



VTCA Aggregates Safety & Operations Seminar 2025

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Title...?

Operational and Health & Safety Benefits of
Molded Rubber Products

**Solving Wear, Impact & Noise
Problems**

*Why Isn't What We Are Doing
Working?*



Solving Wear, Impact & Noise Problems

This presentation is not likely to contain any new information.

My objective is to deliver a stark and blunt reminder that is intended to serve as an aid to successful intervention projects in the future.



Solving Wear, Impact & Noise Problems

- **Why Do They Occur?**
 - Energy/Force
 - Design
- **How Can You Prevent Them?**
 - Avoiding common pitfalls
- ***SOLUTIONS!***
- ***Where Do We Go From Here?***

Wear, Abrasion & Noise?

Why Do They Occur?



Wear & abrasion occurs when the physical characteristics or properties of any material are overcome (overtaken) by the forces being applied to them.

The same physics occur for all materials – mineral, metallic, elastomeric. Once the force applied exceeds the physical capabilities of a material, it will fail.

Wear, Impact & Noise Problems

What factors need to be considered when dealing with a Wear, Impact & Noise problems?

3 Critical Aspects:

- Distance of fall to point of impact
- Weight of the material/density
- Size of the particle

What does this create?

Kinetic Energy

Energy due to motion reflects the **Mass & Velocity** of the object.

$$KE = \frac{1}{2} mv^2$$

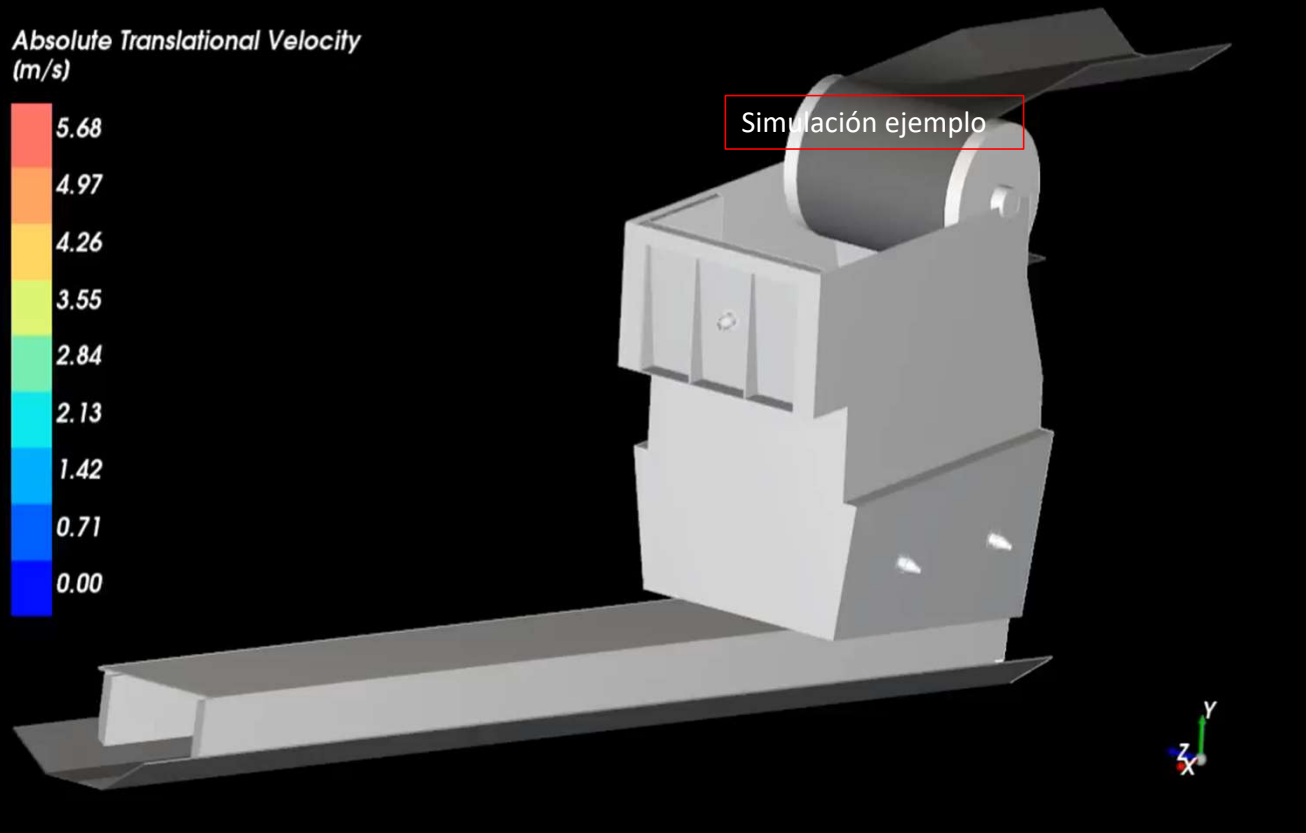
Wear, Impact & Noise Problems



Tiempo:0 s

Operacion Nueva, Vel. 3.6(m/s) 2450 (ton), Diseño V1

Absolute Translational Velocity
(m/s)



Reducing the amount of energy that can be created when transferring material from Point A to Point B is the best way to deal with all Wear, Impact & Noise problems!

The **PROBLEM** is...

"We need to move material for our facilities to work."

**The Majority of Wear,
Impact and Noise
problems are the result
of poor design and or
material application**

RESULTS

- Reduced Throughput
- Equipment & operational inefficiency
- Health & Safety problems
- Reduced Profitability

***"So what do we do
about it?"***

*Material needs to
move in mining and
mineral processes.*

*Should we just let wear and
impact occur and deal with it?*

***Can we reduce or possibly
eliminate these issues?***

YES! YOU Can...

What are the design issues that commonly occur and how do they originate?

- Habit-
- Lack of Understanding
- Limited Exposure to viable solutions
- Failure to calculate TCO

What have you done to stop wear, impact and noise problems from happening?

- Typically, try to use some type of lining system or wear medium
- Wear plates
- Conveyor belts
 - Lining systems
 - Enclosure system

Breaking the Design Box!

Preventing These Issues?

Avoiding Common Pitfalls

- “Because that’s the way we’ve always done it”
- Well, if it worked for them...
- Failing to baseline- get good data
- Know your true costs- of doing something or not doing something different
- Measure and react-

DMAIC-

define, measure, analyze, improve, control



The right solutions can help alleviate Wear, Impact & Noise

Typical Wear, Impact & Noise Solution



SYSTEMIC APPROACH

Considerations

- Application
 - Equipment type
 - Particle size & type (crushed or natural stone, or other)
 - Drop distance (or velocity)
 - Wet or dry
 - Temperature
 - Chemical composition
- Health & safety considerations: weight, confined space, hot work, etc.
- Attachment method required
- Dimensions
- **Economics**
 - **Not everyone looks at this the same way**
 - **Capital costs vs cash availability**
 - **\$\$/ton produced**
 - **Delivery time vs plant up-time**

What types of materials you may have used in solving Wear problems?

