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COMMERCIALIZATION OF STRIP CASTING

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South East Asia Iron & Steel Institute
2000 Vietnam Seminar, Hanoi, Vietnam
November 13-15, 2000

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Synopsis:

BHP and IHI jointly pioneered the development of carbon steel strip casting at the Project M facility at Port Kembla from 1995 to 1999. Now the process has moved to a commercialisation phase following the joint venture agreement with Nucor and IHI. Worldwide, the technology will be marketed by Castrip™ LLC, a company 47.5% owned by BHP. In South East Asia and Australasia, the technology will be marketed by BHP. The first fully commercial strip casting plant is being constructed at Nucor's Crawfordsville plant, using some of the components from the Port Kembla strip caster, plus new equipment.

In addition to the obvious capital savings suggested by the capability to directly cast 1.4 mm thick strip, there appear to be other attractive features of the technology. These features include niche applications for economic production of flat products at a much smaller scale than is the case for conventional technologies. Brownfield conversion of long product minimills to flat products, by substitution of some parts of an existing casting machine, is another possibility.

The extremely rapid solidification characteristics of strip casting also offer the possibility to make unique steel chemistries that might otherwise be impossible to cast using traditional casting technology. For the same reason, the process also has a much higher tolerance to residual tramp elements such as copper, and is not so dependent on use of virgin iron charge materials, when compared to thin slab casting.

1 Introduction

Since 1989, BHP and IHI have been collaborating on the development of strip casting technology. This development process has moved progressively from the laboratory to pilot plant to development plant and most recently, to commercial plant scale. The strip casting project was code-named "Project M". The commercialization process has seen the two original players joined by a third party, US steelmaker, Nucor. A joint venture company, Castrip LLC, has been set up to market the technology worldwide. In South East Asia and Australasia, BHP has retained the rights to the technology.

Several unique features have been discovered during the process of developing and proving the strip casting technology. For example, the extremely rapid solidification rate makes it possible to successfully cast steel chemistries that would normally result in cracking problems for other casting methods. There is a low sensitivity to normally problematic residual elements such as copper and tin, since negligible segregation occurs during the fraction of a second required for complete solidification.

The strip casting technology is not seen as a direct competitor for conventional "thick" slab or the more recent thin slab casting processes. Rather strip casting offers the chance to produce flat products on a relatively small scale, with an economic capital cost. The nominal capacity of 500,000 t/a for a strip caster, means that other niche opportunities such as conversion of an existing minimill billet casting operation to strip casting is viable. Incremental casting capacity to address mismatches between melting and casting capacity, or between melting and hot rolling capacity, is another attractive possibility. It should also be possible to expand the capacity of an existing hot strip mill by transferring production of thin gauge products to an associated strip caster and allowing the hot strip mill to concentrate on thicker gauge strip.

2 Background and Development History

In 1989, BHP and Ishikawajima Harima Heavy Industries (IHI) began to collaborate on the development of twin roll strip casting technology with the commissioning of a five tonne pilot plant at Unanderra, NSW, Australia[i]. The strip caster was supplied with steel from a five tonne induction furnace, with a five tonne induction ladle furnace for temperature and chemistry adjustments prior to casting. This plant was to become known as MP, the Project M Pilot Plant.

The initial focus was 304 grade stainless steel and after successfully producing the first crack free strip that could be processed to sink bowls, the emphasis was shifted to low carbon steel casting. By 1993, cast five tonnes coils 2 mm thick x 1300 mm wide, were successfully pickled, cold rolled, galvanized and roll formed to tile battens which have a tight radius to test the ductility of strip and also adherence of metal coating. This gave the first glimpse of the technical potential for casting low carbon steel.

A range of issues such as the long run quality capability, and the service life of side dams and casting rolls could not be resolved on a five tonnes casting scale. Therefore, it was decided in August 1993 to construct a full-scale development strip casting plant at Port Kembla, NSW, Australia. The Development Plant or MD as it was commonly referred to, was supplied by liquid steel from a pre-existing low powered electric arc furnace (EAF). The relatively slow operation of the EAF limited normal operations to single heat sequences. Using steel supplied from the nearby integrated steelworks, several two and three heat sequences were successfully cast.

Commissioning of this plant began in February 1995, and development work culminated with the production of the first commercial quality coils 2 mm x 1345 mm in December 1997. The maximum coil mass produced was 25 tonnes; typical mass was 15 - 18 tonnes. These coils were processed to roofing products that were used in building projects. Figure 1 below shows a schematic side view of the Development Plant.

