“Avoid 6 Common Recycling Wear Plate Mistakes”
Thank you for requesting this free report. I am positive that the information contained here will provide you with the knowledge necessary to take control of your wear problems, as it has done for hundreds of my customers. You will extend the equipment life in your wear resistant steel components and applications.

By receiving it, you have made the important first step in taking control of your wear resistant headaches, problems, challenges, and issues. Feel free to use any of your favorite sayings when your steel wears out faster in your applications than you planned. I have heard plenty colorful versions over the years.

The saying, “A journey of a thousand miles begins with a single step”, is very accurate and you have quite literally just taken that first step.

The information in this report is a result of over 15 years experience helping my customers achieves the longest material life cycles possible, in their wear resistant steel applications for their businesses.

I am confident this information will do the same for you.

Let’s be absolutely clear on one very important concept.

In most cases, you cannot completely stop wear; you can only control the rate.

Your task is to take control of your wear problems to the point that they are manageable & can be replaced within your normal shut-down schedule.

Be honest; you never buy wear plate because you want wear plate.

You buy wear plate to minimize downtime from premature wear.

Downtime is the enemy, and we will win.
“Avoid 6 Common Recycling Wear Plate Mistakes”

Table of Contents

Table of Contents – Page 2

Definitions of wear – Identifying the cause(s) of your wear challenge.
  Abrasion – Page 3
  Adhesion – Page 4
  Surface Fatigue - Page 4
  Erosion – Page 5

Section One – Evaluating Your Wear Problems
  1) Not treating the causes – Only dealing with the symptoms – Page 6;
  2) Not tracking performance – How much better is the new solution? – Page 7
  3) Not knowing what material are you currently using – Page 7

Section Two – Selecting the Wear Plate
  4) Harder is better, right? – How hard is hard enough? – Page 12
  5) Buy cheap & replace often? – Labor is cheap, or is it? – Page 13
  6) Selecting the right steel for the right job – Page 16
     • Alloy Steel – Page 16
     • Chromium Carbide Overlay – Page 17
     • Stainless Steel – Page 18
     • T-1® – Page 18
     • Manganese – Page 18
     • Tungsten Carbide – Page 19
     • White Cast Iron – Page 19

The Bottom Line & Your Free Recycling Application Analysis – Page 20

These Additional Resources also included in these folders on this CD:
  • Calculators for Welding and Cost Analysis
  • Testimonials and Reference Data with documentation of performance
  • Wear Plate Products that our recycling customers use for longer life
  • Welding Products with Quick Reference Charts to get it installed correctly the first time with no excuses
We have all heard that 80% of our results come from 20% of our actions.

This report identifies the 6 most common wear plate mistakes which cause 80% of the downtime in the recycling industry.

The 2 Sections

The 6 most common wear plate mistakes that cause the most problems all fit into two areas.

- The first is properly Evaluating the Cause of the Wear Problem.
- The second is determining the Correct Wear Plate for your Application.

What is wear?

Wear is defined as: “Damage to a solid surface with progressive loss of material, due to relative motion between the surface and some contacting material”.

There are four major categories of wear:

1. Abrasion, or sliding wear;
2. Adhesion, or metal to metal wear;
3. Surface fatigue, or impact;

Abrasion – is caused by hard, sharp surfaces, imposed onto softer surfaces; including low-stress and high-stress gouging abrasion.

High-stress grinding and gouging causes significant wear in aggregate producers, where you really beat up the equipment.

Another example is polishing jewelry. Jewelers rouge is an example of a low stress process, since polishing is intentionally abrading the surface.

The paper industry has non-stop wear on the log haul deck. Sand, rocks and metal accumulate on the metal deck with tons of wood piled up, and you end up with hard edges wearing on the wear plates which have significant abrasion wear.
**Properties to combat abrasion wear:**
- Alloy content, particularly chromium. Chromium carbides in the microstructure are an excellent choice to fight against abrasion.
- High hardness
- Hardenability: The ability to achieve the same hardness through the entire thickness of the material
- Internal cleanliness: Controlling sulfur inclusions in steel makes the steel more consistent in application
- The ability to work harden is important in combating abrasion

**Adhesion** is action between conforming surfaces. Adhesion is most commonly associated with metal-to-metal wear, which you also see as seizure (bearing failure), and galling and fretting.

**Surface fatigue** is caused by repetitive compressive stresses and pitting. Impact wear is the most common type we see when you're turning large rocks into small rocks.

