การพัฒนาระบบสารสนเทศสำหรับกระบวนการรับคำสั่งซื้อของในโรงงานผลิตนั่งร้านและอุปกรณ์

นางสาว ภรณี ภาสภิญโญ

าบิพบร์บี้เป็นส่วนหนึ่งของอารสือนาตามหลัอสตรปริอเอเวอิศาอรรมศาสตรมหาง

วิทยานิพันธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต สาขาวิชาการจัดการทางวิศวกรรม ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย ปีการศึกษา 2551 ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

INFORMATION SYSTEM DEVELOPMENT FOR ORDER RECEIVING PROCESS OF A SCAFFOLDING AND ACCESSORIES MANUFACTURER

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Engineering Program in Engineering Management The Regional Centre for Manufacturing Systems Engineering Faculty of Engineering Chulalongkorn University Academic Year 2008 Copyright of Chulalongkorn University

Thesis Title	INFORMATION SYSTEM DEVELOPMENT FOR ORDER					
	RECEIVING PROCESS OF A SCAFFOLDING AND					
	ACCESSORIES MANUFACTURER					
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ลักษณะธุรกิจของโรงงานผลิตนั่งร้านและอุปกรณ์ ซึ่งในวิทยานิพนธ์ฉบับนี้จะขอกล่าวอ้างอิงเป็นโรงงานเอบีซี ก่อนข้างซับซ้อนเนื่องจากส่วนใหญ่ประมาณ 80% เป็นการให้เช่า ส่วนที่เหลืออีก 20% จึงเป็นการซื้อขาย ลักษณะธุรกิจ ดังกล่าวทำให้เกิดความซับซ้อนในกระบวนการผลิตและระบบควบคุมสินค้าคงคลัง กระบวนการผลิตประกอบด้วย 2 ส่วน คือ กระบวนการซ่อมนั่งร้านและอุปกรณ์ที่คืนมาจากลูกค้าที่ให้เช่าไป และ กระบวนการผลิตนั่งร้านและอุปกรณ์ใหม่ ระบบสินค้าคงคลังของทางโรงงานประกอบด้วย สินค้าพร้อมส่ง ชิ้นงานระหว่างซ่อม/ผลิต สินค้ารอซ่อม และสินค้าที่ ลูกค้าแข่าไป ความซับซ้อนของโรงงานดังเช่นที่กล่าวมานี้ทำให้มีข้อมูลหลายอย่างซึ่งจำเป็นต่อฝ่ายการตลาดเพื่อจัดการ รับคำสั่งซื้อของในโรงงาน ปัจจุบันฝ่ายการตลาดยังขาดข้อมูลที่จำเป็นและยังไม่มีระบบสารสนเทศสำหรับกระบวนการ รับคำสั่งซื้อ ซึ่งให้ทำการกำหนดวันส่งมอบสินค้าให้ลูกค้าเป็นไปอย่างไม่มีประสิทธิผลและประสิทธิภาพ และนำไปสู่ ความล่าช้าในการจัดส่งของให้ลูกค้าและการยกเลิกคำสั่งซื้อของจากลูกค้าได้

วัตถุประสงค์ของวิทยานิพนซ์ฉบับนี้คือเพื่อพัฒนาระบบสารสนเทศสำหรับปรับปรุงกระบวนการรับคำสั่งซื้อของ ของฝ่ายการตลาดโรงงานเอบีซี ในขั้นแรกผู้จัดทำได้ศึกษากระบวนการรับคำสั่งซื้อของในปัจจุบันและวิเคราะห์ถึงปัญหาที่ เกิดขึ้น จากนั้นข้อมูลที่จำเป็นและรูปแบบทางตรรกวิทยาของระบบสารสนเทศได้ถูกออกแบบขึ้น วิทยานิพนซ์ฉบับนี้ยัง ศึกษาเวลามาตรฐานของกระบวนการซ่อมและกระบวนการผลิตใหม่ของนั่งร้านและอุปกรณ์เพื่อหากำลังการผลิตซึ่งปืน ส่วนหนึ่งของข้อมูลที่จำเป็นสำหรับระบบสารสนเทศนี้อีกด้วย ในขั้นสุดท้ายระบบสารสนเทศถูกพัฒนาขึ้นโดยใช้ ไปรแกรม Visual Basic-based Excel Macro และถูกประเมินผลในแง่ของความสามารถของระบบสารสนเทศต่อการ นำไปใช้งานได้จริง

ระบบสารสนเทศได้รับการประเมินการนำไปใช้งานได้จริงโดยผู้บริหารและฝ่ายการตลาด ซึ่งผลการประเมินคือ ระบบสารสนเทศได้รับการขอมรับเนื่องจากประกอบด้วยข้อมูลที่เพียงพอและรูปแบบทางตรรกวิทยาที่มีประสิทธิภาพที่ จำเป็นต่อกระบวนการรับคำสั่งซื้อของเพื่อที่จะสนับสนุนฝ่ายการตลาดในการการกำหนดวันส่งสินค้าต่อลูกค้าได้แม่นยำ มากขึ้นและสามารถต่อรองกับลูกค้าอย่างมั่นใจได้มากขึ้น นอกจากนี้ผลการทดสอบเบื้องค้นยังซี่ให้เห็นถึงแนวโน้มของ การส่งสินค้าตรงเวลาที่พัฒนาขึ้นกล่าวคือการลดลงของปรีมาณสินค้าที่ส่งล่าช้า 5% และการลดลงของจำนวนคำสั่งซื้อที่ส่ง สินค้าล่าช้า 2% นอกจากนี้ผู้บริหารยังขอมรับถึงความสามารถในการนำไปใช้งานได้จริงและผลงานของระบบต่อการ พัฒนาโรงงานในด้านอื่นๆจากเวลามาตรฐานและแผนการผลิตที่เป็นข้อมูลจากระบบสารสนเทศอีกด้วย

สูนย์ระดับภูมิภาคทางวิสวกรรมระบบการผลิต
สาขาวิชาการจัดการทางวิศวกรรม
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497 16374 21 : MAJOR ENGINEERING MANAGEMENT KEYWORDS: ORDER RECEIVING PROCESS / INFORMATION SYSTEM

PORANEE PHASPINYO: INFORMATION SYSTEM DEVELOPMENT FOR ORDER RECEIVING PROCESS OF A SCAFFOLDING AND ACCESSORIES MANUFACTURER. ADVISOR: ASST. PROF. PAVEENA CHAOVALITWONGSE, Ph.D., 215 pp.

The business model of scaffolding and accessories manufacturer studied in this thesis, hereinafter referred as ABC's company, is quite complicated as the majority of the products are to be rented – at approximately 80% of the time. The remaining 20% is where customers decide to purchase. This has resulted in the complexity of production process and inventory control. The production process is divided into two sectors – repairing products returned from renting customers and manufacturing of new products. In term of inventory, other than finished product inventory and work in process, there are 2 more inventories; waiting-for-repair items, and atcustomer-location. This has resulted in many sets of information required for marketing department to process customers' orders. Currently, marketing department is still lack of certain data to be analyzed and information system to support order receiving process which subsequently results in an ineffective and inefficient designated deliverable date, which eventually leads to lateness in delivery and job cancellation

The purpose of this study is to develop the information system in order to improve order receiving process of ABC's marketing department. Fist, the author studies current order receiving process and analyzes its problems. Then, the information system is designed for required data and logical model. In this thesis, the products covered in the thesis' standard times of both production process sectors are studied to determine the process capacity which is one of the required data for the information system. Finally, the information system is developed by Visual Basic-based Excel Macro and evaluated for its validation.

The information system is validated by ABC's top managements and marketing department. As a result, it is accepted for its sufficient data and efficient logical model which are required in order receiving process in order to support marketing department in designating more accurate available-to-promise date and proactively negotiating with customers. Furthermore, the preliminary evaluation results in the improving trend of on time delivery, that is, reduction of 5% units late and reduction of 2% error available-to-promise date. In addition, top managements also accept for its validations and contributions for further improvements since standard time and production plan are provided as well.

The Regional Centre for Manufacturing Systems Engineering	Student's Signature:
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Academic Year:2008	

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ACKNOWLEDGEMENTS

The author is very deeply appreciated for the knowledge guide, suggestions, valuable comments, and kindly support from Assistant Professor Paveena Chaovalitwongse, Ph.D., thesis advisor, throughout the research study.

Also, the author would like to express her sincerely grateful to Professor Dr. Sirichan Thongprasert, the chairman of thesis committee, Assistant Professor Manop Reodecha, Ph.D., the member of thesis committee, and Associate Professor Somchai Puangperksuk, the external member of thesis committee for their constructive suggestions and valuable comments toward this thesis.

Many thanks to Ms. Charernrat Tanaponpanit, vice president of the studied manufacturer, for her permission to conduct this thesis, her sacrificed times, and her valuable advice during the research. This thesis cannot be completed without your information support. Also, special thanks to Mr. Taveesilp Kiatichai for the computer support.

Finally, special thanks for her beloved parents, family, and friends for all their loves, willpower, and continuously supports that bring her to the completion of this thesis.

รัฐรี สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย

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CHAPTER I INTRODUCTION

1.1 Background of the Research

Current competitive business environment requires a company not only to be able to be survived in the market but also be able to go beyond its competitors. That is, it is important for the company to; for instance, maximum customers orders, rapidly response to customer requirements, eager for continuously improvement, and maintain current customers and attract new ones.

Construction industry is one of the growing industries in Thailand. The company studied in this thesis, referred as ABC Company, manufactures many kinds of scaffoldings and accessories used in the construction business of various scales. With the transferred technology from leading Japanese scaffolding manufacturer, ABC Company is the first and only scaffolding and accessories company in Thailand that has been awarded with the Certificate of Standard from Thai Industrial Standard Institute (TISI).

The business model of ABC Company is quite complex as the majority of the products, approximately 80%, are to be rented whereas the remaining 20% is where customers decide to purchase. As a consequence, it has resulted in the complexity of production process management and inventory control.

In term of production process, it is divided into 2 sectors. That is, in addition to normal manufacturing process, repairing process, which is a process of repairing products returned from customers, is another sector. In term of inventory, there are 2 more categories of product in inventory comparing with other businesses. The 2 more categories are waiting-for-repair items and at-customer-location products. The overall comparison between normal business and ABC company business is illustrated in table 1.1.

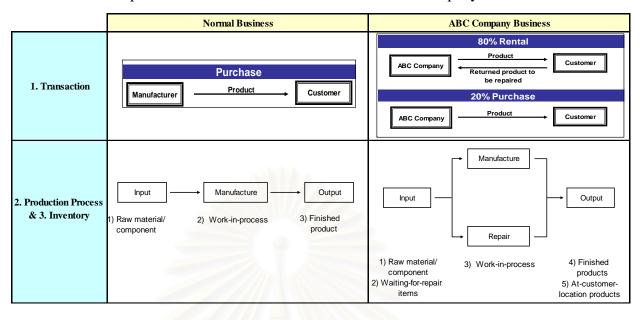


Table 1.1: Comparison between Normal Business and ABC Company Business

From table 1.1, it could be noticed that the complex of ABC business also results in the complex of information as well. One of the company's processes which requires a lot of information to be considered is order receiving process. When can we deliver the products?, How many units that can be delivered?, or Will we repair or will we manufacture? are examples of questions needed to be answered with adequate supporting information such as quantity of finished products, quantity of waiting-forrepair items, and both production process sectors' capacity (repairing process and manufacturing process). In other words, to be able to efficiently process customers' orders in terms of accurately promising product available date and quantity upon the company receives the orders, it is necessary for ABC to have adequate information in order receiving process.

1.2 Statement of Problems

The complexity of business, production process, and inventory result in many sets of information needed to be considered in order to achieve 3 company targets; on time delivery, fully capacity utilization, and repairing process maximization. One of the company's processes that requires sufficient information and also strongly impacts the achievement of company targets is order receiving process which is one of marketing department responsibilities. Without the adequate information providing at order receiving process, designate of product availability is ineffective and inefficient. This eventually leads to late delivery, job cancellation, and more importantly, loosing customers' trusts.

Currently, upon marketing department's staffs receive orders from customers, they compare the order quantity with 2 kinds of inventory quantity recorded in paper sheets (finished product inventory and waiting-for-repair items). Then, in case of repairing returned products from customers or manufacturing products are required, marketing department discusses with production department and use their own experiences to estimate finished date from repairing process or manufacturing process. Eventually, marketing department informs product available-to-promise date based on staffs' experiences to customers which at times can be inaccurate and can result in lateness in delivery and job cancellation problems as ABC is currently facing with once customers have placed their orders.

Despite the fact that the business of ABC is complicated and that a lot of information is required, currently there is no information system supporting marketing department to efficiently process customers' orders in order to proactively negotiate and designate more accurate product available-to-promise date. Therefore, the development of an information system which can provide adequate required data to marketing department in order to improve current order receiving process is an essential part to the business growth and especially in the competitive business environment of ABC Company.

1.3 Purpose and Objective

To develop an information system in order to improve order receiving process.

1.4 Scope of the Research

This thesis covers scopes as follows:

- 1. The thesis does not include the study of demand forecasting.
- 2. The study of managing consumables inventory including gloves, paint, welding rod, gases, etc. are not within the scope of this thesis.
- 3. The products included in this thesis covers only main products of scaffolding and metal form which contributes to around 80% of total revenue.
- 4. The developed information system is running on Visual Basic-based Excel Macro.

- 5. The improvement of integrating the proposed information system to the order receiving process is evaluated based on two indicators:
 - 1) Reduction in %error in available-to-promise date
 - 2) Reduction of late delivery product (no. of pieces)

1.5 Benefits

- 1. Marketing Department can proactively negotiate with customers for availableto-promise date of product.
- 2. Actual production capacity is established for further utilization.
- 3. Daily production detail is provided for further production planning.

1.6 Methodology

First, the author starts with current ABC's order receiving process study at marketing department to analyze the process's flow and also the interaction with other processes and other departments. Then, information that customers require from marketing department when they place their orders and information that marketing department must have to response to those orders are analyzed. Then, cause and effects of lacking of supporting information system in order receiving process are determined.

The development of the information system in this thesis consists of 3 phases; design phase, development phase, and evaluation phase. First, the author analyzes which data are required to be input into the information system and which data are needed as the output from the information system. Then, the required data are developed and collected in the Microsoft Excel. Since ABC has never studied and collected standard production time, the author studies both production process sectors (repairing process and manufacturing process) and develops their standard times using time study technique in order to identify production process capacity which is one of the required input data for the information system. After the required data have been designed and developed, the assumptions related to both order receiving process and production process are determined and then the information system's logical models are designed and developed using Visual Basic-based Excel Macro. Finally, the information system is evaluated for its validation by the company's top management and marketing department. In addition, the author also preliminary evaluates the information system using historical data to show an improving trend of 2 indicators; reduction in %error in available-to-promise and % unit late.

	2008				2009				
	July	August	September	October	November	December	January	February	March
1. Study current order receiving process, examine problems, and determine causes of problems.									
2. Study related literatures and studies.		m							
3. Identify the developed information system objective and scope.									
4. Design required data and collect exist data for the information system.									
5. Study both production process sectors and develop standard time data.									
6. Determine assumptions, design, and develop the information system.									
7. Evaluate the information system, collect, and analyze the evaluation results.									
8. Summarize and report thesis.		20							

1.7 Research Schedule

1.8 Organization of Thesis

This first chapter briefly describes the overview of ABC business, the current situation of order receiving process, and what are problems in this process that ABC is currently facing with. Also, purpose and objective, scope, benefits, and methodology of the newly developed information system in this thesis are explained. Next, theoretical content and literature review related to this thesis are described in chapter 2. Then, the detail of ABC is elaborately described in chapter 3 to help understanding the business characteristic, complexity of production process, and complexity of inventory which result in the complexity of information required in order receiving process. Continuously from chapter 3, chapter 4 describes in details of ABC's current order receiving process, its problem due to the lack of information system, and its problem solution by developing the information system. Then, chapter 5 and chapter 6 explain the details of developing the information system from the design phase, development phase, and eventually evaluation phase. Finally, conclusion, recommendations, and also the future implementation plan of the developed information system for order receiving process in the thesis are described in the chapter 8 as the last chapter.

CHAPTER II

THEORETICAL CONSIDERATIONS AND LITERATURE REVIEW

This chapter covers 2 main sections: theoretical considerations and literature survey. Theories related to information system, work measurement and statistical analysis are firstly described. Then, previous researches related to this thesis are studied.

2.1 Information System

2.1.1 Overview of Information

"Information is data that have been put into a meaningful and useful context and communicated to a recipient who uses it to make decisions" [5]. It involves the communication and reception of intelligence or knowledge. It apprises and notifies, surprises and stimulates, reduces uncertainty, reveals additional alternatives, helps eliminate irrelevant, influences individuals, and stimulates them to action. Nowadays, the need for more information is increasing and a range of users is wider. For instance, investors need information about financial status, organization performance and future prospects, or government agencies need financial and operating activities report for purposes of taxation and regulation, or managements need strategic information for corporate takeover.

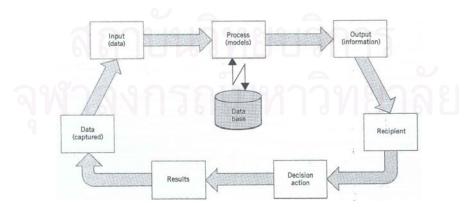


Figure 2.1: The Information Cycle Source: Information Systems: Theory and Practice [5]

In the competitive environment, a company should be able to exploit the opportunity dimensions of informed management, product and service differentiation, and increase productivity. Obviously, information is the principal weapon that will help the company meet goals of winning managers, superior products and services, and higher productivity to eventually success. To produce the information, the building of information system is required.

2.1.2 Introduction to Information System

Information system is a system, automated or manual, involved with collecting, processing, and disseminating data to support users. It aims to provide relevant information to users at the right time, at the appropriate level of detail, and at the desired level of accuracy for the users. Figure 2.2 shows the basic components of the information system.