- Metallic Castings / Forgings
- High % Chrome
- AR Plate, Steel Plate
- Wire Cloth (Screen Media)
- Rubber
- Polyurethane
- Others?
 - Ceramics?
 - Cast impact material?
 - Spray systems?
 - Paint?

What SHOULD drive your choice?



*We want to help you make the **best decision** when dealing with **Wear, Impact & Noise problems.***

THE Solution!

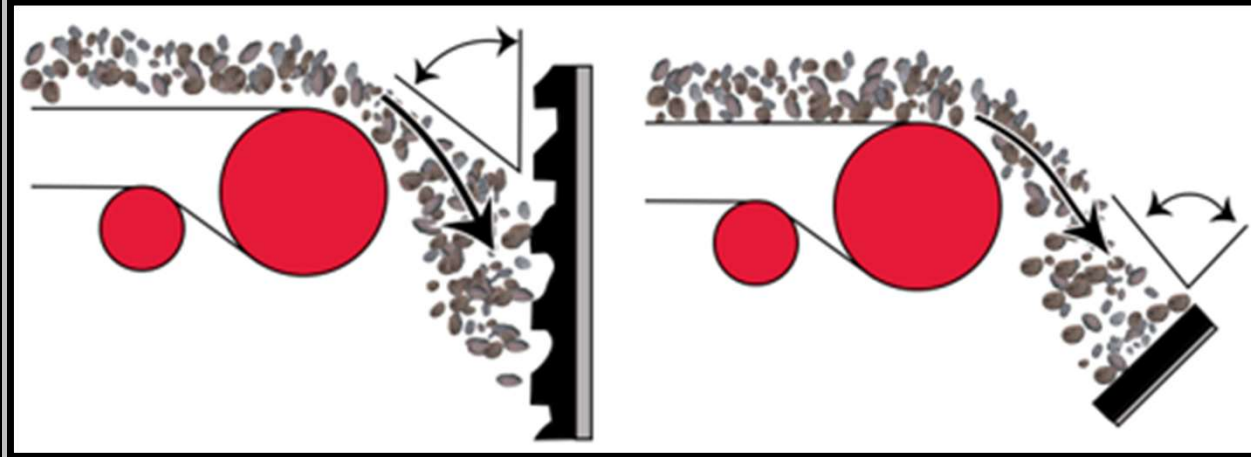
The “Right Solution” in every situation will always be a systemic approach that includes a DMAIC or similar process to define, measure, analyze, improve and control the project. The lack of a systemic approach that takes all variables into account leads to “band-aid” fixes that deliver unsustainable and routinely repeated efforts that never deliver the lasting results you desire.

Design

You can design systems to improve the angle of impact.

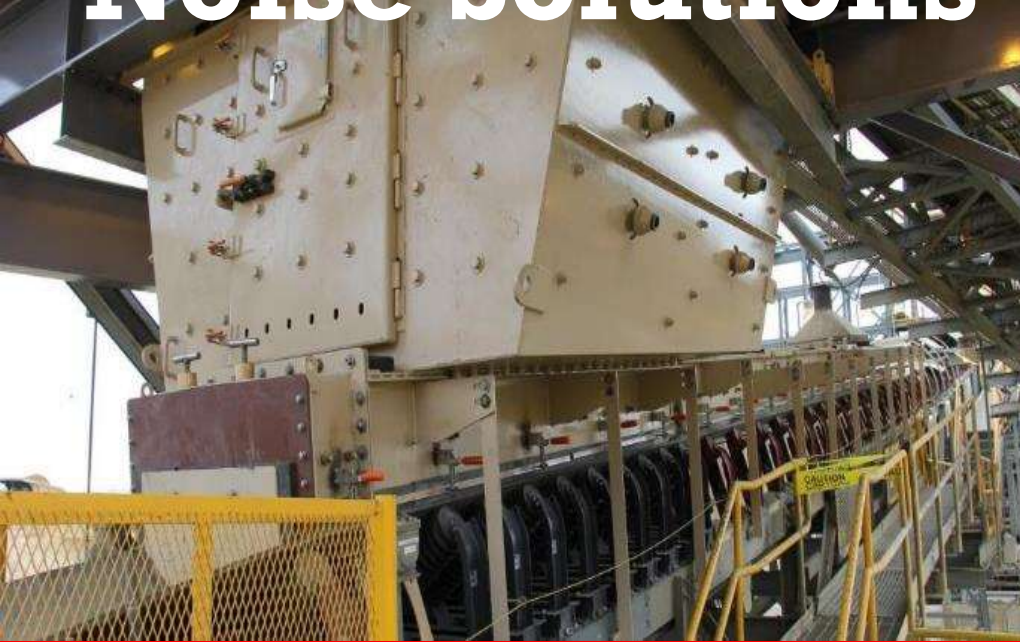
With the correct materials and design, you should be able to design an elastomer system to outlast most metallic impact liners by 50 – 200%.

The harder the ore, typically the better the performance comparison will be (look at compressive strength of the material).



- For acute impingement angles from 10 – 40 degrees, Profile Liners are can be used to change the angle of impact or modify the wear liner for 90-degree impact.
- Creation of Dead Beds is typically the most common method to address angular impact.

Wear, Impact & Noise Solutions



*Increase your liner life with
Valley Rubber's Wear System*

Transfer Points

- Remove energy
- Slow down material velocity
- Create material on material impact
- Protect structural steel
- Minimize maintenance - Maximize wear life
- Maintenance friendly
- Reduce noise

Wear, Impact & Noise

Overview

- Wear and Abrasion issues will always be part of Mineral Processing
- Look to keep impact angles close to 0 degrees or 90 degrees, not in between
- Try to reduce the opportunity for Kinetic Energy to build up
- Rarely will one type of wear liner system fix it all
- Using liners that provide a maximum wear life will provide the best \$/t produced results



We are here to assist you in effective project development, execution and confirmation of success.

Our Engineering, Product Management and Sales Teams, along with our Partners like Old Dominion Equipment and Supply, have an established background in delivering proven **SOLUTIONS!**

Open Discussion

Questions?

