PRECISION, QUALITY AND PROFIT
A SYSTEMATIC APPROACH

Jochen Corts
Walter Engelsberg
Dr. Daniel Hackmann

The only way to survive and earn money in the worldwide business of rolling ferrous or non-ferrous materials is to focus on total product quality and lowering overall cost.

The driving force behind the design of new mills and the upgrading of existing mills is precision which guarantees a reliable rolling process, and only possible with precisely fitted mill components.

To evaluate precision and quality it is necessary to measure, compare and control, the basic intruments for drawing conclusions.

The target of this systematic approach is to define the fundamental tools to set up an individual knowledge base, empowering the mill operators to change from a trial and error approach to a most effective and smooth rolling system control – a kind of evolutionary development which requires a highly advanced information management system – the mind of the mill.

41st ROLLING SEMINAR - PROCESSES, ROLLED AND COATED PRODUCTS
October 26 to 28, 2004 – Joinville - SC – Brazil

Jochen Corts, Managing Director of CORTS Bearing Technology, Germany
Walter Engelsberg, Marketing and Sales, CORTS Bearing Technology, Germany
Dr. Daniel Hackmann, Business Development, PROGESS Software, Swizerland

Three general questions at the beginning:

What is profit? ► the money the market pays for serving demands
How to create profit? ► serve the market demands
Why operate a rolling mill? ► it's a good business because the demand is there

So the market tells us what to do, and therefore the market is the boss – no one else. And as usual it makes sense to listen to the boss and understand his intentions.

In our case, the highly competitve market wants a precise, reliable supply of rolled material at the lowest price level possible. Of course, we want the highest possible profit, and that is no dilemma as long as we understand how to produce quality at the lowest possible cost levels.

This paper is about a sound and simple approach to these issues.

Have you ever asked yourself why it is that a certain period after the time record breaking commissioning of this brand new, hightech rolling mill things deteriorate with increasing mill experience?

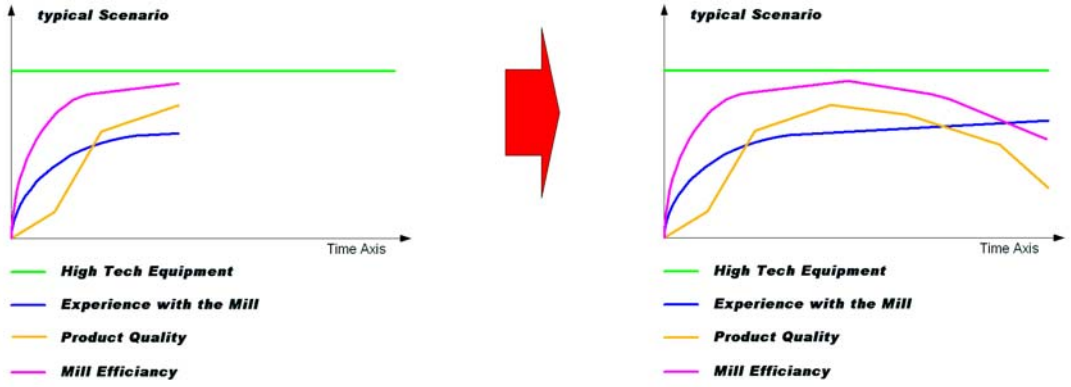

Figure 1 – Mill Practice Experience

Relatively little thought is given to the fact that the hightech equipment is used under the ugliest conditions one can imagine because this happens far down in the mill.

One visits that place rarely, and there is practically no contact with the people working far down there.