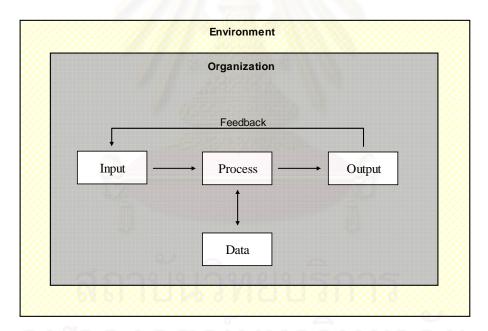


Figure 2.2: The Basic Components of the Information System

Understanding the data and developing the information system provide an opportunity for a company to exceed the company's competitors. The information system is used by many kinds of user such as managers, nonmanagers, professionals, nonprofessionals, and even people outside the company mainly for problem solving and decision making. The first information system is called transaction processing system. Then several information systems were produced such as a management of information system (MIS) which aims to provide information more closely fit with users' needs, a decision support system (DSS) which aims to help users making particular decisions, and an enterprise resource planning (ERP) system which aims to integrate separated systems into one overall system to manage all operations in the company.

2.1.3 Information System Building Blocks

Usually, information system is made up of 6 basic building blocks: input, models, output, technology, data base, and controls.

Input Block

Input consists of transactions, requests, queries, instructions, and messages. It represents all data, text, and images entering the information system. The common ways of entering transaction and text are bar codes, laser, and keyboard.

Model Block

Model block consists of logical-mathematical models which operate input and stored data to produce the desired output. Some modeling techniques such as decision tables, decision trees, data flow diagram (DFD), flowchart, and prototyping are used to design and document system specification.

Output Block

The product of the information system is output; for instance, financial reports, answers to queries, results of programmed decision making. It can be produced on computer screens, audio devices, or printers. The output should be the quality information for all users both inside and outside the company. The quality of output depends on its accuracy, timeliness, and relevancy.

Technology Block

This block is considered as a toolbox of information system work. It takes the input, runs the models, stores and accesses the data, produces and delivers the output, and helps control the total information system. 3 main components are combined in this block: a computer and auxiliary storage, telecommunications, and software.

Data Base Block

This block is where all necessary data are stored to serve the needs of all users. 2 viewpoints of data base are considered: physical viewpoint and logical viewpoint. Physical viewpoint relates with how data are stored whereas logical viewpoint relates with how to search for, associate, and retrieve the stored data to meet users' specific information.

Control Block

Control block is designed to ensure the protection, the integrity, and the smooth operation of the information system. To overcome a variety of threats such as system failures, errors, sabotages, hackers, natural disasters, incompetent employees, inadequate operation procedures, and poor management, the controls like records management system, hardware and software monitors, backup systems and offsite storages, and security devices are required.

Information system designers also need to consider 10 forces that may have impacts on the system. Those 10 forces are integration, user/system interface, competitive forces, information quality and usability, systems requirements, data processing requirement, organizational factors, cost-effectiveness requirements, human factors, and feasibility requirements (see figure 2.3)

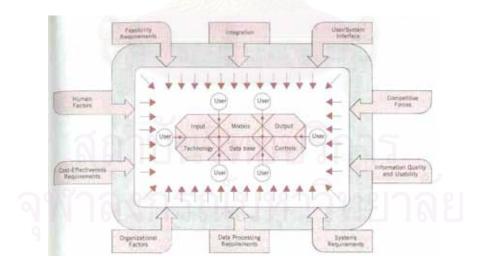


Figure 2.3: Forces Impacting on the Information System Building Blocks Source: Information Systems: Theory and Practice [5]

Integration

The information system should be implemented in the company with connectivity and communication among departments. In other words, it should be just as important on the shop floor as in the office.

User/System Interface

The better the interface between users and the system, the better the information flow. The richness of this force depends on the strength and variety of building blocks capabilities. Input block will allow users to communicate with the system. Model block will help in transactional tasks and will be coupled with data base to serve more as a knowledge base especially during management dialogues. Output will provide the informational needs for users. Technology block will result in time and space reduction. And finally, control block will provided authorized users with a dependable system.

Competitive Forces

To survive in the world of significant change and competition, the company must be able to design the system that enhances management, product and service differentiation, and productivity.

Information Quality and Usability

It is necessary to provide information that is accurate, timely, usable, and relevant with users' requirements.

System Requirements

The requirements of information system are as follow:

1) reliability - how dependably a resource performs its function.

2) availability – the system is accessible to users.

3) flexibility – the system is able to change or adapt regarding to user requirements change.

4) installation schedule – the period of time between the need for the system and its result.

5) life expectancy and growth potential – the ability to meet requirements for a reasonable time and the ability to grow even if needs change.

6) maintainability – the ability to maintain the system since malfunctions have to be solved, or general system improvements have to be made.

Data Processing Requirements

The requirements of data processing deal with 4 issues.

1) the volume of relevant data – the amount of data that must be processed to meet information goals.

2) complexity – a number of intricate data operations to be performed to achieve information goals.

3) time constraints – the amount of time permitted between when data are available and the information is required.

4) computational demands – a combination of the former 3 issues for a specific information requirement.

Organizational Factors

The nature, type, size, structure, and management style of a company have a great effect on how the information system is designed and will serve users.

Cost-Effectiveness Requirements

It is necessary to identify benefits to be derived from developing the information system. In addition, the amount of money spent on the information system development has a direct impact on its design.

Human Factors

The information system should work compatibly with users, not against them. The system should be easy to use, friendly, and natural. Also, it should be able to adapt with like, dislikes, habits, skills, and tasks of users.

Feasibility Requirements

There are 5 categories of feasibility analysis.

1) technical feasibility – determination of the level of access to technology for information system development.

2) economic feasibility – availability of the funds for designing, developing, and implementing the system.

3) legal feasibility – no conflicts exist between the information system and legal obligations.

4) operational feasibility – the requirements involves with developing and operating the system.

5) schedule feasibility – the ability of the newly developed information system to operate within the given time frame.

2.1.4 Information System Development

Because of the differences in work procedures and requirements of each company, a development method is variable. However, generally the development of information system consists of 6 stages: preliminary investigation, analysis, design, preliminary construction, user review, final construction, and system test and installation (see figure 2.4).

Preliminary Investigation

System developers, users, as well as all other involved people firstly conduct an analysis to define the newly developed information system objectives, scope, constraints, and risks to evaluate system feasibility and obtain the users feedbacks. *Analysis*

System developers define users' needs and analyze their requirements for each system module using a variety of information collecting techniques and gather them into the form of process, data, and object models. In addition, the information processing procedures are analyzed and documented in detail.

Design

System developers review all requirements and study design alternatives. The exact logic to be followed in processing must be determined. Also, the system developers must design specifications, components, and interfaces of each system module using various kinds of modeling techniques.

Preliminary Construction

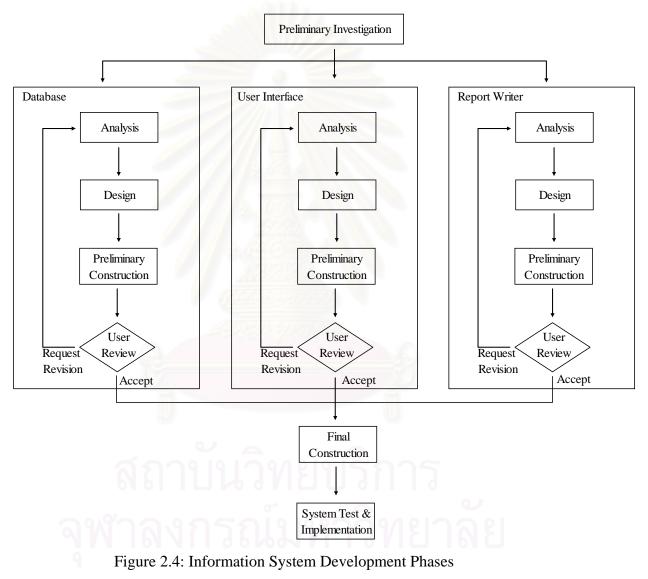
System developers construct and test each module software and data of the system. The programs required for processing logic operation are written. Furthermore, acquiring user feedback is needed for adjustment.

Final Construction

Each module software is integrated into the complete information system and tested along with data. Hardware is tested, facilities are constructed, and users are trained.

System Test and Implementation

System developers test the newly developed information system including software, data, and all other information resources such as hardware, facilities, and procedures. In addition, after the information system has been implemented for some time, periodically review, maintenance, and auditing should be conducted to ensure that the system still meets users' requirements.



Source: Management Information System [27]

2.1.5 Data Flow Diagram (DFD)

Data flow diagram (DFD), one of the system development tools, graphically represents how data flows through interconnected process in a system by using 4 symbols (see table 2.1). DFD enhances the ability of analyst to understand the system

easier, the ability to communicate at all levels, the possibility to examine the system in overview and at a detailed level, and the ability of analyst to specify the system at the logical level.

Symbol	Definition
	Environmental Elements: Both the source of data and where the system terminates are represented by a rectangle.
	Data Flow: It consists of a group of logically relevant data that goes from one point or one process to another. The arrow symbol is used to illustrate the flow direction of data.
	Process: A process is something that transforms input into output. Each process symbol is identified with a label.
	Data Storage: Data storage, a repository of data, is represented by an open-ended rectangle or an oval as well.

Table 2.1: Data Flow Diagram Symbols

Source: Management of Information Systems [27]

2.1.6 The Role of Information in Problem Solving

The problem itself can be divided into 3 types based on its structure.

- 1) Structured Problem: The problem that its elements and relationship among elements are understood by problem solver.
- Unstructured Problem: Opposite to the structured problem, problem solver may not understand this kind of problem at all. Elements and their relationships are unknown.
- Semi-Structured Problem: Most of problems are neither clearly understood nor completely unstructured. This kind of problem consists of some elements or their relationships that are understood and some that are not.

Problem solving could be considered as a key activity of both management and non-management in a company. The result of problem solving is solution and in order to get the solution, problem solver needs information. According to Herbert A. Simon, there are 4 stages of problem solving (see figure 2.5) [27]. The first stage is intelligence activity in which information in term of environment condition calling for a solution is gathered. The second stage is design activity. This stage involves with inventing, developing and analyzing all possible courses of actions or solutions. Then the next stage is choice activity which is the stage of selecting the solution. Finally, the forth stage, the review activity is performed to assess the past selected solution.

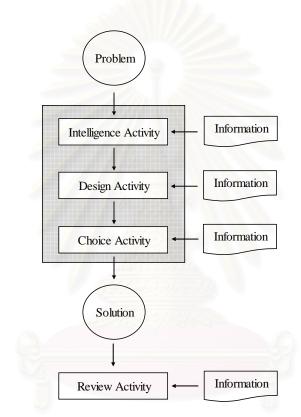


Figure 2.5: Information Supports Each Problem Solving Stages Source: Management Information Systems [27]

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2.1.7 Decision Support System

Decision support system (DSS) is a system that can help human by integrating various sources of information, structuring the decision model, and supporting in making the optimal choices. DSS does not make a decision itself; rather managements or users are the one who makes decision based on choices supported by DSS. DSS consists of 3 mains components: data management, model management, and dialog

management or user interface. Data management system or DBMS consists of necessary relevant data and information. Model management system or MBMS contains one or more models for analysis the performing system. Dialog management is the interface between the system and decision makers or users.

Decision itself can be divided into 3 types.

- Structure Decision: A decision that relevant data, process, and evaluation can be well specified and finally the decision can be evaluated in a structured way.
- 2) Unstructured Decision: A decision that consists of a little agreement on relevant data, process, and evaluation nature. Generally, an unstructured decision is not made regularly or it is made in situations in which the environment is not well understood.
- 3) Semi-Structured Decision: A decision which is in the middle of the former 2 types of decision. There is not much structured in relevant data, process, and evolution and human based judgment still involves. This is the type of decision that DSS focuses on.

There are 3 main important procedures of making a decision.

- Need Identification: A process of determining why a decision has to be made.
- Alternative Analysis: Alternatives are analyzed according to variable constraints. At this stage, a what-if analysis is a tool that has been widely used.
- Decision: The final process is decision making. Decision makers such as DSS users, or managements make a decision that is practical and gives the best desired result by considering the provided alternatives.

2.2 Order Receiving Process

The effectiveness and efficiency of processing customer orders not only ensure market success but also affect overall profitability of a company [14]. Simultaneous with the customer order information is the coordinated information among departments within the company such as marketing department, accounting department, or production department (see figure 2.6).

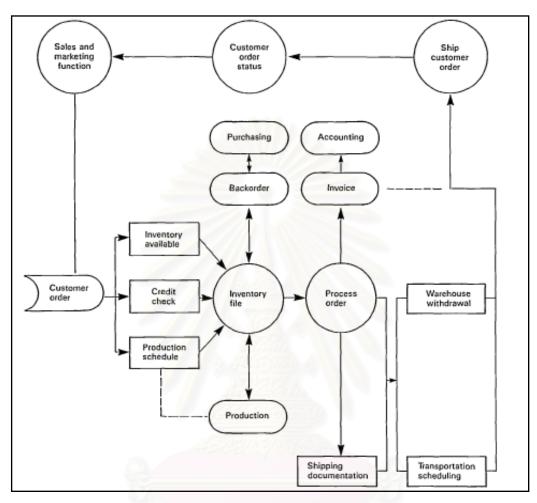
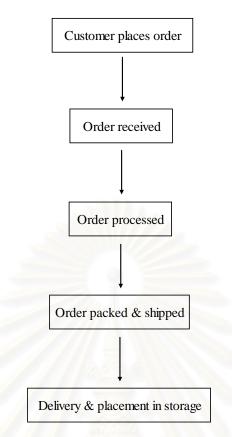
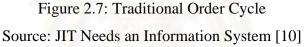


Figure 2.6: The Order Receiving Process Flow Chart Source: Effective Logistics Management: How Should We Process Orders? [14]

Generally, the order receiving process starts when customer places an order, then company receives, processes the order, and finally delivers the order as the last step. The common approach to view this concept from order placement to order receipt is traditional order cycle depicted in figure 2.7.





According to John Gattorna *et al.* [14], there are 4 activities to process customer's order.

- (1) Order acquisition: No other activity is able to take place until an order is received. The acquisition of customer's order can be divided into 3 stages; order generation, order data recording, and order data transmission. Several ways for recording and transmitting an order to a company are provided once the order is generated. Direct phone calls from customers still the most popular way of transmitting orders. Although many companies record received order into a computer program, some continue to record the order on conventional order form.
- (2) Order entry: At present, customer's order entry interfaces with computerized program. Entering an order is interactive and can be immediately accessed by an operator.

- (3) Order document processing: There is no identical document processing system. The characteristic of this system depends on the company background, available products, production lines, customer behaviors, and internal data system. In this activity, the document is processed by 2 methods; sequential system or parallel system. The following activity can not be performed until the preceding one is finished in the former system whereas some operations can be performed in parallel in the latter system. Obviously, the major issue of the strict sequential system is that the delays in the early activity create further delays later on.
- (4) Order status information: The order status information could be considered as one element of customer service. Expected delivery date, estimated delivery lead time, or revised detail of items cannot be delivered report could be regularly or routinely submitted to customer.

Order receiving process is also important application of cooperative information system because of its relevant with other important business processes such as inventory control, production management, or supply chain management. Figure 2.8 illustrates the order receiving process and its interfaces with other processes.

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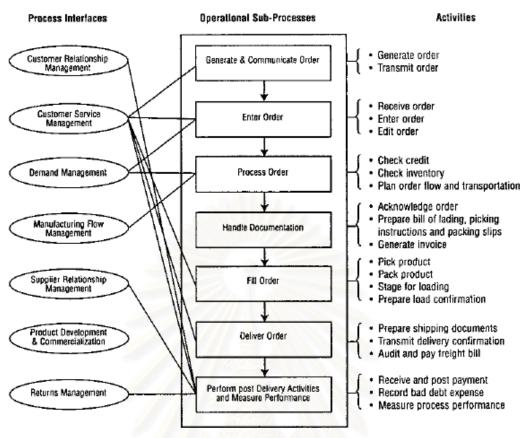


Figure 2.8: The Operational Order Fulfillment Process Source: The Order Fulfillment Process [9]

From figure 2.8, it could also be implied that the larger quantity of information exchanged, the better the order receiving process's performance should be. Upon a company receives an order from a customer, both internal and external information are generated. Order detail, payment method, inventory level, production capacity, transportation, or delivery time is an example of order receiving process's information. Unreliability of this information also means uncertainty to the customer. Therefore, to measure the quality of order receiving process information, the variables of in time, accurate, convenient to access, and reliable are used.

- In time arrives in the agree time or before lead time is frozen
- ♦ Accurate free from obvious mistakes
- Convenient to access easy access without further processing
- Reliable the probability that an order remains unchanged

Variable	Definition – order information quality	Definition – forecast information quality	Source (order information quality) English (1999), Lindau (1995) Byrne and Markham (1991), Croxton (2003), English (1999), Petersen (1999), Whipple <i>et al.</i> (2002)		
In time	Arrives in the agreed time – before lead time is frozen	Arrives in the agreed time – within the supplier's planning horizon			
Accurate	Free from obvious mistakes	Free from obvious mistakes			
Convenient to access	Easy access without further processing	Easy access without further processing	Closs et al. (1997), English (1999), Keebler et al. (1999), Moberg et al. (2002), Petersen (1999).		
Reliable	The probability that an order remains unchanged	The probability that a forecast remains unchanged	Mattsson (2002), Moberg et al. (2002)		

Figure 2.9: Variables to Measure Information Quality

Source: Measuring Information Quality in the Order Fulfillment Process [13]

2.3 Work Measurement

2.3.1 Introduction to Work Measurement

Work measurement is one technique of work study which is a valuable tool of management for systematically raising the productivity of a plant or an operating unit.

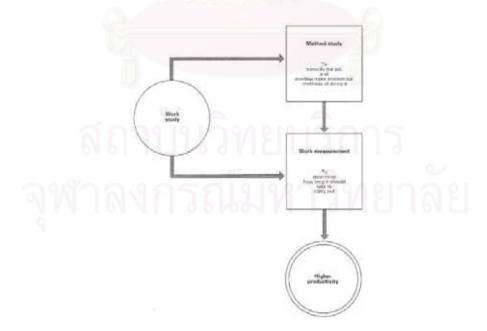


Figure 2.10: Work Study Techniques: Method Study and Work Measurement Source: Introduction to Work Study [23]

The definition of work measurement according to the British Standards Institution is "the application of technique designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance". It involves with determining the length of time it should take to finish the work and establish that time into standards. Setting standard time is vital for further analysis of; for instance, capacity planning, process design, scheduling, estimate labor costs, and budgeting. Richard Chase *et al* [6] and George Kanawaty [23] described that standard time is necessary for several reasons.