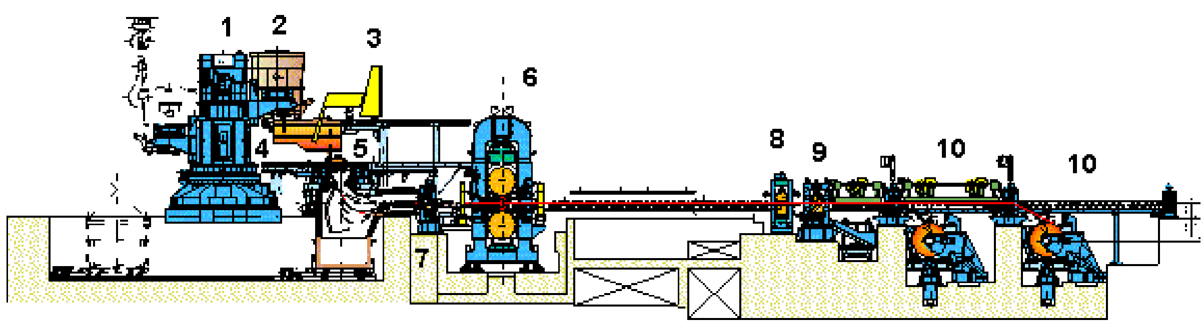

Figure 1. General arrangement of the development plant at Port Kembla. Main features: 1. Ladle Turret, 2. Ladle, 3. Plasma Torch, 4. Tundish, 5. Twin Casting Rolls, 6. In-line Rolling Mill, 7. & 8. Pinch Rolls, 9. Shear, 10. Coilers.

An extended casting campaign was further undertaken in the middle of 1998 to confirm repeatability of the casting process for this operating regime. Material produced was successfully side trimmed, pickled, cold rolled to 0.42 mm thickness, and then metal coated (Zincalume® (55%Al/45%Zn) and Galvanized), painted and roll formed into a number of roofing and walling profiles. The final product was utilised in actual building projects.

In addition, a limited quantity of as-cast material was converted to pipes (21.3 mm to 88.9 mm diameter sections) and tubes (25x25 mm and 50x 50 mm square sections). After demonstrating a capability to cast 1.9 mm thick material for cold mill feed, development efforts were directed towards increasing the caster productivity from 40 t/m/hr to 60 t/m/hr and also on the production of thinner gauge material specifically down to 1.0 mm thick[ii].

The business drivers for this direction were to improve the economics of strip casting by firstly improving the return on capital invested (by improving productivity to the point where a typical plant would produce around 500kt/a). And secondly, by producing a product that can compete in specific markets with material currently supplied via the cold rolling process. Some of the development history milestones are shown in Figure 2, below.

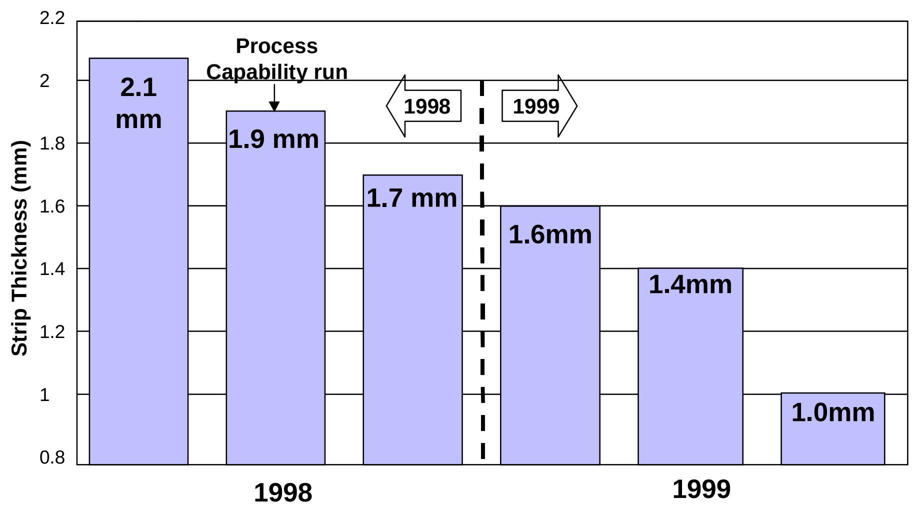

Figure 2. Progress in successfully casting thinner strip.

3 Commercialization Phase

3.1 Strategy Evaluation

In early 1999, a small team was formed to build on the technical success achieved and commercialise the technology. BHP embarked on a nine month strategy evaluation process involving a cross-section of people from across BHP with expertise in the strategy, finance, technical and commercial areas.

The process was wide ranging, including the issuance of an information memorandum to prospective partners seeking participation in a joint venture organization with BHP and IHI. This was followed by a formal due diligence process carried out by BHP and IHI, which included demonstration of the strip casting process at the Project M Development Plant. A "data room", containing technical, marketing and commercial information relating to Project M was established for interested parties.

3.2 Castrip LLC

In March 2000, a joint venture was formed to license the Strip Casting patents and technology worldwide. The participants in the joint venture organization, named Castrip LLC, are BHP 47.5%, Nucor 47.5% and IHI 5%. Castrip has worldwide licensing rights to the technology, with the exception of Australasia and South East Asia. BHP has seconded 11 people from the Project M Development Plant to Nucor's Crawfordsville site, to provide expertise for the first commercial strip caster.