But after some years of production, the expensive reference faces of your multi million investment look like this:

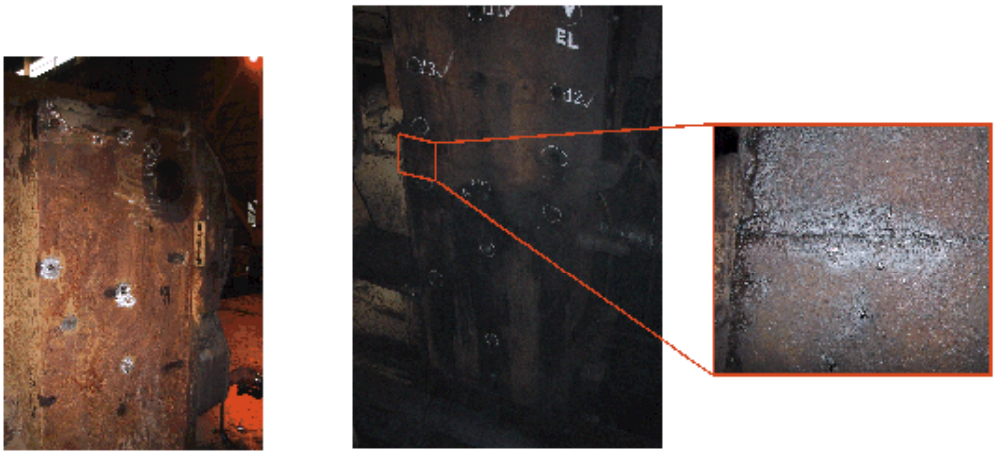

Figure 2 – Deteriorate Surface

So the possible condition of your mill equipment after several years of use could be slightly out of the original tolerances, as shown in figure 3:

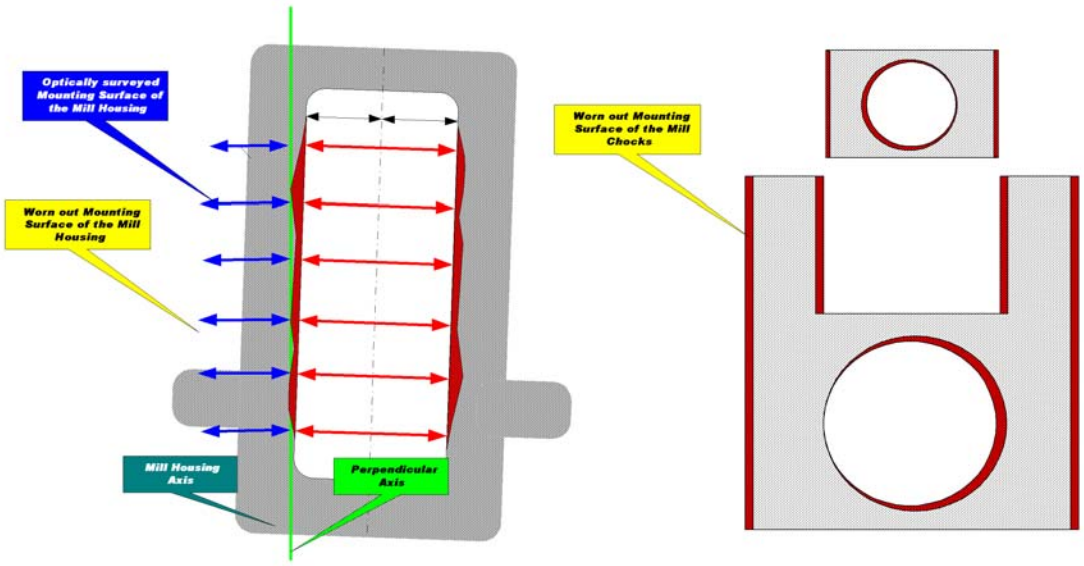

Figure 3 – Worn Sliding Surfaces

And the surfaces of your flat bearings between the chocks and housings could look like this:

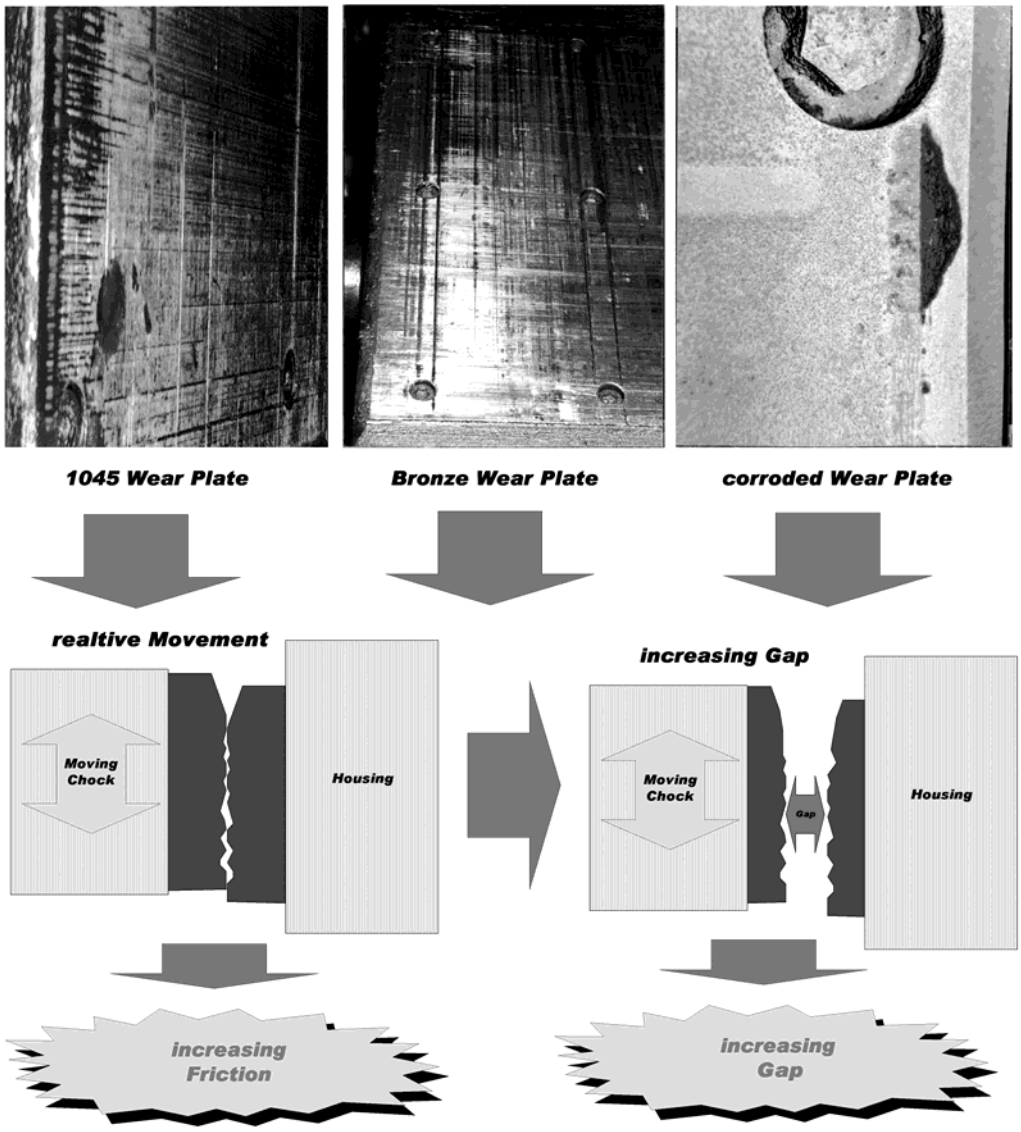

Figure 4 – Comparison among different Wear Plate Material

This has potential further consequences for the equipment and, far more important, for your mill reliability and finally product quality as shown in the following figure 5:

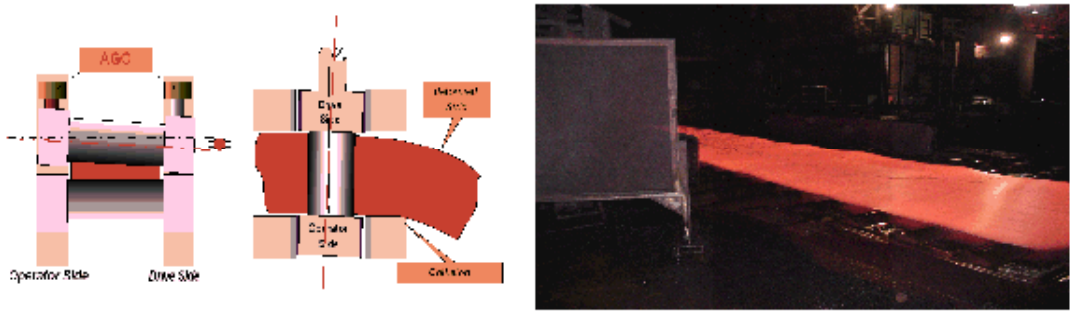

Figure 5 – Non Rectangular Assembling

Due to the fact that the outcome of this situation is corrupting our original target to earn money, we have to ask ourselves why we are experiencing this situation and if we are not the only ones, that is, if it is kind of a general rule.

To understand this, we must understand the overall system in which we find ourselves. And that means taking a closer look at the structure of the rolling mill itself.

At the uppermost level, the CEO level, it is normally decided to invest in a new rolling mill and what the production scope for this mill should be. As soon as this decision is made, the responsibility for the type of mill, the design and detailled layout is handed over to the second level, the directors, who work together with level three, the managers, who are responsible for the details of the fixed housings with drivetrain and all the related equipment. This equipment is handled by the fourth level, the mill department and roll shop.

This means that far away from the decision makers, the responsibilities for the equipment is split in a way. At level five the maintenance people responsible for chocks and housings have no official, direct contact with management.

As producer and supplier of the precision flat bearings between housings and chocks we really appreciate this situation, caught, so to speak, in the middle. But that is of little interest to the mill owner. The matter of fact is that the missing joint responsibility for that flat bearing system is not set up properly and should attract even the highest level of attention in the company.

The reasons for this are quite simple, they are already there in the answers to our first three questions:

Rolling of steel is business because there is demand in the market, but it is only a good business if one follows the rules of your market. Remember, the market is the boss:

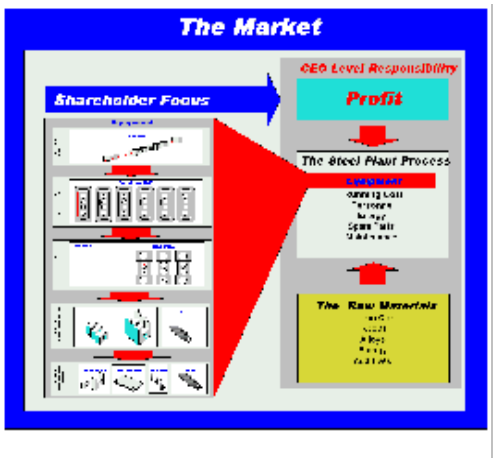

Figure 6 – The Market Guidelines

This is a severe mistake from our point of view, and it is difficult to understand for an outsider. The CEO is responsible for profit and gets incentives for high performance in that area. Profit by itself is dependent on quality and cost efficiency. But the CEO has no idea of the actual situation of the technical system that is set up to produce quality and has to live with the notion, and has only the magic tool cost cutting to improve efficiency. Therefore, seen from an outside perspective, one gets the impression that the direct influence of the CEO on his incentives is quite limited.

Even if it is a bit dirty down on the floor, the CEO level should know some details from this fifth level. Let's put it another way: If it stinks in the ivory tower, the reason may sometimes be found in the cellar, because if oxygen is missing, it normally stinks. Unfortunately the missing information in the mill has no such alarm system.

On the other hand, direct access to the endless details of a rolling mill cannot be the responsibility of the CEO. His purpose is to have the overview and to be empowered to find strategic solutions to business challenges.

Thus, to ease the access to the details for the CEO level, a preselection of those details is imperative. We concentrated on the definition of selection criteria as well as the handling of the selected details based on the assumption that measuring could be an appropriate way to define and control quality – which is after all what the market demands.

To understand the rolling mill system, it makes sense to structure it into the following modules:

- ❑ Module 1 – Basic Components
- ❑ Module 2 – Equipment Setup
- ❑ Module 3 – Production
- ❑ Module 4 – Product and Customer Needs

Every module as well as the awareness of the interdependence between the modules requires a specific measurement and quality control strategy.

