# THE MORGAN XPERTMANAGER™ SYSTEM – A MILL MANAGEMENT TOOL FOR IMPROVING OPERATIONS[1]

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## Abstract

A comprehensive approach to mill management in materials processing has been incorporated in a software system that is available for implementation in new and existing mills. The system consists of various components that collect process data, analyze the data and present production evaluations that can be used to improve many aspects of the operation – from identifying equipment problems, optimizing distribution of manpower, developing operator efficiency and increasing product quality. The system has been successfully implemented in a rod and bar rolling mill and has proven to be a very useful tool to both operators and managers. Significant opportunities for improvement of productivity, and therefore profitability, are made possible with the information that it provides

**Key words**: Mill management; Level 2; Utilization; Productivity.

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# 1 INTRODUCTION

The focus of technology development for rod and bar mills continues to be improved production rates, efficiency and product quality. Improvements in overall mill performance can be realized through equipment technology, processing technology and operational efficiency. The ability to process orders quickly and efficiently is a key element in the success of any mill operation.

The main function of the Level 2 control system is to provide continuous communication with the Mill Control System and to serve as an intermediate supervisory processing stage to control the flow of information between the Mill Information Systems and the Mill Control System. In combination with the XpertManager™, it becomes a powerful mill management tool whose main purpose is to improve business and operating practices in a rolling mill and within all mills of a steel group enterprise. Improvements can be realized through a combination of standardizing practices, systems, processes, quality and performance parameters, plus eliminating obsolete systems, and enabling real time decision-making. The use of powerful analytical tools now available in the system being described here make improvements even more attainable. Standardization of management systems also provides the opportunity to benchmark all mills within a company's global operations.

In most mills today, there is a large gap between the MRP/ERP level of the company and the floor operations. Once the production plan is determined, there is little or no interaction with operations to determine if the plan is optimized for the mill and the expected mill performance achieved. Operating practices on the mill floor have typically been developed over time and are not always the most efficient for the particular operation. In addition, many of the systems intended to aid in the management of the operation are outdated and difficult to upgrade. These systems are typically not in tune with mill performance parameters in the world today and therefore are not able to provide the measurements necessary to benchmark against other mills in an operating group. Therefore, new tools are required to help advance these mills to world class operations.

Most mills today are lean organizations without the skilled software engineering personnel with rolling mill know-how needed to develop these new tools. Meanwhile, the need for collecting and analyzing reliable, real-time information on the operation is becoming more and more critical to successfully run the facility.

The Morgan XpertManager™ – Real Time system has been developed to satisfy these needs. This system provides a link between the ERP or MPR system and the mill floor by collecting all critical data on the process and the operation in real time from PLCs and control systems, analyzing the data, then presenting an evaluation of the operation to operations and mill management. The information can be made available to anyone in the organization, from the floor operator to the CEO. These process evaluations can identify areas of the operation that have opportunity for improvement. It is thus a tool to help increase production speed, decrease delays, improve quality and process yields and maximize the utilization of working centers. The system helps implement standard rolling mill managerial procedures based on Best Management Practices and then becomes a tool to support them. It serves as a means of fully monitoring all critical process variables and thus controlling the

quality of the final product – even providing Product Quality Certificates to certify that quality.

When applied to multiple mills, the XpertManager™ provides a standard way of measuring mill performance and thus the possibility to benchmark different rolling mills within a steel company group. It can also help identify areas for improvement and provide useful information for justifying investment areas in the mills and a standard way to measure performance before and after the investment.

## 2 SYSTEM DESIGN AND STRUCTURE

The intended mission of the complete system, XpertManager™, Level 2 and Tracking is to increase productivity and competitiveness of working centers by:

- Providing precise and reliable real time information to operations
- Providing continuous communication with the Mill Control System
- Linking ERP/MRP system and floor operations
- Providing data and tools to track and analyze operations
- Generating Product Quality Certificates
- Enabling performance comparison between mills within the enterprise

The following Figures 1 and 2 show diagrammatically how the XpertManager™ System is structured within the realm of the rolling mill. Figure 1 shows the levels of information systems in the mill, from the floor operations to the corporate level. Figure 2 shows the structure of the system.