BHP has also appointed a Strip Casting Business Development Manager. This role will initially be mainly concerned with supporting the BHP personnel on secondment to Nucor at Crawfordsville. Another important aspect is to develop a strategy for BHP to capitalize on the licensing rights for strip casting in South East Asia (Australia, New Zealand, Thailand, Malaysia, Singapore, Vietnam, Philippines and Indonesia).

Nucor will be the initial licensee of Castrip LLC with the world’s first truly commercial Thin Strip Caster now under construction at Nucor’s Crawfordsville, Indiana plant.

3.3 Nucor Crawfordsville Castrip Plant

Nucor's plant at Crawfordsville is renowned for pioneering the development of the thin slab casting process in the early 1990's. This same site has been chosen for the construction of the first commercial thin strip caster (MC caster). The Crawfordsville Castrip facility will reuse some of the key mechanical components from the MD plant, with enhancements and further improvements, plus new equipment. Liquid steel will be provided from the existing 110 tonne EAFs. A new purpose built Ladle Metallurgy Furnace (LMF) will be installed. It is intended to supply the strip caster with both carbon and stainless steel (via an AOD vessel). Other researchers working on strip casting have concentrated almost exclusively in stainless steel. Castrip development has concentrated mainly on carbon steels, although detailed pilot plant work was done on stainless steels. This work suggested that the technology should also be suitable for production of thin gauge stainless steel.

The Crawfordsville Castrip facility (see Table 1 below) is expected to be operational in late 2001.

Table 1. Nucor Crawfordsville Castrip Plant

Parameter	Specification
Ladle Handling	Twin Arm Turret
Heat Size	110 tonnes
Mode of Operation	4 Heat Sequence
Casting Mould Type	Twin 500 mm diameter casting rolls
Casting Speed	80 m/min (typical)
	150 m/min (maximum)
Strip Thickness	0.7 - 2.1 mm
Strip Width	2000 mm (maximum)
Coil Mass	25 tonnes
Tundish Capacity	23 tonnes
Tundish Flow Control	Slide Gate
Distributor Type	Transition Piece
In Line Reduction Mill	
Mill Stand	Single Stand - 4 High with Hydraulic AGC
Work Roll Dimensions	475 mm x 2050 mm
Backup Roll Dimensions	1550 mm x 2050 mm
Rolling Force	30 MN (maximum)
Main Drive	3500 kW
Strip Cooling	
Cooling Table	10 top and bottom headers
Shear	Drum Type
Coilers	
Coiler Size	2 x 40 tonne coilers
Mandrel	760 mm diameter
Nominal Annual Capacity	300,000 to 1,000,000 tonnes

4 Technical Features of Strip Casting

Strip casting enables the elimination of intermediate process steps which exist in conventional strip production resulting in a process that is not only simpler, but in many respects more challenging from the process point of view[iii]. The nature of the process also creates some unique circumstances, which further improve the flexibility and cost effectiveness.

4.1 Process Fundamentals

Unlike conventional slab casting, strip casting is carried out without mould flux, resulting in direct contact between the liquid steel and the mould surface as shown in Figure 3.

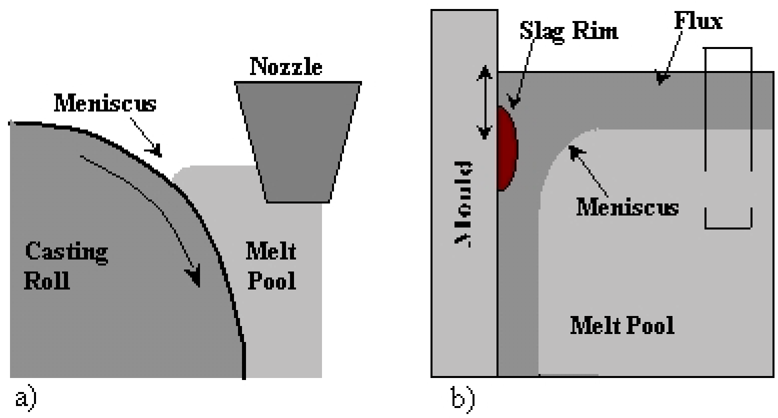

Figure 3. Schematic representation of moulds (a) twin roll strip casting (b) slab casting.

This regime is accompanied by much higher heat fluxes and solidification rates as summarized in Table 2.

Table 2. Key process differences between twin roll and slab casting.

Parameter	Strip	Thin slab	Thick slab
Strip thickness, mm	1.6	50	220
Casting speed, m/min	80	6	2
Average mould heat fluxes, MW/m^2	14	2.5	1.0
Total solidification time, s	0.15	45*	1070**
Average shell cooling rate in mould, °C/s	1700	50	12

* k factor = 29
** k factor = 26

4.2 Rapid Solidification

The extremely rapid solidification rate, which is in the order of 100 to 200 milliseconds, means that there is little opportunity for segregation of elements. Consequently, relatively high levels of normally problematic "tramp" elements, such as copper and tin can be tolerated, without causing quality problems. Thin slab casting is typically limited to maximum copper residual levels of 0.10 to 0.15%, in order to avoid cracking problems associated with the ductility trough. This then necessitates the use of costly premium scrap or virgin iron sources such as pig iron or HBI, in order to dilute the residuals contributed from obsolete scrap sources.

