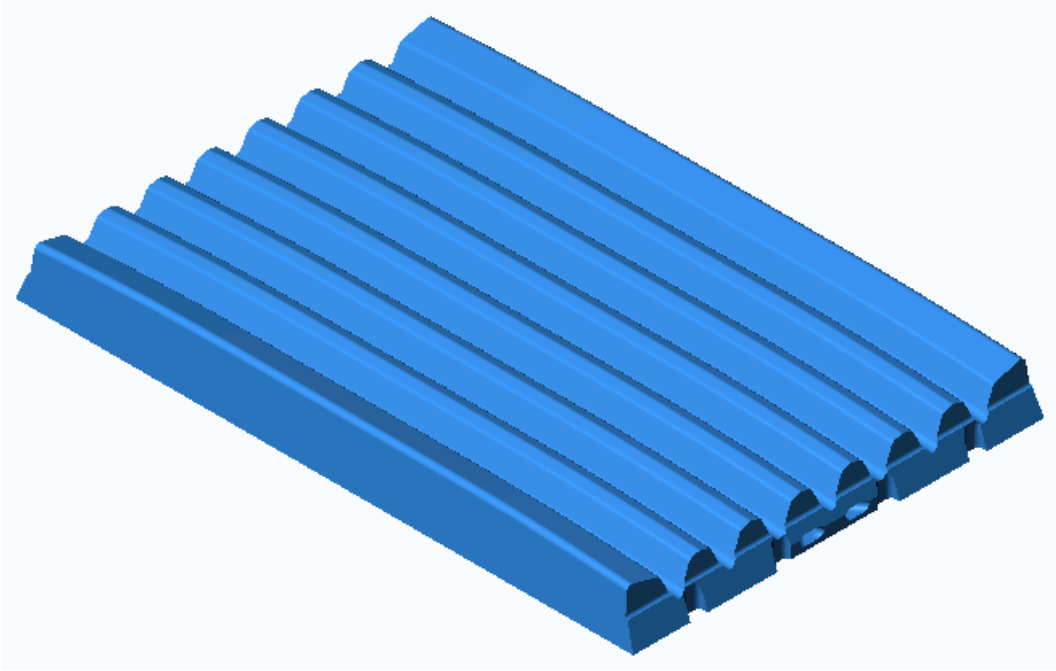




Coarse Corrugated (CC)

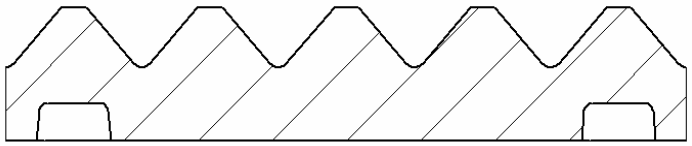
- Laminar material
- Abrasive material
- High amount of fines
- Large setting

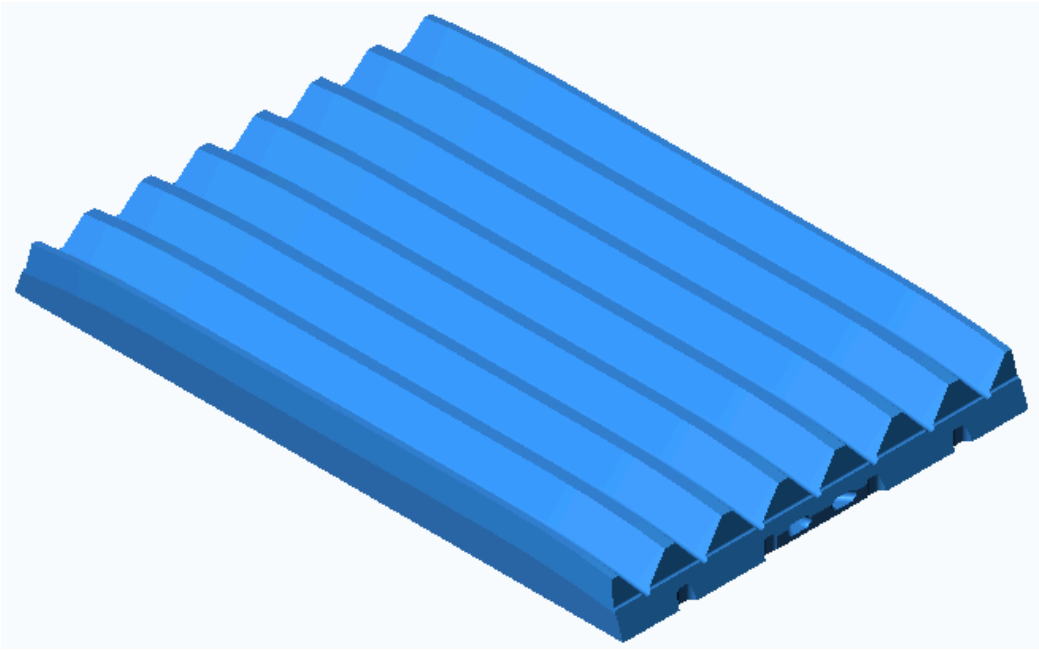




Sharp Tooth (ST)