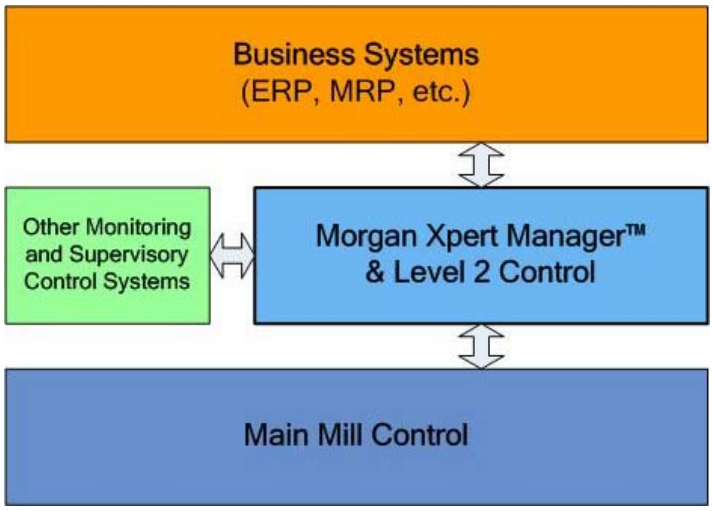


**Figure 1**. Levels of Mill Information Systems.

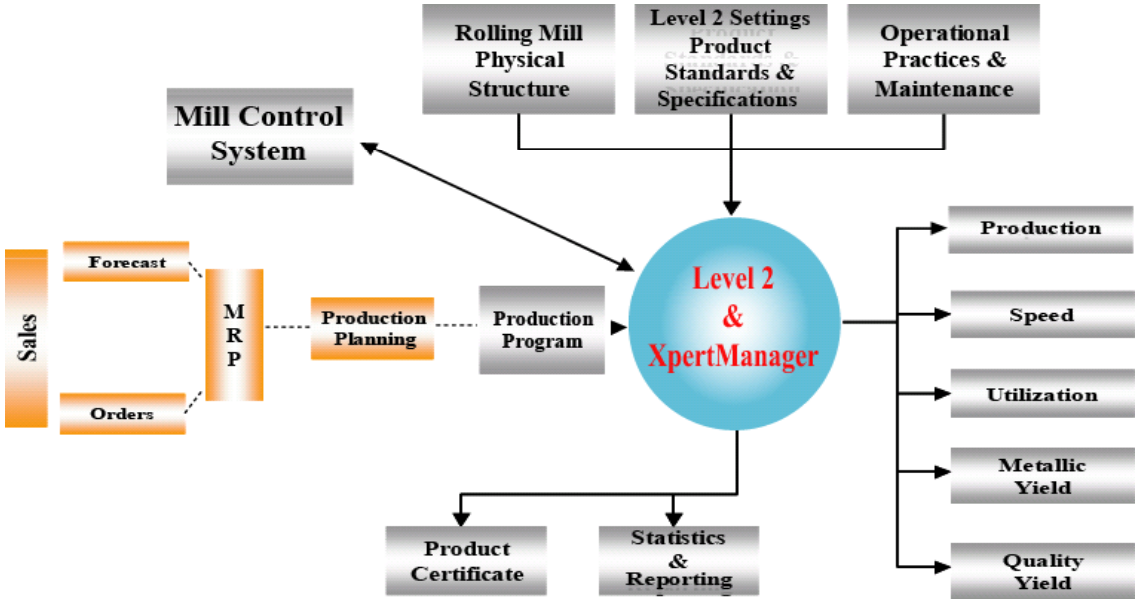


**Figure 2**. The Morgan XpertManager™ System Structure.

The system structural components are:

- Rolling Mill Physical Structure - configures all Mill Layout & Organization, Strands, Systems, Equipments, Parts, Failures as well as Areas and Work Units responsible for them, etc.
- Product Standards - configures all the products Layout & Performance, ERP or Reference numbers, grouping and sub-grouping according with steel types, families, etc, the standard performance of each product, like Rolling Speed, Billet Gap, Delays (Operational, Mechanical, etc), Metallic Yield, Quality Yield, etc.
- Product Specification - all process operation parameters and tolerances, mechanical & non-mechanical properties, dimensions, attributes, etc, that the final product should meet and have, this allows a Product Certificate for each coil.
- Product Level 2 - all settings, from Furnace to Power & Free or cooling bed, required by the recipe to fabricate each product according with rolling mill layout and existing equipment, controls, process, practices, etc.
- Operational Practices and Maintenance - where one defines utilization of the facility, working days, maintenance shut downs, product change standards, crews, etc, this from a standard of each practice, operation or maintenance action in the mill.
- Production Program (Level 2 & XpertManager™) - the link with the ERP/MRP System, where the XpertManager™ gets the Production Order, heat numbers and Production Plan that is sent to the Rolling Mill Floor. With this in place, the system is ready to measure and track the real

performance of the mill against the standards that are used for planning and programming the use of the facility. Changes in production scheduling, such as pass schedule changes, product changes, insertion of new rush orders etc. are also handled by the scheduler.

Having a link to the Supervisory Control and Control Systems and monitoring being done by the XpertManager™ Tracking Server, which is explained and detailed later, the system is ready to benchmark all the performance of the mill, as well as analyze variations. Therefore, the process specifications and final properties can be verified, providing the capability to generate certificates for each coil that is tagged.

XpertManager processes all of the gathered data, verifying the Real Performance against the Standard Performance expected or Planned from the Mill. This is done in all of the aspects of the Working Center, for example:

**Production Speed**, (TPH, Rolling Time, Billet Gap, etc)
**Utilization Time** (Delays, Shut Downs, Product Changes, Roll Changes, etc)
**Metallic Yield** (Cobbles, Flying Shears, Furnace Yield, Coil Trimming, etc)
**Quality Yield** (On Line, Off Line, On Hold Material, Causes, etc)

These can be analyzed by crew, shift, campaign, group of products or sizes, dates, customer, etc. The capabilities of the XpertManager™ are extensive in terms of finding and crossing information, looking for trends, frequencies, and generally to identify opportunity areas in all the parameters that define the performance of the working center.

Statistics, Reports, Quality Certificates, etc. are abundant in the system and also can be customized specifically for each customer. In addition, if other custom or proprietary formats are required, XpertManager™ is fully compatible with the Microsoft Office Suite (Excel, Word, Power Point, etc.). All of this real time information can be fed back to the ERP/MRP Systems in the MES (Manufacturing Execution Systems) / Supply Chain Level, therefore closing the loop with them.

## 3 SYSTEM IMPLEMENTATION

The XpertManager™ system has been successfully applied to the rolling mill management functions of the rod and bar mill of HYLSA in Puebla, Mexico. This mill underwent a major modernization in 1992 with the addition of a new rod outlet to increase mill output. It produces a range of plain round and rebar products - bars up to 42mm are finished in straight lengths onto a cooling bed and rods from 5.5mm to 26.0mm are produced on the rod outlet consisting of a pre-finishing mill, Vee No-Twist® Mill, Reducing Sizing Mill, water boxes, pinch roll, high speed laying head and Stelmor® conveyor.

Prior to the installation of the XpertManager™, the mill was operating with SAP and a relatively up-to-date system of electrics and process controls. The tracking system had been developed in-house, with a series of various managerial systems that had also been developed in-house over time, based on that tracking. These included systems for production control, delay reporting, quality control and measurement of metallic yield.

The need for a new kind of system was clear, since the mill had several different software systems to help running the operations, from Excel spreadsheets and manual processes, old RPG programs, programs running under Windows 3.1, etc.

With increasing demand on improving the efficiency and productivity of the operation, these various systems became less and less able to provide the required information quickly and accurately enough to aid in making these improvements. The main problems were that the systems were based on old platforms, they did not talk to each other and they did not use all the data generated in the state-of-the-art rolling mill control systems. There was limited availability of information on the Intranet and several of the systems could not be updated with information on mill layout changes, such as with the latest addition of the Reducing Sizing Mill.