In order to quantify this phenomenon, a series of test heats were cast at the Development Plant. In all cases, the strip with high residuals had similar quality levels to 'low residual' strip. Scale levels were also similar between the two groups. A number of high residual chemistries were explored, including copper up to 0.55%, tin up to 0.16%, and total residuals (Cu + Ni + Cr + Sn + Mo) up to 1.16%[iv].

As would be expected, there was an attendant increase in yield strength and decrease in elongation (%) with the higher residuals. At the highest residual level, yield strength increased by 150 MPa and elongation decreased by 10%. In-line hot rolling further strengthened the strip. This suggests that there is an opportunity to make a range of relatively high strength steels using cheap raw materials. Since the strip quality is unaffected by the high residual levels, the ferrous feed requirements for strip casting should be less demanding than for other casting technologies.

4.3 High Productivity with Thin Gauge

The twin roll casting process is ideally suited for producing thin strip. Machine throughput in strip casting increases with decreasing strip thickness, unlike conventional strip production processes where productivity declines. A typical throughput characteristic curve for a twin roll caster is presented in Figure 4. This indicates that as the cast thickness decreases from 2.0 mm to 1.6 mm the throughput increases by approximately 25%. As the strip thickness decreases, the cross sectional area between the rotating moulds becomes relatively small compared to the mould surface area, so reducing the amount of heat to be extracted.

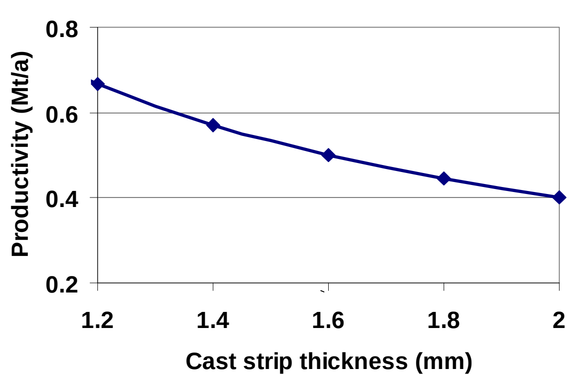

Figure 4. Effect of cast strip thickness on machine throughput (1233 mm wide, k-factor = 16.25, Yield = 94.1%).

4.4 Operational Flexibility

A strip caster does not have a dummy bar for start-up situations. Metal is cast directly through the rolls, and then the strip is picked up and fed through the first pinch roll set. Therefore, there is no time taken to charge or remove a dummy bar during start-up. Machine start-up and tail-out can be completed within less than a minute each. In the event of downstream problem after the pinch roll, strip can be collected in a special dump box under the casting rolls, until the problem is fixed, then picked up and fed into the pinch roll again.

The main operating floor is completely automated. Robots are used to set the pre-heated refractory side dams and distribution nozzle in place above the rolls, as the tundish moves into the on-cast position from preheating. As well as reducing manning requirements, this arrangement helps eliminate operator exposure to liquid steel, thereby improving operational safety.

4.5 Scale of Operation

The strip casting process is approximately 60 meters long, measured from the ladle turret centerline to the coiler. This compares to 300-400 meters for a thin slab casting operation, and 500-800 meters for a conventional slab caster and hot strip mill. This is shown graphically in Figure 5 below.

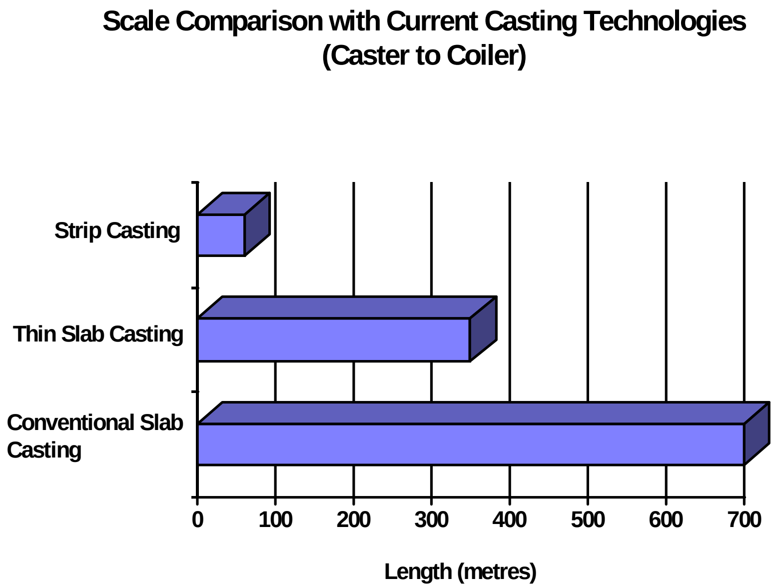

Figure 5. Line length from caster to coiler for various strip production routes.