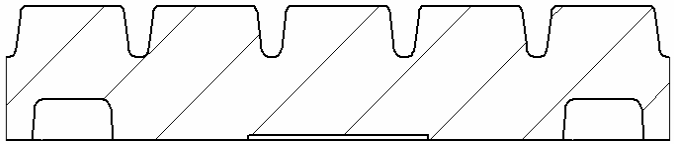
- Increased nip action
- Laminar material
- Abrasive material
- Large amount of fines



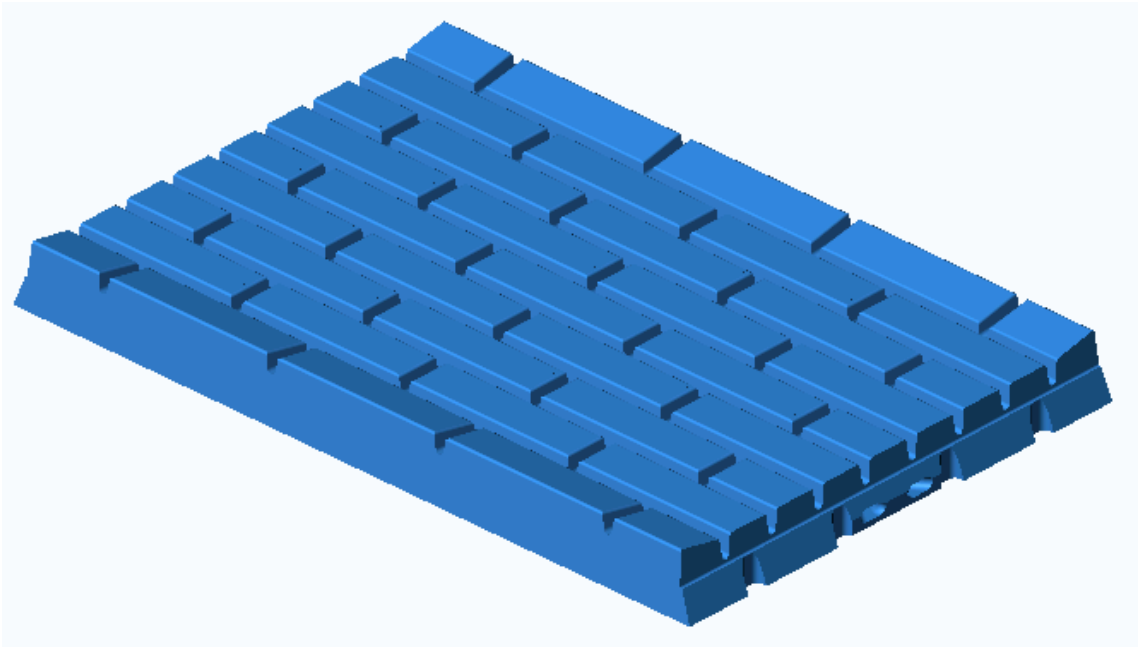


Heavy Duty (HD)

- Extremely abrasive material
- Increased liner life
- No demands on particle shape