**Same material, different wear:**

Sandblasting is an example where you can have different types of wear using the same materials. Sand traveling through the sandblaster nozzle is abrasion wear.

When the sand contacts the material that you are sandblasting, it causes impact.
wear. It is very important to determine exactly what is causing the wear rather than only dealing with the symptoms.

**Properties to combat surface fatigue:**
- High strength
- High toughness
- Through hardness
- Fine grain

**Erosion** is caused by motion of fluid, liquid, or gas. Corrosion is within this category, also slurry erosion, solid particle impingement as well as fluid impingement erosion.

![An example of cavitation caused by low pressure of a liquid on the backside of a pump impeller](image)

In a pump or boat propeller, the low pressure area created on the back (non-pushing side) creates air bubbles, and when they implode, they “ping” the surface causing cavitation.

**Corrosion** is also a type of Erosive Wear. The following photo show erosion caused by chemicals that have attacked the metal.

![Chemical corrosion is an example of Erosive Wear](image)

Chemicals in a paper-making process are an example of this type of wear.

The combination of corrosion and abrasion often combine in certain industry applications. Stainless steel is the standard material used for corrosion, but it's not a good choice for abrasion.

A prime consideration for selecting a wear resistant material for an application with combined causes is to select a material that's going to work on both.

A good choice here would be a dual phase, heat treated, stainless steel like Duracorr® which handles corrosion like 304 stainless, yet at 300 BHN, is more abrasion resistant than T-1® steel.

**Properties to combat erosive wear:**
- High hardness
- High toughness
- Ductility
- Through hardness
- Carbides in the microstructure
- The ability to work harden

Now that we have covered the background, we can look at the most common wear plate mistakes in the scrap metal recycling industry.
Section Number One:
Evaluating Your Wear Problems

Mistake Number One:

Treating the symptoms rather than dealing with the causes.

Patch over patch over patch deals only with the symptoms & doesn’t address the cause of the wear.

Long before you can begin to get control of your wear problems, you must identify the type and source of your wear issue.

This may require you to “think outside the box”, particularly when you are very familiar with your own equipment.

First identify the type of wear causing your greatest wear.

Is it abrasion or impact? Is corrosion involved? Is it a metal to metal application? Is there adhesion? Seldom is there only one cause, there often are 2 or 3 combining factors working together. And they can combine to wear out your equipment and kick your butt.

If you determine your problem is caused by approximately 20% impact and 80% abrasion; your first selection should be a material that works best for abrasion and document the performance.

Please recognize when I am say this it may sound almost childish in its simplicity, yet is virtually ignored in practice at many scrap metal recyclers.

Unfortunately, “We have always done it this way”, seems to have a death grip on treating the symptoms of wear. I see people continuing to do the same thing, time after time; continuing to deal only with the symptoms & not the cause.

When you find the cause & address it, your downtime literally drops like a rock.

Long ago they adopted the tradition of making temporary repairs. They were temporary until they became the “Standard Operating Procedure”. People stopped looking for the actual cause of the wear problem.

My definition of a temporary repair:

The repair is only temporary until the next shift starts. Since it is no longer a problem for their shift at that time, it must have been permanently repaired.

It is absolutely critical to identify the causes of the wear, so that you can determine the correct solution.
**Mistake Number Two:**

Not tracking performance in your challenging wear applications.

Everyone uses a slightly different unit of measure to document the life you get from your current materials.

Your standard unit of measure used as a benchmark may be tons produced, units, machine hours, or between shutdowns.

It is critical that you document on the performance of your current & test materials for comparison on any changes so you can document their effectiveness.

If you have nothing to compare the results of the new material, you will never know if this or any other solution you attempt works any better than what you are currently using.

The same can be said of not documenting your efforts to control your wear issues. This enables you to make accurate comparisons & knowledgeable decisions.

If you want to frustrate a person who is trying to delivery longer wear life for you, tell them you don’t remember where you installed the test sample, or how long it lasted. It can cause you to have an “Excedrin® headache”.

*In 1865, Lewis Carroll (1832-1898) wrote in his book “Alice in Wonderland” “If you don’t know where you are going, any road will take you there.”*

**Mistake Number Three:**

Not knowing what material are you currently using.

Once you have determined what type of wear is causing your problems, and have benchmarked your current performance, you must verify what materials you are currently using.