1) To schedule work and allocate capacity.

2) To provide an objective basis for motivating the workforce and measuring a worker's performance.

3) To evaluate performance of existing contracts.

4) To provide benchmark for improvement.

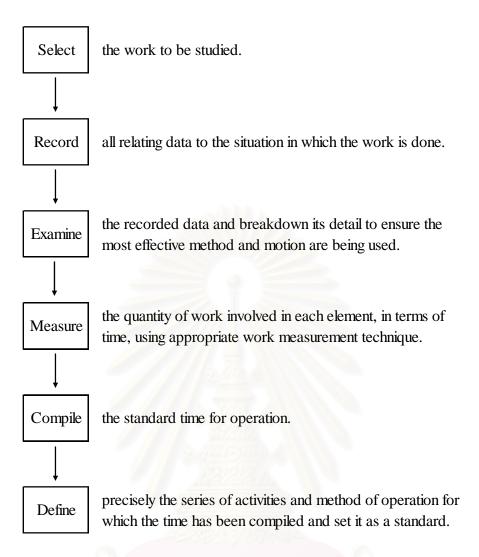
5) To provide the basis for production planning and control.

6) To provide information for production cost and labor-cost control and to enable standard costs to be fixed and maintained.

7) To provide information that can enable selling price and delivery date estimation.

To carry out work measurement, there are 6 basic procedures:

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2.3.2 Work Measurement Techniques

Generally, there are 4 basic techniques which are commonly used for measuring work and setting standards. The 4 basic techniques are predetermined time standards, standard element times, work sampling and time study. The first two techniques are considered as indirect method while the latter two are considered as direct method. The appropriate choice of techniques depends on the level of desired detail and the nature of the work itself. Generally, highly detailed and repetitive work is usually measured by time study or predetermined time standard. When work is performed with fixed-processing-time equipment, standard element time method is used. And when task involves with a long cycle time, work sampling is the choice.

(*i*) *Predetermined Time Standards:* This technique either uses generic movement times generated in laboratory or utilizes previous published and widely accepted standard element times. One of the most widely used systems throughout the

world is Methods Time Measurement (MTM) which is based on a research of basic elemental motions and times. By this approach, the work must be divided into its basic elements or motions, rated for the difficulty, and then compare with the appropriate MTM data table for assigning time measurement units (TMUs) to finally obtain the standard time for each element or motion.

(Jistunce Moved (rockes)	TIME (TMU)			WEIGHT ALLOWANCE						
	A			Hand in Motion B	Weight (pownds.) up to:	Dynamic Fector	Static Constant TMU	Case and Description		
3% or lines	2.0	2.0	28	17	13	1.00	Q	A. Move object to other base		
1	25	25	14	2.3						
1	3.8	45	:52	2.8			100 100 10			
1	4.5	-57	8.7	38	78	1.00		er epsitet stop.		
- 4	6.1	8.9	8.0	13			-			
1	13	8.0	32	5.0	12.5	1.11	3.9			
6	8.1	85	10.3	4.7				B. Move ebject to approxi- mate or indefinite location.		
7	1.1	8.2	TLL	.8.8	17.5	1.17	55			
1.1	9.7	10.8	111.0	12						
	16.5	11.5	12.1	78	22.8	1.21	24			
2.10	11.3	12.2	12.5	14	22.5	1.39	1			
13	12.9	12.4	15.2	10.0			- 81			
10.16	14.4	14.8	16.5	31.4	12.6	133	10.8			
18	15.0	15.8	18.7	12.8						
18	17.8	17.8	33.4	14.2	22.5 1.39 12	1				
20	18.2	163	22.1	ISA.		12.5	1			
22	20.8	78.4	13.8	11.0	42.5	1000	14.3 0	Antestes year		
24	32.4	20.8	35.5	10.4		1.41		C. Meve object to exact		
28	21.0	21.8	77.5	19.8	1999	1.30	248	lecation.		
28	25.5	23.1	253	21.2	0.5					
30	22.1	24.2	30.7	111	1275.00	1				
Additional	88	8.6	\$35		TMU per inch over 30 inches-					

Table 2.2: Example of Method Time Measurement (MTM) Table

Source: Operations Management [37]

Predetermine time standards method has several advantages. First, they are established in a laboratory where the actual activities are not interrupted by direct observation. Next, since the standards are set prior to the work is performed, it is useful for planning. Third, there is no need for performance rating. Finally, they are based on large numbers of workers under controlled environments. However, there is one important disadvantage of this technique: that is, it is necessary to have a skillful and well trained analyst. This technique is particularly useful for very short repetitive time cycles such as assembly work in the electronics industry.

(ii) Standard Element Times: The times established from this technique derived from the historical study data. The following steps are the procedure of using standard element times technique.

1) Analyze the work to identify its elements.

2) Check the historical records, and record them. Use time study to obtain others, if necessary.

3) Modify record times, if necessary.

4) Sum the times of all elemental works to obtain the normal time, and factor in allowances to obtain standard time.

There are several advantages of this technique. One of them which can be obviously noticed is the potential of cost and effort saving since there is no need to conduct a completely new time study for each work. Next advantage, which is similar to predetermine time standards method, is the less disruption of actual operation. Another advantage is that there is no need for performance rating since the times are generally averaged. However, one important disadvantage of this technique according to William Stevenson [37] is that the times may not exist for enough standard elements to make it worthwhile.

(*iii*) Work Sampling: Work sampling also known as activity sampling is another work measurement technique which was developed by L. Tippet in the 1930s. This technique estimates the proportion or percent of time that a worker or a machine spends on each work by sampling. The random observations are done to record each work that a worker or a machine performs. This technique focuses on determining how workers allocate their times among various activities. The results are counts of a number of times of both activity and non-activity. Work sampling estimates include some degree of error. Hence, management must decide on the desired confidence level and accuracy. In work sampling technique, the most commonly used is 95% confidence level. The procedure of work sampling can be summarized into 5 steps:

1) Cleary identify workers and machines to be studied. And inform the workers and their supervisors the purpose of the studied to avoid awakening of suspicions.

2) Perform a preliminary sample to obtain an estimate of the parameter value (such as percent of time a worker is busy).

3) Calculate the sample size required. Formula below gives the sample size for a desired confidence and accuracy:

$$n = \frac{z^2 p(1-p)}{h^2}$$

$$n = \text{ required sample size}$$

$$\mathcal{Z} = \text{ number of standard normal deviations for the desired confidence level}$$

$$p = \text{ estimated value of sample proportion (of time worker is observed busy or idle)}$$

$$h = \text{ acceptable error level, in percent}$$

An easier way to determine sample size is the read off the number of observations needed directly from a Nomogram as in figure 2.11.

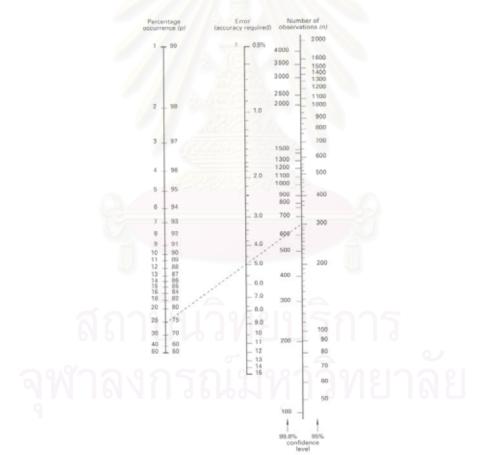


Figure 2.11: Nomogram for Determining Number of Observations Source: Introduction to Work Study [23]

4) Prepare observation schedule.

5) Observe and record worker activities.

6) Determine the estimated proportion of time spent on each specified activity.

For more understanding of this work sampling method, an example of determining employee time allocation with work sampling is described.

Example1: The manager of one company estimates his employees are idle 25% of the time. He would like to take a work sample that is accurate within 3% and wants to get 95.45% confidence in the results.

Solution: Determine a number of observations from following equation:

$$n = \frac{z^2 p(1-p)}{h^2}$$

where n = required sample size Z = 2 for 95.45% confidence level p = estimated of idle proportion = 25% = 0.25 h = acceptable error of 3% = 0.03 Thus $n = (2)^2 0.25 (1-0.25) (0.03)^2$

= 833 observations

Then the manager wants to be sure that his employees have adequate time to provide prompt and helpful service. He believes that the service for clients deteriorates rapidly when employees are busy more than 75% of the time. So, he does not want his employees to be occupied with client service activities more than 75% of the time.

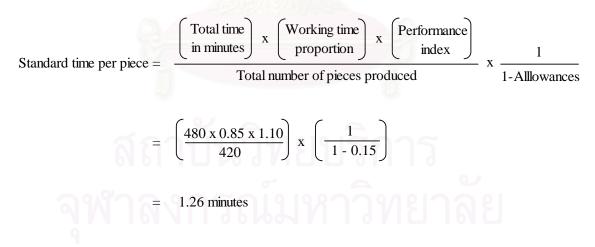
Solution: Define "work" and then execute observations.

No. of Observations	Activity
485	On the phone or meeting with a client
126	Idle
62	Personal time
23	Discussion with supervisor
137	Filing, meeting, and computer data entry
833	

The analyst concludes that from 833 observations, 188 observations (126 idle and 62 personal time) are not work related. Since 188/833 = 22.6% is less than the manager target to ensure a high service level. Therefore, he should find a way to reduce workloads, reassignment of responsibilities, or hiring additional manpower.

Example2: Calculating standard time from work sampling.

Information	Activity	Data for One Day
Total time expended by operator (working time and idle time)	Computer payroll system	480 minutes
No. of parts produced	Inspection department	420 pieces
% Working time	Work sampling	85%
% Idle time	Work sampling	15%
Average performance index	Work sampling	110%
Total allowances	Compnay time-study manual	15%



Work sampling provides several advantages. First, it is less expensive comparing with time study technique since one analyst can simultaneously observe several workers and no timing device is required. Second, unlike predetermined time standards method, it is not necessary for highly skill or well trained analyst. Next, work sampling uses sudden observations over a long period and does not proceed interferingly, so it is unlikely to affect the study's results. Fourth, the temporarily delay of the study results in a little effect. In contrast, there are some drawbacks as well. First, this technique does not appropriate with work that has short cycle time. Also, because it is less intrusive, it tends to be less accurate. Third, if the analyst does not follow random routes of observation, it could yield biased or incorrect results. Finally, this method does not breakdown elements of work as complete as time study method which will be discussed in next.

(iv) Time Study: Time study was introduced by Frederick Taylor in 1881 and is still the most widely used method of work measurement especially for short and repetitive works. Generally time study is made with a stopwatch, a study board, or time study forms, either by direct observation or from a videotape analysis. Taking a time study requires a regular form consisting of element codes, descriptions, rating, and element durations. These data could be recorded in the plain paper, however, it is more convenient to use a standard form to ensure that each study is of the same consistent format, that all relevant data are recorded, and that the completed studies is more reliable.

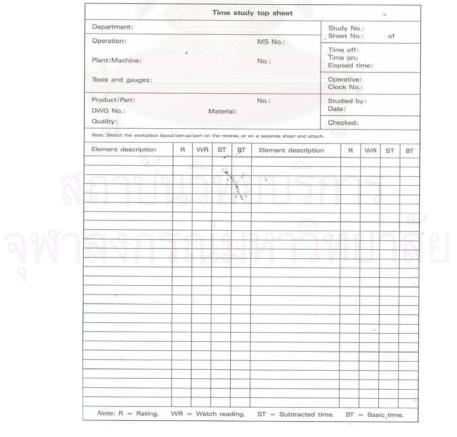


Table 2.3: Example of Time Study Sheet

Source: Operation Management [37]

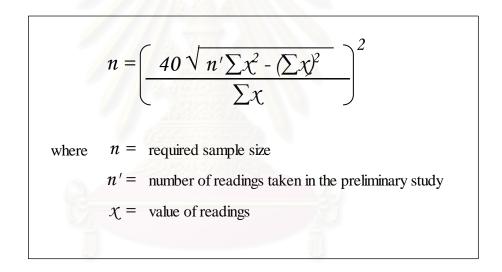
There are 8 steps of procedure to establish time standard using time study technique.

1) Define the work to be studied. Record all information available about the work, the operative, and the surrounding conditions which are possible to affect the study.

2) Breakdown the work into elements that still can be timed and recorded.

3) Decide the samples needed to be measured.

To determine the sample size or a number of readings that must be made for each element in order to give the desired confidence level of 95.45% and with accuracy of $\pm 5\%$ error margin, the following equation below is used.



Other than statistical method, a conventional guide for determining a number of cycles to be timed is also used by some researchers and some companies (see table 2.4).

Table 2.4: Number of Recommended Cycles for Time Study

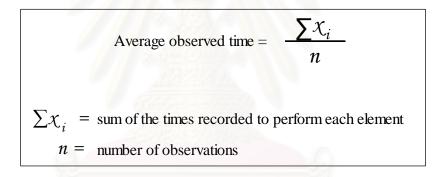
Minutes per	To	To	To	To	To	To	To	To	To	To	Over
cycle	0.10	0.25	0.50	0.75	1.0	2.0	5.0	10.0	20.0	40.0	40
Number of cycles recommended	200	100	60	40	30	20	15	10	8	5	3

Source: Introduction to Work Study [23]

4) Time and record the work. At the same time, rate the worker's performance.

There are 2 main methods of timing with stop-watch: cumulative timing and flyback timing. For cumulative timing, the watch starts at the beginning of the study and then runs continuously throughout the study until the whole study is completed. The individual element times are obtained by successive subtractions after the study is completed. For flyback timing, each element is timed separately. The hands of the stopwatch are returned to zero at the end of each element and are allowed to start immediately.

5) Compute the average actual observed time. The average observed time is the times for each work element measured, and can be calculated as the following equation.



6) Determine performance rating and then calculate for normal time of each element.

Normal time is the observed time adjusted for worker performance to make it usable for all workers. It is computed by multiplying the observed time by a performance rating. That is,

Normal time = (Average observed time) x (Performance rating factor)

Rating is the assessment of worker's rate of working relative to the analyst's concept of the rate corresponding to standard pace. When assessing performance, the analyst must compare the observed performance with the concept of normal. Obviously, performance rating could be the source of conflict between labor and management. Although no one has been able to suggest a way around this matter, sufficient training of analysts can result in a high degree of consistency in ratings. Also, in order to avoid any bias, a second analyst may be called in to together do performance rating.

A normal rating is 1.0. A performance rating of 0.9 indicates a speed that is 90% of normal, where as a rating of 1.10 indicates a speed that is slightly faster than normal or than average. For example, if a worker performs a task in 5 minutes and the analyst rates his performance as 20% higher than normal or than average. The normal time would be 5x1.2 = 6 minutes.

7) Add the normal times for each element to develop a total normal time for the work.

8) Compute the standard time.

Standard time is derived by adding to normal time allowances for personal needs (such as washroom and coffee breaks), unavoidable work delays (such as equipment adjustment, machine breakdown, and lack of materials), and worker fatigue (physical or mental). Allowances can be based on either job time or time worked (e.g. a workday). If the allowances are based on the job time, the standard time is

Standard time = Normal time (1 + Allowance Factor)

If the allowances are based on a percentage of the time worked, the appropriated standard time formula is

Standard time = $\frac{\text{Total normal time}}{1 - \text{Allowance factor}}$

In practice, allowances may be based on the judgment of analyst or negotiation between labor and management. Nonetheless, personal allowances are often in the range of 4% to 7% of total time depending on the distance to the restroom or to the canteen whereas delay allowances and fatigue allowances are based on actual studies of the delay that occurs and the knowledge of human energy expenditure respectively. Table 2.5 below shows typical allowances in percentage for various classes of work.

Table 2.5: Typical Allowance Percentages for Working Conditions

I he say for a set of the set	Percent	Pe	rcent
A. Constant allowances:		4. Bad light	
1. Personal allowance	5	a. Slightly below recommended	0
2. Basic fatigue allowances	4	b. Well below	2
3. Variable allowances:		c. Very inadequate	5
1. Standing allowance	2	5. Atmospheric conditions	
2. Abnormal position allowance:		(heat and humidity)-variable	0-10
a. Slightly awkward	0	6. Close attention:	
b. Awkward (bending)	2	a. Fairly fine work	0
c. Very awkward (lying, stretching)	7 .	b. Fine or exacting	2
3. Use of force or muscular energy		c. Very fine or very exacting	5
(lifting, pulling, or pushing):		7. Noise level:	
Weight lifted (in pounds):		a. Continuous	0
5	0	b. Intermittent-loud	2
10	1	c. Intermittent-very loud	5
15	2	d. High-pitched—loud	5
20	3	8. Mental strain:	
25	4	a. Fairly complex process	1
30	5	b. Complex or wide span of attention	4
35	7	c. Very complex	8
40	9	9. Monotony:	
45	11	a. Low	0
50	13	b. Medium	1
60	17	c. High	4
70	22	10. Tediousness;	
		a. Rather tedious	0
		b. Tedious	2
		c. Very tedious	5

Source: Operation Management [37]

Although time study provides accuracy of setting standard time, there are some limitations of this technique as well. First, to do time study, it requires well trained and skillful analyst. Second, the standard time can not be set up until the actual works are performed. Also, this method disrupts the normal work routine, and workers may resent it in many cases.

For more understanding of this time study method, an example of computing standard time by this method is described.

Example1: One company promotes its management development seminar by mailing thousands of individually composed and typed letters to various firms. A time study has been conducted on the task of preparing letters for mailing. On the basis of the following observations, the company wants to develop a time standard for this task. The personal, delay, and fatigue allowance factor is 15%.

Observations (in Minutes)									
1	2	3	4	5	Performance Rating				
8	10	9	21*	11	120%				
2	3	2	1	3	105%				
2	1	5*	2	1	110%				
	1 8 2	1 2 8 10 2 3	1 2 3 8 10 9 2 3 2	1 2 3 4 8 10 9 21* 2 3 2 1	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$				

Solution:

1) Delete unusual observations which are those with an asterisk (*).

