Low cost, high quality billet caster upgrade

The need to respond quickly to customer requirements in terms of caster design and capabilities, yet keep costs to an absolute minimum by optimum use of new and refurbished equipment is particularly important for small steel companies. The STS billet caster at the Al Tuwairqi Group steel plant illustrates what can be achieved.

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NSF and STS SrI

Prior to 2003 the National Steel and Iron Company, Saudi Arabia had only rolling facilities – buying billets from the market or its own melting shop located in the UK. In 2003 the group decided to install its own steel plant and billet caster, using many items of machinery from decommissioned plants to minimise costs, but complemented by new, advanced solutions where the process demanded the best machinery for efficient productivity and quality.

The whole project was fully managed by Al Tuwairqi personnel including basic design, project management, erection and start-up for production, aided by individual new equipment suppliers. Other important contributions from Al Tuwairqi were the manufacturing of many structural parts, steel and concrete buildings and many other components.

The project progressed in a number of phases:

PHASE 1: 650 KT/ YR
The production facilities included:

- Scrap receiving and preparation area
- Melting furnace of 65t tap weight
  (see Figures 1 and 2)
- Ladle furnace with automatic ferroalloy feeding systems
- Dust collection system for environmental control
- 3-strand continuous billet caster
- 6m billet transfer station
- Treated water complex

In June 2003, STS was awarded the contract for the continuous casting machine, aiming to keep the investment to an absolute minimum.

The caster had the following features within the initial scope of supply:

- Tundish size 12t
- Radius 8m

Fig.1 Electric arc furnace

Fig.2 Furnace tapping
CASTING

New primary and secondary water automation system
New automatic torches (see Figure 4)
Billet size 150 x 150mm x 6m long
Casting speed 2.8–3.2m/min

The phase 1 project timescale was completed extremely rapidly; only one year from the start of building foundation work to the first cast billets being produced. With this configuration the plant produced 600kt/yr.

PHASE 2: INCREASED CASTER CAPABILITY
After the promising results of initial production, phase 2 of the project was immediately approved for increased casting capacity ready for increased steel supply to 850kt/yr. The object was to cast billets 14m long and up to 200mm square.

The facilities in this phase included:

- New cantilevered, liftable tundish cars
- Larger tundish with 20t capacity
- Tundish nozzle changer
- New pneumatic straightener (see Figure 5)

As with phase 1, the project was completed quickly. The project timescale and achievements for phases 1 and 2 are shown in Table 1.

PHASE 3: INCREASED CAPACITY
To increase steel output the EAF and LF size needed to be increased and additional facilities provided at the

<table>
<thead>
<tr>
<th>Table 1 Project timescales and achievements</th>
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<tr>
<td><strong>Started first building foundation</strong></td>
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<td><strong>First heat through whole plant</strong></td>
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<td><strong>24 hour production</strong></td>
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<td><strong>29 heats in 24 hours (orig design capacity)</strong></td>
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<td><strong>31 heats in 24 hours</strong></td>
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<td><strong>108 sequenced heats</strong></td>
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<td><strong>Rejections less than 0.4%</strong></td>
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Fig.3 Continuous casting machine apron
Fig.4 Automatic torch cutting system
Fig.5 Withdrawal unit
Fig.6 Discharge area

New fourth strand
New solid dummy bar system
New turnover cooling bed (see Figure 6)
New billet transfer system (see Figure 7)
New cold billet grouping table for easy magnet handling
Larger capacity furnace and ladle size to 90–100t
Ladle turret (see finite element design in Figure 8)
New fifth strand in the space of the previous four strands
New re-designed solid dummy bar system
Electromagnetic mould stirrers

to facilitate the extra strand within the original caster dimensions all the machinery of the original four strands had to be re-spaced.
Completion of phase 3 is expected by December 2005.

CONCLUSIONS
Phased, rapid and economically viable development from a bar mill rolling purchased billets to a self-contained mini-mill has been demonstrated through excellent teamwork between STS and NSIF and the lack of any serious safety incidents. The use of new, refurbished and locally sourced equipment helped minimise costs yet maintain the necessary quality requirements.

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