Many times people are unsure what they used the last time, can’t remember what they bought or who sold it to them. Or it may have been installed before you started at your current position, or lost forever in the last computer “upgrade”.

You are able to quickly and easily determine what material you are using by simply using a magnet and a hand held grinder.

*Spark Test Criteria:*

- The lower the carbon content, the longer the sparks
- The lower the carbon content the lighter color the sparks
- Alloying elements show up in the spark stream as forks or bursts and repeating forks & bursts
- More alloy gives more spark volume

The July 4th sparklers of our youth had a wonderful example of bursts, where they split like the fingers on your hand. This illustration shows bursts repeating down the spark stream.
Forks are a split in the spark stream, usually at the end or repeating as shown in the drawing.

It is similar to the two fingers you use to throw a curve ball.

The alloys present in the spark stream show not only as forks or bursts; they can occur at the end or repeat over the length of the spark. Often the more alloys in the steel, the greater the spark volume.

With this information, you will be able to quickly determine what materials are currently installed. Combining this with the recommended materials for specific applications in the following sections, and you will know which to select for the longest life for your use.

Aggregate applications often use mild steel, high carbon steel, manganese, white cast iron, AR steel, alloy steels and chrome-carbide overlaid plates, or even some stainless steels. Here is how to determine what material you have.

Performing the Spark Test:

Start with a known piece of mild steel for a comparison base. What you will see from mild steel are long, light-colored sparks with no forks and no bursts.

Mild Steel - The sparks may travel over ten feet. Having almost no forks or bursts means it contains no alloy.

The low carbon content of 0.2% to 0.3% will yield light yellow sparks.

Mild steel will have an average hardness of 130 BHN, and used for structural purposes, and is not recommended for wear resistance.

Manganese - steel is non-magnetic as cast, making it the only wear resistant steel you can identify using a magnet.

Manganese Steel - Magnetic only in impacted areas, has a large spark volume traveling over 6’, yellow orange sparks with no forks or bursts.

The greatest attribute of manganese is the ability to work harden. As the manganese work hardens, the impact area transforms to a slightly magnetic condition. This is the only wear resistant
steel that changes in this manner. With the exception of the overlaid plates, all other wear steels are fully magnetic.

**Plain Carbon Steel vs. Alloy Steel**

Alloy steels have special physical and mechanical properties due to the presence of metal elements such as nickel, chromium, vanadium, tungsten or higher levels of silicon or manganese over that found in plain carbon steels.

To illustrate the difference between plain carbon and steels with additional alloys, the next two photos show steels with approximately the same carbon content.

1045 is a plain carbon steel containing 0.45% Carbon and .75% Manganese.

4140 is an alloy steel containing 0.45% Carbon, and 0.85% Manganese, 0.25% Silicon, 1.00% Chromium and 0.20% Molybdenum.

Compare the difference in spark volume, presence of forks and bursts show there are additional alloys present in 4140 steel that are not in the 1045 steel.

**Alloy Steel** – Sparks are light yellow in color, up to 6’ long.

**Chromium Carbide Overlay** plate is easily identified by the irregular surface appearance, made by welding a mild steel base plate with a highly alloyed hardsurface welding wire.

The surface on overlaid plates often show stress checks that are created in the manufacturing process.
You can easily determine the quantity of chromium carbides present by comparing the number of stress checks present in the overlay.

The greater the amount of stress checks, the greater the carbide content.

An overlaid plate will containing up to 46% Chromium-Carbide, contains 36.7% Chromium, 4.8% Carbon, 1.6% Manganese, .67% silicon & iron balance, Chromium carbide plate shows almost no sparks off the grinding wheel. Just a thin spark stream and a red-orange ring around the wheel.

The Stainless Steel Family

Here are the variations of stainless steel:

**Austenitic** – non-magnetic
304 & 316 are the food grades
18% Chromium, 8%Nickel

**Martensitic** – magnetic
410 grade - Knives, forks & spoons
12% Chromium, 0.10%Carbon

**Ferritic** – magnetic
409 grade - automotive exhaust
12% Chromium, .008% Carbon

**Duplex Stainless: **Austenite and Ferrite
**Durralex**® - Better corrosion fatigue resistance than austenitic grades. 22% Chromium, 5% Nickel & 3% Moly

**Dual Phase Stainless: **Martensite & Ferrite
**Duracorr**® Better abrasion resistance
12% Chromium, 1% Nickel, .3% Moly

The most common stainless steels are the austenitic 300 series (304, 316, etc.) and are not recommended for wear resistant applications, due to having a hardness level of only 180 BHN. They are primarily used for corrosion resistance and food applications.

