

Research On the Application of Intensive Processing and Distribution Management of Steel Bars Based on Wisdom Technology

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Abstract. For the site that cannot achieve the scientific processing production management of reinforcing steel bars, and cannot ensure the saturation capacity of steel bars equipment utilization, resulting in large loss of reinforcing steel bars, low processing efficiency and other conditions, Chongqing East Station in the construction process innovation proposed cloud computing, big data, Internet of things, intelligent control as the core technology, steel bars processing "three savings" (save material, save labor, save effort), "two guarantees" (guarantee quality, guarantee progress), and "one excellent" (excellent management) as the principle. It adds intelligent sensors to the traditional steel bars processing equipment, connects the steel bars management platform with the steel bars processing equipment through information technology, and realizes the information management of the whole process from raw material incoming, testing and inspection, steel sample turning, material list uploading, online audit, optimization of material breaking, production scheduling and processing, and distribution to the field. It provides a reference for exploring and realizing the standardization, normalization, intelligence and scale development of construction steel bars processing and distribution management.

Keywords: Reinforcing steel; intelligent; processing and distribution; management; steel intensive processing.

1. Introduction

As an important part of the construction of the main body of the structure, reinforcing steel bars engineering plays a vital role in the implementation of cost management and quality control of the project. In many places and fields in China, the reinforcing steel bars processing industry still maintains the earliest and most primitive processing and management methods. Centralized steel bars processing and distribution refers to a specialized steel bars processing organization with an information-based production management system. Its main use is a complete set of automatic steel bars processing equipment. After a reasonable process flow, the reinforcing steel bars in the fixed processing place concentrated processing into the engineering required to form steel products. According to the project construction plan, the reinforcing steel bars required by the site will be distributed to the construction site for installation and construction of the reinforcing steel bars processing mode [1]. As seen from the process, steel bars processing and distribution is a number of technology integration technologies, including information-based production management technology, specialized processing technology for reinforcing steel bars, automated steel bars processing equipment, and modern logistics and distribution technology [2].

This thesis uses the industry 4.0 technology architecture system, which integrates BIM technology, Internet of Things technology, cloud computing and big data analysis technology to generate an integrated smart technology solution for centralized steel bars processing management and distribution. The solution opens up all aspects of steel bars production management, solves outstanding problems, and achieves quality improvement, efficiency and cost reduction in the steel

bars processing base combined with favorable conditions such as fixed sites and closed plant operations. At the same time, centralized steel bars processing cannot only reduce the risk of quality management and safety and civilization management, but also enhance the quality control of steel bars processing, improve the quality level of steel bars processing and innovate the safety management mode.

2. Processing Base for Reinforcing Steel Bars

2.1. Engineering Overview

Chongqing East Station Railway integrated transportation hub high-tech economic zone infrastructure project includes Kaicheng Road, widening and eastern extension of Xingtang Road and parts of the eastern distribution corridor, with the total length of about 14.3 km, using urban trunk road standard construction, design speed of 60 km/h, the main line standard road width for two-way 8 lanes. Steel bar processing plant tasks belong to the pile foundation project: 3658t, bridge and bridge accessory works: 20,854t, roadbed and roadbed accessory works: 3452t, culvert foundation and wall: 900t, tunnel and underpass: 13,303t, total: about 42,167t (according to the preliminary statistics of the first drawing).

2.2. Processing Site and Production Allocation

The site of the processing plant has a planned area of about 14,400 m², with a length of about 137 m and a width of about 105 m. It includes a production area (5280 m²), a living area (444 m² for management personnel and 1184m² for construction personnel) and an office area (1147m²), with a hardened road of 2740m². The production area adopts a fully enclosed large color steel factory, the living area adopts a double-layer color board house, and the office area adopts a new integrated modular board house. The office area is made of new integrated modular board room. There are two working areas in the plant: the first working area is the steel shearing and bending area, which includes the processing area of coiled snail, bar shearing and bending area, small equipment processing area, raw material storage area and semi-finished products storage area; the second working area is the steel cage processing area, which includes sawing and snapping production line, steel cage production area, raw material storage area and semi-finished products storage area. The plant is divided into pedestrian and vehicular traffic, and pedestrian passages are set up between floors, so that operators crossing the work area can use pedestrian passages. The plant adopts the industry's first-class Glodon steel bars processing management platform, which can realize intelligent steel bars sampling, online steel bars feeding, online control of equipment operation, online steel bars storage, processing, out of storage, and real-time positioning of transportation vehicles after leaving the storage. It can effectively reduce personnel and save steel bars. The equipment and personnel allocation is shown in Table 1.