Module 1 - The basic components of any rolling facility are not only the asset of the mill, they are the reference base for the whole process. To be able to evaluate this

reference base it is necessary to measure, document and control the core elements of this basic structure, the housings, the chocks, the bearings and the rolls as well as their geometric relation to each other.

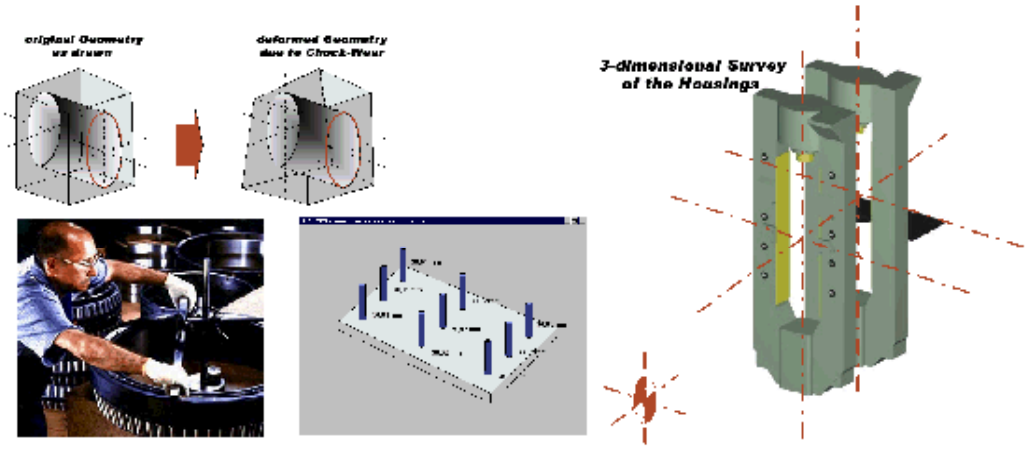

Figure 7 – Critical Dimensions

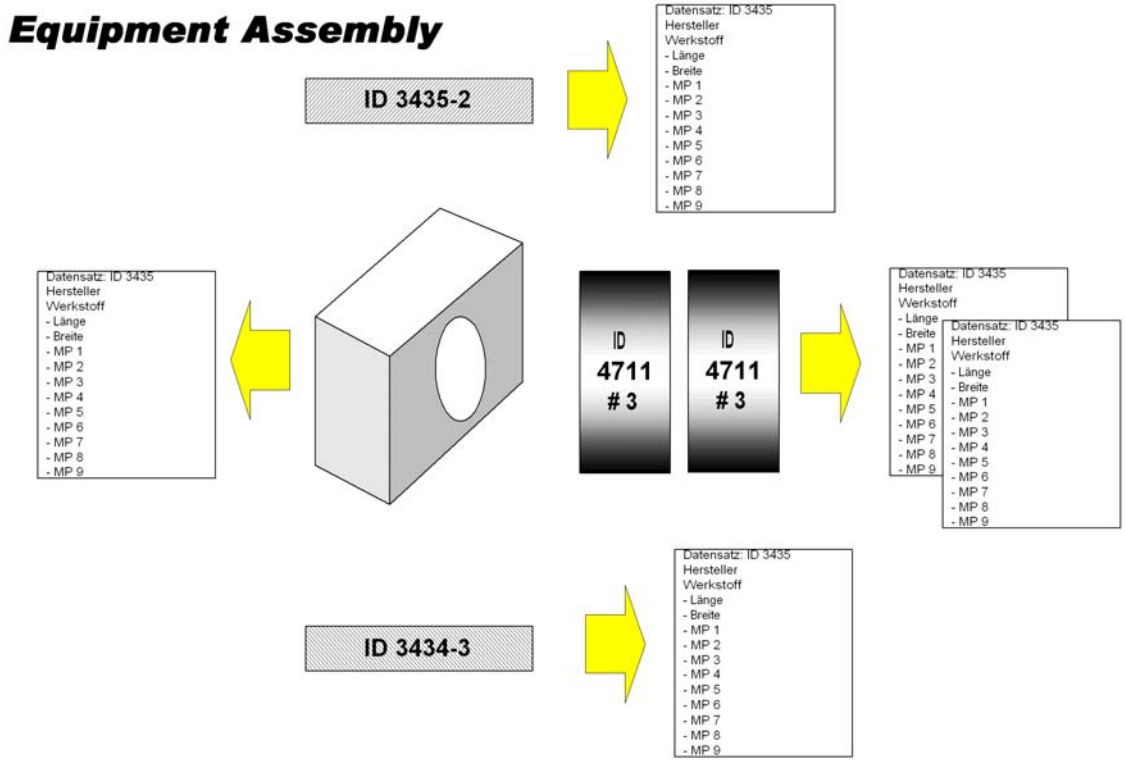

Figure 8 – Equipment Assembly Data

Collecting all these details creates an enormous volume of information. Especially when one imagines the free combination of all those components, it becomes clear why the CEO level lacks awareness of those details.

The proper definition and execution of the information selection is imperative. Unfortunately, the profile of questions can

change quickly for the CEO, and it is not possible to define “The Rule”. The selection process is dynamic and has a tendency to turn chaotic. Furthermore, one must take the information generated from the following modules into consideration as well.

Module 2 – Equipment Setup gets the tools prepared for production. The basic elements are joined by components like axles and bearings. Again, it is necessary to measure, document and control the geometry and long term behavior of the components and tools to be prepared for further conclusions concerning the production process.

Module 3 – Production means shifting from the quasi-static setup of module 1 and 2 to rolling, to production. Now it is imperative to get knowledge about the behavior of every single element of the mill as well as the complete equipment under different production conditions and how to interpret this behavior concerning the production results. This knowledge allows one to create control systems with feedback and feedforward capabilities to actively optimize the highly dynamic rolling process.

Module 4 – Product and Customer Needs is the final chapter in this overall collection of static and dynamic data, which is the knowledge base of the rolling process. And we are certain that the CEO should have access to this knowledge base of knowhow and expertise for the specific rolling process. He should be able to use the brain of the mill for which he is responsible.