2) Compute the average time for each work element.

Average time for A = 8 + 10 + 9 + 11 = 9.5 min. 4

Average time for B =
$$2 + 3 + 2 + 1 + 3 = 2.2$$
 min 5

Average time for C =
$$2+1+2+1 = 1.5$$
 min
4

3) Compute normal time for each work element.

Normal time = (Average observed time) x (Performance Rating)

Normal time for $A = 9.5 \times 1.2 = 11.4$ min.

Normal time for $B = 2.2 \times 1.05 = 2.31$ min.

Normal time for $C = 1.5 \times 1.10 = 1.65 \text{ min.}$

4) Compute the total normal time by adding the normal times of each element.

Total normal time = 11.40 + 2.31 + 1.65 = 15.36 min.

5) Compute standard time for the work.

Standard time =
$$\frac{\text{Total normal time}}{1 - \text{Allowance factor}}$$

= $\frac{15.36}{1 - 0.15} = 18.07 \text{ min}$

2.3.3 Weighted Mean

The arithmetic mean is the most frequently used measure of central location. However, in some cases there is a reason to weight data values differently such as when there are several observations of the same value. Weighted mean is computed by:

Weighted Mean
$$(\overline{\chi}_w)$$
 $\frac{\sum w_i \chi_i}{\sum w_i}$
where w_i = weight of *i*th data value χ_i = *i*th data value

2.4 Literature Review

Every company has to deal with complexity of both external and internal factors especially the surrounding of intense and competitive market environment that can weaken the company efficiency and growth opportunity. In order to be able to compete with competitors, improve competitive advantage, and strengthen survival ability; the development of information system is required. The information system has been recognized for creating and sustaining competitive advantage of a company [16]. It enhances the company's ability to meet objectives and goals. According to their study, Donald Falconer and Alan Hodgett [11] found that most of large Australian companies recognize for the value and importance of the information system and are undertaking the information system strategic planning.

Information system began to evolve in late 1960s [24]. Beynon-Davies P. [31] defined information system as "a system involved in the gathering, processing, distribution and use of information and as such support human activity systems".

Information system has been developed with the assist of different computer programs, such as Visual Basic or Delphi, and use Microsoft Access or SQL to support the database. Its benefits have been studied by a great number of researchers to help find solutions in regards to their subjects as described below:

Many researches are found focusing on developing information system to improve sales efficiency in many kinds of industry [21,34,35]. The newly developed information system is used to solve the problem of error in customer data collection, to reduce the time in managing data of purchase contract, to eliminate the problem of outdated and duplication of customer information, or to improve the current unsystematic database system. The orderly organized, updated, and adequate data as a result of the information system development reveals several advantages such as the improvement of sales decision making, the increase of officers' performances, the high potential in customer services, the reduction of delay delivery, and more recent and efficient report to management.

The implementation of information system also plays an important role in improving purchasing efficiency and scheduling delivery time [7,39]. To solve problems of unable to schedule product delivery time, wrong material orders, long lead time in finding relevant information, and insufficient data in supporting material and supplier selection, which are caused by the lack of systematic data provided, the information system is developed to orderly collect and organize all necessary data to help automate the flow and provide all recent and efficient business information needed to be considered.

The information system was also developed to help collecting and managing essential data in production used for estimating manufacturing cost in Jewelry industry [2]. As a consequence, benefits of systematic data collection and accurate cost analysis enhance the effectiveness of pricing strategy, cost control, and management decision and control.

Technical related aspect such as quality of performance test is also researched to improve its efficiency by implementing information system [41]. The existed lengthy report system was replaced by the information system development. The implementation helped achieve in real time result analysis, more standard report with less reporting procedures, faster response to problems, and defect reduction. Maintenance evaluation system of subway is also another technical related aspect that information system is studied to improve its efficiency [40]. The tunnel structure and track rail normally work under heavy and severe operation, therefore, it is necessary to develop appropriate and efficient information system for managing maintenance information.

Within the university is where the information system is developed as well. With the similar main objectives of helping processing data recording, performing user inquiries and generating report, the information system was designed and developed its structure for a university press [22]. In addition, the newly developed information system also resulted in organized data collection system, reduction of press material shortage, and reduction of excessive quantity of supplied newspapers relatively compared with student demands.

The information system is also developed for rental business such as car rental. Due to the rapidly increasing desire for information system allowing Europe wide exchange and administration of information, distributed information system is studied to deal with complexity of involved enormous qualitative and quantitative data [3]. Furthermore, the information system is also integrated with Radio Frequency Identify (RFID) based on web services to create the information platform which data can through and exchange by internet, reduce business integration barriers, and help accelerate its deployment. The study by Kuo-Shien Huang and Shun-Ming Tang [19] on bike rental business indicates that the implementation of this technique not only provides new business model for the company but also creates the company profit opportunity. That is, it extends the bike rental services since the data can be interchanged among rental locations. In addition, the company can receive report quickly since the system provides real time information with the use of common information system and database which can economize on customers data input or creation.

Several researches also study in developing the information system for managing order process. First, David M. Dilts [10] introduced the just-in-time logistic information system (JIT-LIS) model to deal with the change in JIT environment where revolution in the information system is required. The example of Seat Company for automotive industry who follows this model is described. With the JIT-LIS model, the company is able to dramatically reduce inventory amount, achieve just-in-time deliver seats to automotive assembly plant, and increase the international competitiveness of the entire industry. Another related research belongs to Linda Hendry [18]. The objective of this research is to develop a decision support system (DSS) named Customer Orders Planning Program for managing customer enquiries for make-to-order sector of British industry. The program presents information that user can easily understand and consider as many customer orders as required. This research indicates that the output of DSS assists in capacity planning, provide realistic delivery date, and control overall shop workload. This also enhances users' ability to not only negotiate with customer for feasible delivery date but also analyze whether special actions are required in order to achieve promised delivery date.

In summary, an information system is widely used in both manufacturing business and non-manufacturing business. The main contribution of information system is to collect all required data into a system where those data will be systematically organized, easily accessed, updated, and logically processed for further utilization and interpretation to eventually provide effective and efficient output or information for a user.

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CHAPTER III

BACKGROUND OF THE CASE STUDY COMPANY

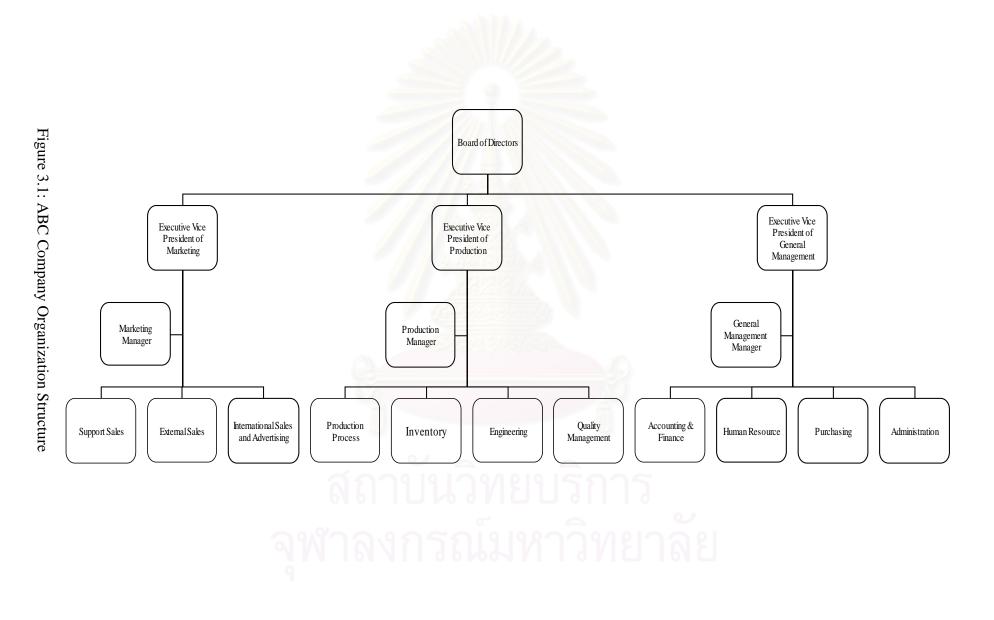
This chapter describes information of ABC Company. First, basic information and the company organization are provided. Then in order to have more understanding of the company business, available products, production process, inventory, business and sales characteristic are described. However, this chapter focuses on the company business, production process, and inventory which are necessary for further analysis of problem that the company currently encounters describing in the next chapter.

3.1 Introduction to ABC Company

ABC Company was established in March 1990 with a headquarter located in Samutprakarn province and a distribution branch located in Rayong province. The company manufactures, sales, and rents high quality steel scaffolding and accessories used in the construction industry throughout Thailand and neighboring countries. With the transferred of advanced equipment and production technology from scaffolding manufacture in Japan, ABC is the first and only scaffolding company in Thailand that received the Certificate of Standard from the Thai Industrial Standard Institute (TISI)'s.

3.2 ABC Company Organization

The company divides responsibilities into 3 departments; marketing department, production department, and general management department (see figure 3.1).



3.2.1 Marketing Department

Responsibilities of marketing department includes every activities related to marketing both locally and internationally, customers, and competitors such as pricing strategy, product delivery commitment, market research, competitor information benchmarking, customer feedback improvement, customer service, new product advertising, and product promotion. This department is divided into 3 sections.

- Support sales section: this section's main responsibilities are to receive order from local customers, and then collaborate with production process section to confirm and commit the deliverable date and quantity of products to customers.
- II) External sales section: this section's main responsibilities are to visit local customers to provide company information and collect customers' information and requisitions for further improvement.
- III) International sales and advertising section: Although this section's duties cover all responsibilities of support sales section and those of external sales section, this section supports only customers in neighboring countries. Also, this section is responsible for supporting and providing the first 2 sections with advertising and promotion material.

3.2.2 Production Department

Production process, inventory system, product engineering, and quality management are the main duties of this department.

I) Production Process section: this section is responsible for both scheduling production plan and producing products (either by manufacturing or repairing) as soon as possible to finally meet the committed timeline of deliverable date and quantity.

II) Inventory section: this section duties cover confirming the amount of products in every inventory system and reporting to marketing department every morning.

III) Engineering section: this section is responsible for the research, design, and development of the new product.

IV) Quality Management section: this section assures that the quality of products delivered to customers meet the standard and customer expectation. In

addition, internal quality system of the company is also included in this section's responsibilities.

3.2.3 General Management Department

Responsibilities of general management department cover all works which are related to accounting & finance, human resource, purchasing, and administration.

I) Accounting & Finance section: this section is responsible for all activities related with money and accounts; for instance, cost control, billing, payment, loans, etc.

II) Human Resource section: this section involves with recruitment, salary structure, training system, etc.

III) Purchasing section: this section involves with purchasing product component and materials to be used in both office site and production site.

IV) Administration section: this section deals with other miscellaneous responsibilities such as company regulation, documentation.

3.3 Number of Employees

The total employees of 324 are divided into

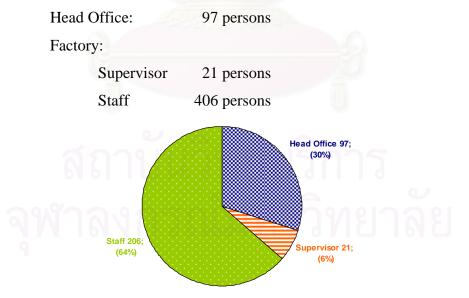


Figure 3.2: Number of Employees

3.4 Product

ABC products can be divided into 4 main groups; scaffoldings, metal form, other accessories, and safety product group.

3.4.1 Scaffolding Group

Scaffoldings are the main products that result in high revenues for the company. They consist of various products such as

- ➤ vertical and horizontal frame
- ➤ round pipe and square pipe
- ➤ steel stairs
- ➤ cross brace
- ➤ walking panel
- ➤ arm lock
- fixed clamp and swivel clamp

Vertical Frame	Steel Stairs	Cross Brace	Sw ivel Clamp	Fixed Clamp
िच्चन	Ħ	///	amp	-
	Ħ			
PQ	H	~	10	1:00
1 1	#	/ . \		700

Horizontal Frame	Round Pipe	Square Pipe	ArmLock	Walking Panel
		T	((.	

Figure 3.3: Example of Products included in Scaffolding Group

3.4.2 Metal Form Group

This group is the second main products of ABC Company. The products are:

- \succ metal form
- \triangleright angle corner form
- \succ inside and outside corner form
- ≻ U-clip

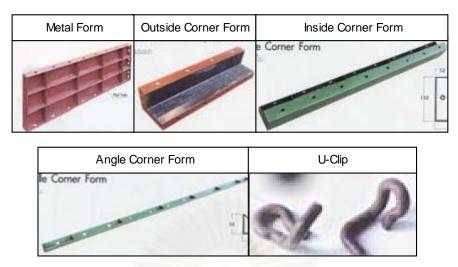


Figure 3.4: Example of Products included in Metal Form Group

3.4.3 Other Accessories Group

This product group is mainly assembled with other products in scaffolding group or metal form group. Many kinds of accessories are available:

- ➤ square support
- ➢ column clamp
- ➤ table form
- ➤ temporary fence

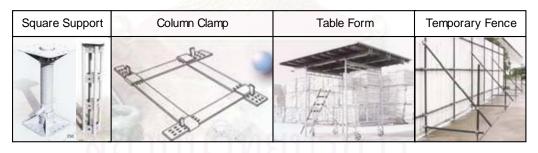


Figure 3.5: Example of Products included in Accessories Group

3.4.4 Safety Group

The main purpose of this safety group is to both prevent workers or other things falling down from the construction site and prevent pedestrians or other people at lower level get injured from those falls as well. The examples of product in this group are as follows:

- Raschel safety net
- ➢ protector sheet

\succ mesh sheet

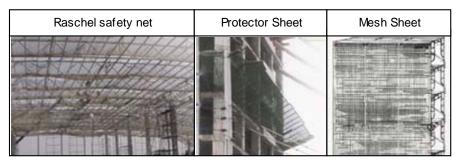


Figure 3.6: Example of Products included in Safety Group

3.5 Business and Sales Characteristic

The business model of ABC Company is quite complicated. The majority of the products are to be rented – at approximately 80% of the time. The remaining 20% is where customers decide to purchase. This has especially resulted in the complexity of production process and inventory system which will be described next in section 3.6 and 3.7 respectively.

Currently ABC divides customers into 7 groups based on the project type that products are used.

- 1. event: those customers who rent or purchase products for short period activities.
- 2. decoration: those customers who rent or purchase products for decorating or renovating purposed activities.
- 3. gas station
- 4. discount store or convenient store
- 5. factory
- 6. condominium: this type of customers also includes those who rent or purchase product for building and school as well.
- 7. tall building: this type of customers relates with very long project period construction such as tall buildings and express way.

The orders by month of year 2006-2008 are illustrated as in figure 3.7. It shows an increasing trend of customer orders.

Total Order (Units)	January	February	March	April	Мау	June	July	August	September	October	November	December	Total
Year 2006	563,652	762,595	842,788	363,459	521,566	596,530	698,594	732,409	701,220	713,298	849,380	708,503	8,053,994
Year 2007	1,017,150	882,745	761,341	420,441	705,566	719,119	745,601	796,093	641,759	959,736	964,185	927,962	9,541,698
Year 2008	1,115,804	908,050	1,156,302	784,378	977,254	-	-	-	-	-	-	-	4,941,788

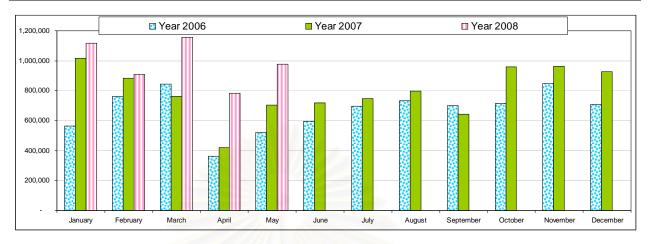


Figure 3.7: Total Order by Monthly of Year 2006 – 2008

3.6 Production Process

Even though, ABC Company aims to have the scaffoldings and accessories by repairing returned goods from customers which costs less, the company continuously manufactures the products in order to meet the customers' rising demand as well. Therefore, the production process can be divided into 2 sectors – repairing products returned from renting customers (repairing process) and manufacturing of new products (manufacturing process).

Repairing process starts with sanding the returned products from customer to clean up the rust or any residue left on surface. Repairing step which includes polishing, bending, welding, and grinding is the next step before the products go to the final step of painting. Unlike the repairing process, manufacturing process starts with cutting the purchased components into the required dimension and shape, then they will be assembled and welded into the product type that customers order, and finally go through painting booth as the final step.

The process flows of repairing process and manufacturing process are depicted in figure 3.8 and figure 3.9 respectively.

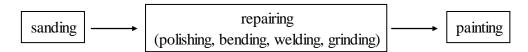


Figure 3.8: Repairing Process Flow

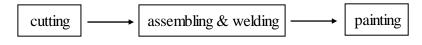


Figure 3.9: Manufacturing Process Flow

3.7 Inventory

Inventory of ABC Company can be quite complicated. Since the main business of ABC is rental scaffolding and accessories, there are 2 more inventories; waiting-for-repair items and at-customer-location products, in the system besides of finished products and work-in-process. The 4 categories of product in inventory can be summarized as below:

- 1. finished products: in-storage items which are complete and ready to be delivered to customers
- 2. work-in-process: unfinished items which are in either production process or repair process
- 3. waiting-for-repair items: in-storage items which are queuing to be repaired
- 4. at-customer-location products: renting items which are located at customers' site

3.8 Conclusion

From the background of ABC Company, it can be noticed that there are more details and more complicated information related to the 3 main sections of business model, production process, and inventory comparing with other normal businesses. Unlike normal business, in term of business model, 80% of the ABC products are to be rented and only 20% are to be purchased. In term of production process, it consists of 2 processes: repairing process and manufacturing process. Nonetheless, it is one of the company targets to fulfill customers' demands by having products through maximizing repairing process which costs less. In term of inventory, there are 2 more kinds of inventory comparing to normal business: waiting-for-repair items and at-customer-location products.

