KAWASAKI STEEL TECHNICAL REPORT No. 16 June 1987

Camber Control Techniques in Plate Rolling*



Synopsis:

New unique measuring and control techniques of plate

2 Camber Measurement

During rolling, this plate progresses in the positive direction of the x-axis, while sideslipping and rotating

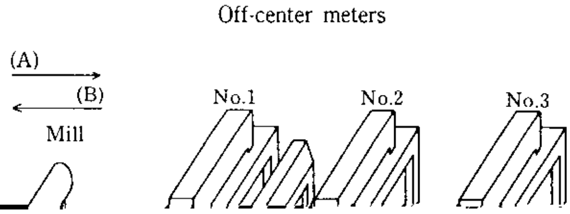
[illegible]

were posed:

here that there is no such sideslipping [illegible]

[illegible]

$$
\left.
\begin{aligned}
F(x_1) &= a_0 + a_1 x_1 + \sum_{j=2}^{n} a_j x_1{}^j \\
F(x_2) &= a_0 + a_1 x_2 + \sum_{j=2}^{n} a_j x_2{}^j
\end{aligned}
\right\} \cdots\cdots\cdots (6)
$$



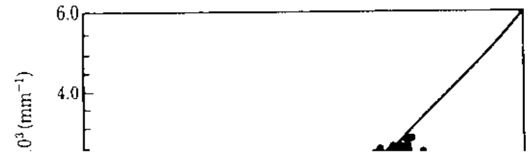
Then two measured off-center values $F(x_1)$ and coefficients $a_0, a_1, \ldots, a_n$ of the nth order polynomial $y = F(x)$, which expresses plate camber, are calculated. The camber profile thus determined is fully used in camber control and displayed in patterns on the CRT

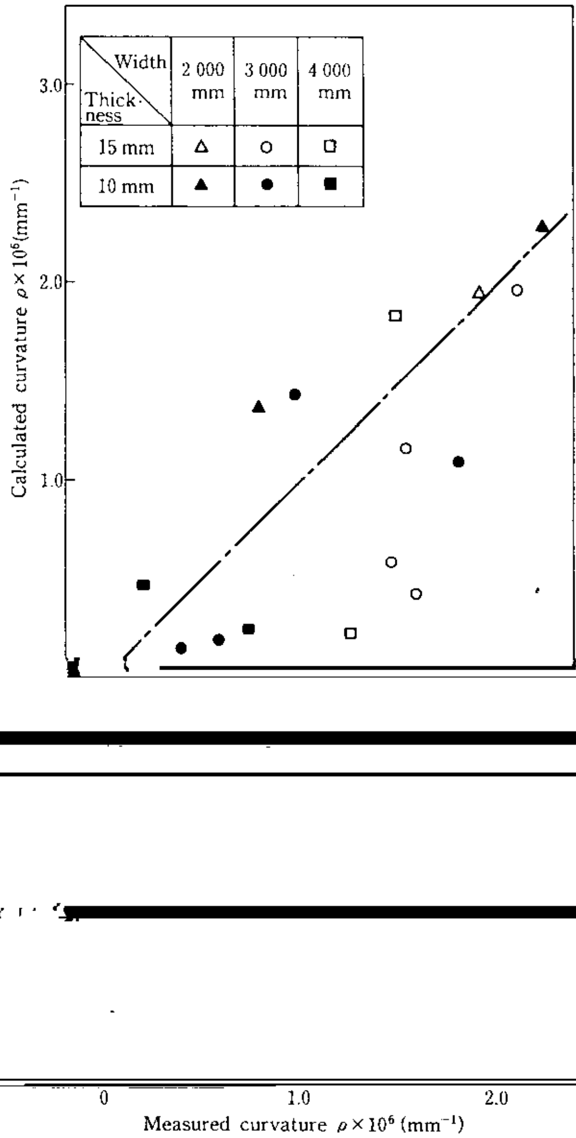
rolling can be faithfully expressed.