Consequently, the strip casting process offers the following main advantages:

- Facilitates easy backward and forward integration into existing operations, particularly conversion from long products to flat products.
- Integration with existing flat products facilities, allowing a large hot strip mill to concentrate on thicker gauge, and a strip caster to concentrate on thinner gauge.
- Rounding-out of existing EAF and possibly cold rolling capacity.

- Less obtrusive than conventional technologies, and requiring less land and building space, therefore reducing site and development costs.
- Smaller scale and less production steps go hand in hand with improved energy efficiency. The Castrip process utilizes around 50% of the energy of thin slab casting and hence reduces greenhouse gas emissions by approximately 40%.

5 Cost Competitiveness of Strip Casting

5.1 Projected Operating Cost

As shown in Figure 6, metallic feed constitutes approximately 50% of total operating costs to produce strip cast steel from scrap using an EAF. Other major costs per tonne of output are electricity, refractories and alloys. The possibility of using lower cost scrap types was discussed in section 4.2, and it is clear that any reduction in the major cost item will have a positive effect on the overall economics.

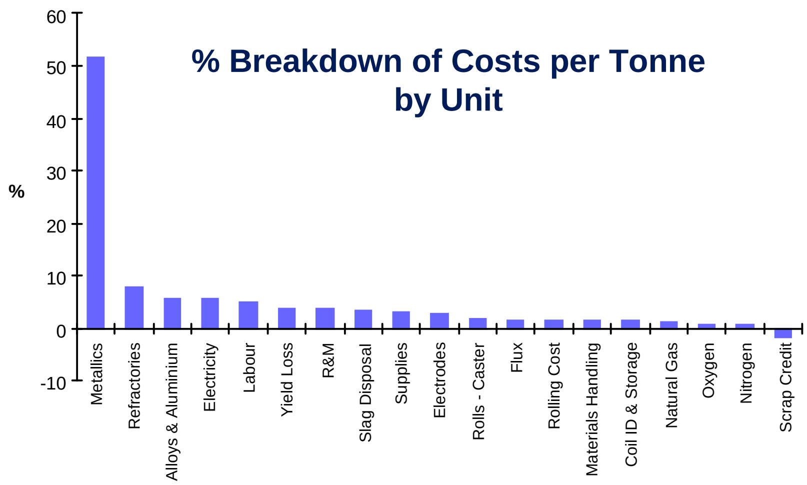

Figure 6. Main Cost Elements for production of strip cast steel from scrap using an EAF. **[Chart data from BHP financial modeling].**

As mentioned in section 4.3, process productivity improves with thinner section. Still thinner gauge material can be produced by use of the in-line reduction mill. The in-line reduction mill incurs an operating cost dependent on the percentage reduction. The maximum cost is expected to be just over US$3 per tonne, for a 42% mill reduction.

5.2 Light Gauge Strip

Strip casting has a unique cost position in the production of light gauge strip products compared to current hot rolled and cold rolled production processes. This advantage improves as thickness is reduced as depicted in Figure 7.

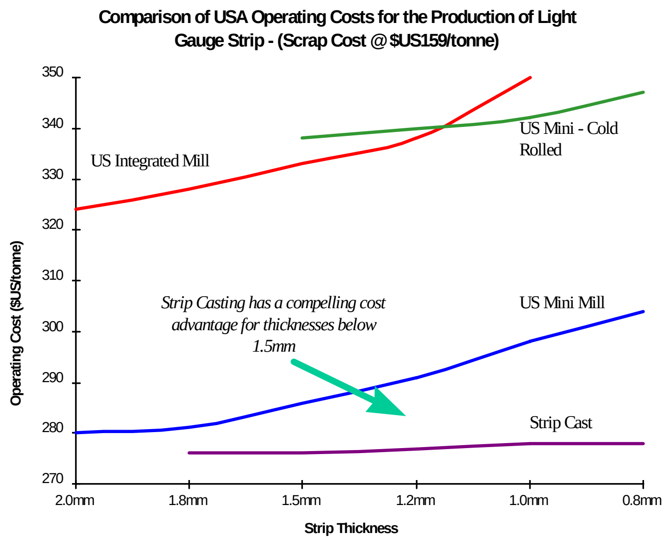

Figure 7. Production cost for light gauge strip for various process routes. **[Chart data sourced from BHP, Economic Associates, CRU Thin-gauge Hot Rolled Vs Cold Rolled, September 1998].**

5.3 Freight Costs

Freight is a critical cash cost for all steel plants. It impacts both at an input level bringing raw materials such as scrap and iron ore and coal to the mill and at a customer level with mills forced to freight equalize to secure sales against other mills.

While the cost of production for most steel products has continually reduced over the past twenty years, in some regions freight costs tend to rise with inflation and in total, represent a significant percentage of total delivered cost. Figure 8 below, illustrates a typical relationship between distance of transport and freight cost in the US.