Another factor in the decision to implement the XpertManager™ is that the company did not have the time and the resources to develop such a system by themselves. However, they were very much aware of how important and valuable it would be to have real time reliable information available, with the possibility to analyze, in a powerful crosschecking way, all the main parameters of the performance of the mill - utilization, speed, quality, metallic yield, etc. In addition, there could be cross-checking with systems, crews, shifts, equipment, responsible departments, etc, as well as process control parameters with ISO; QS Customers and non-conformities.

With all this background, a decision to implement the XpertManager™ was taken, and it was implemented in a six month project with no interruption (zero downtime required) of the rolling mill operation. Critical elements of this effort were to be improvement of product tracking and consolidation of data from various systems to provide mill personnel with critical information needed for each position from the mill floor to the executive level.

## 4 XPERTMANAGER™ SYSTEM OPERATION

With all of the critical data in one place under the DataBase Server and access deployed throughout the enterprise, from the roller to the corporation, passing through Rolling Mill Manager, Plant Manager, etc., each one of the persons involved in improving the performance of the rolling mill are empowered with information required and the powerful tools to analyze now up to one year of production.

Access to the information is provided through a series of screens, selected from the Control Center main screen, shown in Figure 3. The tree structure on the left hand side of the screen allows the user to easily view every part of the system from the products and line structure to the many analyses of production, quality and performance of teams on the mill floor.

From data accumulated in the system over time on production and products over time, analyses can be run on many different aspects of the operation. The reader can easily imagine the kind of trends and interesting data you could find analyzing 1 year of operational data by campaigns, size, crew, shift, responsible operator, mechanical, electrical, equipment systems, delays, frequencies, etc. The possibilities are endless and all are related with the main performance parameters of the mill - the ones that really matter in making the operation profitable and resulting in return on investment of the working center.

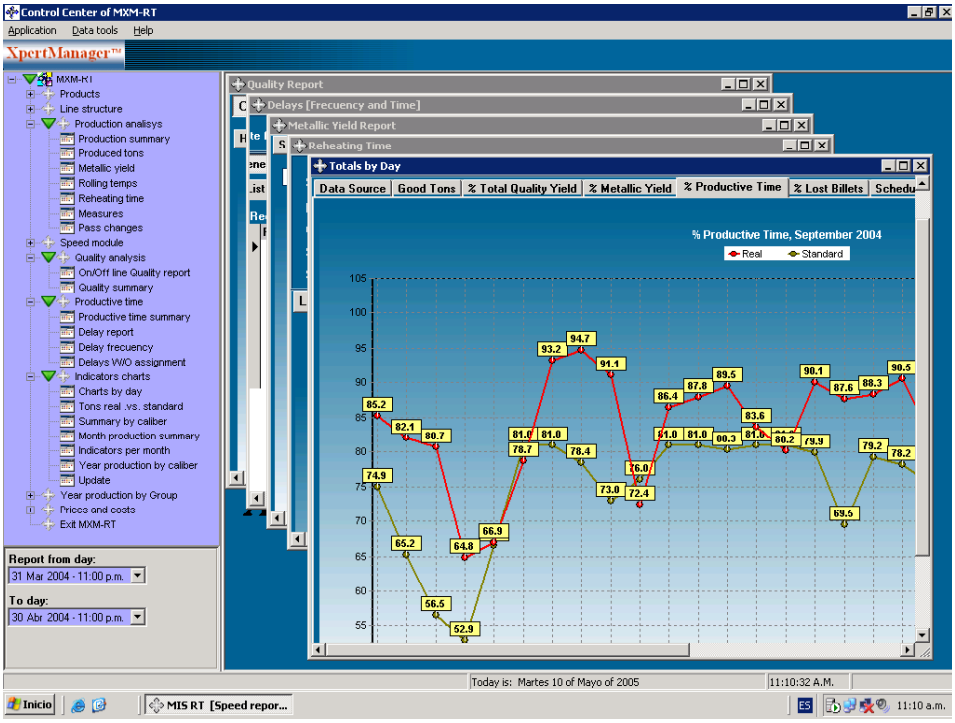


**Figure 3.** XpertManager™ Control Center main screen.

Examples of some of the on-line reports available to system users are shown in Figures 4 and 5. Figure 4 shows actual tons rolled in a month for various grades compared to standard tons for each grade – the benchmark used to compare the actual tons.