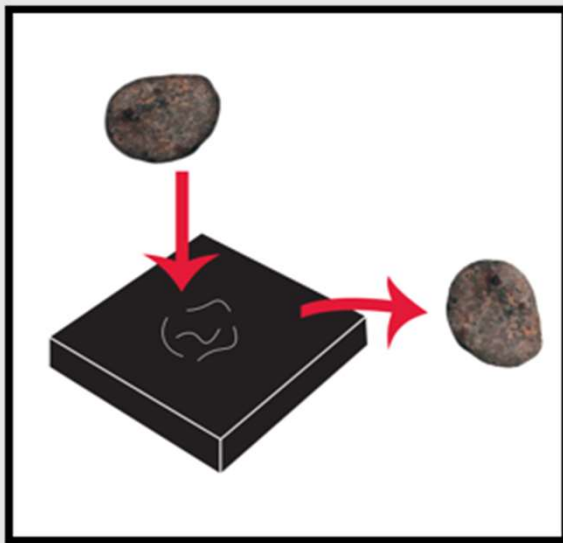
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Resiliency – What is it?

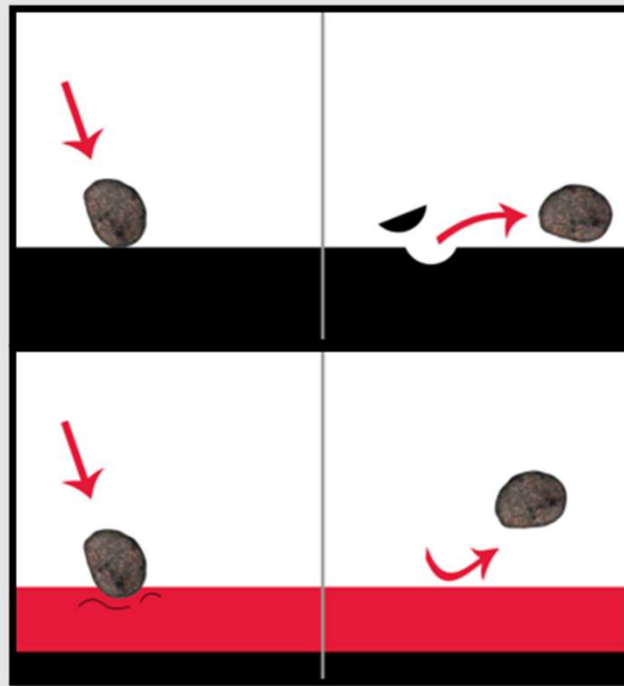
The ability of a product to absorb & return energy.

- It is a critical aspect of a products wear performance.
- Typically, elastomers have much better resiliency than metallic lining systems.

The diagrams relate to rubber but applies to most elastomers.



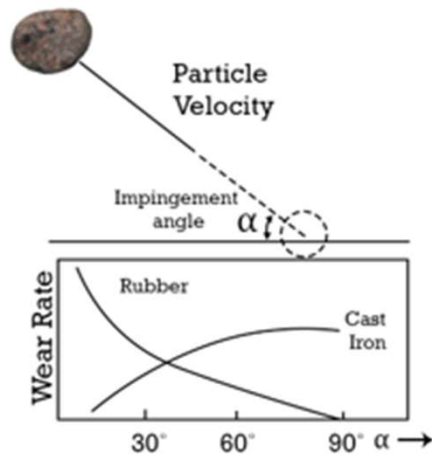
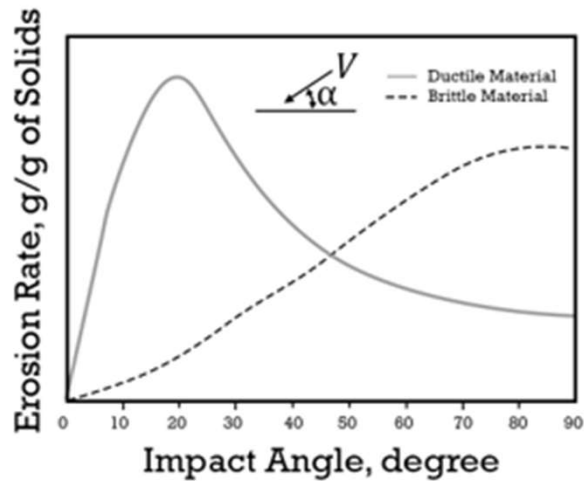
Rubber Liners absorb energy from the impacting rock by deformation, then repel it like a spring.



Abrasive particle striking non-elastic metal surface. Conversion of kinetic energy into impact, friction (heat) & noise.

Abrasive particle striking resilient rubber surface. Rubber deforms under load & returns most of the kinetic energy to the particle without the rate of wear experienced above.

Angle of Impact



Materials act differently under impact load.

The Angle of Impact is a big factor on the performance of your wear liner.

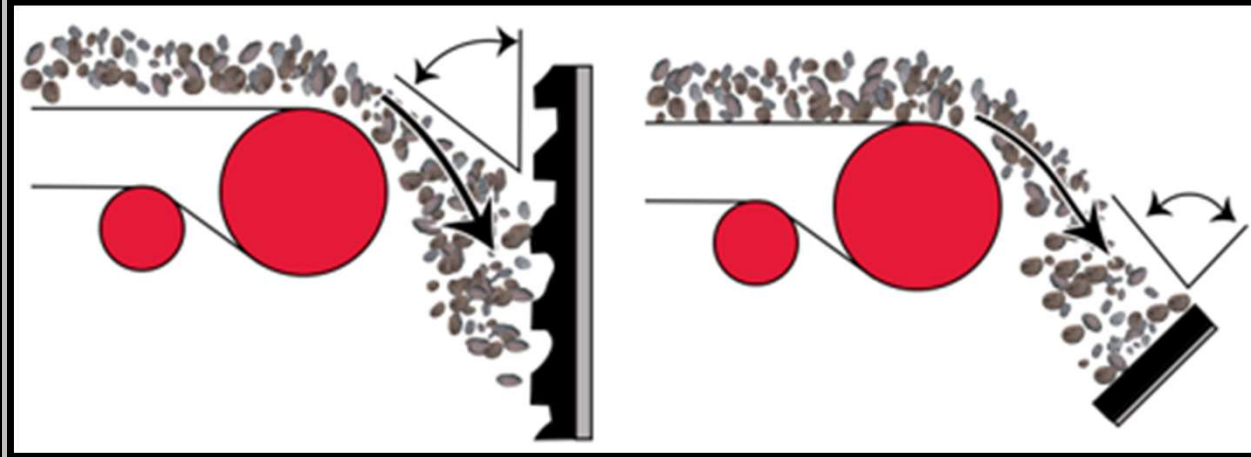
For Sliding Abrasion (0 – 10 degrees) & Direct Impact (80 – 90 degrees), elastomers should be considered.