Table. 1 Equipment and personnel allocation

Instrument s	unit type	power(k W)	quantit y of device	Operatio n number	Unit capacity(da y)	Theoretical capacity(da y)
CNC intelligent hoop bending robot	YT12S	29.5	2	2	7-15 t	14-30 t
CNC steel cage rolling welder	YTGH2200	45	1	1-2	8-10 t	8-10 t
CNC sawing and sleeve grinding line	YTJS-40	58	1	1	30-40 t	30-40 t
Bending center equipment	GL-G2L32	19	1	2	30 t	30 t
CNC steel shearing and bending production line (fully automatic)	YTQW400- 32S	81	1	1	Shearing 100 t Bending 30 t	Shearing 100 t Bending 30 t
CNC vertical round bending machine	YTLS-2000	28	1	1	over 400 t	8-15 t

2.3. Advantages of Centralized Processing of Reinforcing Steel Bars

Centralized processing process control of reinforcing steel bars is the key to restrict the connection of various processes in engineering construction. Based on the current promotion and application of technology and information technology products, centralized processing can fundamentally avoid difficult problems such as confusion in the field station during decentralized processing, improper utilization of short materials generated by processing, and serious material waste. In general, the centralized processing of reinforcing steel bars has the following advantages [3]:

First, the processing efficiency is high. The daily per capita processing efficiency of the traditional processing method is generally 1-2t, while the daily per capita processing efficiency of the centralized processing and distribution mode can reach more than 6t (the latter is more than 3 times of the former), which can meet the demand of steel bars processing in large-scale engineering construction.

Second, high degree of Informa tionization. It can be docked to the construction information management system, which can monitor the production progress in real time and facilitate the organization and coordination management.

Third, processing automation and intelligence. The use of factory processing methods facilitates the use of advanced industrial processing technology and equipment to ensure the processing efficiency of formed steel products while improving the quality of products.

Fourth, quality traceability. Each batch of formed steel products have complete production and inspection information, which can prevent the use of "thin" steel bars in construction projects and ultimately ensure the quality of the project.

Fifth, green environmental protection. There is no noise, photoelectricity, dust, waste discharge and other pollution of on-site processing, solving the problem of nuisance, while factory production saves raw materials of steel bars and avoids waste.

Sixth, high production safety. It can reduce the temporary steel bars processing site occupation, construction site is neat and civilized, and exclude the unsafe hidden danger brought by the steel bars processing and production. Its production safety is high.

Seventh, cost reduction. After the centralized processing of steel bars, the unified use of resources can be realized, which can actually reduce the input of temporary construction and reduce the auxiliary cost.

Eighth, material management is easier to achieve, avoiding the loss of materials as well as improving the level and capacity of processing; the unified use of resources can unify the original scattered processing of the so-called scrap and reduce the rate of depletion[4].