Comparison: 316 Stainless steel has very small spark stream, less than 3’ long, yellow orange in color with no forks.

Compare the 316 photo above to the heat treated, dual phase stainless in the photo below.

**Duracorr**, a product of Mittal Steel, is a magnetic, dual-phase stainless steel with 1% Carbon. Sparks are light yellow, the larger spark stream with forks traveling 3’.

Duracorr® has 300BHN hardness and the corrosion resistance of the 300 series stainless steels. It works well for wear applications having combined corrosion & abrasion issues.
Duracorr® has 0.25% carbon, 1.50% Manganese, 1.0% Nickel, 12% Chromium, .25% Moly & .70% Silicon. The chemistries & results are very different.

**White Cast Iron** – is a wear resistant casting having over 30% Chromium and 5% Carbon. They combine to form chromium-carbides like the overlaid plate on the prior page.

![White Cast Iron](image)

*White Cast Iron has few reddish sparks less than 1’ long and few forks.*

It is called white cast iron due to the silvery color when the casting is fractured. It is cast to shape and is not weldable.

For comparison, Gray Cast Iron has no nickel or chromium yet has slightly more spark volume.

![Gray Cast Iron](image)

*Gray Cast Iron has few reddish sparks 1’ to 3’ long with a few forks and bursts.*

It is called gray cast iron due to the color of the fracture, and is not used in wear resistant applications.

**Tungsten Carbide** – shows no sparks, just a red-orange glow around the grinding wheel.

![Tungsten Carbide](image)

Bonding tungsten carbides in an air hardened steel allows for fast application of these wear resistant carbides in a wide variety of Aggregate applications.

Tungsten carbides are available in various sizes.

**Perform magnet and grinder tests on known steels, and then on your own “mystery metals” to determine what you have currently installed. Once you know what is currently in use, only then can you determine your best material option.**
Section Number Two:

Selecting the Correct Wear Plate

Mistake number 4:

Is harder automatically better?

You may ask yourself, if the 400 BHN wear plate I have been using for years was good, than 600 BHN plate should be far better, right? The answer is not that simple.

So, just how hard is hard?
And how can we tell how to tell when one hardness will perform better than another?

On outward appearances, most steel looks about the same, whatever the actual hardness. On closer inspection, that is not actually close to being the case.

Available as AR240, AR360, AR400, AR500, etc., AR steels have a harder surface area, averaging 0.020” thick than the center of the plate. The greater the thickness, the lower the hardness is at the center of the plate.

The number following the letters, AR, used to represent the Brinnel hardness, although that has since become a fairly generic name and seldom represents the actual Brinnel hardness any longer. We have seen imported AR400 plates sold as AR400, actually test as low as 302 BHN.

AR plates show good initial wear until the wear is through the 0.020” thick harder surface. Then it shows more wear in 3 days than it did in 3 months; and you wonder what changed in your materials to cause such a dramatic shift in visible wear. The answer is nothing changed. What happened was you have just worn through the thin, harder area and now the steel is not nearly as hard and wears away rapidly.

Time for a snack?
Think about an Oreo® cookie; everyone loves that tasty crème center between the chocolate cookies.

Like the cookies in an Oreo®, many steels sold for wear resistant applications are only “hard” for about 0.020” deep from the surface. The center is not much more than mild steel.
With the Oreo’s® having their cookie on top and bottom, they are similar to the common AR or “abrasion resistant” steel.

The best solution is to have a material with the same high hardness completely through the thickness of the steel. Making a plate through hardened requires additional alloy content.

The data below is from an independent test at a limestone quarry, where they ran the same tonnage of the different materials down a discharge chute & measured the depth of wear. This was the most accurately documented, real world application test I have seen yet.

