

Laser Alignment for the Caster Machine Repair Aisle

Editor's note: Each year, AISE's Maintenance Technology Div. and Subcommittee No. 40 on Maintenance and Reliability Strategies recognize reliability improvements and achievements in the iron and steel industry. The 2001 Reliability Achievement Bronze Award was bestowed on Dofasco for its unique continuous caster alignment program.

Introduction

Dofasco pioneered a continuous caster laser alignment system that has achieved significant segment repair cost and time savings and has resulted in increased segment life and improved as-cast slab quality.

Dofasco operates two continuous casting machines—No. 1 and No. 2 casters were commissioned in 1987 and 1996, respectively (Table 1).

When the casters were installed, Dofasco chose to perform all mold and segment rebuilding in-house with Dofasco personnel. Maintaining segment roll alignment and profile to a high degree of precision is critical to production of defect-free continuously cast slabs. Realizing this requirement, Dofasco has developed and implemented a laser alignment system to ensure that all segment rolls are set to the proper elevation in both frames.

Table 1

Caster Specifications

	No. 1	No. 2
Design	Hitachi Zosen/Demag	Voest-Alpine
Annual capacity	2.7 million tons	1.35 million tons
Total machine length	38 meters	33 meters
Mold configuration	straight	straight
Segment configuration	quick change segment, segment 0,19 segments	14 segments

Background

When the No. 1 caster was brought on-line, alignment stands and templates were supplied by the OEM and used by Dofasco to align segment rolls to the passline and profile (Fig. 1). Segment frames and corresponding templates were set on alignment stands

Figure 1



Originally segment rolls were aligned using templates and feeler gauges, introducing significant variability.

and feeler gauges were used to set roll profiles and passlines. This procedure was very time consuming and was a source of variability due to tradespeople fitting practices. With aim dimensional tolerances of 0.002 inches, variability was a major issue.

To improve upon the template method, Dofasco soon implemented an aligning procedure using an optical level, as caster tradespeople had extensive experience and knowledge of this method (Fig. 2). All dimensions from the base pads to the top of the rolls were calculated and put into a formula on an inspection sheet. When aligning rolls, tradespeople would take optical readings and plug the results into the formula. Rolls could be aligned in approximately half the time required for templates and feeler gauges, but variability still existed from differences among tradespeople reading the precision scale.

The optical level method prevailed at Dofasco for several years until conception of the laser alignment system. Dofasco employees took note of contractors using laser beams to measure elevation and flatness while pouring concrete in the plant. While tolerances for concrete work were wide (0.250 inches), the application launched the precision laser alignment concept.

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Figure 2

The second generation alignment method employed use of an optical level. This method cut alignment time approximately in half, but variability was still an issue.

Laser Alignment System

Working with a laser manufacturer, Dofasco designed a system using a single laser beam, height gauge target and software to align caster segment rolls (Fig. 3).

Alignment can be performed simultaneously on four segment frames using a single laser scanner. The laser scanner magnetically locks into place on a machined steel surface that rests on a pedestal supported by 80 feet of piling and 10 feet of concrete. This solid base provides reliable benchmarks checked at the start of each alignment procedure.

By rotating on its base, the scanning laser projects a flat horizontal plane. Coarse and fine pitch and roll adjustments simplify setting the laser plane, which can be made parallel to a surface with an accuracy of 0.0001 inches per 10 feet. The unit also is capable of projecting a straight beam. The low-power diode laser (less than 1.0 mW) is safe and visible to the naked eye and energy efficient.

The height gauge target provides actual vertical distance from the laser scan plane to the benchmark and each roll surface being measured (Fig. 4). The target is capable of providing measurements for flatness, straightness and roll alignment. An interface built into the height gauge provides a digital readout and exports data directly to the portable computer. Software, written in Visual Basic, contains specifications for each segment and performs calculations to determine required shimming adjustments. Shimming values are accurate to 0.0006 inches per 10 feet. In addition, data can be plotted, archived and used to generate reports.

Results

With the advent of laser aligning, the time required to rebuild segments has been drastically reduced. Compared to the original template method, repair times have been decreased in excess of 50%. Laser aligning times

are also much shorter than when done using the optical method (Fig. 5).

Significantly reduced variability in segment alignment has also been achieved. To verify installed alignment, a roll gap device is mounted on the starter bar and used at the start of every cast to check caster profile. Segments are now consistently re-

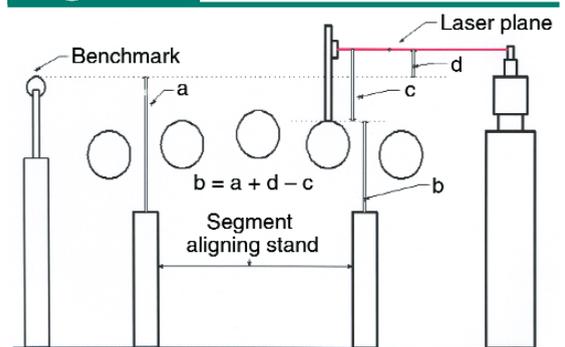
built and installed with transitions well below the allowed standard of 0.12 inches. This reduced variability has directly improved as-cast slab quality and segment life. Longitudinal and transverse cracking associated with misalignment has been reduced to zero and segment life has been extended by over 30%.

Summary

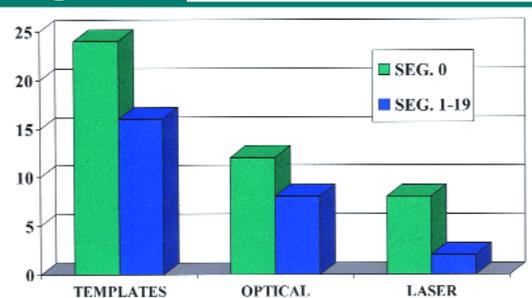
Through development of a laser alignment system for rebuilding caster roll segments, Dofasco has realized reduced repair times and improved segment life and as-cast slab quality. The system is used for repairs on both the No. 1 and No. 2 slab casters.

Figure 3

The laser alignment system is comprised of a single laser beam source, a height gauge target and software to calculate the shimming arrangement.

Figure 4

The vertical distance from the laser plane is measured for each roll using the height gauge target. Software calculates the shimming required to reach specification. Legend: a = distance from aligning stand pad to benchmark; b = alignment specification; c = measured distance from roll surface to laser plane; d = measured distance from benchmark to laser plane.

Figure 5

Comparison of alignment times by method for No. 1 caster.

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