A histogram of measurement errors with the camber meter is shown in **Fig. 5**, where errors are evaluated by converting them into an error of camber values (Ca in

Table 2 Rolling conditions in model mill

Specifications of model mill	Type of model mill	2 Hi
	Work roll diameter	200 mmϕ





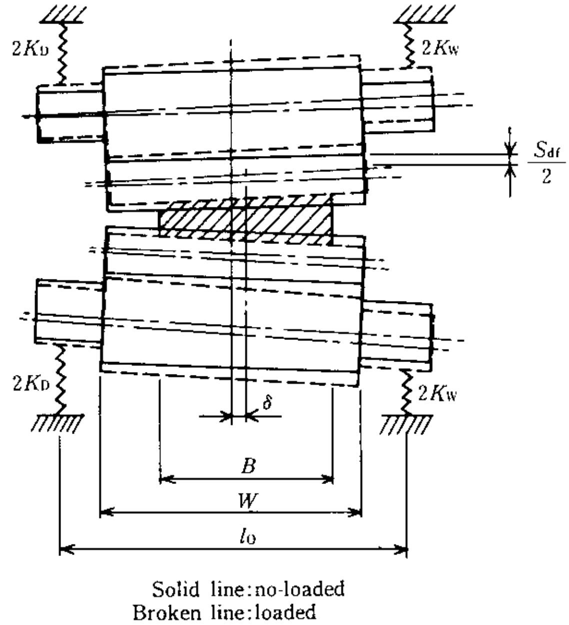


Fig. 8 Wedge model on the assumption that rolls are

Fig. 7 Comparison of curvature ρ between calculated and measured values (steel rolling)

by adjusting the model equation depending upon the plate width and thickness in the commercial rolling operation.

3.1.2 Wedge observation model

where P_W: Work-side rolling load

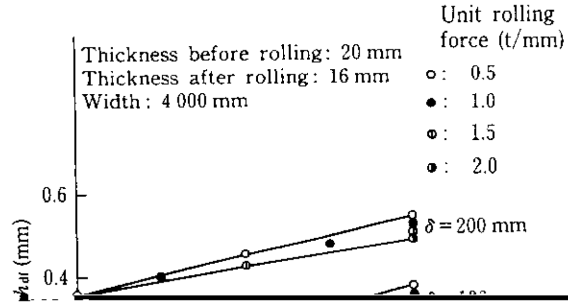
P_D: Drive-side rolling load

K_W: Work-side mill constant

K_D: Drive-side mill constant

B: Plate width

S: Difference between ...



$$h_{df} = (e_1 + e_2(C_W))f_1(\delta) + e_3 f_2(P_{df}) + e_4 f_3(S_{df}) + e_5 f_4(H_{df}) \cdots\cdots (9)$$

where P_{df}: Rolling load difference (Work-side load − drive-side load)

$e_1 \sim e_5$: Correction coefficient for basic model equation

$f_1 \sim f_4$: Basic model portion

(3) Verification of Model Equation

the measured value, and accuracy in using the model for control purposes has satisfactorily been ensured.

3.2 Camber Control Method

This section concretely describes the method of controlling the camber after the measurement.

First, the measured camber $y = F(x)$, which has

time, the following equation is used for observing the wedge:

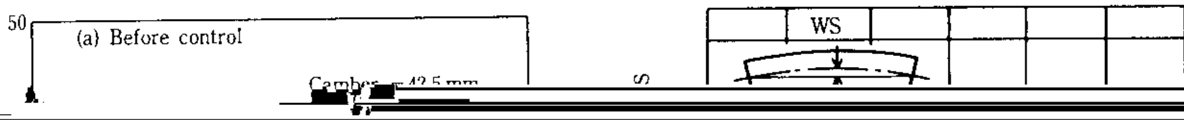
$$h_{df} = \alpha_1 P_{df} + \alpha_2 S_{df} + \alpha_3 \delta + \alpha_4 \quad \cdots\cdots\cdots (12)$$

where $\alpha_1 \sim \alpha_4$: coefficients

Wedges are observed using this Eq. (12), and the screwdown position is adjusted depending upon the deviation from the aimed wedge. Equation (12) is a

ed into curvature ρ by the following equation:

If the wedge is regulated to the aimed wedge, the plate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(a) Before control
WS