<table>
<thead>
<tr>
<th>Manufacturer or Alloy Type</th>
<th>Brinell Hardness</th>
<th>Depth of Wear mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tricon Metals TriBraze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Astralloy V</td>
<td>461</td>
<td>0.180</td>
</tr>
<tr>
<td>REM 500</td>
<td>473</td>
<td>0.191</td>
</tr>
<tr>
<td>Astralloy EB</td>
<td>425</td>
<td>0.208</td>
</tr>
<tr>
<td>Hadfield Manganese (13Mn)</td>
<td>224</td>
<td>0.211</td>
</tr>
<tr>
<td>AISI 4340 Steel</td>
<td>455</td>
<td>0.211</td>
</tr>
<tr>
<td>Amera Braze 500</td>
<td>514</td>
<td>0.224</td>
</tr>
<tr>
<td>Ford Wearalloy AR500</td>
<td>509</td>
<td>0.226</td>
</tr>
<tr>
<td>Hardox 500</td>
<td>469</td>
<td>0.246</td>
</tr>
<tr>
<td>AmeraBraze</td>
<td>415</td>
<td>0.258</td>
</tr>
<tr>
<td>Star Oneal</td>
<td>387</td>
<td>0.373</td>
</tr>
<tr>
<td>Hardox 400</td>
<td>392</td>
<td>0.384</td>
</tr>
<tr>
<td>Ford Wear alloy AR360</td>
<td>368</td>
<td>0.465</td>
</tr>
<tr>
<td>Type 304 Stainless Steel</td>
<td>156</td>
<td>0.542</td>
</tr>
<tr>
<td>USS T-1 Steel, (AISI Type A514)</td>
<td>269</td>
<td>0.800</td>
</tr>
</tbody>
</table>

The names listed are ® or™ of their various owners.

Analyzing the test data:
It is important to compare the depth of wear to the Brinell hardness values listed. You will notice that hardness alone does not guarantee wear resistance.

The answer is using additional alloys to achieve a through hardened plate.

Any machine shop will tell you the same thing when they drill AR400. It takes the drill some time to pierce the harder surface. Once through, the drill will remove the steel in a curl much like mild steel. It will then slow down again as it works to get through the harder surface at the bottom of the plate.

My customers often report that simply changing from AR400 to a through hardened plate often delivers 2 to 3 times more uptime in their wear applications.

What % Alloy Do You Look For?

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon (C)</td>
<td>.18/.24</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>.75/.100</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>.50/.85</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
<td>1.60/1.80</td>
</tr>
<tr>
<td>Molybdenum (Mo)</td>
<td>.20/.30</td>
</tr>
<tr>
<td>Titanium (Ti)</td>
<td>.01/.10</td>
</tr>
</tbody>
</table>

When comparing alloy percentages, these ranges delivered a verified through-hardened wear plate. Lower percentages of any one material cannot achieve a through-hardened plate.
You must always select the welding product for the chemistry of the steel you are welding.

**Here is an easy way to quickly determine how much alloy is present in any wear plate:**

If the manufacturer of the alloy plate instructs you to weld the plate using 7018, it immediately tells you it has a very low quantity of alloys in the plate, And It Is ALMOST CERTAINLY NOT THROUGH HARDENED.

Standard 7018 weld rod does not have the chemistry to weld chromium, nickel and molybdenum alloys.

In reviewing Lincoln Electric’s MSDS for their popular 7018MR electrode, [http://content.lincolnelectric.com/pdfs/products/msds/US-M291.pdf](http://content.lincolnelectric.com/pdfs/products/msds/US-M291.pdf), it contains manganese, but none of the alloying elements are present in the welding rod to match the chemistry necessary in a plate to make it through hardened.

For joining TriBraze®, a through hardened alloy steel plate, Kennametal® Tricon® specifies Tri-Weld 3 in stick & flux-core wire form. The MSDS for Tri-Weld 3 shows that it contains molybdenum, nickel and three different chromium alloys, along with.

The 7018 simply cannot handle the alloying elements in the TriBraze®.

**Mistake Number 5:**

**Buy cheap & replace often?**

When I began my career in wear resistant metals and maintenance welding, I often heard, “I can afford to have my guys take extra time to “fix on it when we’re slow.”

I certainly don’t hear that anymore. The maintenance welding crew at one of my customers went from 31 men in 2001, to 2 men in 2007. And they are not alone.

Many scrap metal recyclers, like many industries, have realized that the largest single factor in most repairs is the installation labor expense. It often outweighs the initial material cost.

Here are the remains of an inexpensive AR steel that had to be replaced after it failed prematurely, causing an unplanned breakdown. The initial lower cost quickly turned into a budget-buster.
Comparisons on page 12 show that alloy steels can deliver double or triple the life of conventional AR steel.

Invest a little now, or a lot later

Investing just a little more upfront can prevent you from not only buying the lesser quality material 2 or 3 times; you have to remove the steel that didn’t work the extra two or three times before you get tore-install the same material. Now you get to do it all over again.