To this end we have designed an overall mill information system, which offers structured and selected access to the neccessary details, skipping the rest. Based on this systematically structured setup, the rolling mill can be compared to an independent living system, which is able to react to market or customer demand. Naturally, it takes into consideration that there will be constant change and adaptation of this living rolling system to changing environmental and market conditions.

Finally, based on these well selected key pieces of information, the CEO level is able to decide intelligently for cost cutting, where cost cutting is a measure to reach quality and cost efficiency. We also have heard about situations, where investment was used as well as a measure to reach quality and cost efficiency as it is not always wise to cut the travel budget of the sales people to achieve more efficiency.

Information management is the key to qualiy and cost efficiency, and based on our theoretical assumptions, it may be the key to profit.

RESUMO

A única forma de sobreviver e lucrar no negócio mundial de laminação de materiais ferrosos e não ferrosos é focar em qualidade total de produto e em redução do custo global, que são as premissas básicas para o projeto de laminadores novos e a reforma de laminadores existentes.
A base para as bitolas dos produtos e sua precisão é um processo de laminação confiável. Para avaliar a precisão e a qualidade é necessário medir, comparar e controlar.É adequado então, estruturar um sistema completo de laminação, nos seguintes módulos:

Módulo 1 - Equipamento Base
Módulo 2 - Componentes e Ferramentas
Módulo 3 - Produção
Módulo 4 - Necessidades do Produto e do Cliente

Cada módulo, bem como a avaliação da interdependência entre os módulos, necessita uma medida específica e uma estratégia de controle.

O objetivo desta abordagem sistemática é definir as ferramentas fundamentais para o "set-up" de uma base de conhecimento individual, forçando os operadores do laminador a mudar de "tentativa e erro" para um sistema de controle de laminação mais efetivo e simples - um tipo de desenvolvimento evolucionário o qual, ao final, necessita de sistemas altamente avançados de gerenciamento de dados - o cérebro do laminador.