3. BIM Cloud Management Platform for Reinforcing Steel Bars Engineering

3.1. Functional Modules

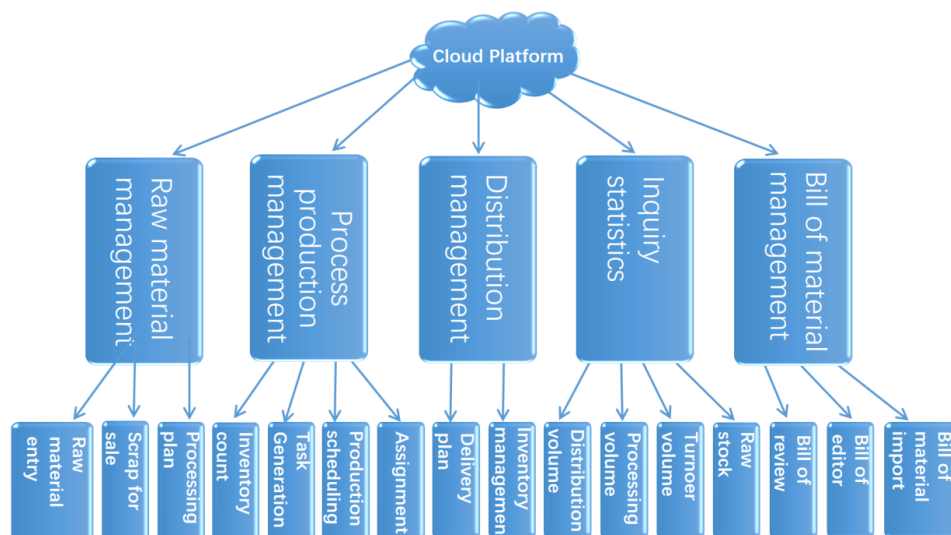


Fig. 1 Functional module diagram of cloud platform for reinforcing bar centralized processing

One of the characteristics of steel bars processing data is the large volume and variety of styles. Organizing the processing data is a tedious and complicated process[5]. The use of software tools for deepening the design of drawings not only enhances the work efficiency of job designers, but also allows compatibility with data formats of different manufacturers due to the standard interface of the platform and directly reduces the secondary transcription link of processing plants. In addition, it can also reduce unnecessary transcription errors, which greatly improves its efficiency and work quality, saves labor costs, and is more convenient for processing plants to quickly summarize and classify data and develop processing plans.

Chongqing East Station Intelligent Transportation Project takes RMES cloud platform as the core, and the software at the flip terminal software (Maisi Technology) as the basic data source. Through the intelligent controller, the direct communication between the platform and CNC processing equipment is completed, and the auxiliary equipment such as professional printers of material plates and intelligent scanning guns are used to improve the on-site production and processing management efficiency. With the cloud platform as the nerve center, 5 major modules such as raw material management, processing production management, distribution management, query statistics and bill of material management (Fig. 1), and 16 specific links such as raw material intake, distribution plan

and bill of material import as the grasp of small modules, it can improve the standardization, scientization, normalization and systematization of the whole process and multi-perspective safety production management of the steel bars project management platform, and realize safety and efficiency The development of safety and efficiency, safety and health, safety and environment is harmonious.

