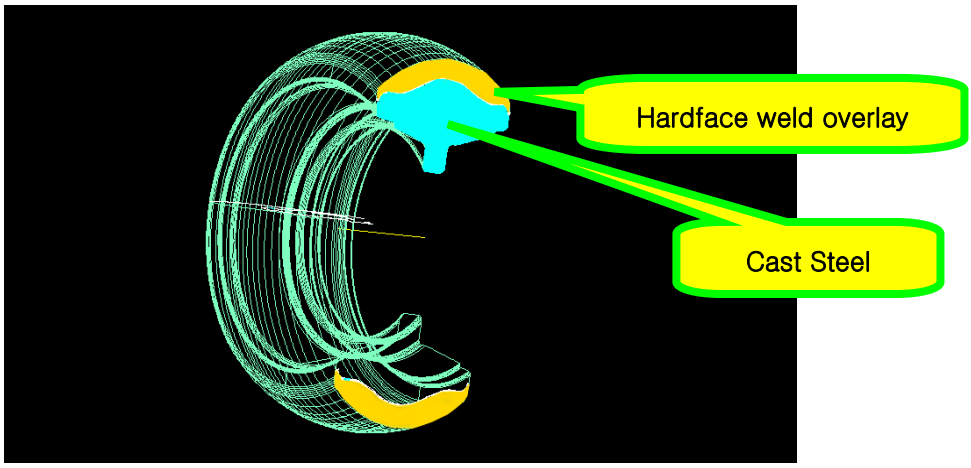
* Comparison between Jung Won Hardfacing Vs. Hi-Cr Casting

1) Structure of Hardfacing Roller Tire

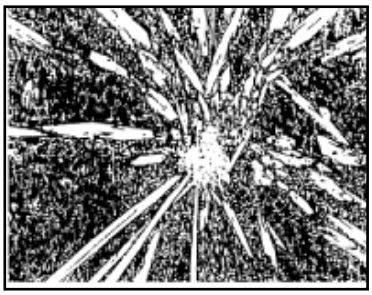
Our hardface roller tires consists of a cast-steel base metal interior and a built-up hardface Welded exterior. As result, the interior of cast-steel should ensure the core of roller tires sufficient ductility and toughness, and exterior of built-up hardface welding alloy warrants surface wear and impact resistance to withstand harsh grinding environments. Eventually, our roller tires improve the performance and the service lifetime. (Pls. refer to the below picture)



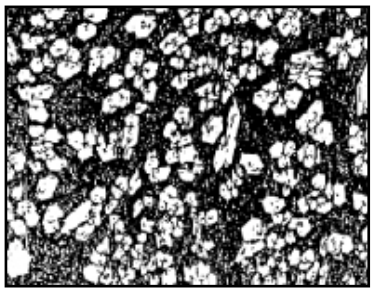
2) Micro Structure and General Service Lifetime

Item	Casting (Hi-Cr)	Hardfacing
1) Micro-structure	Coarse (Cr-C)	Minute (Nb-C)
2) Service lifetime	x 1	X 1.3 - 1.5
3) Crack occurrence possibility	Highly possible	Rarely occurred

CASTING (Hi-Cr)



HARDFACING (JW-65)



The cooling rate significantly affects Microstructure of Metal. Slower cooling speed of Cast grinding elements can cause Coarse Microstructure, while High cooling speed of Hardfacing deposit achieve Minute Microstructure. This metallurgical structure differentiate the lifetime between Casting and Hardfacing Elements.

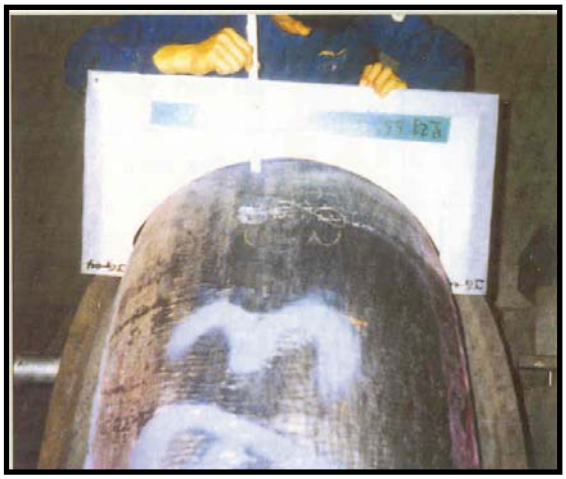
The below laboratory data of Rubber Wheel Abrasion Test results shows that weight loss of Hi-Cr family casting is three(3) times more than Hardfacing ones.