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Additional Benefits

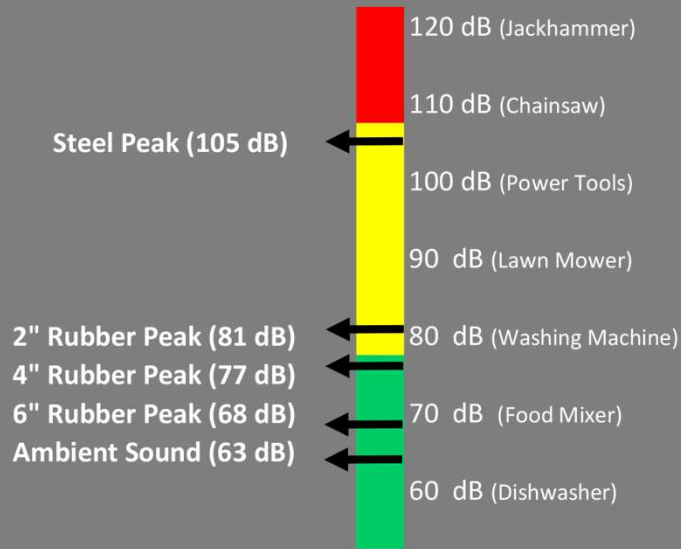


Chart adapted from the OSHA webpage "How Loud is Too Loud"

Noise Reduction

Sound Attenuation Testing

	Ambient Sound	Peak	Increase from Ambient	Decrease from Base
Bare Steel - Base	63 db.	105 db.	42 db.	
2 in. Rubber Liner	63 db.	81 db.	18 db.	24 db.
4 in. Rubber Liner	63 db.	77 db.	14 db.	28 db.
6 in. Rubber Liner	63 db.	68 db.	5 db.	37 db.

Reduction in MSHA concerns by:
 Reducing confined space issues

- Improved liner life
- Less issues with plugging chutes
- Reduction in dust

Elastomer Wear Lining Systems

- Lining systems made of either: rubber, polyurethane or a combination of these with steel and ceramics, will help to provide maintainable protection in vulnerable wear and impact areas of the process.
- Shape, attachment style, and thickness of wear material are typically customized to suit the application requirement.
- So why not use them in crushers, mills, etc.?
 - Resilience works against the required operation of the equipment (absorbs energy).



Types of Elastomers

An elastomer materials physical characteristics can be heavily impacted by its chemistry.

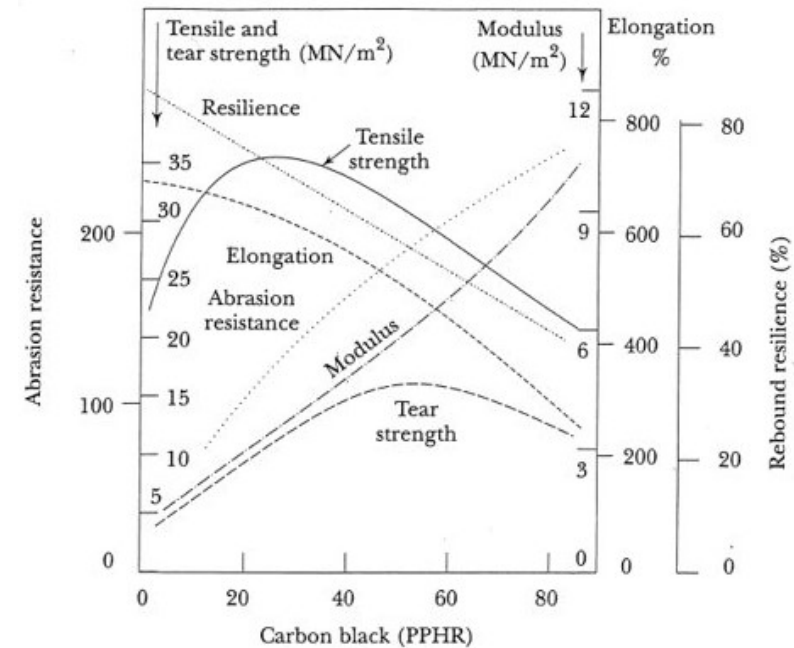
Specific materials can be made for specific applications.

Changing one aspect of the formula can impact many other physical characteristics.

- Natural Rubber
- Liquid latex
- EPDM's
- Synthetic Rubbers
- Injection Molded PU's
- Open Cast PU's
- Silica Reinforced
- Carbon Reinforced
- Abrasion Resistant
- Adhesion Resistant

Adjustments

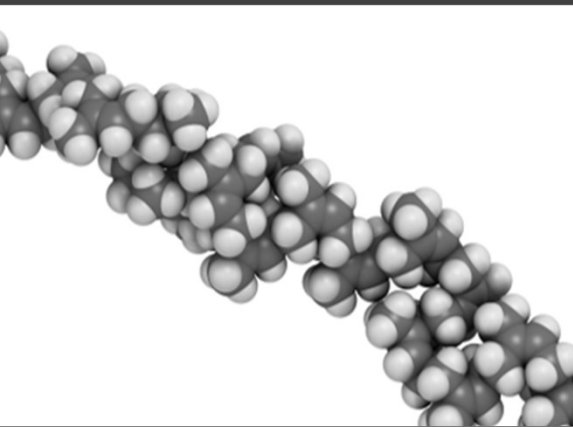
Adjustments made for toughness, or abrasion resistance, may impact many other characteristics, especially resilience.



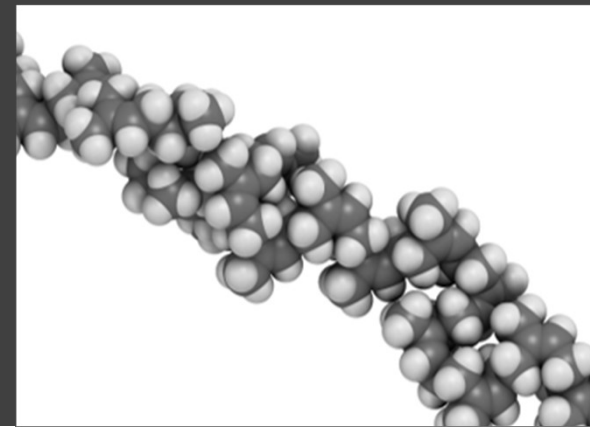
Molecular Weight

Molecular weight of an elastomer can have a large bearing on its ability to return energy into a system (its resilience).

- High molecular weight = Longer chains = Better resilience
- Low molecular weight = Shorter chains = Lower resilience



Remember the rope!