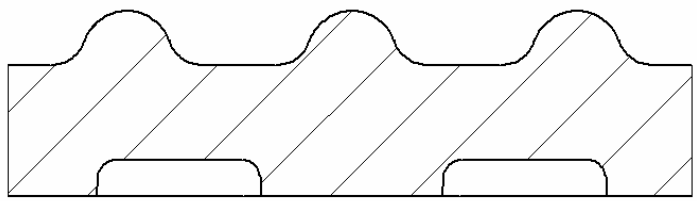


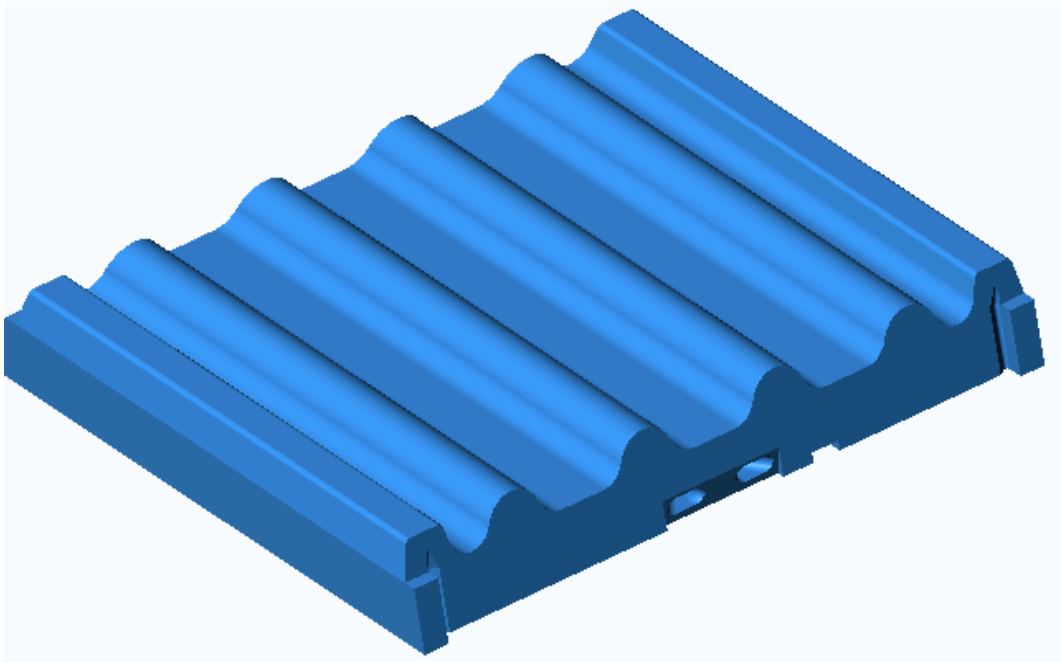
- Can be combined with CC or ST for improved particle shape



Wide Wave (WW)

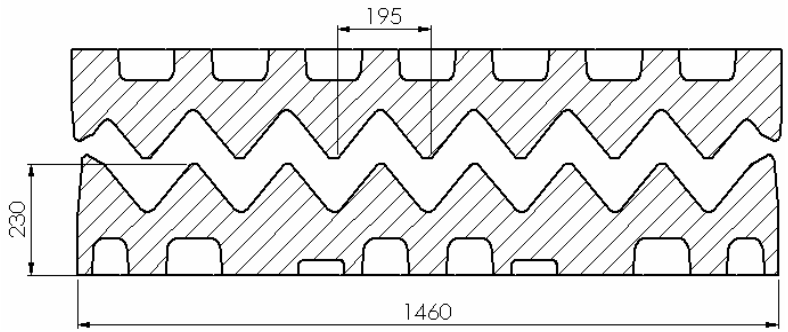
- Extremely flaky material
- Less abrasive material
- Muddy material
- Good particle shape