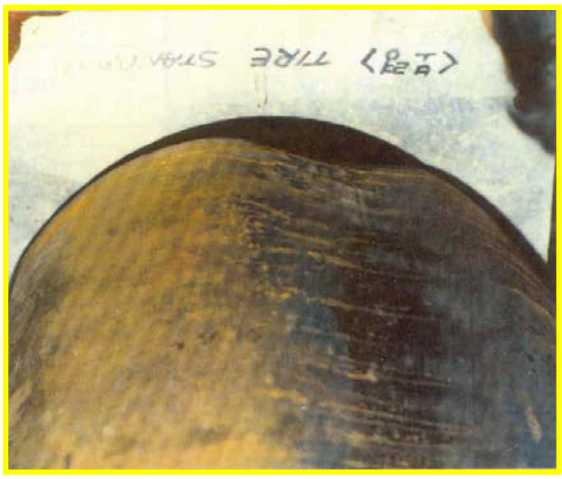
Test piece	Material	HARDNESS(HRC)	Weight Loss (g)	Remarks
FCW 6	3C-20Cr-Ni-Mo	57-60	0.3296	Casting
Ni-Nard IV	3C-10Cr-Ni-Mo	58-61	0.3924	
JW-55	4.5C-26Cr-Si	55-60	0.1214	Hardfacing
JW-65	5C-22Cr-Nb-Mo	60-64	0.0942	

4) Studies

- Case studies #1 (Boryung Power Plant), Coal Mill

Hardfacing Casting(Hi-Cr)



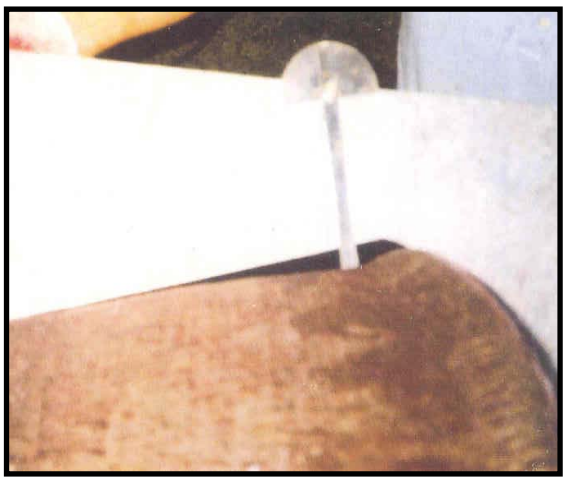


Jung Won	Manufacturer	B & W
Aprox. 23,000 Hrs	Operating Hours	Aprox. 8,000 Hrs
21mm	Max Wear Depth	47mm

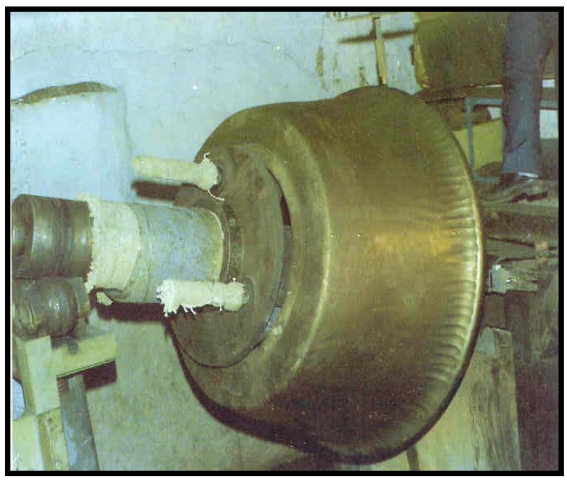
Explanation : J.W repaired/hardfaced the B&W's worn-out R/T, which have been pulled out after aprox. 8,000 Hrs (R/T in right picture), And J.W rebuild R/T (left picture) go last more than 23,000 Hrs and, total operating hour is more than 31,000 hrs. The max wear depth when pull out, Jung's is much superior than B&W's one.

- Case studies #2 (Samchunpo Power Plant), Coal Mill

Hardfacing



Casting (Hi-Cr)



Jung Won	Manufacturer	ABB/CE
Aprox. 20,000 Hrs	Operating Hours	Aprox. 8,600 Hrs
20.5mm	Max Wear Depth	42mm

Explanation : J.W repaired/hardfaced ABB/CE's worn-out R/T, which have been pulled out after aprox. 8,600 Hrs (R/T in right picture), And J.W rebuild R/T (left picture) go last more than 20,000 Hrs and, total operating hour is more than 28,600 hrs. The max wear depth when pull out, Jung's is much superior than ABB/CE's one.