Additional Benefits

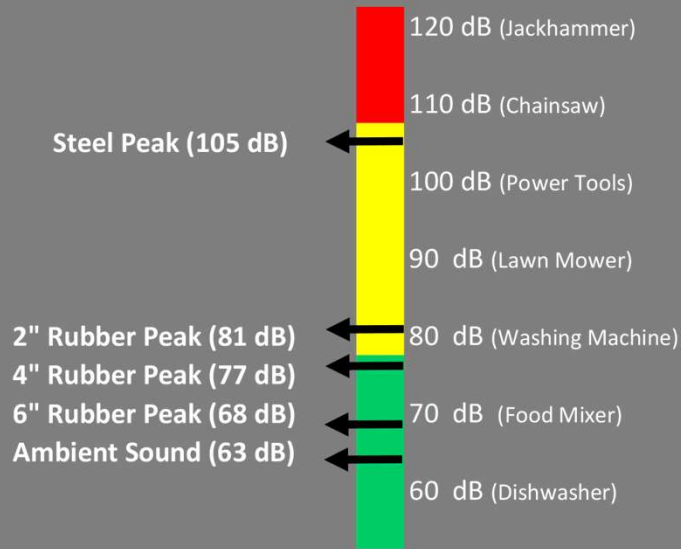


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Wear & Impact



*Increase your liner life with
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Transfer Points

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Wear & Impact - Some Options

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Molded Rubber Liners

Typically - Plate backed

- Thickness range: 1/2" to 6"+
- Steel backing plate from 1/8" to 1/2" thick
- Different fastening styles
 - Counterbored bolt holes (can be used for bolting or plug welding)
 - Welded stud
 - Exposed steel edge (for welding)
 - T-Track style (adjustable)
 - Magnets
- Large molded part sizes can be done (up to 72" W x 120"+L)





Profile Liners

- Rubber lining performs best when the angle of impact is close to 90° .
- Profile liners with a single 45° saw tooth pattern can be used in two ways:
 - Used with the sloped side up, the impact surface is presented to the material stream at close to a 90° angle, improving wear life in most cases.
 - Used with the sloped side down, the 90° edge becomes a shelf on which materials will collect, thereby creating a protective rock layer that in turn (partially) protects the rubber.



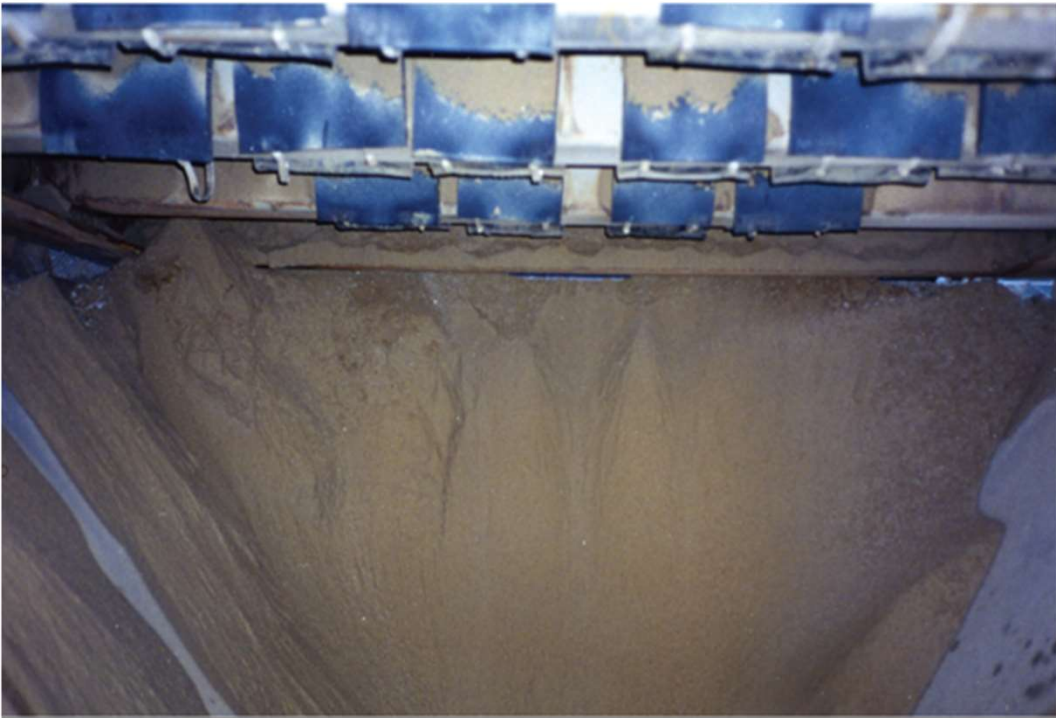
Inflatable Rubber Liners

Problem-Solving Liners for Sticky Materials

- Inflatable Liners are made 1" to 5" thick with a 1/4" steel backing plate.
- The inflatable wear surface is made from a 50 - 60 duro rubber compound and is bonded to the backing plate only around the perimeter of the liner (about 2" wide), creating an inflatable bladder in the center portion. This bladder when inflated, stretches and causes any "stuck" material to break and fall off.
- These liners can be molded in basically any shape necessary. It is recommended that narrow dimensions (of less than 8") be avoided to allow for a proper inflation area.



Before: Chute backs up as material sticks & **After:** Inflatable liners keep the chute clear & functional.