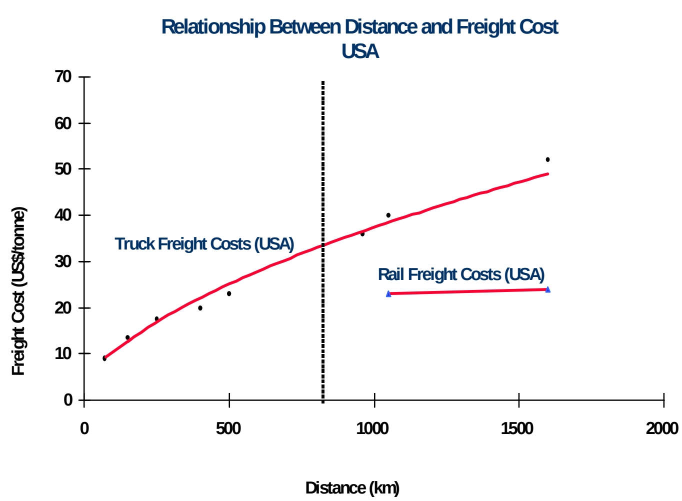

Figure 8. Freight cost as a function of transport distance in the USA. **[Chart data from BHP financial modeling].**

Transport costs become a significant factor in markets that are not large enough to sustain steelmaking and rolling technologies of conventional scale. As a result, users in these markets are forced to rely on imported or remote domestic supplied feed products. In these cases transport costs can be a very significant percentage of product cost.

The ability to locate a plant in close proximity to both a scrap source and final customers is rarely possible with conventional steelmaking technology as the production scale inevitably means having to secure sales in markets some distance away to maintain efficient operating volumes.

The small size of the strip casting operation provides an opportunity to permanently remove inbound and outbound freight costs from the supply chain by having the ability to locate close to both customers and scrap suppliers.

5.4 Estimated Capital Cost

Figure 9 represents the estimated capital cost breakdown for a strip casting facility. An operation with an annual capacity of around 500,000 tonnes can be established for approximately US$166 million. This amount is based on a 'greenfield' operation; therefore, lower capital cost options are possible for 'brownfield' sites where existing meltshop, land, or buildings are available.

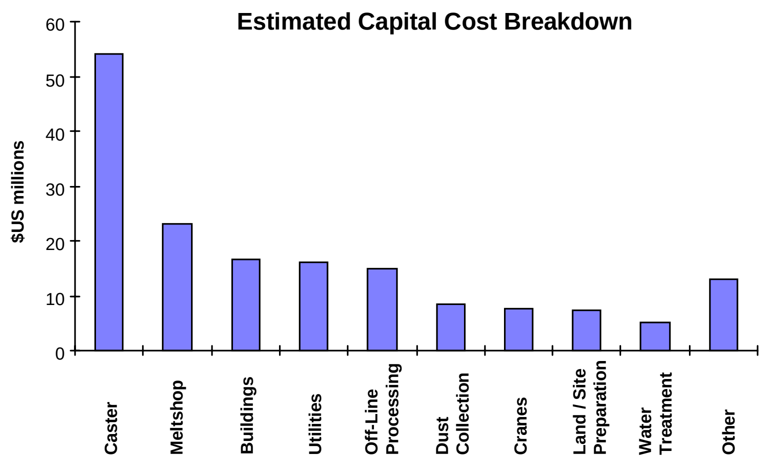

Figure 9. Estimated capital cost to establish a 'greenfield' meltshop and strip caster. **[Chart data from BHP modeling].**

The strip casting process is economically viable at volumes of 400,000 to 500,000 tonnes per annum. This presents a number of unique advantages over conventional strip-making technologies, including:

- the opportunity to enter markets that are currently too small to be economically viable for conventional technologies
- smaller operations provide improved scope for plants to be located in close proximity to both scrap sources and customers, reducing expensive freight costs
- localized operations also have the potential to reduce lead times and shipping times, with a positive impact on both customer and operating inventory costs

6 Markets and End Use Applications for Strip Cast Products

6.1 General Market Opportunities

Worldwide consumption of sheet steel products is forecast to continue to grow well into the next century as highlighted in Figure 10.

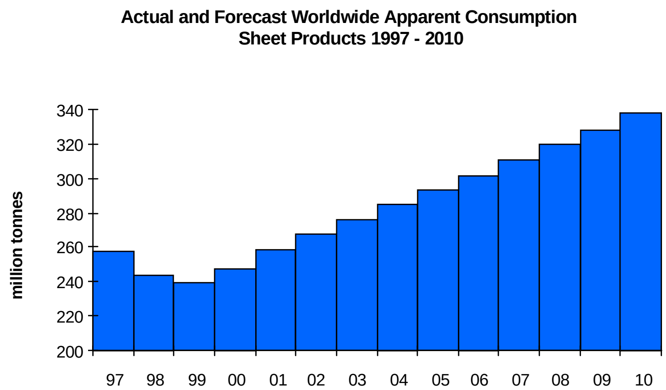

Figure 10. Forecast world production of sheet steel products. **[Chart data from World Steel Dynamics - Global Steel Product Matrix, December 1998].**

Developing countries are following the developed world's trend towards an increasing flat products mix. This trend is typically seen in stronger demand for sheet products for use in the construction and manufacturing markets. This consumption growth will provide the platform for investment in new sheet capacity and the development of lower cost, more efficient production processes.