The more complexity of ABC's business especially of these 3 sections, the harder the company's business decision making and processing. One of the company processes that is directly involved with these 3 sections' complexities is order receiving process. This process uses many sets of information from business model,

production process, and inventory to process customers' orders and fulfill their demands. Also, its efficiency is one of the factor that directly effects the achievement of company targets: on time delivery, fully capacity utilization, and repairing process maximization.



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CHAPTER IV

THE ORDER RECEIVING PROCESS OF THE CASE STUDY COMPANY

This chapter discusses about ABC Company order receiving process and its problems. The business process is firstly discussed to give an overview how the rental business is performed. Then, this chapter describes the current order receiving process to explain the flows and the involvement of each department. Finally, the analysis of this process and the summary of the problems causing from the lack of supporting information system are discussed respectively.

4.1 Overall Business Process

The overall business process of ABC Company is illustrated in figure 4.1.



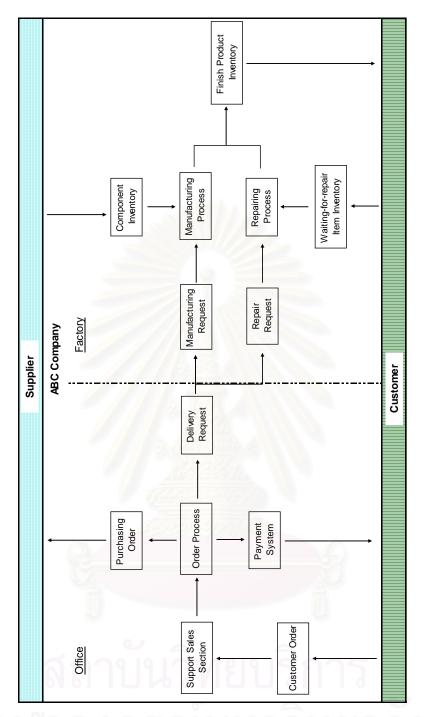


Figure 4.1: Overall Business Process of ABC Company

4.2 Current Order Receiving Process

The current order receiving process involves with 3 departments.

1. Marketing Department: Currently, upon marketing department receives an order from a customer, only 2 categories of inventory are cross-checked manually on paper documents submitted from production department to decide whether the order will be completed, whether the product can be

delivered on time, or whether the required order quantity will be finished. The 2 categories are:

- finished products (in-storage items which are complete and ready to be delivered to customers): includes daily quantity of finished products ready to be delivered. The record is done on paper document without any systematic clarification of how many have been included in that day's order.
- 2) waiting-for-repair items (in-storage items which are queuing to be repaired): includes daily items waiting to be repaired. The quantity is recorded on paper document without information of when the products will be scheduled for repair or when they will be completed.

Then, the order is passed to production department and shop floor in order to prepare the products within the timeline given to customer. In other words, the order is forwarded or pushed to the next step of production to either repair or manufacture the products as soon as possible. In addition, if the quantity in finished products and waiting-for-repair items are less than the order quantity, marketing department must inform general management department the purchase detail as well.

- 2. Production Department: This department submits finished products and waiting-for-repair items inventory data sheets to marketing department everyday. In addition, production department's staffs use their own experiences in determining the possible finished date and quantity to support marketing department in promising product deliverable date and quantity. Also, after receiving repairing detail and manufacturing detail from marketing department, production department schedules both repairing process and manufacturing process to fulfill customer orders within the timeline that marketing department has given to customers.
- General Management Department: Purchasing section receives purchasing detail from marketing department. Then this section orders components and materials from suppliers in order to support production department scheduling in manufacturing process.

To help understanding ABC's current order receiving process, a flow chart of overall flow is illustrated in figure 4.2.

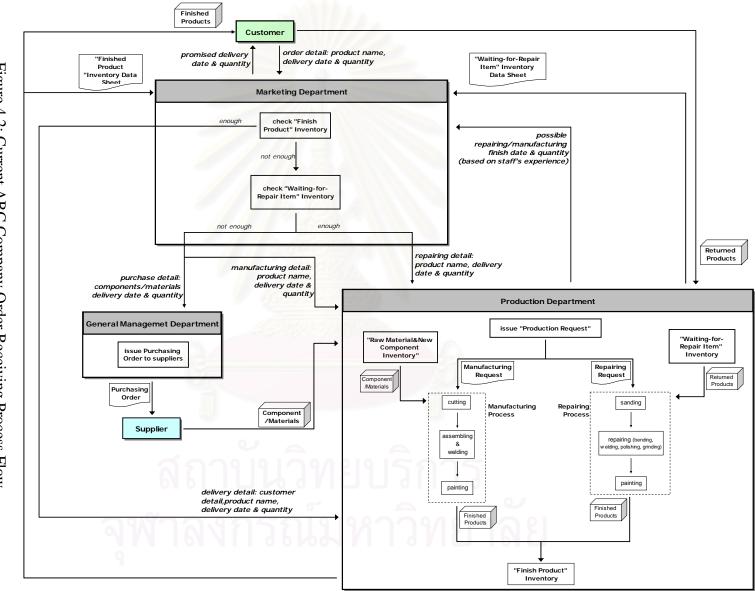
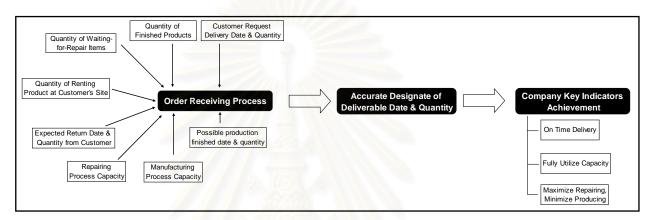
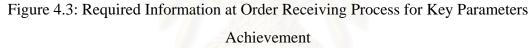


Figure 4.2: Current ABC Company Order Receiving Process Flow

4.3 Problem Analysis of Current Order Receiving Process

To be able to compete in the rental business, ABC aims to achieve 3 main indicators; on time delivery, fully-utilized production capacity (both manufacturing process and repair process), and maximum available product from repairing process. Successful achievement of those indicators requires efficient and adequate information available to be analyzed in order receiving process in order to efficiently respond and fulfill customers demands (see figure 4.3).





Currently marketing department processes order receiving from customers based on 2 data: quantity of finished products and quantity of waiting-for-repair items to identify product delivery date and quantity. In addition, designated supply date and number of products to be delivered are now based on staffs' experiences, which at times can be inaccurate.

Also, the rental period has never been asked from each customer and recorded; thus the expected actual return date or predicted return date is likely impossible. This has actually made ABC Company relying more on manufacturing new products instead of expecting the returned products, which could have been of less costs.

In addition, the capacity of both production process sectors; repairing process and manufacturing process, is now based on production department staffs' experiences, which make the overall process difficult to manage.

In spite of the fact that more necessary data and information should be provided for marketing department to increase the ability in improving order receiving process by accurately promising the delivery date and quantity to customers, ABC has never collected and analyzed them before. Those other necessary data and information include

a) other kinds of inventory; goods still at customer location and estimation of product rental period have never been asked from each customer and recorded; thus maximizing finished products through repair process which costs less is difficult to manage.

b) standard processing time; the actual capacity by determining standard time of both production processes (manufacturing process and repairing process) has not yet been studied.

In conclusion, all the above issues have required that marketing department spends a far amount of time in order receiving process to confirm the availability of product for customers. Moreover, despite the facts that various types of products are being produced and that the processes are becoming more sophisticated as the business grows, there is no information system to provide marketing department with required data, constraints, and alternatives for processing customer orders in order to achieve key performance indicators of the business as already described in Figure 4.3.

The lack of data to be analyzed and the lack of information system to support order receiving process of marketing department has subsequently resulted in an inaccurate designated delivery date and number of available products to be delivered, which eventually leads to lateness in delivery and job cancellation. These problems can be considered as one of the important factors that can significantly threaten company competitiveness and its business opportunity. Figure 4.4 shows product delay delivery quantity and the percentage of product that can be delivered on time from January 2006 – May 2008.

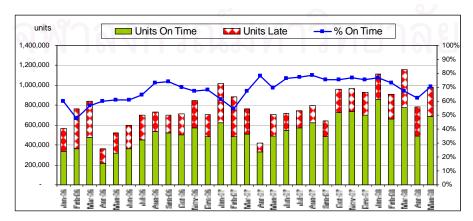


Figure 4.4: Customer Orders Delay Delivery by Month of 2006 – 2008

4.4 Problem Solution

To improve ABC's order receiving process, it is essential to develop an information system, which can support marketing department by providing required data and ensuring that those data, related constraints, and alternatives are integrated and systematically structured to yield more accurate product availability information.

To develop the information system, some required data, which have not yet been developed, have to be firstly studied and recorded. Those data are standard processing time of both production processes (repairing process and manufacturing process). Then, the logical model of the information system such as analysis steps, methodology of production scheduling, or assumptions, are designed. Finally, the newly information system for order receiving process is developed.



สถาบนวทยบรการ จุฬาลงกรณ์มหาวิทยาลัย

CHAPTER V

THE DESIGN AND DEVELOPMENT OF THE INFORMATION SYSTEM DATA

First, this chapter explains the overall development steps of developing the information system. Then this chapter describes more in the design phase and development phase of the data flow and data storage of the information system.

5.1 Overall Development Steps and Methodologies of the Information System for Order Receiving Process

To develop the information system for order receiving process, this thesis divides development steps into 3 phases; design phase, development phase, and evaluation phase as described in figure 5.1.

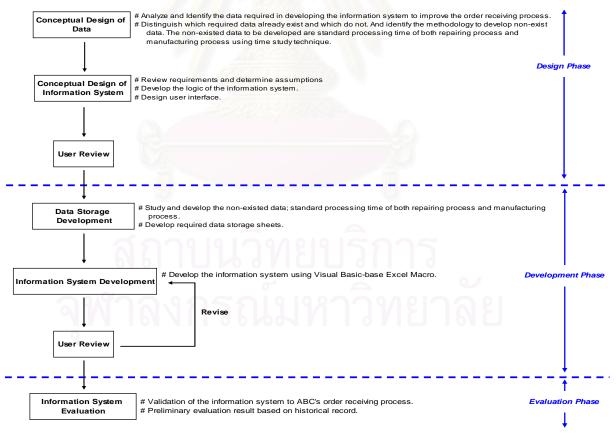


Figure 5.1: The Overall Steps of Information System Development for Order

Receiving Process

Design phase consists of 2 steps as below;

1) Data conceptual design: First, data required to be input into the information system for improving current order receiving process are identified. Then, they are distinguished into 2 categories; existed data and non-existed data. Existed data are the data that can be founded in ABC's records or database whereas non-existed data are the data that ABC has never studied and developed before. Finally, methodology for developing the non-existed data is determined.

In this thesis, the non-existed data which are studied and developed are standard processing time of both production process sectors (repairing process and manufacturing process) using time study technique.

2) Information system conceptual design: This step concerns with developing the information system's logical model which operates the data, requirements, and other inputs under the determined assumptions.

3) User review: The designed data and the designed information system have been proved by ABC before they are developed.

Development Phase

Development phase consists of 3 steps; data storage development, information system development, and user review.

1) Data storage development: The first step is to study and develop the nonexisted data; standard processing time of both process sectors using time study techniques. Then, all data required for the information system are collected in data storage sheet using Microsoft Excel.

2) Information system development: The information system for ABC's order receiving process is running on Visual Basic-based Excel Macro.

3) User review: Again, to confirm that the newly developed information system meets the objectives and that the users can operate, ABC has proved the information system before it is evaluated.

Evaluation Phase

The newly developed information system is evaluated for its validation to ABC's order receiving process by top managements and marketing department based on its purpose and objective of improving this process by providing adequate information to be able to designate more accurate product available-to-promise date to customers. The preliminary evaluation result based on historical data is also described to shows the improving trend of on time delivery.

5.2 The Design of the Information System Data for Order Receiving Process

5.2.1 Calendar: Calendar is the data storage that keeps ABC's working day. It consists of:

1) date in one year (starts from 1st of January to 31st of December)

2) day in each week (starts from Monday to Friday)

3) normal weekly holiday(s)

4) company special holiday(s)

5.2.2 Repairing product list: This data storage keeps the information of all products that are included in the thesis' scope and can be repaired in ABC's repairing process. This thesis covers 49 products of ABC's and all of them are in this list. Repairing product list consists of:

1) product code of all 49 products covered in the thesis

2) product name of 49 products covered in the thesis

5.2.3 Manufacturing product list: This data storage keeps the information of products which are included in the thesis' scope and can be manufactured in ABC's manufacturing process. From 49 products covered in the thesis, 6 of them can be manufactured. However, this thesis studies manufacturing of 1 product only. Similar to repairing product list data storage, manufacturing product list consists of:

1) product code of 6 products which can be manufactured

2) product name of 6 products which can be manufactured

5.2.4 *Inventory*: This data storage is where inventory quantity and booked order quantity of each product are kept. The data are updated and calculated with customer order quantity to determine the product availability channel (through finished product inventory, repairing process, manufacturing process, or outsource). Inventory consists of:

1) product code of all 49 products covered in this thesis

2) product name of all 49 products covered in this thesis

3) quantity of each product in the finished product inventory

4) quantity of each product in the waiting-for-repair items inventory

- 5) quantity of booked order in case of some units are reserved
- 6) last updated date

5.2.5 *Repairing process capacity*: The repairing process is divided into 3 sets of data storage according to repairing process's 3 sub-processes; sanding sub-process data storage, repairing sub-process data storage, and painting sub-process data storage. However, each data storage consists of the same information which are:

- 1) product code of all 49 products covered in this thesis
- 2) product name of all 49 products covered in this thesis
- 3) group code (S for sanding sub-process, R for repairing sub-process, and P for painting sub-process)
- 4) a number of manpower available and a number of manpower used per 1 team
- 5) weighted average standard time

5.2.6 Manufacturing process capacity: The manufacturing process capacity is divided into 3 sets of data storage according to manufacturing process's 3 sub-processes; cutting sub-process data storage, assembly & welding sub-process data storage, and painting sub-process data storage. Since the painting sub-process is cross utilization of both repairing process and manufacturing process, the painting sub-process data storage is the same as in repairing process capacity. The data that are kept in the manufacturing process capacity are:

- 1) product code of all 49 products covered in this thesis
- 2) product name of all 49 products covered in this thesis
- 3) standard time of 1 product studied in this thesis
- 4) a number of manpower available and a number of manpower used per 1 team of 1 product studied in this thesis
- machines' name a number of machine available and a number of machine used of 1 product studied in this thesis

5.2.7 *Customer order*: This data storage keeps information about customer order which is the input for processing the order with the information system and also keeps the information about product availability which is the output from the information system. Therefore, the customer order consists of:

Customer order information;

1) order number

2) order date

3) customer detail; name, contact person, contact number, e-mail

4) delivery request date

5) order product code

6) order product name

7) order quantity

8) expected return date

Product availability information;

9) repairing finished date

10) manufacturing finished date

11) estimate delivery date (the latest date of either repairing finished date or manufacturing finished date)

12) delivery quantity through finished product inventory

13) delivery quantity through repairing process

14) delivery quantity through manufacturing process

15) delivery quantity through outsource

5.2.8 *Repairing plan*: This data storage provides the information about the detail of product, quantity, and order number that is in the sub-process of sanding and repairing in each working hour. Therefore, the repairing plan consists of:

1) sanding sub-processes and repairing sub-process

- 2) date in one year (starts from 1st of January to 31st of December)
- 3) each working hour

5.2.9 *Repairing schedule*: This data storage is where information about work load in the sub-process of sanding and repairing is provided. The repairing schedule consist of

1) sanding sub-processes and repairing sub-process

- 2) date in one year (starts from 1st of January to 31st of December)
- 3) each working hour

5.2.10 Manufacturing plan: This data storage provides the information about the detail of product, quantity, and order number that is in the sub-process of cutting and assembly & welding in each working hour. Therefore, the manufacturing plan consists of:

1) cutting sub-processes and assembly and welding sub-process

2) date in one year (starts from 1st of January to 31st of December)

3) each working hour

5.2.11 Manufacturing schedule: This data storage is where information about work load in the sub-process of cutting and assembly and welding is provided. The manufacturing schedule consist of

1) cutting sub-processes and assembly and welding sub-process

2) date in one year (starts from 1st of January to 31st of December)

3) each working hour

5.2.12 Painting sub-process plan: Since the painting sub-process is cross utilization of both repairing process and manufacturing process, the painting sub-process plan data storage individually provides the information about the detail of product, quantity, and order number that is being painted in each working hour. Similar to the previously two data storages, this data storage consists of:

1) date in one year (starts from 1st of January to 31st of December)

2) each working hour

5.2.13 Painting sub-process schedule: This data storage is where information about work load of painting sub-process is provided. The painting sub-process schedule consist of

1) date in one year (starts from 1st of January to 31st of December)

2) each working hour

In order to clearly identify who is responsible for developing each required data and at which level related department can access the data, table 5.1 shows source and authorization of data required in the information system.

Required Data for	Source of Data			Data Autl	Data Authorization	
the Information System	Development Method	De velopment Responsibility	Top Management	Marketing Department	Production Department	General Management
Calendar	Input working days and holidays	General Management Department	\bigcirc	\bigcirc	\bigcirc	\bigcirc
Repairing Product List	Repairing Product List Input product name and code that can be repaired	Production Department	0	\bigcirc	\bigcirc	\bigcirc
Manufacturing Product List	Input product name and code that can be namufactured	Production Department	0	\bigcirc	\bigcirc	\bigcirc
Inventory	Input quantity of each inventory	Production Department	0	0	\bigcirc	\bigcirc
Repairing Process Capacity	Develop manpower and standard time of repairing process using time study technique	Production Department	0	0	\bigcirc	\bigcirc
Manufacturing Process Capacity	Develop manpower and standard time of manufacturing process using time study technique	Production Department	0	0	\bigcirc	\bigcirc
Customer Order	Input customer order detail	Marketing Department	0	0	\bigcirc	\bigcirc
Production Plan	Result from the information system	tem.	0	0	\bigcirc	\bigcirc
Production Schedule			0	\bigcirc	\bigcirc	\bigcirc
Remark: Authorization]	Remark: Authorization Level 🔘 ;Can access & input/revise the data	Can access but can not input/revise the data	not input/revise the		not neither input/rev	X ;Can not neither input/revise nor access data

Table 5.1: Required Data Development Responsibility and Authorization

5.3 The Development of the Information System Data for Order Receiving Process

From the designing of data flow and data storage of the information system, now this section explains their developments.