Does that even sound practical?

Yet many people are so locked into repeating this same process over and over again because; “It’s the way we have always done it”, or “That is what the OEM recommends for it”.

I had a customer once tell me, “I don’t have time to search for something better”. What he failed to understand is that he would have more time to concentrate on the important tasks, if he were not so occupied fighting only the urgent tasks.

Don’t forget about the lost production!
You have to include the profit you miss due to lost production. The cheaper steel just became much more expensive.

Your bottom line shows you ended up with far fewer tons produced per life cycle than if you had invested a little more up front to get a higher quality, longer lasting product.

You can never recover poorly invested dollars or lost production time due to downtime. Those minutes can NEVER be captured & re-used; they are gone.

Your equipment can only run so many tons per hour, and when the clock ticks past, that opportunity is gone forever.

When you evaluate all of the factors in selecting the correct wear plate vs. a cheap wear plate, the initial cost difference for a lesser performing product becomes absolutely insignificant.

One of my customers knows all about getting more value per dollar spent thru longer life, greater production and more bottom line profit.

His standard saying when someone is proposing a product or plan that has absolutely no hope of delivering a profit is, “We don’t spend stupid money”.

If your results are not generating a profit, the rest of the details really do not matter all that much.

I am including a Cost Analysis Calculator on the CD that contains this report, so you can see exactly which one will deliver your greatest benefits & profits.

The current economic crisis will separate the producers from the pretenders. How can I help you?
Mistake Number 6:

Selecting the right steel for the right job.

When you look at wear resistant steels objectively, you don’t buy wear plate simply to have wear plate.

You buy wear plate to deliver the longest possible life for your equipment.

Here are your material guidelines for maximum life from your wear resistant steel investment.

**Alloy Steel:** Your best choice for Impact with Abrasion combinations:

If you battle impact with abrasion, or abrasion with impact; a through-hardened alloy steel plate should be your first selection for Abrasion and Impact.

Recall in Mistake Number 4 lists the reasons why through hardened alloy steels will deliver longer life than generic AR steels.

**Welding:**

Low carbon, alloy steels are easy to weld with the proper joining alloys.

Remember, joining alloy steels requires welding products which are selected for the chemistry of the steel you are welding.

For welding and cutting, be certain to use adequate preheat per manufacturers recommendations.

**Forming:**

Guidelines for the minimum radius when forming are 8 times the material thickness.
Chromium Carbide Overlay:
Best in straight Abrasion Challenges:

For combating Abrasion Applications, Chromium Carbide Overlaid plate will outperform most materials including alloy steels and ceramics.

Look for plate with the highest percentage of chrome carbides to give the longest wear life for Abrasion applications.

The chocolate chip cookie on the right has more chips & tastes better. Chromium carbide plate with a higher percentage of carbides will last longer.

Clad plate works very well in
- Chutes
- Fan blades and fan housing liners
- Flat back elbow wear plates
- Dozer blade liners
- Bucket heel pads
- Cyclone inlet target areas
- Conveyor components
- Screw conveyor flights & troughs
- A multitude of other applications

An Important Note Using Clad Plates:

It is essential that the entire surface of clad plates be fully supported.

The mild steel base plate that the chromium carbide is welded onto is not utilized here for structural purposes.

Remember that Chromium Carbide Overlaid plate is recommended for abrasion only or moderate impact applications.

Forming Chromium Carbide Overlay:

Guidelines for the minimum radius when forming are: 8 times the material thickness with the overlay on the inside of the radius, and 20 times the material thickness with the overlay on the outside of the radius.

Welding:

You can join the mild steel base metal with your standard steel wire or stick. However, it is important not to dilute the weld puddle with the chromium carbide, as most welding rods are not compatible.
Joining the carbide layer requires an all-steels welding alloy like Multi-Alloy 85, which joins any type of steel to any other type of steel.

Joining products are not as hard as the clad overlay so you must cover the weld joints with a hardsurface welding alloy. Wear Arc 355 or Super-C wire, which have the same chemistry as the clad overlay will do an excellent job.

Manganese: Is for impact only applications: There's absolutely no other steel like manganese, because it's designed for impact. It thrives on being beat up.

Manganese in an abrasion application like this one, will wear away quickly. Manganese requires impact to work-harden the surface, increasing the hardness from 260 BHN to nearly 400 BHN.