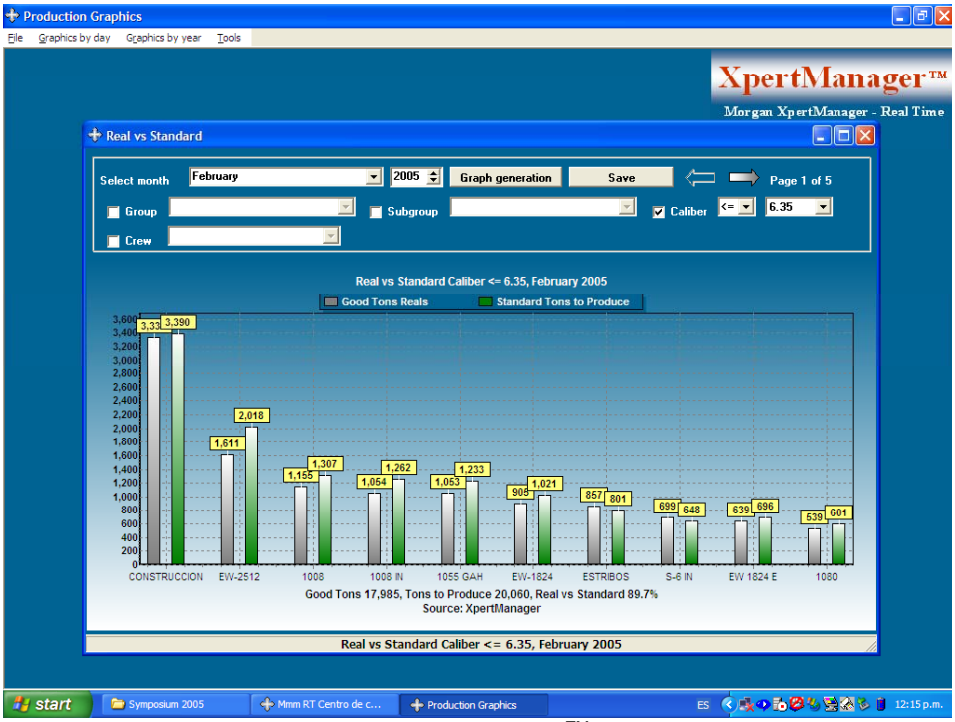


**Figure 4**. Example of XpertManager™ report on production.

Figure 5 shows metallic yield for various heats over a user-specified time period. Many more reports and analyses are available in the system, giving the user a wide range of production and quality analysis capabilities.