One of the major remaining opportunities available to the steel industry, is that presented by light gauge hot rolled products. It is estimated that a large portion, perhaps as high as 40% of the cold rolled and coated market, is based on the requirement for thin gauge, rather than metallurgical or surface characteristics.

To date, there has been little incentive for mills, particularly large integrated mills, to accelerate the technical and market development of light gauge hot rolled products, as it would serve only to reduce the total output of a hot strip mill and also possibly cannibalise existing cold rolled markets.

However today, the trend towards light gauge hot rolled products is accelerating, and is forecast by CRU to grow from 21.0 million tonnes in 1997 to 37.7 million tonnes by 2007, based on a lower production cost, driving price led market penetration. This represents a forecast annual growth rate of 6%, which makes this segment potentially one of the fastest growing niches in the global steel market.

Figure 11 shows that while Europe will continue to be the largest consumer of thin gauge hot rolled, the fastest growth is forecast in the US, where the market is expected to more than double from 4.3 million tonnes in 1997 to 9.3 million tonnes in 2007.

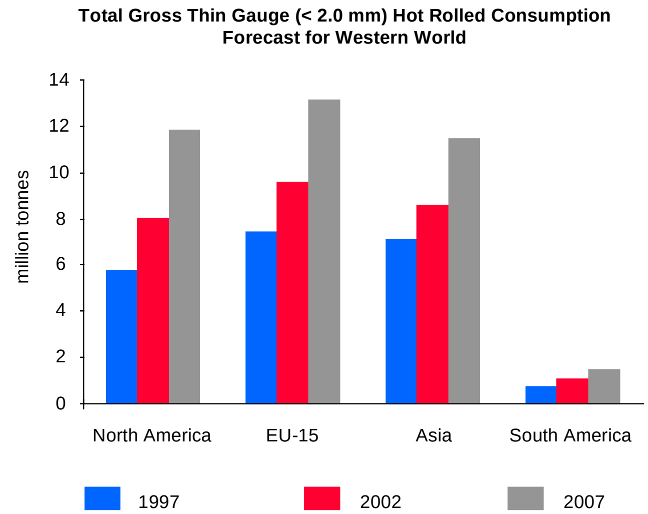

Figure 11. Forecast consumption of thin gauge (<2.0 mm) steel in Western World. **[Chart data from CRU, September 1998].**

The construction and metal goods sectors are forecast to be two of the primary drivers underpinning the increased consumption of light gauge hot rolled strip in the next decade. Growth in the tube segment is also significant, but reflects large inroads already made by thin gauge hot rolled. These are also the market sectors where the strip casting process is best positioned to produce products of a quality demanded by customers.

As Figure 12 depicts, significant growth is forecast for both the United States and European Union in these sectors.

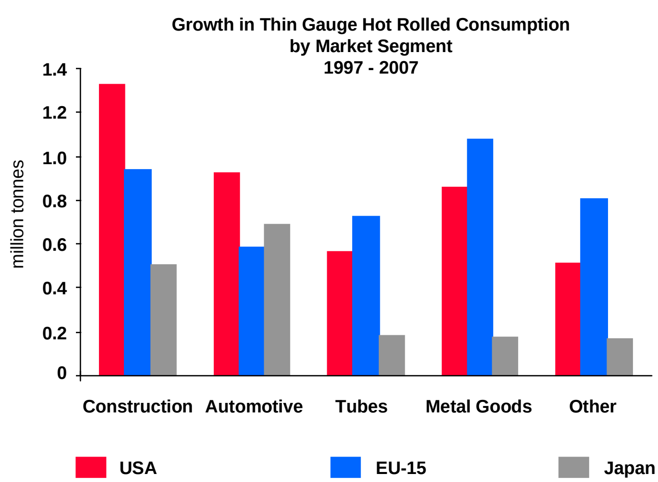

Figure 12. Growth in consumption of thin gauge hot rolled steel by market segment. **[Chart data from CRU, September 1998].**

A combination of BHP and external market research has identified a range of initial target markets for strip cast products. These markets can be generically described as falling into four major segments:

- Cold Mill Feedstock
- Coated Construction Products
- Mechanical Tube
- Manufactured Goods

6.2 Cold Mill Feedstock

There are potentially large opportunities for the use of strip cast products as feedstock for cold mill operations. CRU estimate that today somewhere between 2% and 6% of cold rolled is produced using an ultra light gauge hot band and this intermediate market will provide an attractive entry level.

This semi finished market offers a number of advantages for the strip casting technology including:

- large volumes of relatively few specifications;
- the potential to locate adjacent or within close proximity to customers to reduce freight costs and improve flexibility;
- the ability to focus research and technical development significantly on one major customer as opposed to spreading the focus among hundreds of finished product users;
- and the ability to potentially offer unique benefits as outlined below.