5.3.1 Calendar: Calendar shows all working days in one year round. User must input the first date, the company weekly holiday, and the company special holidays as depicted in figure 5.2.

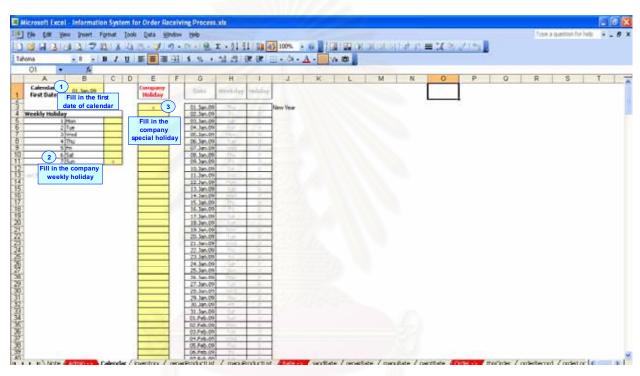


Figure 5.2: Calendar Data Storage

5.3.2 *Repairing Product List:* User must input each product's code and name that can be repaired. This thesis covers 49 products and all of them are in the repairing product list.

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A	B	C	D	E	F	6	H	1	3	K	1	M
Product Code 1	Product 2	Product Code										
114-0102 Fill in	Jack Base 68-40 Fill in											
114-0103 product code	Jack Base 68-60 product name					_						
114-0202 [product code	U-Head Jack 8U-40	1114-0338										
114-0203	U-Head Jack BU-60											
112-0401	Waiking Panel HS-418											
213-2304	Walking Panel HS-518											
213-2315	Steel Planky LPO-40 (210x4000)											
112-0501	Steel Stars SSE-17											
112-0106	Vertical Frame TFT-1205											
112-0103	Vertical Frame TFT-1215											
112-0102	Vertical Frame TFT-1217					_						
213-0106	Vertical Frame TFT-1217 Gal.											
112-0301	Horizontal Frame VFT-1218											
112-2202	Square Pipe 50+50x1500											
5 112-2205	Square Pipe 50:50:3000											
112-2211	Square Pipe 50:50:6000											
112-2507	Square Pipe 50x100x4000									-		
112-2511	Square Pipe 50x100x6000									-		
112-2303	Square Pipe 75 x 75 x 2000											
112-2305	Square Pipe 75 x 75 x 3000											
2 112-2401	Square Pipe 100 x 100 x 1000											
3 112-2403	Square Pipe 100 x 100 x 2000	112-2403										
112-2404	Square Pipe 100 + 100 + 2500	1112-2404										
112-2405	Square Pipe 100 x 100 x 3000	2112-2425										
112-2407	Square Pipe 100 x 100 x 4000											
112-2408	Square Pipe 100 x 100 x 4500											
112-2409	Square Pipe 100 x 100 x 5000											
9 112-2411	Square Pipe 100 x 100 x 6000											
0 112-2101	Found Pipe 48.6x1000							-				
1 114-1302	Round Pipe 48.6x1500 Gal.							-				
2 112-2104	Round Pipe 48.6x2000										-	1
114-1904	Rond Pre 40.6x2111 Gal				S 200 100	Extension of the			A	A COLOR	Industriel	

Figure 5.3: Repairing Product List Data Storage

5.3.3 Manufacturing Product List: Like repairing product list, user must input each product' code and name that can be manufactured. From total of 49 products covered in the thesis, 6 of them can be manufactured. However, the thesis studies only manufacturing of walking panel HS418.

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•0102 Vertcal Frame TF1-1217 0110 •0103 Vertcal Frame TF1-1215 010 •0001 Stare SSF-12 000 •0001 Walking Panel (H5-418) 000 •0013 Image: Transme TF1-1218 000 •0014 Fill in product code Fill in product name	N	M	-L-		K	· J.	1		-	0	F	E		D						and the second se
-0003 Vertical Frame FF1-1215 Con -0006 Vertical Frame FF1-1205 Con -0501 Steel Stars 55E-17 Con -0001 Horizontal Frame FF1-1218 Con -0003 1 Waking Funel H5-418 Con Fill in product code Fill in product name Fill in product name															Under	Friduct		Product		Product Code
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Figure 5.4: Manufacturing Product List Data Storage

5.3.4 Inventory: This storage sheet collects codes and names of all 49 products covered in the thesis. Each product inventory status and each product book order quantity are updated by users. The method for updating is described in the next chapter (section 6.2, chapter 6).

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	Item	Product Code	Product	2	Inventory 03	Inventory 08	Booked Order	Last Spdate	Update						
2	11	1 Fill in	Jack Base 85-40 pro	Fill in duct name	Update	Update	Update	D TLAN	Reset						
4		roduct cod	U-Head Jack BU-40 U-Head Jack BU-60		quantity of	quantity of waiting-	quantity of	0 Stitled m	ciro						
6 7 8	6.2	12-0401 13-2304 13-2315	Walking Panel HS-418 Walking Panel HS-518 Steel Planky UPO-40 (210x	40001	finished product inventory.	for-repair items inventory.	booked order.	o an tare in O (Rithmadd)			1				
9		12-0501	Steel Stars SSE-17	1000)	1,034	30	-	3 310-03							
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ij	17.1	12-2507	Square Pipe S0x100x4000		436	256		a anna an							
9.		12-2511	Square Pipe 50x100x6000		190	4,363	1								
0		12-2303	Square Pipe 75 x 75 x 200		225	163									
1		12-2305	Square Pipe 75 x 75 x 300		621	406		22.0mm.00							
2		12-2401	Square Pipe 100 x 100 x 1		630	4,706	1								
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4		12-2404	Square Pipe 100 x 100 x 2		373	416		Contraction of the							
5		12-2405	Square Pipe 100 x 100 x 3		0	196		77 Jan 191							
		12-2407	Square Pipe 100 x 100 x 4		285	522		JALANA D			-			-	
1		12-2408	Square Pipe 100 x 100 x 4		46	21				-	-	-			
0		12-2409	Square Pipe 100 × 100 × 5		473	274		0 30 Mpr 300			-				
9		12-2411	Square Pipe 100 x 100 x 6	000	168	3,628		0 011 m 780			_				
0		12-2101	Round Pipe 48.6x1000 Round Pipe 48.6x1500 Gal		1,570	6,159		0 =111= 00							

Figure 5.5: Inventory Data Storage

5.3.5 Repairing Process Capacity: Since repairing process capacity is one of the data that ABC have never studied, therefore, the standard time of repairing process is determined using time study technique. From 49 products covered in this thesis, they are divided into 2 main product groups; scaffolding and metal form.

1) Scaffolding Group: Repairing scaffoldings consists of 2 sub-processes; repairing sub-process (polishing, bending, welding, and grinding) and painting sub-process. Some products have these 2 sub-processes separated but some have not.

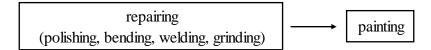


Figure 5.6: Repairing Process Flow of Scaffolding Group

1.1.) Repairing Sub-Process: In this sub-process, scaffoldings are divided into 3 sub-groups (see table 5.2) according to the difference in repairing work elements. In addition, according to ABC's standard, all products except round pipe are divided into 3 levels of difficulty; low difficulty, medium difficulty, and high difficulty depend on the customer return condition. For round pipe, there are only 2 difficulty levels; low difficulty and medium difficulty since the product characteristic and its function is the least severe comparing to others. Overall steps in determining repairing sub-process standard time of scaffolding group are described in figure 5.8.

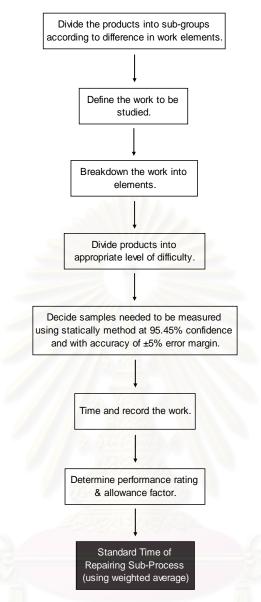


Figure 5.7: Overall Steps in Determining Repairing Sub-Process Standard Time of

Scaffolding Group

Each sub-group product and its repairing sub-

process work element is described in table 5.2.

	Scaffold	ing Group: Rep	airing Sub-Process Work Element and Manpower		
Sub-Group	Product Name	Product Code	Work Element of 1 Working Team	Manpower Used (Head/Working Team)	Manpower Available (Total Head)
	Jack Base BB-40	114-0102	1. Put the product on the working station.		
	Jack Base BB-60	114-0103	 Confirming the screw. Straighten the product by bending. Palishing the grad advanced advanced by the screw of a scr		
R1	U-Head Jack BU-40	114-0202	 Polishing the rust and other residue left on the surface. Repair welding. Edge painting. 	3	9
	U-Head Jack BU-60	114-0203	7. Packing.		
	Walking Panel HS-418	112-0401	1. Put the product on the working table.		
	Walking Panel HS-518	213-2304	2. Confirming the dimension by comparing with		
	Steel Planky LPO-40 (210x4000)	213-2315	standard dimension steel bar. 3. Straighten the product by bending.		
	Steel Stairs SSE-17	112-0501	4. Polishing the rust and other residue left on the surface.		
R2	Vertical Frame TFT-1205	112-0106	 Turnover and repeat element 3 and 4. Repair welding. 	2	26
	Vertical Frame TFT-1215	112-0103	7. Grinding.		
	Vertical Frame TFT-1217	112-0102	8. Taking the product down from the working table and		
	Vertical Frame TFT-1217 Gal.	213-0106	put it into the array. 9. For galvanized steel, apply anti-rust paint.		
	Horizontal Frame YFT-1218	112-0301	10. Packing		
	Square Pipe 50x50x1500	112-2202	1. Putting the product on the working platform.		
	Square Pipe 50x50x3000	112-2205	2. Straighten the product by bending.		
	Square Pipe 50x50x6000	112-2211	 Polishing the rust and other residue left on the surface. Repair welding. 		
	Square Pipe 50x100x4000	112-2507	5. Pipe modification (if necessary)		
	Square Pipe 50x100x6000	112-2511	6. Painting (for square pipe only).		
	Square Pipe 75 x 75 x 2000	112-2303	7. Packing.		
	Square Pipe 75 x 75 x 3000	112-2305	- States		
	Square Pipe 100 x 100 x 1000	112-2401			
	Square Pipe 100 x 100 x 2000	112-2403	24		
	Square Pipe 100 x 100 x 2500	112-2404			
	Square Pipe 100 x 100 x 3000	112-2405			
R3	Square Pipe 100 x 100 x 4000	112-2407		3	16
K3	Square Pipe 100 x 100 x 4500	112-2408		5	10
	Square Pipe 100 x 100 x 5000	112-2409	10005005		
	Square Pipe 100 x 100 x 6000	112-2411	רו וז רו ואוע		
	Round Pipe 48.6x1000	112-2101			
	Round Pipe 48.6x1500 Gal.	114-1302			
	Round Pipe 48.6x2000	112-2104	เมหาวทยาล	¥ I	
	Round Pipe 48.6x2000 Gal.	114-1304			
	Round Pipe 48.6x3000	112-2106			
	Round Pipe 48.6x4000	112-2108			
	Round Pipe 48.6x4500	112-2109			
	Round Pipe 48.6x5000	112-2110			
	Round Pipe 48.6x6000	112-2112			

 Table 5.2: Repairing Sub-Process Work Elements and Manpower of Each Sub-Group

 of Scaffoldings

1.2) Painting Sub-Process: In this sub-process, work elements of each product are the same. Overall steps in determining painting sub-process standard time of scaffolding group are described in figure 5.8. Products needed to go through this sub-process and the work elements are described in table 5.3.

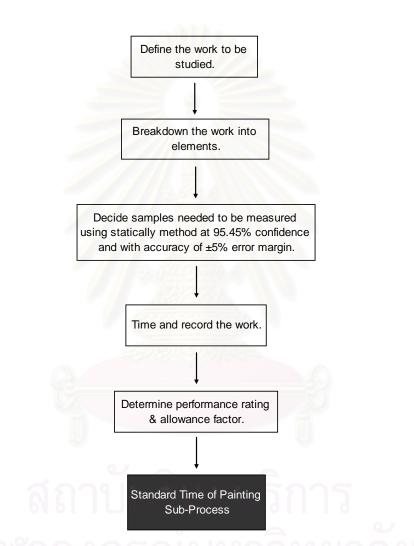


Figure 5.8: Overall Steps in Determining Painting Sub-Process Standard Time of Scaffolding Group

	Scal	folding Group: I	Painting Sub-Process Work Element and Manpower		
Group	Product Name	Product Code	Work Element per 1 Working Team	Manpower Used (Head/Working Team)	Manpower Available (Total Head)
	Walking Panel HS-418	112-0401	1. Put the product on painting bath.		
	Steel Stairs SSE-17	112-0501	2. Pour down the paint.		
	Vertical Frame TFT-1205	112-0106	 Taking the product down from the bath. Packing 		
	Vertical Frame TFT-1215	112-0103	U U		
	Vertical Frame TFT-1217	112-0102	2.2.1		
	Horizontal Frame YFT-1218	112-0301			
P1	Round Pipe 48.6x1000	112-2101		3	9
	Round Pipe 48.6x2000	112-2104			
	Round Pipe 48.6x3000	112-2106			
	Round Pipe 48.6x4000	112-2108			
	Round Pipe 48.6x4500	112-2109			
	Round Pipe 48.6x5000	112-2110			
	Round Pipe 48.6x6000	112-2112			

Table 5.3: Painting Sub-Process Work Elements and Manpower of Scaffoldings

Finally, each scaffolding' sub-group standard time of repairing process is illustrated in figure 5.9 – figure 5.12.

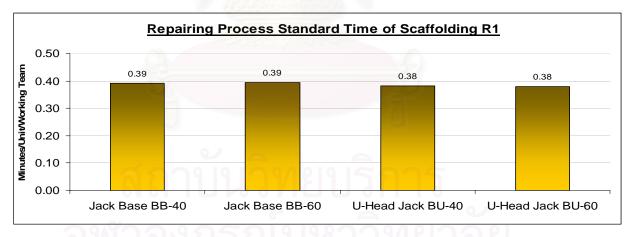


Figure 5.9: Repairing Process Standard Time of Scaffolding R1

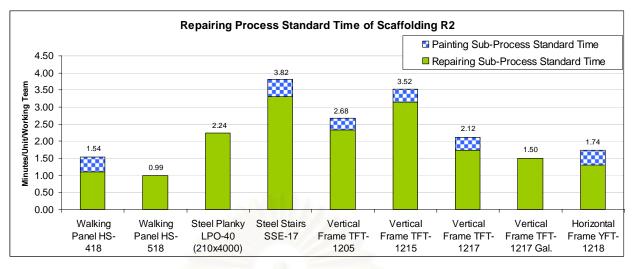


Figure 5.10: Repairing Process Standard Time of Scaffolding R2

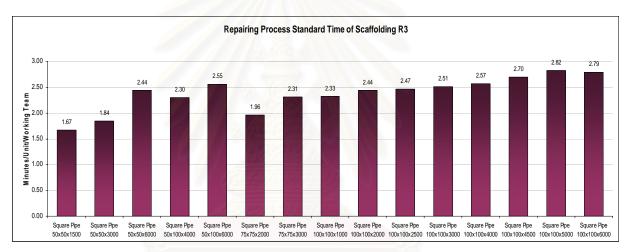


Figure 5.11: Repairing Process Standard Time of Scaffolding R3

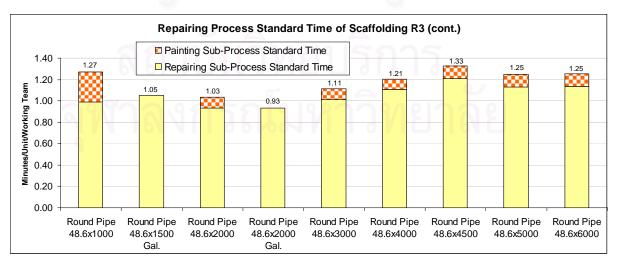


Figure 5.12: Repairing Process Standard Time of Scaffolding R3 (cont.)

2) Metal Form Group: Repairing metal forms consists of 2 sub-processes (see figure 5.13); sanding sub-process and repairing sub-process (polishing, bending, welding, and grinding). Also, similar with scaffoldings, 3 levels of difficulty are divided. Overall steps in determining repairing process standard time of metal form group are described in figure 5.14.

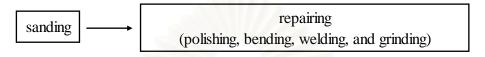


Figure 5.13: Repairing Process Flow of Metal Form Group

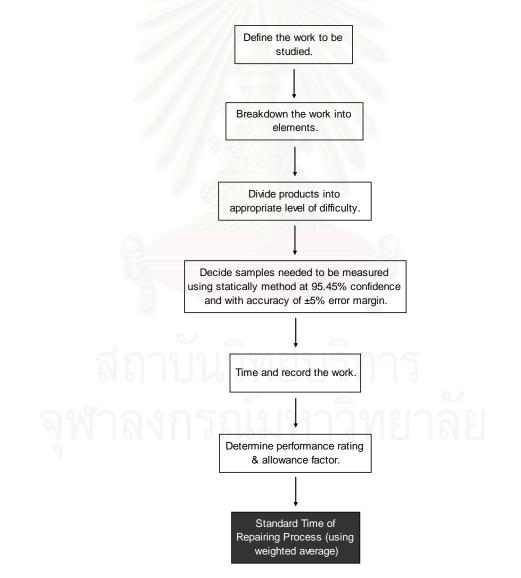


Figure 5.14: Overall Steps in Determining Repairing Process Standard Time of Metal Form Group

Work elements and manpower of each sub-process of metal form repairing process are described in table 5.4 and table 5.5. Repairing process standard time of metal form is illustrated in figure 5.15.