- Case studies #3

*Tong Yang Cement (560Tons/ Hr, Dia.2900mm x 880w), Raw Mill

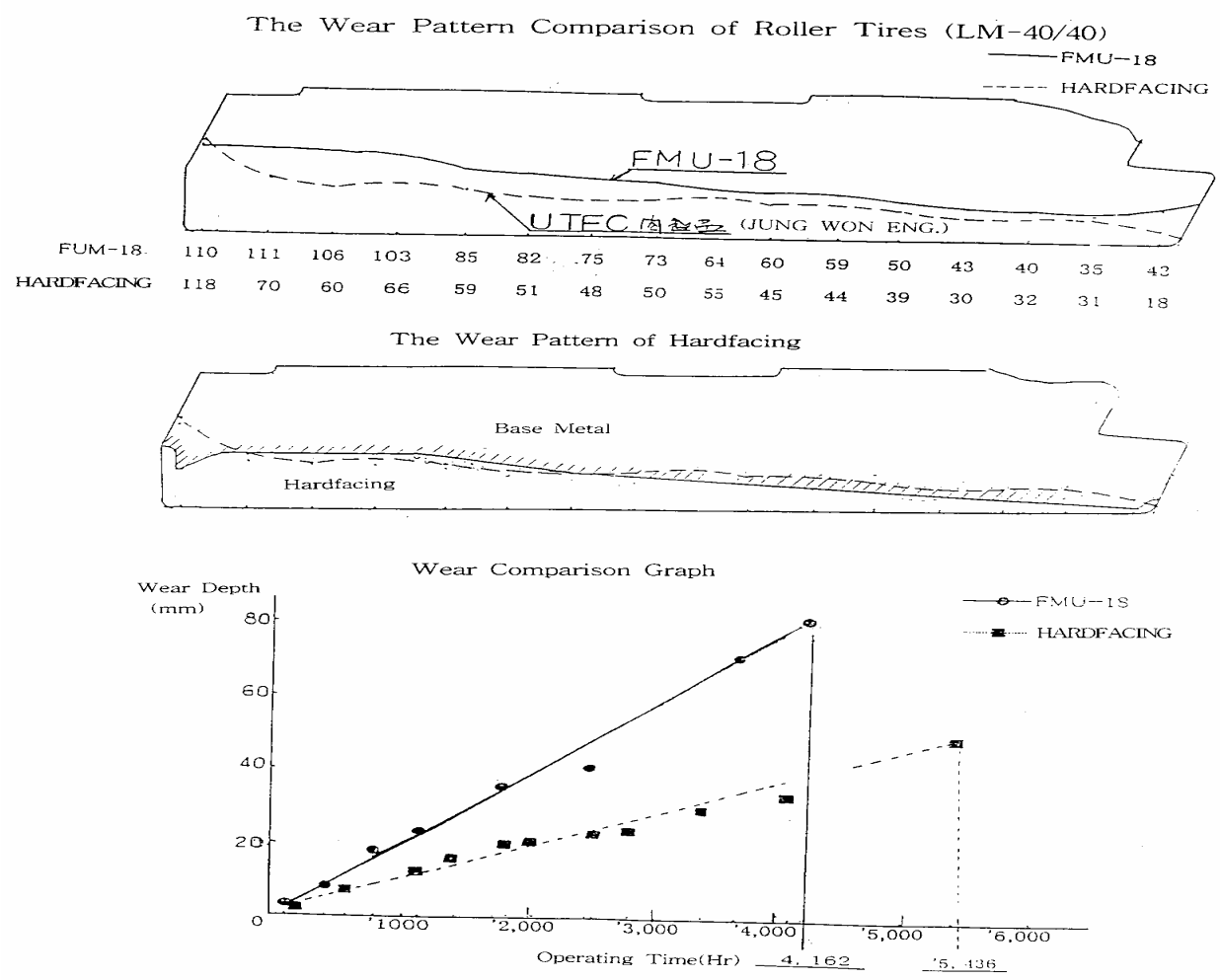


Manufacturer	"P" Company (Germany)	"P" Company (Germany)	Jung Won Eng.
Material	Ni-Hard IV casting	Ni-Hard IV casting	Cast Steel + H/F
Operating hour	Aprox. 5,400 Hrs	Crack occurred during operation	Aprox. 8,500 Hrs
Max. wear depth	110mm	N/A	52mm
Decision	Discarded	Discarded	Rebuilding

Explanation : The above Polysius Roller Tire is the same size as that of your 590Ton Mill.
The left picture is Polysius supplied casting Roller Tire , and show 5,400 Hrs with 110mm Max wear depth, and the middle picture is also Polysius supplied Casting Roller Tire but Crack is occurred,
The Right one is Jung Won's Hardfaced Roller Tire achieved 8,500 Hrs operating hours with Max. wear depth 52mm only, and moreover it can be repairable by giving the same guarantee life as that of Jung won's brand new ones.

- Case studies #4

* Jung Won (Hardfacing) vs Magoutteaux (Hi-Cr Casting)
  Mill Type : Raw Mill (LM-40/40),
  STUDY sourced by UBE Techno Engineering (Japan)



Explanation : Ube Techno Eng. tested Jung Won's Hardfacing Roller Tire and Magoutteaux' Hi-Cr Casting Roller Tire(FMU-18) in the same Mill, and carried out periodic Check, and obtain the above Test Results.

Matgoutteaux' Casting R/T operated approx. 4,100 Hours achieved Max. Wear depth aprox. 80mm, meanwhile, Jung Won's Hardfaced one, approx. 5,400 Hours with Max. Wear depth approx. 50mm.

5) Conclusion,

From the above studies, we may induce that Jung Won's Hardfacing ones can achieve much longer service lifetime than Hi-Cr casting ones, moreover it is stable in view of probable causes of Crack. Repairability is also superior than Hi-Cr casting due to adopting mild steel base metal, and in case of coal mill, Jung Won's Brand-new ones can be repairable minimum two (2) or three(3) times.

- End-