BEFORE

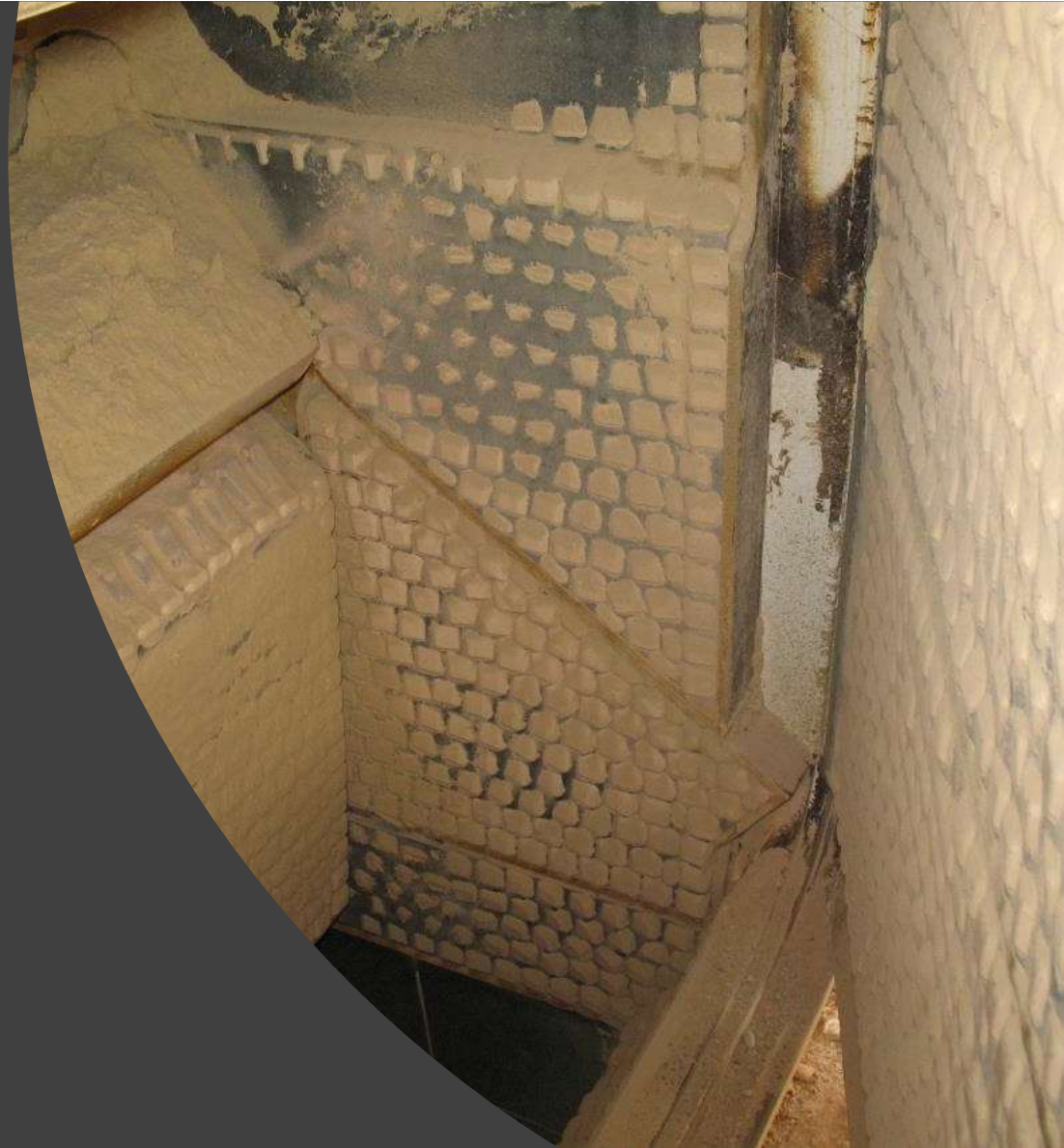
AFTER

Inflatable Liners - Performing

Elastomer Ceramic

Lining Systems

The ceramic handles the abrasion while the elastomer absorbs the energy.



Properties of Ceramics

Good Properties

- 87 - 94% Alumina
- Compressive strength 2.5 - 3.5Mpa
- Toughness 2.3 – 3.4Mpa
- Hardness = 9+ on MOH's scale
- Specific gravity = 3.6 (.12 lb./in³)
- Non-corrosive
- Non-metallic
- Non-porous
- Mid-range thermal conductivity
- Can be produced in custom shapes
- Cylindrical and spherical shapes are mass produced as grinding media

Not So Good Properties

- Very low tensile/sheer strength
- Difficult to cut
- Relatively expensive
- Chemically resistant (difficult to bond with other materials)
- Smooth surfaces
- Some can have poor impact resistance

Rubber-Ceramic Liners

- Require a rubber backing of approximately 25% of the ceramic thickness
- Steel plate backed – typically
 - Various thicknesses: 0.75" – 6"
 - Different fastening styles
 - Molded part sizes up to 96" long, and 40 ft² depending on thickness
- Variety of ceramic shapes and sizes available
- Standard material 60-70 Duro with most Elastomers compounds available

**Adhesion capabilities and process controls
are critical for success**





Elastomer Wear

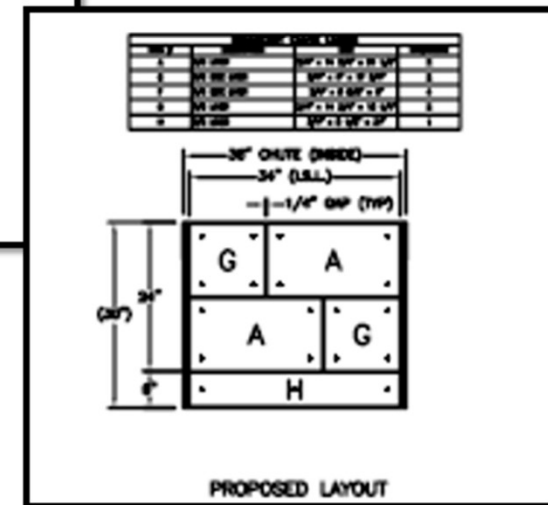
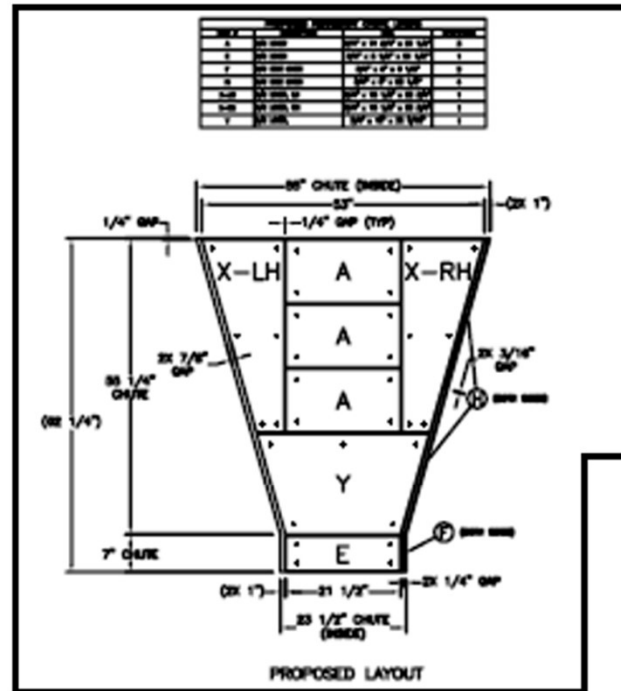
& Impact Applications

- Chute Lining (Screen Undersize, Ore Feed Bins, etc.)
- Screen Box Feed & Discharge Lip Liners
- Screen Box Impact Liners
- Conveyor Skirting
- Feeder Liners
- Conveyor Transfer Points
- Mill Feed Chutes
- Feed & Discharge Chutes, & Launderers for various types of milling & crushing operations
- Truck Boxes
- Custom Made Wear & Impact Liners
- Others

Custom Designs Available

- Can be made to client specifications
- Custom Layouts (for all liner types)