Today, a one stand reversing cold mill operation will typically input a 2.0 to 2.5 mm hot band to achieve an annual throughput of 350,000 to 450,000 tonne. For many of these operations, a significant amount of their order book is comprised of very light gauge final thickness in the 0.33 to 0.45 mm range. These thicknesses take on average five passes to achieve final thickness. By inputting a much lighter (1.0 to 1.8 mm) strip cast band, it is possible to achieve the final thickness with fewer passes, thus ‘freeing up’ additional cold mill capacity.

6.3 Coated Construction Products

6.3.1 Purlins

Purlins are cold formed secondary structural members used to support roofing or cladding in the construction of commercial and industrial buildings. Purlins are typically formed into “c” or “z” shapes from light gauge hot rolled strip, and are prepainted to ensure the sections arrive on the job site with a surface free of corrosion.

Approximately 65% of US consumption is within the strip cast gauge range. All of the material for this market is slit prior to forming and surface characteristics are not important, making this market a clear target for strip cast products.

6.3.2 Decking

Decking is a structural element used in a floor assembly or a vertical or lateral carrying element in a roof system. Today decking users roll deck profiles from either painted full hard cold rolled strip or galvanized strip. The US market is split roughly equivalently between either while Europe is predominantly galvanized.

A strip cast product with yield strength of 350 to 410 MPa and tensile strength at least 8% higher may allow the development of new, differentiated deck profiles that could lead to downgauging of current deck thicknesses.

The potential to utilize cast strip as a substrate for metallic coating is very significant, and while the coating market is not a market in itself, it does provide a conduit into a wide range of potentially lucrative markets.

6.3.3 Culvert Pipe

Culvert is large diameter galvanized, corrugated pipe placed under roads and in other areas as a conduit for water. Highway construction and storm sewers are the major uses for the product. The gauges used by the market fall significantly within the capability of strip cast product.

6.3.4 Structural / Framing Studs

Coated studs and frames are used in both load bearing and non-load bearing wall applications, primarily in commercial construction. Load bearing applications use gauges more compatible with Castrip capability. The penetration of steel into residential markets is considered embryonic, with timber still holding the dominant share, however there are significant opportunities for steel penetration into these markets.

6.4 Mechanical Tube

Cold-formed mechanical tube is small diameter, light wall, electric resistance welded (ERW) tube which is consumed in a wide range of applications including:

- residential, office, institutional and hospital furniture
- electrical conduit
- fencing
- exercise equipment
- scaffolding
- seat frames, etc.

While the geographic demands and issues will vary somewhat, the common premise is focus on feed cost, and it is here that Castrip has the potential to deliver a lower cost feed to this industry.

6.5 Manufactured Goods

This segment contains a wide range of goods that are characterized by applications that typically use cold rolled strip, primarily due to gauge availability and which do not have demanding surface requirements.

Examples of applications would include:
- commercial and retail racking and shelving
- pallet racking
- electrical control boxes
- air conditioning vents and louvres
- lockers, etc.

The ability to deliver a more economical substrate for powder coated and non-exposed manufactured goods would be a powerful proposition for the range of markets comprising this segment.

6.5.1 Steel Drums

Steel drums are used for a wide range of applications including chemicals, oils and foodstuffs. The industry manufactures a range of steel containers from small 5-10 liter up to 200 liter drums and it is the latter product that represents a significant opportunity for strip cast products. Today, 95% of industry use is cold rolled, principally because the desired gauge range of 0.7 to 1.4 mm is not available as hot rolled feed.

Table 3. Summary of Commercial Proposition for Strip Cast Products

Target Market	Sub Segment	Commercial Proposition
Cold Mill Feedstock	Reversing Mills Supplying the Construction Market	• Additional cold mill throughput. • Lower inventory and freight costs.
Coated Construction Products	Structural Decking	• Higher strength/ductility decking products, with a safer to install non-slip surface.
	Painted Purlin	• Lower painting costs derived from availability of wider light gauge strip.
	Culvert	• Lower cost substrate for coated culvert strip.
	Framing / Stud	• Lower cost coating substrate enabling an acceptable return to be extracted from this market.
Tube	Mechanical	• Lower cost feed product for tube applications including, fencing, furniture, electrical conduit, and chemical container frames.
Manufactured Goods	Racking/Shelving Electrical Control Boxes, Vents.	• Lower cost substrate for powder coated goods.

7 Conclusion

The revolutionary Project M strip casting process developed by BHP and IHI has moved to the next stage. These two companies in joint venture with Nucor have formed a company, Castrip LLC to market the technology worldwide. The world's first commercial strip casting plant for carbon steel is currently being built at Nucor's Crawfordsville Indiana, USA, site.

The unique features of the strip casting technology offer a range of new opportunities to allow economic production of flat products on a smaller scale than has previously been possible. The production of thin gauge strip at a low operating cost is an attractive possibility. The technology can also be used to optimize the productivity of existing hot and cold rolling mills.

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