Table 5.4: Sanding Sub-Process Work Elements and Manpower of Metal Forms

		Metal Fo	rm Group: Sanding Sub-Process Work Elen	nent	
Group	Product Name	Product Code	Work Element	Manpower Used (Head/Team)	Manpower Available (Total Head)
	Metal Form 200x1200	114-5304	1. Put the product on sanding machine		
	Metal Form 300x1200	114-5504	conveyer.		
	Metal Form 400x1200	114-5704	2. Product automatically goes through		
	Metal Form 500x1200	114-5904	sanding sub-process.		
	Metal Form 600x1200	114-6104	3. Taking the product down from sanding		
S 1	Metal Form 800x1200	114-6204	machine conveyer.	3	3
51	Metal Form 200x1500	114-5305		5	5
	Metal Form 400x1500	114-5705			
	Metal Form 450x1500	114-5805	13 4CB 6		
	Metal Form 500x1500	114-5905			
	Metal Form 600x1500	114-6105	a Ton A		
	Metal Form 800x1500	114-6205			

	Table 5.5: Repairing	Sub-Process	Work Elements and	Manpower of Metal Forms
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Sub-Group		Product Code	Repairing Sub-Process Work Element and Work Element	Manpower Used (Head/Team)	Manpower Available (Total Head)
	Metal Form 200x1200	114-5304	1. Put the product on the working table.		
	Metal Form 300x1200	114-5504	2. Polishing the rust and other residue left on		
	Metal Form 400x1200	114-5704	the surface.		
	Metal Form 500x1200	114-5904	3. Straighten the product by bending.		
	Metal Form 600x1200	114-6104	4. Taking the product down from the		
R4	Metal Form 800x1200	114-6204	working table and put it into the array.	2	28
N4	Metal Form 200x1500	114-5305	5. Grinding all 4 sides.	2	20
	Metal Form 400x1500	114-5705	6. Paint marking all 4 sides.		
	Metal Form 450x1500	114-5805	7. Packing		
	Metal Form 500x1500	114-5905		0.1	
	Metal Form 600x1500	114-6105			
4	Metal Form 800x1500	114-6205	219192779161	าลย	

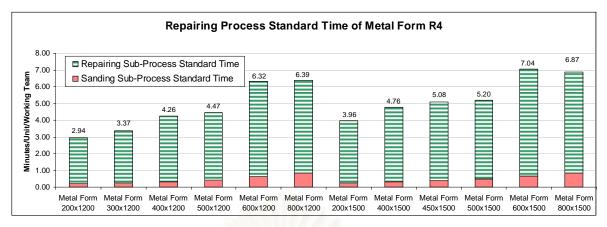


Figure 5.15: Repairing Process Standard Time of Metal Form Product

Finally, the data storages of every sub-processes of repairing process; sanding sub-process, repairing sub-process, and painting sub-process, are developed as in figure 5.16, figure 5.17 and figure 5.18. For any product which is not in any sub-process, the standard time shall be recorded as zero.

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Product Name	Product Lode	Code	FOCAL PREAD	Head/ Teams	weighted Average		anding (min/	pc)		
Square Pipe 50x100x6000	112-2511	- 34	3	3	6.00	1000				
Square Pipe 75 x 75 x 2000	112-2303	51	-	-						
square Pipe 75 x 75 x 2000	112-23/5	SI	Fill in	Fill in	Fill in			and the second sec		
guare Pipe 100 x 100 x 1000	112-2400	\$1	number of	number of	standard time			-		
guare Pipe 100 x 100 x 2000	112-2403	71	workers	workers per	from time					
guare Pipe 100 x 100 x 2500	112-2404	- 11			study result.					
guare Pipe 100 × 100 × 3000	112-24(6	31	available.	1 team.	study result.					
guare Pipe 100 x 100 x 4000	112-2407	11						1		
guare Pipe 100 x 100 x 4500	112-2408	34	-	-	3.00					
guare Pipe 100 x 100 x 8000	112-2409	31		3	9.00			A CONTRACTOR OF		
guare Pipe 100 x 100 x 6000 Round Pipe 49.6x1000	112-2411 112-2101	52	3		0.00					
Round Pipe 48.6x1500 Gal	114-1302	58			6.00					
Round Pipe 48.6/2000	112-2104	36	3		0.00			and the second se		
Round Pipe 45.6x2000 Gal	114-1204	51			0.00					
Round Pipe #8.6x3000	112-2106	31	0.73		6.00	1				
Round Pipe 18.5x1000	112 2108	51			8,00					
Round Pipe 48.6x4500	112-2109	51	1	1	0.00					
Round Pipe 48.6x5000	112-2110	51		0.010	0.00					
Round Pipe 48.6x6000	112-2112	51	3	1.4	6.00					
Hetal Form 200x1200	114-5304	11	1	3	0.75	0.27	0.23	0.17		
Metai Form 300+1200	114-5504	- 91		10 131	8,25	0.27	0.25	0.22		
Metal Form 400:1200	114-5794	- 51	3	3	0.31	0.33	0.29	0.27		
Hetal Form \$200x3200	114-5904	31	3	3	0.43	0.52	0.37	0.30		
Hetal Form 600x1200	114-6104	- 58	3	3	0.64	0.70	0.63	0.58		
Pletal Pore 800x1200	114-6204	31	3	3	9,56	0.92	0.87	9.73		
Hetal Form 200+1500	114-5305	51	1	3	0.24	0.27	0.20	0.17		
Hetal Form 400x3500	114-5705	58	3	3	0.33	0.36	0.32	0.28		
Netal Form 450x1500	314-5805	St	3	3	0.39	0.42	0.38	0.32		
Hetal Form \$00x3500	114-5905	31	3	3	0.48	0.55	0.47	0.43		
Hetal Form 500x1500	114-6105	58	1	1	0.68	0.75	0.68	0.63		
Metal Form 800x1500	114-6205	51	1.9		0.56	0.92	0.90	0.77		

Figure 5.16: Sanding Sub-Process Standard Time and Manpower Data Storage

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Steel Stars 330-17	112-0301	82	25		3.30	0.00	-					+
Vertoal Frame TFT-1205	112-0106	82			2.33	0.00						+
Verbox Priete (PT-1215	112-0103	82	2		3.34	8.00	-					-
Vertical Frame TFT-1217	112-0102	82	2		1.74	0.00	_					+
Vertical Prane TPT-1217 Gal.	213-0106	82		7	1.50	0.00	-					
Horidontal Frana 197-1218	112-0301	82	26		1.90	0.00	-					+
South's Pole 50x50x1500	112-2202	82	1		0.95	0.75						+
	112-2205	8.8	- 18			0.78	-					+
Square Page 50x50x3000 Square Page 50x50x6000	112-2211	83	36		3.37	0.75	-					+
	212-2507	83	2			0.73	-					+
Square Pipe 30x100x4000 Square Pipe 50x100x6000	112-2511	RJ	3		1,94	0.75	-			-		+
Square Pipe 75 x 75 x 2000	112-2303	10	16	4	12	0.75	-					+
Source Pipe 75 x 75 x 3000	112-2305	83	26		1.56	0.75						+
Square Ppe 100 x 100 x 1000	112-0401	83	28		1.41	0.02	-					+
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Square Pipe 100 x 100 x 2500	112-2404	R3	18		1.16	0.91	-					+
Square Poe 300 x 300 x 300 -	112 2105	83	15		1.52	0.71	-					+
Square Poe 100 x 200 x 4000	112-2407	R3	2		1.66	0.91	- 10					+
Source Poet 200 x 200 x 4500	112-2408	83	1	1	1.79	9.91	-					+
Square Poe 100 x 100 x 5000	112-2409	83	18		1.91	0.91			1			+
Square Poe 100 x 100 x 6000	112-2411	83	14	1	1.71	0.91	-					÷
Round Pipe 48.6x1000	112-2101	83	14		0.47	0.57	-					1
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Figure 5.17: Repairing Sub-Process Standard Time and Manpower Data Storage

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Square Pipe 75 x 75 x 2000	112-2300	P1		1		0.29				
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quere Pipe 100 x 100 x 6000	112-2411	F1		3		0.20				
Round Pipe 48.6-1000	112-2101	P2		9		0.20				

Figure 5.18: Painting Sub-Process Standard Time and Manpower Data Storage

5.3.6 Manufacturing Process Capacity: Manufacturing process capacity is another data that ABC has never studied, therefore, the standard time of manufacturing process is determined using time study technique. From the total of 6 products that can be manufactured, only 1 product is studied; walking panel HS418. Manufacturing process consists of 3 sub-processes as figure 5.19.

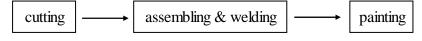


Figure 5.19: Manufacturing Process Flow

Painting sub-process is common with repairing process. Therefore, step in determining its standard time and its result is the same with repairing process's and is not described in this section again.

Steps in determining manufacturing process's cutting, assembly and welding sub-process standard time is explained in figure 5.20. Then cutting sub-process's and assembly and welding sub-process's work elements and manpower are described in table 5.5 and table 5.6 respectively. And finally, manufacturing process standard time of each product is illustrated in figure 5.21.

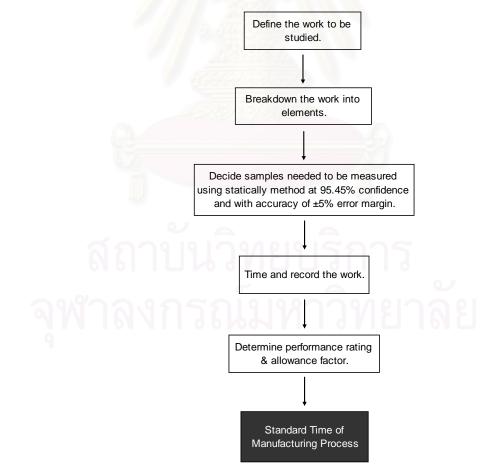


Figure 5.20: Overall Steps in Determining Cutting, Assembling and Welding Sub-Process Standard Time

	Manufact	turing Process; Cutting Sub-Process Work E	lements	
Product Name	Product Code	Work Element	Machine Used	Machine Avaiable
Walking Panel HS-418	112-0401	C1. Cut square pipe no.1.C2. Fiber cut square pipe no.2.C3. Bend square pipe no.1.C4. Fiber cut round pipe.	E F C F	C = 2 machines E = 1 machine F = 1 machine

Table 5.5: Cutting Sub-Process Work Elements and Machine

Table 5.6: Assembly and Welding Sub-Process Work Elements and Machine

Ν	Ianufacturing H	Process; Assembly&Welding Sub-Process V	Vork Elements	
Product Name	Product Code	Work Element	Manpower Used (Head/Team)	Manpower Available (Total Head)
Walking Panel HS-418	112-0401	A&W1. Weld hook. A&W2. Assy panel. A&W3. Weld panel. A&W4. Weld Zn plate.	5	10

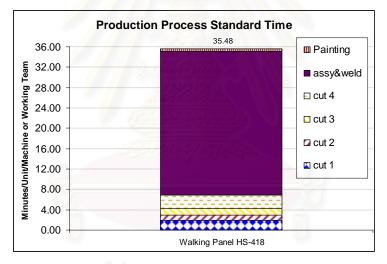


Figure 5.21: Manufacturing Process Standard Time

Similar to repairing process capacity data storage, the standard time of products which are not in manufacturing process's scope shall be recorded as zero. The cutting sub-process's and assembly and welding sub-process's standard time, manpower detail, and machine detail are in the data storage as depicted in figure 5.22 (painting sub-process is common with repairing process as in figure 5.18).

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Square Pipe 50:50		0.00	0.00								1000				1	10000	1					
Square Pipe 50/50		0.00	0.00						-		10000	10.000					1					
Square Pipe S0x100		0.00	0.00	100						10000							1					
Square Pipe 50x100		0.00	0.00						1 mil						- And		1		and the second			-
Square Pipe 75 x 75		0.00	0.00	1000					1		1					1000	1			and the second		-
Square Pipe 75 x 75		0.00	0.00	1.00					1	-	1000					1000	1			A Laboration		-
Square Pipe 100 x 10		9.00	0.00	1.00							-				-	1000	1	and state and				-
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Square Pipe 100 x 10		9.00	0.00	1	-		-			-						1	1				-	
Square Pipe 100 x 10		0.00	0.00	100							1						1					-
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		n m																				

Figure 5.22: Cutting Sub-Process and Assembly and Welding Sub-Process Standard Time and Manpower/Machine Data Storage

5.3.7 Customer Order: As mentioned in the previous section that customer order consists of 2 main data sections; customer order information and product availability information. Customer order information is where user must input the information whereas product availability information is the result provided by the logic of the information system. To input customer order, the steps are described in the next chapter (section 6.2, chapter 6).

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A	Section 1: Customer Order Inform	nation		d .		Sect	ion 2: Prod	uct Avaibil	ity Inform	ation		
1 Order Number	Fill in order date and order			hew	Order	Edit Order						
Internal Reference	number Staff			0.4	ulate	Complete	1					
Customer	Tel			r 010e	1779AU ()	Order						
2 Contact	Fill in customer detail			E e								
Notes	Email				lear.	Retrieve	1					
3		Result fr	om the IS model;the	char	Contractor 1	Order						
Peared residence	III in request delivery date Est Delivery		e from each product ablity information	Lieu	Factory	Run Test			E-M	mated Deli		
Item Product Code	ill in expected return date	Qty	Note	Ready.	Recar	Return*	Tanw.	Beatr	Fatur	Return*	Tarre	Gend
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5	Fill in ordered product detail				process	or outsource		manı	ufacturing	process o	r outsour	ce
	Fill in ordered product detail					г						
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				h								

Figure 5.23: Customer Order Data Storage

5.3.8 *Repairing Plan:* The information in repairing plan data storage is the result from the information system's logic. It provides the user with the sanding sub-process and repairing sub-process schedule detail by hour.

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Figure 5.24: Repairing Plan (Sanding Sub-Process and Repairing Sub-Process) Data

5.3.9 *Repair Schedule:* The information in repair schedule is % work load resulting from the information system's logic. It provides the user with % work load of sanding sub-process (S1) and repairing sub-process (R1-R4) by hour.

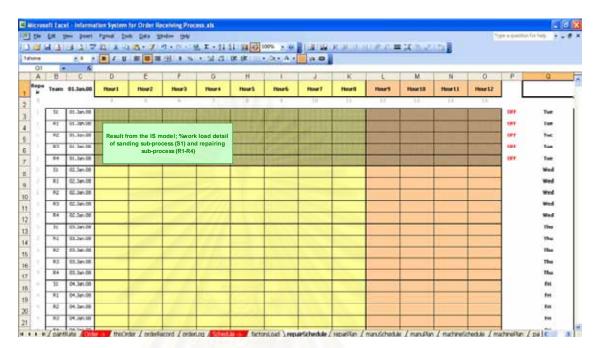


Figure 5.25: Repairing Schedule (Sanding Sub-Process and Repairing Sub-Process) Data Storage

5.3.10 Manufacturing Plan: Similar to repair plan, the information in manufacturing plan data storage is also the result from the information system's logic. It provides the user with the cutting sub-process and assembly and welding sub-process schedule detail by hour.

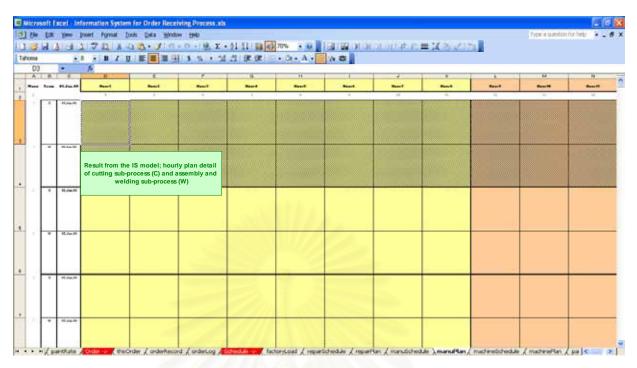


Figure 5.26: Manufacturing Plan (Cutting Sub-Process and Assembly and Welding Sub-Process) Data Storage

5.3.11 Manufacturing Schedule: Similar to repair schedule, the information in manufacturing schedule is % work load resulting from the information system's logic. It provides the user with % work load of cutting sub-process (C) and assembly and welding sub-process (W) by hour.

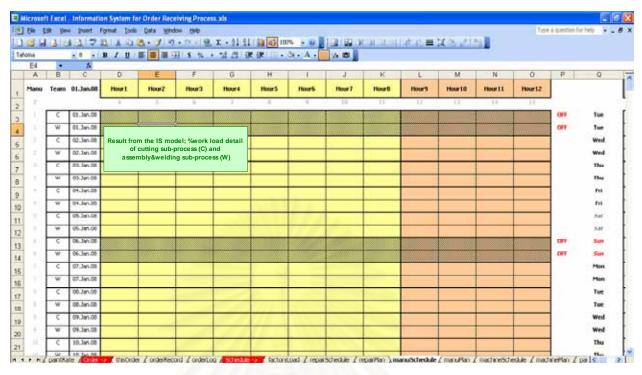


Figure 5.27: Manufacturing Schedule (Cutting Sub-Process and Assembly and Welding Sub-Process) Data Storage

5.3.12 Painting Sub-Process Plan: Since painting sub-process is cross utilization of repairing process and manufacturing process, therefore, its data storage is individually depicted. Like repairing plan and manufacturing plan, the information in painting plan data storage is also the result from the information system's logic. It provides the user with the painting sub-process schedule detail by hour.

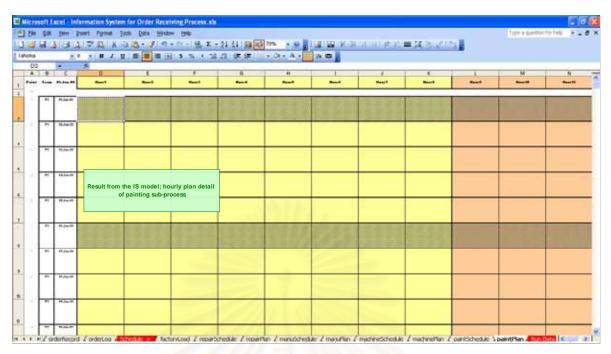


Figure 5.28: Painting Sub-Process Plan Data Storage

5.3.13 Painting Sub-Process Schedule: Similar to repair schedule and manufacturing schedule, the information in painting sub-process schedule is % work load by hour resulting from the information system's logic.