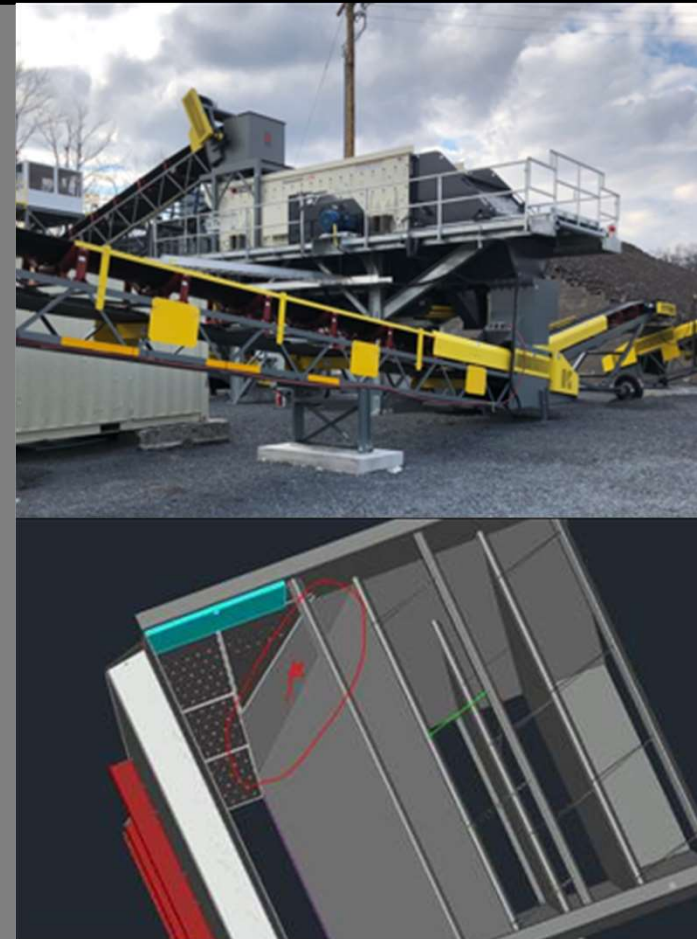
REMEMBER: The design of a chute itself can be critical in Wear & Impact performance.



Rubber-Ceramics

The Application:

- A small portable Aggregate Plant
- Feed & Discharge Chutes
- Significant Wear & Impact issues
- AR Plate, Castings used
- Noise issues (close to local housing)
- 450 – 600TPH – Primary Circuit
- Scalping Screen Discharge
- 8" Top Size, with 12" long slabs at times
- AR plates – wearing out in 1 – 3 weeks
- Chute drawings sent to Valley Rubber to create liner installation layout



Rubber –Ceramics: Aggregates

Results:

- Installed April 2019 – replaced in February 2023 (46 months in service)
- Secondary & Tertiary systems were installed
- Significant noise reduction
- Created confidence in Rubber-Ceramics
 - Created confidence in Valley Rubber solutions



Wear & Impact

Elastomer Lining Systems

Many suppliers offer several abrasion resistant Elastomer solutions:

- **Plate-Backed Rubber & Polyurethane Liners**
- **Profile Type Impact Liners**
- **Conveyor side wear liners (canoes)**
- **Dust suppression – basic skirting to elaborate systems**
- **Modular Style Panels**
- **Inflatable Liners**
- **Plate-Backed Rubber/Ceramic, PU/Ceramic Liners**
- **Plate-Backed Rubber/Chrome-White-Iron (CWI) Liners**
- **Screen Media – various solutions incorporating Elastomers**

- **Very few offer custom made liners**
- **Very few offer combinations of materials**
- **Very few offer performance warranties**

General Elastomer Rules



Durometer gauge used for testing hardness.

- Try and make material impact either with a Sliding Impact (0 -10 degree) or a Direct Impact (80 – 90 degree).
 - Stuck in the range of 30 – 60 degree is typically the worst situation for all materials.
- Softer Elastomers – 30 to 50 durometer, are better for wet Sliding abrasion and fine particles. (3/4" - 1/2" and below).
 - Polyurethane (be aware of hydroscopic issues – ethers, esters), Natural Rubbers.
- Harder Elastomers - 60 – 80 durometer, are better for direct impact and large particles.
- Always look at synthetic Elastomers or metals if hydrocarbons or acids are involved in high %'s.
- For Impact applications, the overall thickness of a liner should generally be half the thickness of largest particle it will encounter. Thicker is better for wear life.
- Combinations of Elastomers and harder materials (ceramics and metals) should be considered in high impact areas.