When welding Manganese, you need to keep the heat under 500 degrees F. absolute.

Some welding products will describe how their deposit is 260 BHN as welded, and will work harden to 388 BHN. This tells you it is high in manganese, because it work hardens when you beat up the surface.

A Brinnel hardness chart is at the end of this report for your comparison.

For pure impact only wear such as the main impact plates in a shredder, manganese is your first choice.

If you determine that your applications are due to impact with a measurable percentage of abrasion, you would be well advised to test an alloy steel when the opportunity arises.

Stainless Steel Applications For Corrosion & Abrasion Areas:

Some people use austenitic stainless steel and assume it is wear resistant because:

- I can’t cut it with a torch
- It stays shiny & doesn’t rust.
- It is readily available

While austenitic stainless is the common choice for corrosion applications, the most common grades at 50 to 80 BHN are not designed for wear applications.

The exception to the rule:
A heat treated, dual phase stainless steel such as Duracorr 300®️, a product of ArcelorMittal®️️ steel, achieves 300BHN hardness with the corrosion resistance of 304 stainless.

T-1®️️ or A514 steel is a high strength, low alloy steel, which is not designed to be wear resistant. T-1®️️ has a tensile strength of 100,000 ksi. It is used by O.E. manufacturers for loader buckets due to lower cost. Refer to the chart on page 13 to see how it performs in wear resistant applications.

Note: T-1 is a registered trademark of US Steel.
**Tungsten Carbide**

Tungsten is the hardest material next to diamonds and is valuable for wear resistance.

Here the tungsten carbide particles are cast in place where they provide excellent wear resistance for high stress grinding abrasion.

Tungsten carbides are available in a variety of sizes and can be cast in many different shapes.

For fine particle abrasion utilize smaller dimension carbides to prevent the particles from wearing around the carbides.

Cast into shape is a much more effective method of putting the wear resistance right where you need it. Tungsten is so heavy that the tungsten carbides formed in hardfacing wires, often sink to the bottom of the weld puddle. This offers little wear resistance on the weld bead, where you wanted protection. Instead, the protection of the tungsten welded in solution often ends up lower than the surface you are trying to protect.

Tungsten needs to be surrounded by a matrix material. Take care not to melt them into a solution during welding installation. Being heavier, when tungsten is melted during welding, it sinks to the bottom of the weld puddle. This makes them less effective than when they are meter-dropped into the molten puddle during welding.

**White Cast Iron** – is often used in abrasion applications requiring thick sections that are not frequently accessible.

**White iron is NOT WELDABLE.** It isn’t able to be hard surfaced or touched up between rebuilds or maintenance shutdowns.

Chromium carbide clad plate is often a lower cost alternative.
The Bottom Line:

Because there are a wide variety of materials on the market today that claim to be “wear resistant”, it is certainly is a case of “buyer beware” when selecting materials for your applications.

I have tried to deliver this report in an unbiased manner, to give you the knowledge and information necessary for you to achieve the longest life for your challenging recycling applications.

After helping my customers for over 15 years get the most production and life from their equipment, I take great pride in my ability to determine the causes and presenting the most cost effective solutions to the issues you see on a daily basis.

Looking for a 2nd Opinion?

Perhaps you, like many of my customers, appreciate being able to “call in the cavalry” and have a set of experienced eyes look over the issue and brainstorm with you for potential solutions and help to determine which is the best choice for you’re application.

I’d love the opportunity to do the same for you. The testimonials in the left column at www.WearAnswers.com will give you just a small sampling of the successes different customers have achieved working together with me and using the suggestions and materials we determined would provide them with their best performance.

Free 45 Minute Recycling Application Analysis

Your interest to gain control over your wear related challenges prompted you to order this free report.

As a thank you, we will provide you with a comprehensive, no obligation, and totally free, 45 minute “Recycling Wear Plate Application Analysis”.

What’s the catch? There isn’t one.

You don’t have time to interview every current or prospective vendor for every problem wear issue you have.

I believe you have found information in this report that is beneficial to you and your wear plate performance.

If you allow me the opportunity to assist you in evaluating your own worst wear problem, I will give you a no-obligation analysis and recommendation for achieving longer wear life, so you can concentrate on your other distractions.

Email RichFercy@gmail.com with a couple of dates that will work for your schedule and we will have your local representative set it up with you.

You will then see firsthand how I work for your benefit and see how it makes sense to work together for a common goal: Longer wear plate life, in your recycling applications.