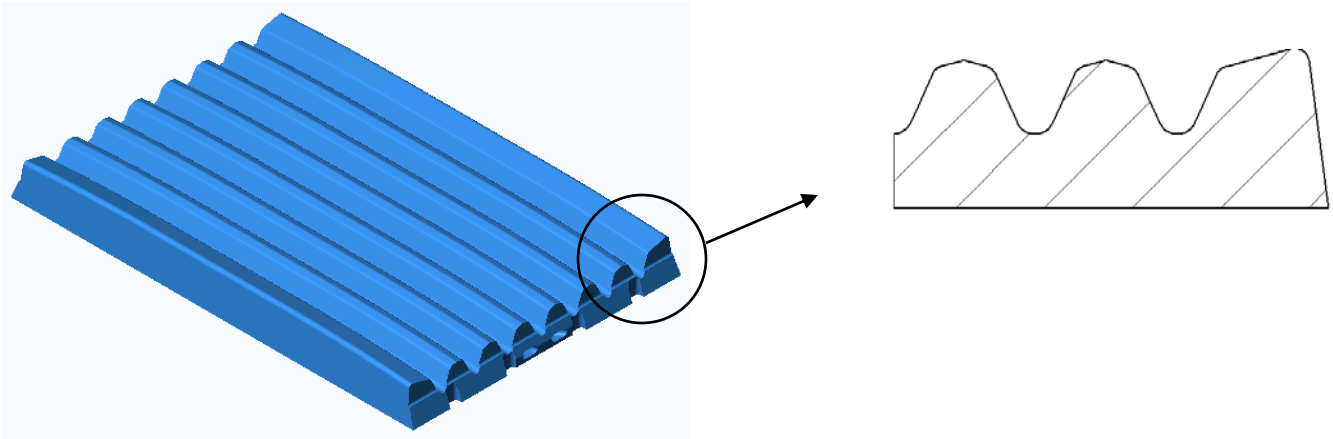


Improvements

- **New ST jaw plates for large crushers**
- **One piece**

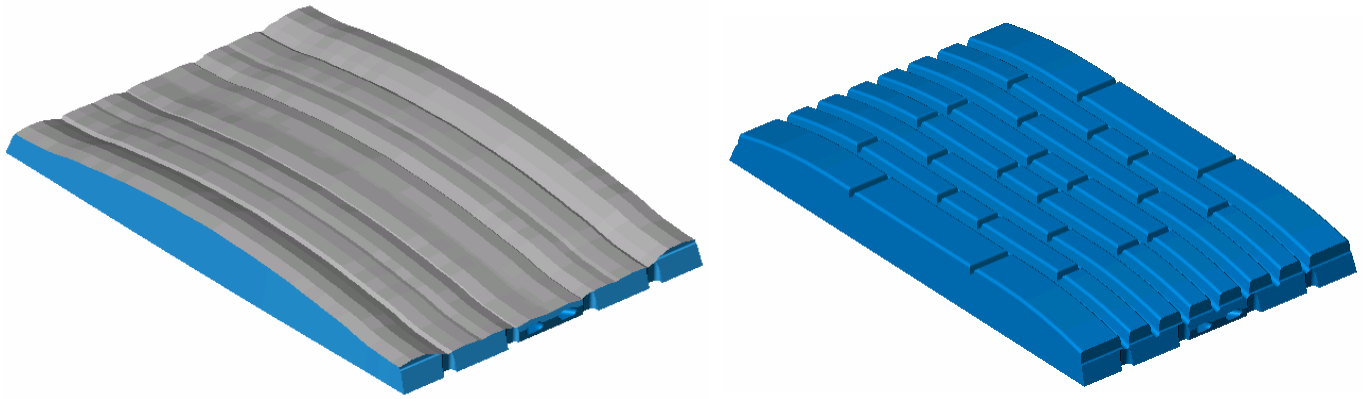


- **Angled teeth to reduce cheek plate wear**

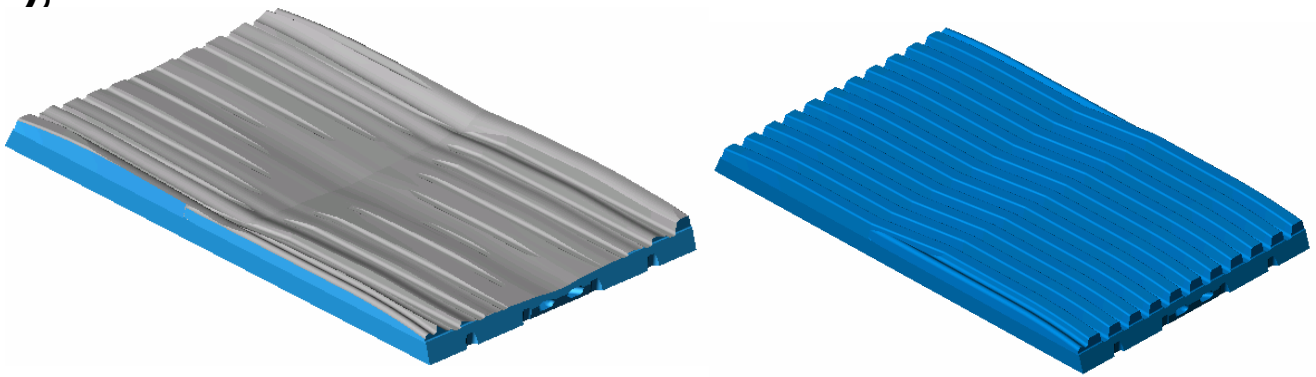


Study of Wear Profiles

- **Heavy Duty (HD)**



- **Wide Teeth (WT), Z**



- **Please report to Crushing Technology Group**

Manganese steel

History:

- **1880 – Sir Robert Hadfield 12% Mn, 1% C**
- **Hardening by deformation**
- **Strömhard increased the Mn- och C-content.**

Important parameters when casting manganese:

- **High quality scrap – Impurities means lower quality**
- **Casting temperature – Decides grain size**
- **Heat treatment – Time enough to get to center of casting**
- **Water quenching – Low thermal conductivity. High carbon and chromium content means more carbides. Thick castings means risk of cracking.**

Manganese steel

To choose from Sandvik alloys: M1, M2 and M7

- **Soft and abrasive material – M2, M7**
- **M2 and M7 have less significance in fine crushing**
- **Try and see – Please report to Crushing Technology Group**

Pirates promote 24% manganese steel.