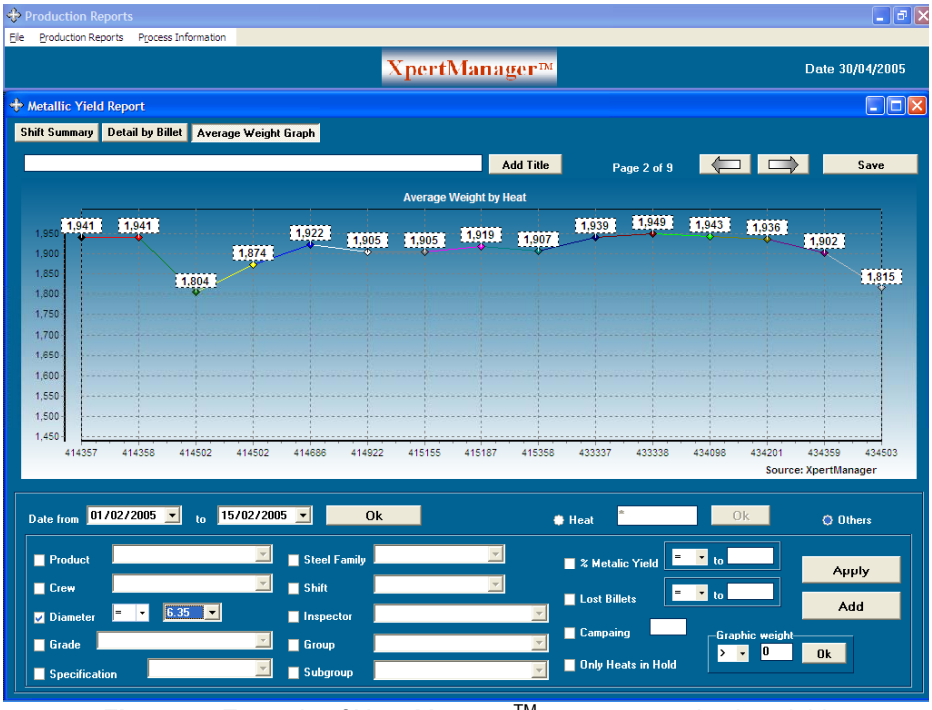


**Figure 5**. Example of XpertManager™ report on production yield.

## 5 BENEFITS OF THE SYSTEM

After more than one year of continuous operation of the XpertManager™ system, it has been possible to demonstrate the actual benefits of having a real time management system providing operators and managers with valuable information on the production and product quality.

By selecting one six month period before the system installation and one six month period after the installation, both with similar product mixes, a comparison of mill performance was made. Mill Utilization Time increased by 4%, Production in tones/hour increased by 1.5%, Metallic Yield improved by 2% and Quality Yield improved by 0.5%. Obviously, the combined effect of these improvements was increased profitability of the operation. There have been many secondary benefits as well, including more satisfied rolling mill customers and improved communication within the rolling mill itself.

## 6 SUMMARY

The initial implementation of the XpertManager™ System was a demanding project in terms of linking and configuring all the data required to prepare the platform of the system to be capable of standardizing the performance of the products and to manage the way they were meant to be produced. Over time, these standards and specifications of the products have been fine tuned and are now much more precise, therefore giving more capability of forecasting the performance of the working center.

The training and commissioning of the XpertManager was very easy with the people involved from the rolling mill and it is now is part of all the daily, weekly and monthly meetings. With on-line information to be presented and analyzed from all the important disciplines and parameters of the rolling mill, it is now a very important and key part of the daily operations, as well as for the planning and strategic analysis required by the company.

# MORGAN XPERT MANAGER – UMA FERRAMENTA DE GERENCIAMENTO DO LAMINADOR PARA MELHORIAS NA OPERAÇÃO[1]

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**Resumo**

O sistema baseia-se numa completa sistemática de como tratar um processo de laminação quando incorporado a um software que está apto a ser implementado em laminadores novos e existentes . O sistema consiste em vários componentes que coletando informações de processo, as analisa e demonstra seu desempenho, o que poderá ser utilizado para melhorar o desempenho do laminador e alguns aspectos operacionais - da identificação dos problemas nos equipamentos, otimização e distribuição da mão-de-obra disponível, desenvolvendo a eficiência operativa e aumentando a qualidade do produto final. O sistema já eficazmente implementado e um laminador de fio-máquina e de barras, vem provando consistentemente ser uma ferramenta útil tanto para a operação como para o gerenciamento. Oportunidades significativas de incremento de produtividade e, não obstante rentabilidade vem sendo possível através das informações geradas por este sistema.

**Palavras-chave:** Automação; Sistemas informatizados; MES; Gerenciamento de processos; Gerenciamento informatizado de laminadores; Nível 2; Produtividade.

[1] *Contribuição Técnica ao 42º Seminário de Laminação Processos e Produtos Laminados e Revestidos; 25 a28 de Outubro de 2005, Santos, SP, Brasil.*
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