3.2. Post Functions

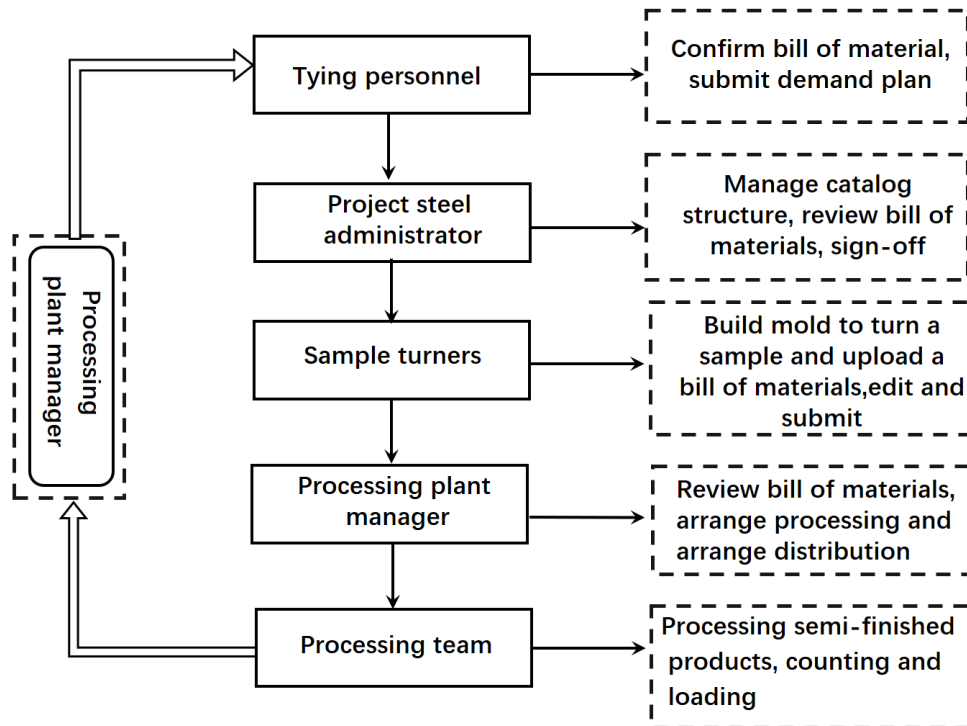


Fig. 2 Schematic diagram of post function

It is necessary to give full play to the role of each employee in the work. According to the strengths and abilities of personnel, their work can be reasonably arranged, their strengths can be brought into play, their responsibilities can be clarified, so that they can work with authority and keep every gate for the project. The project adopts BIM technology to import and process the collected data into the information system and use the cloud management platform to carry out information-based real-time control of the bill of materials, scheduling, processing and distribution. In order to guarantee the information flow of the program, the tasks and responsibilities of each role in the steel bars processing link are clearly divided here (as shown in Fig. 2), with reasonable division of labor and clear responsibilities to give full play to the role of each personnel.

3.3. Management Process

In order to further improve the management level of the project department, fully implement the regularized, standardized, procedural and information-based project management, and establish the awareness of quality in project construction, according to the engineering characteristics and reality of Chongqing East Station project, the project department implements the refined management methods, from personnel management to the design of "feedback mechanism", to achieve the effect of "defining clear authority and responsibility, giving responsibility to the person, making clear scheme to every personnel", and to improve the project to find problems and solve the response speed of dealing with problems. In this project, according to the order of information flow, the project begins with the instruction issued by the project's steel bars management personnel and ends with the completion of the closure of the information flow when the project's steel bars management personnel receives the finished steel bars.

3.4. Bill of Material Management

After receiving the order, the processing plant should review the bill of materials to ensure that the bill of materials conforms to national norms, to avoid errors caused by the mistakes of the samplers, and to ensure that the samplers' bill of materials takes full account of the use of raw materials as far as possible. The audit of the sample material list mainly relies on the project technical personnel, and the system can assist in the audit. The audit is assisted by the calculation of the mold rate, the size extremes and the number of roots. The former is to check whether the bill of material is fully considering the use of raw material, and the latter is to prevent the reworking personnel from inputting wrongly, which will lead to the processing length and root number problems. (Modulus: the length that can be divided by 9 or 12 is the modulus length. (The higher the modulus, the more likely to improve the raw material output rate).

3.5. Processing Task Management

The processed bill of materials for reinforcing steel bars will be categorized with data, generate machining solutions according to the required process, and match to the relevant machining equipment, and the task can be fine-tuned manually. Tasks that cannot be processed by CNC equipment are assigned to manual equipment for processing. It is necessary to refer to the semi-finished product requirement plan to add the specified bill of materials to form the machining plan. Split and merge the planned bill of materials, filter the tasks suitable for batch processing, and assign the processing tasks to the corresponding processing units according to the processing process. List all the equipment under the processing unit and assign tasks to the available equipment. When production is busy, task scheduling can be performed between equipment to balance the equipment load.

3.6. Processing Task Management Terminal

After the machining solution is generated, the tasks that need to be processed using CNC equipment are sent wirelessly through the Internet of Things Platform to the CNC equipment that has been intelligently modified (each equipment needs to be retrofitted with an intelligent controller), and the process of the tasks being performed can be fed back to the RMES cloud platform through the intelligent controller at any time. At the same time, the processing of the equipment can be viewed in real time on the digital production monitoring terminal. The monitoring terminal requires workers to log in with their real names, so that they can check the progress of tasks and the tasks they need to perform at any time. Through the accumulation of data, the effectiveness of the equipment can be measured, making it easy for managers to quickly identify production problems and improve processing capacity. Processing task management terminal receives processing tasks, issues CNC data, prints semi-finished product labels, submits completion status simplifies processing personnel operations, and receives tasks directly at the equipment for processing without printing processing orders in advance.

3.7. Distribution Management

The finished semi-finished products are to be factory counted, as each bundle of semi-finished steel bars (the same member with the same shape and specification reinforcing steel bars using the same identification plate) or finished steel bars has a logo plate, which can be quickly counted by scanning the QR code of the logo plate and generating a distribution order.