- **The manganese content do not show the wear resistance.**
- **Mn-content expand the austenite zone, enabling higher carbon and chromium content.**
- **Higher Mn, Cr och C-content increase wear resistance *marginally* but also increase the cracking risk *substantially*.**

Wear Problems - Summary

1. **Choose the correct standard crushing chamber – Both mantle and concave**

2. **Make the feed distribution as good as possible – Here is a lot to gain, rebuild if possible**

3. **If there still is a problem with the wear profile – Contact the 3C-group**

4. **To boost liner lifetime even more –**

   Try a different manganese alloy

The capacity is too low?

- Make sure the crusher is choke fed
- Increase the eccentric throw
- Select a coarser crushing chamber
- Reduce the moisture content

The product size is too coarse (or the circulating load is too high)

- Reduce the C.S.S.
- Reduce the throw to enable a finer C.S.S.
- Select a finer crushing chamber
- Increase eccentric speed

The product contains too much fines

- Increase the C.S.S.
- Reduce the throw for a more gentle crushing
- Select a coarser crushing chamber
- Reduce the amount of fines in the feed

The product shape is not acceptable

- Make sure the crusher is choke fed with a minimum of stops for idling
- Select a C.S.S. that is close to the product size with high demands on cubicity
- Reduce the reduction ratio, i.e. reduce the top size of the feed
- Reduce the lower fraction limit of the feed a little in order to add some fines

The crusher is packing

- Reduce the reduction ratio
- Reduce the amount of fines in the feed.
- Avoid dirt or moist in the feed
- Adjust the feeding arrangement for even distribution (and central feeding of Hydrocones)
- Avoid segregated feed
- Inspect the crushing chamber for uneven wear

Excessive wear at the bottom part of the crushing chamber

- **Select a finer crushing chamber in order to move the crushing work upwards**

Uneven wear around the concave ring

- Adjust the feeding arrangement for even distribution (and central feeding of Hydrocones)
- Avoid segregated feed
- Use a distributor for MF and finer crushing chambers

Too short liner life

- Try the M1+ material for the mantle and concave
- Try the M1+ material only for the mantle

We know what we are talking about!

- Manganese steel????
  - ✓ Cold work hardening + toughness
- Manganese content????
  - ✓ heat treatment + alloys + solving carbon + cooling&carbides
- Thicker manganese????
  - ✓ tramp iron protection + risk of carbides + shape of profile
- Tonnes or hours = money????
- Surface finish????
  - ✓ It does matter!
- Machining????
  - ✓ It does matter!
- Experience in design, manufacturing & process????
  - ✓ >10000 years
- Sandvik quality and development????
  - ✓ Tooling and Material Technology

Preventive maintenance

- **Warranty policy**
  - ✓ **Design, material or manufacturing**
  - ✓ **Report to Sandvik Rock Processing within warranty time**
  - ✓ **Used according to maintenance manual and in appropriate applications.**
  - ✓ **Service and repair carried out by SRP authorised personnel**
  - ✓ **Use Sandvik Rock Processing genuine parts**

Preventive maintenance

- **Parts policy**
  - ✓ **Genuine Parts = optimal safety and economy**
  - ✓ **Latest design and quality**
  - ✓ **10 years supply of parts**

Preventive maintenance

- **Storage of parts**
  - ✓ **Check corrosion protection regularly**
  - ✓ **Place wood under heavy components**
  - ✓ **Seals and gaskets shall be stored under dark, dust free and dry conditions, preferably at room temperature.**
  - ✓ **Bushings should be kept standing**
  - ✓ **E.g. dust seal ring should be stored flat**

Proactive Elements for Success:

- **Availability of Parts**
  - ✓ **Operational cost, process, performance**
- **Reliability of Parts**
  - ✓ **Effective maintenance, operational cost, uptime**
- **Maintenance**
  - ✓ **Operational cost, uptime**
- **Process**
  - ✓ **Desired product, minimise waste, utilise plant, adopt to changes**
- **Performance**
  - ✓ **Capacity, uptime, quality**