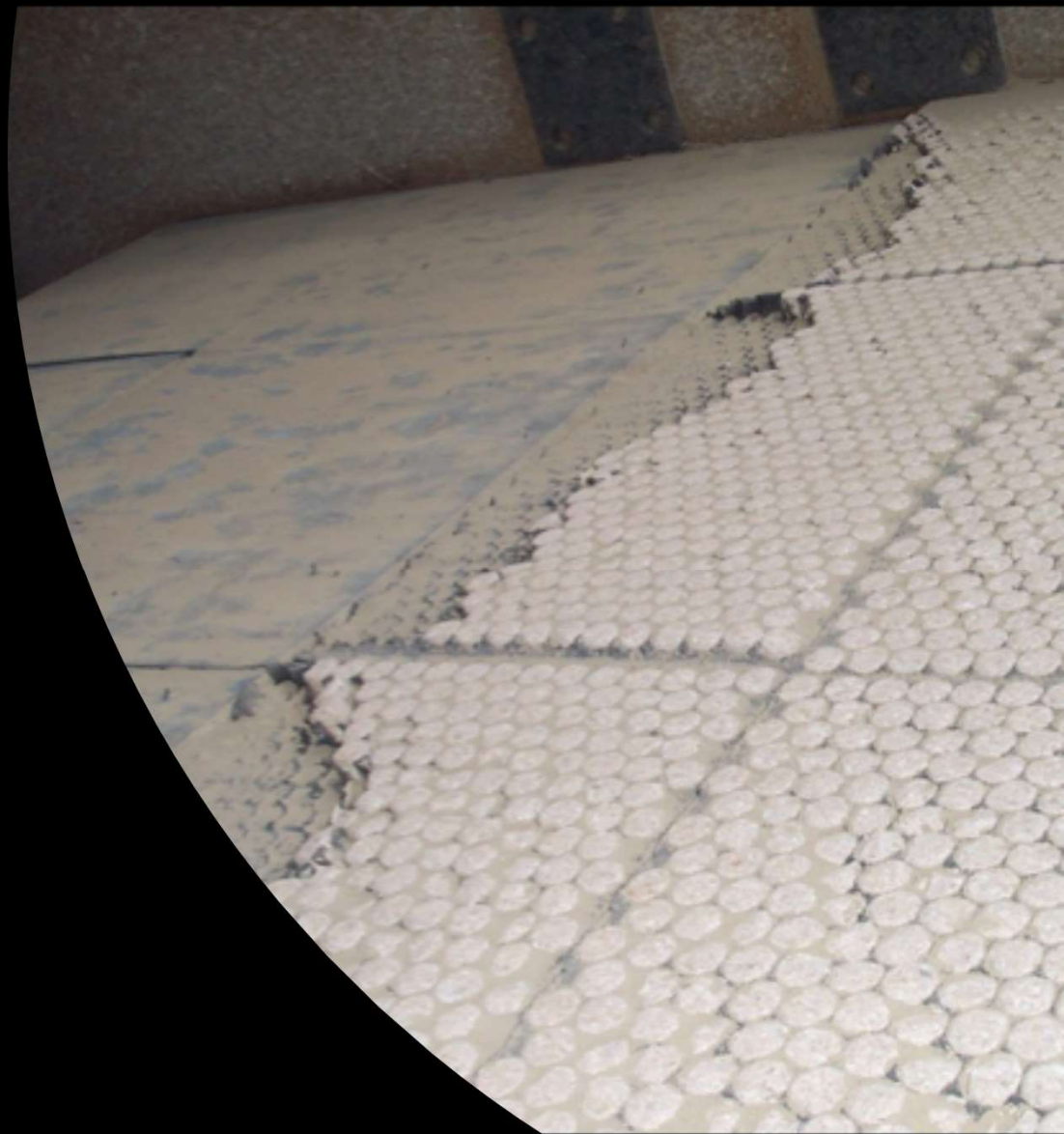


Failure Modes

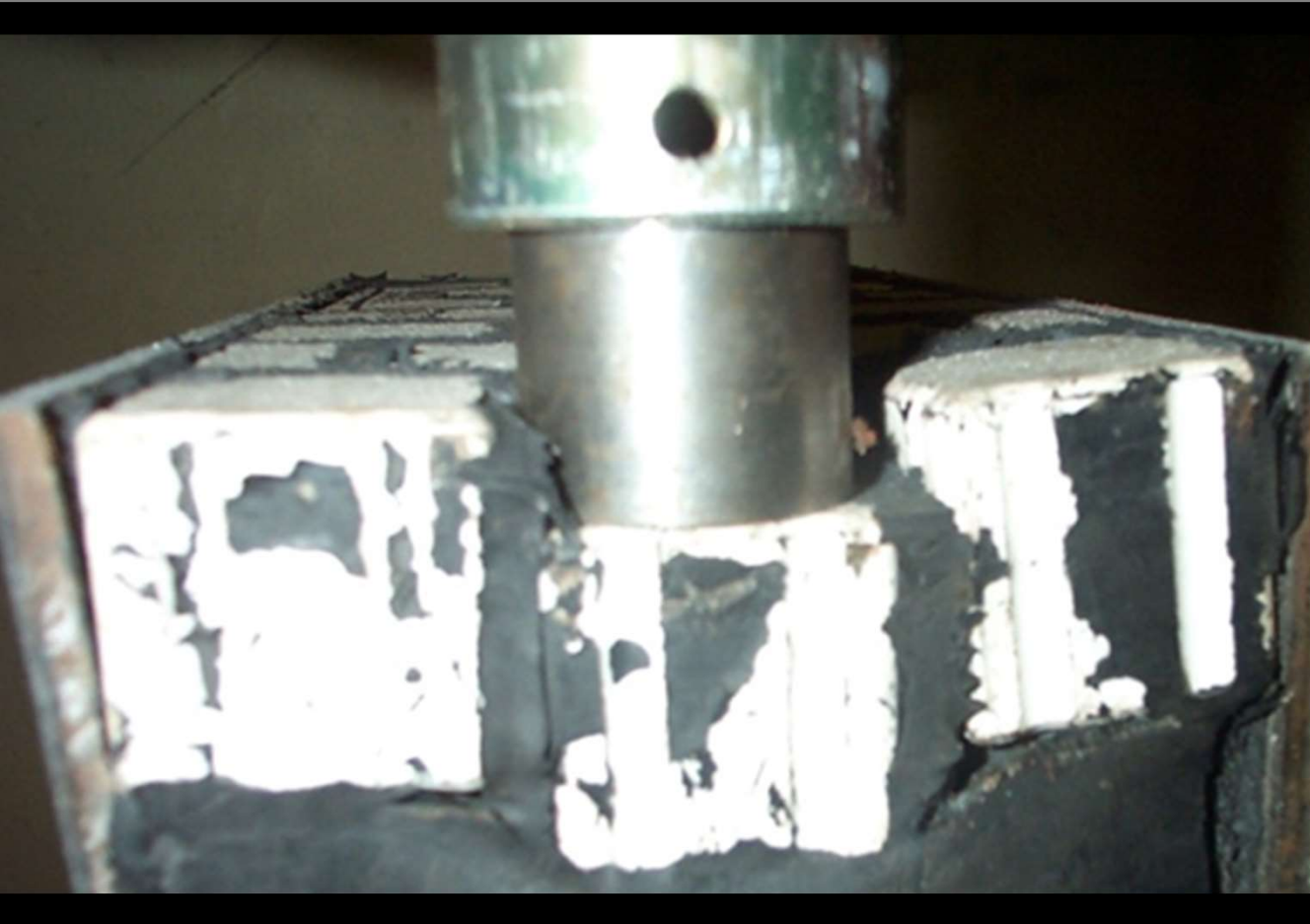
Rubber-Ceramics

Product Failure Modes

- Improper application
 - High impact
 - Large particles
 - High velocity
 - High load
 - Environment problems
- Peeling
 - Lack of / not enough edge protection
 - Design gaps too big
- Weak points
 - Counter bores
 - Joint racing



Failure Modes



- Extra rubber under the ceramics is not always a good thing
- Too much independent movement of the ceramics can cause shearing at the bond layer

Wear, Impact & Noise

Overview

- Wear and Abrasion issues will always be part of Mineral Processing
- Look to keep impact angles close to 0 degrees or 90 degrees, not in between
- Try to reduce the opportunity for Kinetic Energy to build up
- Rarely will one type of wear liner system fix it all
- Using liners that provide a maximum wear life will provide the best \$/t produced results

Cost Effective Warranty

When properly installed and maintained, the cost of Valley Rubber liners will be less than the competitors in the same application for the same period and usage.

This is a wear life warranty and is only applicable when an Application Information Sheet is submitted and approved before placing the order. A prorated adjustment will be made if the life cost is not equal to or better than the competitor.

Open Discussion

Questions?

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