The tying team personnel put forward the demand plan of steel semi-finished products processing plant administrator to develop the distribution plan. Complete distribution process: loading count, outgoing registration, delivery registration, sign-in registration. The relevant personnel on site verify the semi-finished or finished reinforcing steel bars based on the distribution order, complete the site counting work, and scan the distribution order QR code to complete the site acceptance. The acceptance data can be transferred back to RMES cloud platform to complete the entire order closure.

3.8. Query Statistics

The post home page shows the statistical information of post-related data, and the personal center shows the statistical information of data completed by individuals. The data of the whole process can be traced from the beginning of raw material incoming to the processing and distribution outgoing. Firstly, according to the internal equipment arrangement of the processing plant, the block model map is drawn, and the capacity of each CNC equipment can be monitored in real time, the processing data process share analysis, equipment utilization analysis, etc. More detailed data can be queried in the statistics page, and statistics can be made by part and process time, and the statistical results can be displayed in the form of charts. In the production and processing link, the task completion can be monitored at all times through the task monitoring large screen.

3.9. Residual Waste Management

The RMES platform has two main ways of obtaining residual waste information. The first is through the use of handheld devices to take inventory of stock information. The second is through the use of an optimized breakage processing solution to automatically obtain the residual material information. If there are really unusable reinforcing steel bars in the residual material, it will be disposed of as scrap, and the project will normally be weighed and processed periodically. The RMES platform provides statistics on the whole process from the raw material incoming to the delivery, forming a large screen of management data. It is convenient for processing plant managers to understand the whole process of steel data at all times for analysis and provide decision support for management improvement.

4. Innovation Significance

4.1. Labor Saving

The material list process recipe can be transferred in the whole process, and completely free the duplicate entry manual. Using reasonable and orderly production scheduling and the most reasonable human resources to output the maximum processing capacity; from raw materials to turning samples, to processing and distribution, all data are automatically aggregated and transmitted, reducing management manpower investment.

4.2. Raw Material Saving

This project realizes the optimization of raw material breaking through big data technology to improve the raw material output rate. This project implements the processing scheme and guarantees the actual output rate of steel bars processing through intelligent control system. It can grasp the material usage of raw materials, semi-finished products, finished products, residual materials, scrap and experiments in time and effectively control the number of raw materials used.

4.3. Mental Energy Saving

This project can reduce the problems in the task issuance, data statistics and process supervision of managers through big data and cloud computing. This project realizes the curing of operation workers' work through Internet of Things and intelligent devices, and reduces all risks brought by operation arbitrariness. This project also assists leaders to understand the production progress timely, accurately and comprehensively through intelligent devices and big data analysis in the cloud.

4.4. Progress Assurance

This project uses cloud computing technology to reasonably arrange the processing plan and guarantee the output of the optimal executable plan. The project uses Internet of Things technology and intelligent equipment to ensure that the program is executed strictly according to the plan. Through real-time feedback of processing data from intelligent equipment, the supervision of on-site

processing progress can be guaranteed in all aspects. When the flexible production strategy guarantees that the processing plan is changed, the processing plan should be adjusted in time to ensure that the processing is carried out in an orderly manner.

4.5. Quality Assurance and Optimal Management

Cloud platform directly connected to intelligent equipment to ensure accurate data transmission, to avoid errors processing intelligent equipment in strict accordance with the parameters of processing, to guarantee the processing quality of raw materials, semi-finished products as well as finished products whole process inspection, and to provide quality services for steel bars processing.

The platform uses the Internet of Things technology to realize the data integration of the whole process of the processing link and improve the comprehensiveness of management. It can also use cloud technology to realize data transmission and integration within the effective time and improve the timeliness of management. According to the business division module, it can effectively implement the enterprise reinforcing steel bars management strategy, achieving the strategy to the people, to the team, to the equipment, to the project, to the material order, and to the cycle. With the help of big data technology, the industry needs of raw material traceability and processing traceability in steel bars processing management are realized [6].

5. Summary

This thesis presents a research, development and application technology applied to an intensive processing, management and distribution system for reinforcing steel bars. The system can realize wireless docking with CNC reinforcing steel bars processing equipment and real-time monitoring of production management data at the processing site, enhance internal management efficiency, improve raw material utilization rate, and guarantee project construction progress. This thesis provides an idea and reference for promoting the development of process, standardization, normalization, convenience and wisdom of intensive steel bars processing and management distribution.

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