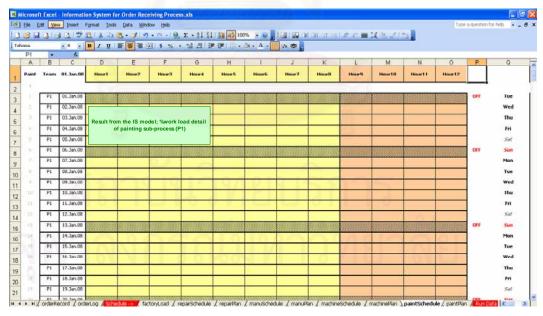


Figure 5.29: Painting Sub-Process Schedule Data Storage

After all data are designed and developed, next chapter explains the design phase and the development phase of the information system for ABC's order receiving process.

CHAPTER VI

THE DESIGN, DEVELOPMENT, AND EVALUATION OF THE INFORMATION SYSTEM

This chapter starts with the design of the logical model of the information system. Then, the development of the information system is explained. Finally, this chapter describes the information system evaluation results.

6.1 The Design of the Information System for ABC's Order Receiving Process

After all required data are designed and developed, they are brought into the newly developed information system. First, this section shows the logical model and the assumptions of overall information system. Then, the logical model and the assumptions of repairing process, manufacturing process, and painting sub-process are separately described.

6.1.1 Overall Information System Logical Model and Assumptions

The logical model of the information system is in figure 6.1. The logical model of

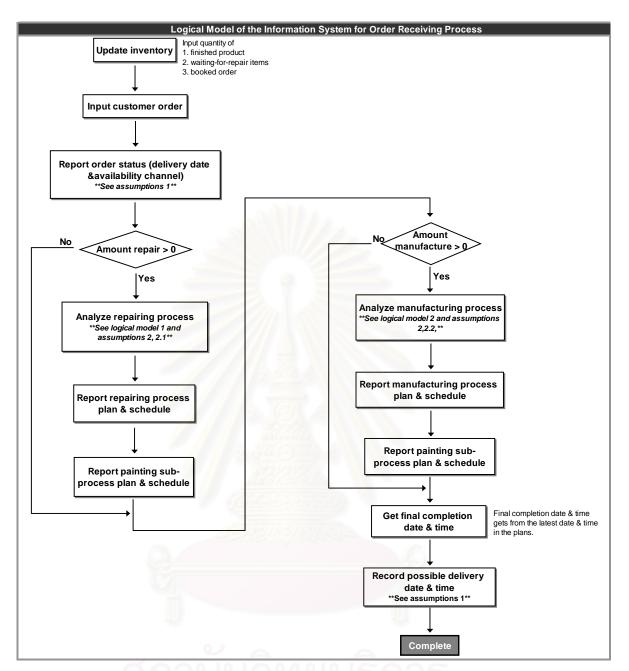


Figure 6.1: The Overall Logical Model of the Information System for Order

Receiving Process

Assumptio	n1: Report Order Status & Estimated	d Deli	ivery Date & Quantity
1. Report o	rder status: after deducting booked orde	er quar	ntity from finished product inventory
and wait	ting-for-repair items inventory,		
Give	Customer order quantity =	А	Units
	Finished product inventory =	В	Units
	Waiting-for-repair items inventory =	С	Units
Then	1. If $A < B$, then deliver product "A" u	units th	rough finished product inventory.
	2. If $B < A < C$, then deliver product	"B" un	its through finished product inventory
	and "A-B" units through repairing pairing pair	rocess	
	3. If B+C < A, then deliver product "I	3" unit	s through finished product inventory,
	"C"units through repairing process,	and "A	A-(B+C)" units through manufacturing
	process or outsource.		
2. The estin	nated of possible delivery date is from th	e final	date and time of production plan. Time
required	for preparing and loading product on ve	ehicles	and the vehicles available time is not included.

6.1.2 Production Process Assumptions and Logical Models

Production processes of ABC consist of repairing process and manufacturing process. Before going to each production process's (repairing process's and manufacturing process's) logical model and assumptions, the assumptions covering both production processes are firstly described to help understand their logical models' rational (see assumption 2).

Assumption2: Production Process Assumptions

- 1. Scheduling method is First In First Out (FIFO).
- 2. From the repairing process flow and manufacturing process flow (see figure 3.8 and 3.9), in order to allow the following sub-process have input to work on, the production plan is divided into 1 hour period and the output is divided into 1 hour batch size.
- 3. There is no set up time between each 1 hour period.
- 4. The 1 hour period is a time segment of 1 hour within a day. When end of day is reached, the next hour period goes to the next working day.
- 5. Within 1 order, the production works on 1 product until the output quantity equals to the order quantity then goes to the next product.
- 6. All products in the current order must be completed before going to the next order.
- 7. All the work elements in current sub-process must be completed before the following sub-process can start.
- 8. The following sub-process begins on the next available hour.
- 9. The number of being produced units in the current sub-process can not exceed the total units produced from all previous sub-processes.
- 10. Load of production process (%) in each hour period identified in the schedule sheet is calculated from

Hourly load of production process (%) = Allocated (minutes) X number of workers used 60 minutes X Available Workers

6.1.2.1 Repairing Process Logical Model and Assumptions

Logical model of repairing process is divided into 3 sections of analysis steps according to its 3 sub-processes; sanding, repairing, and painting sub-process analysis steps. First, the assumptions of repairing process are described (see assumption 2.1) then its logical model (logical model 1) is depicted in figure 6.2.

Assumption 2.1: Repairing Process Assumptions 1. For repairing process, each sub-group only works on their responsible tasks. There is no cross-utilization between each sub-group. 2. Time used in repairing each order quantity is calculated from For sanding and repairing sub-process; Required time (minutes) = To be repaired quantity (units) X Weighted average standard time (minutes/unit/working team) Number of teams available For painting sub-process; Required time (minutes) = To be repaired quantity (units) X Standard time (minutes/unit/working team) Number of teams available S. Unocuppied time is the unoccupied minutes within 1 hour period.

4. Allocated time is minumum of either unoccupied time or required time; min(unoccupied, required).



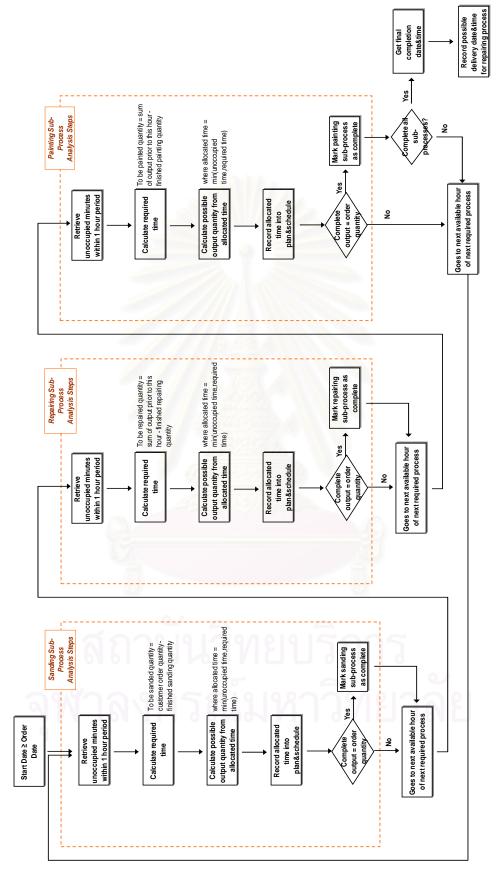


Figure 6.2: The Logical Model 1; Logical Model of Repairing Process

To help understanding the logical model, the examples of repairing metal form 600x1200 and TFT 1205 are explained.

Example: Repairing metal form 600x1200 and TFT 1205 on 20 March, 2009

Product:	Order Quantity	Sanding Weighted Av. Std. Time	Repair Weighted Av. Std. Time	Paint
1. Metal form 600 x 1200	100	0.64	5.68	0
No. of team available		1	14	0
2. TFT1205	100	0	2.33	0.35
No. of team available		0	13	3

Result:

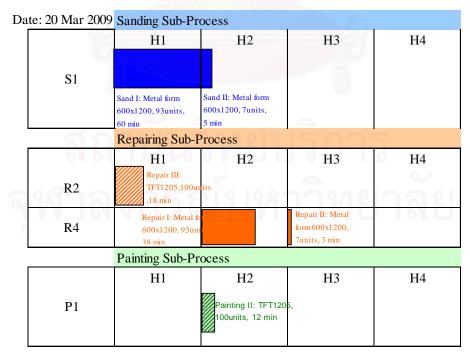
1) Calculation Detail



Metal form 600 x 1200	
Sand I: 1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (order q'ty x std. time)/no. of teams avail.	64 minutes
3. calculate possible output = allocated time x no. of teams avail/std. time	93 units
allocated time = min(unoccupied time, required time) =	60 minutes
4. record allocated time into plan	60 minutes
5. complete sub-process?	No (output q'ty \neq order q'ty)
6. go to the next available hour	
Densiving I: 1 retrieve uncesswied minutes within 1 hour period	60 minutes
Repairing I: 1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (sumofprior output x std. time)/no. ofteams avail.	38 minutes
3. calculate possible output = allocated time x no. of teams avail/std. time allocated time = min(unoccupied time, required time) =	93 units 38 minutes
4. record allocated time into plan	38 minutes No. (output c'ty \neq order a'ty)
5. complete sub-process?	No (output q'ty ≠ order q'ty)
6. go to the next available hour	
Painting I: 1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (sumofprior output x std. time)/no. ofteams avail.	0 minutes
3. mark this sub-process complete	
4. complete all sub-processes	N_{O} (not all sub-process mark complete)
Sand II: 1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (order q'ty-finished quantity)xstd. time/no. of teams ave	
3. calculate possible output = allocated time x no. of teams avail/std. time	7 units 5 minutes
allocated time = min(unoccupied time, required time) =	
4. record allocated time into plan	5 minutes $V_{\rm ext}$ (output situ = order situ)
5. complete sub-process?	Yes (output $q'ty = order q'ty$)
6. mark this sub-process complete	
7. go to the next available hour	
Repairing II: 1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (sumofprior output x std. time)/no. ofteams avail.	3 minutes
3. calculate possible output = allocated time x no. of teams avail/std. time	7 units
allocated time = min(unoccupied time, required time) =	3 minutes
4. record allocated time into plan	3 minutes
5. complete sub-process?	Yes (output q'ty = order q'ty)
6. mark this sub-process complete	
7. complete all sub-processes	Yes (All sub-process mark complete)
8. get final completion date & time	20 Mar 2009, H3

	TFT1205	
Sand III:	1. retrieve unoccupied minutes within 1 hour period	55 minutes
	2. calculate required time = (order q'ty x std. time)/no. of teams avail.	0 minutes
	3. mark this sub-process complete	
	4. go to the next available hour	
Repairing III:	1. retrieve unoccupied minutes within 1 hour period	60 minutes
	2. calculate required time = (sumofprior output x std. time)/no. ofteams avail.	18 minutes
	<pre>3. calculate possible output = allocated time x no. ofteans avail/std.time allocated time = min(unoccupied time, required time) =</pre>	100 units 18 minutes
	4. record allocated time into plan	18 minutes
	5. complete sub-process?	Y_{es} (output q'ty =order q'ty)
	6. mark this sub-process complete	
	7. go to the next available hour	
Painting II:	1. retrieve unoccupied minutes within 1 hour period	60 minutes
	2. calculate required time = (sumofprior output x std. time)/no. ofteams avail.	12 minutes
	3. calculate possible output = allocated time x no. of teams avail/std. time	100 units
	allocated time = min(unoccupied time, required time) =	12 minutes
	4. record allocated time into plan	12 minutes
	5. complete sub-process?	Yes (output q'ty =order q'ty)
	6. complete all sub-processes	Yes (All sub-process mark complete)
	7. get final completion date & time	20 Mar 2009, H2

2) Summary Plan



3) Summary Result

The order on 20 March, 2009 to repair metal form 600x1200, 100 units and TFT 1205, 100 units is finish on the third hour and the second hour of the same day, 20 March 2009, respectively.

6.1.2.2 Manufacturing Process Logical Model and Assumptions

Similar to repairing process, logical model of manufacturing process is divided into 3 sections of analysis steps according to manufacturing process's subprocess; cutting, assembly & welding, and painting sub-process analysis steps. First, the manufacturing process's assumptions are described (see assumption 2.2) then its logical model (logical model 2) is depicted in figure 6.3.

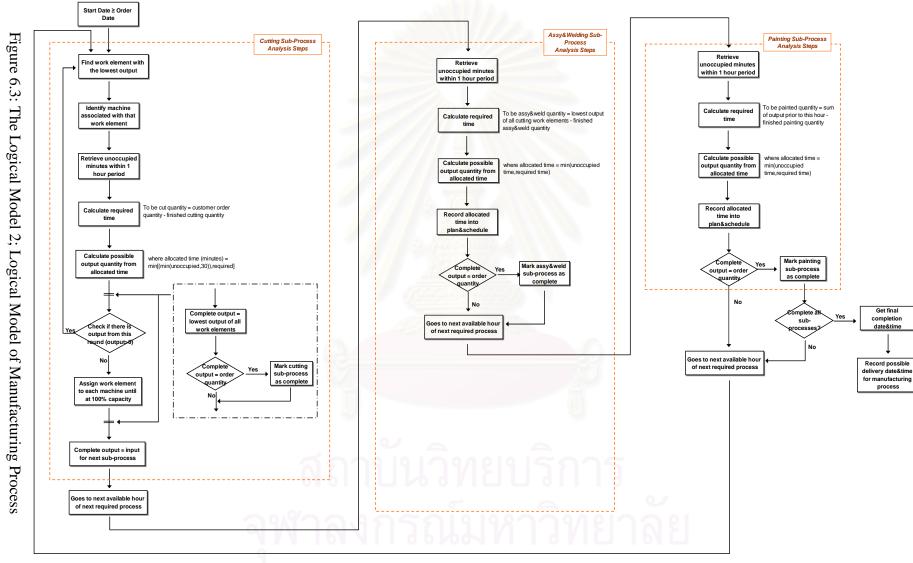
Assumption 2.2: Manufacturing Process Assumptions

 Time used in manufacturing each order quantity is calculated from For cutting sub-process;
 Required time (minutes) = To be manufactured quantity (units) X Standard time (minutes/unit/machine or working team)
 For assembly and welding sub-process and painting sub-process;
 Required time (minutes) = To be manufactured quantity (units) X Standard time (minutes/unit/working team)

Required time (minutes) = To be manufactured quantity (units) X Standard time (minutes/unit/working team)

Number of teams available

- 2. Unoccupied time is the unoccupied minutes within 1 hour period.
- 3. For assembly and welding sub-process and painting sub-process, allocated time is minimum of either unoccupied time or required time; min(unoccupied,required).
- 4. For cutting sub-process, since the lowest output of all cutting work elements is the input to next sub-process and since some work elements share the same machine, therefore, in order to allocate the output for all cutting work elements, the unoccupied time is divided into 30 minutes. Therefore, allocated time in cutting sub-process is min[(min(unoccupied,30)),required]; where 30 minutes is per 1 machine or 1 working team.





To help understanding the logical model, the example of manufacturing HS418 is described.

Example: Manufacturing HS418, 20 units on 20 March, 2009

		Standard 7	Fime (mi	in/unit/ma	achine or	team)	
Product:	Order Quantity	C1	C2	C3	C4	AW1	Paint
1.HS-418	20	1.90	1.05	1.32	2.62	28.27	0.43
Machine Associated		Е	F	С	F		
No. of machine/team avaiable		1	1	2		2	3

Result:

1) Calculation Detail



i: 1. find work element with the lowest output	C1
2. Identify machine associated with that work element	E
3. retrieve unoccupied minutes	60 minutes
4. calculate required time = (order q'ty x std. time)	38 minutes
5. calculate possible output = allocated time / std. time	15 units
allocated time = min[(min(unoccupied,30)),required] =	30 minutes
6. complete output = lowest output of all work elements	0 units
7. complete output = order quantity?	No
8. check if $output > 0$ from this round	Yes
ii: 9. find work element with the lowest output10. Identify machine associated with that work element	C2 F
-	
11. retrieve unoccupied minutes	60 minutes
12. calculate required time = (order q'ty x std. time)	21 minutes
13. calculate possible output = allocated time / std. time	20 units
allocated time = min[(min(unoccupied,30)),required] =	21 minutes
14. complete output = lowest output of all work elements	0 units
15. complete output = order quantity? 16. check if output ≥ 0 from this round	No Yes
16. check if output > 0 from this round	res
iii: 17. find work element with the lowest output	C3
18. Identify machine associated with that work element	С
19. retrieve unoccupied minutes20. calculate required time = (order q'ty x std. time)	120 minutes 26 minutes
21. calculate possible output = allocated time / std. time	20 01103
allocated time = min[(min(unoccupied,30)),required] =	26 minutes
22. complete output = lowest output of all work elements23. complete output = order quantity?	0 units No
24. check if output > 0 from this round	Yes
iv: 25. find work element with the lowest output	C4
26. Identify machine associated with that work element	F
20. retrieve unoccupied minutes	39 minutes
28. calculate required time = (order q'ty x std. time)	52 minutes
29. calculate possible output = allocated time / std. time	11 units
allocated time = min[(min(unoccupied,30)),required] =	30 minutes
30. complete output = lowest output of all work elements	11 units
31. complete output = order quantity?	No
32. check if output > 0 from this round	Yes
a statistica (a portanti la	
v: 33. find work element with the lowest output	C4 F
34. Identify machine associated with that work element 35. retrieve unoccupied minutes	9 minutes
36. calculate required time = (order q'ty - finished units) x std. time	23.55 minutes
37. calculate possible output = allocated time / std. time	3 units
allocated time = min[(min(unoccupied,30)),required] = 38. complete output = lowest output of all work elements	9 minutes 14 units
39. complete output = order quantity	No
40. check if output > 0 from this round	Yes
40. check if output > 0 from this found	105
wie 41. Card and a large startic the large starting	61
vi: 41. find work element with the lowest output	C4
	F
42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes	F 0 minutes
42. Identify machine associated with that work element	•
42. Identify machine associated with that work element 43. retrieve unoccupied minutes	0 minutes
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time 	0 minutes 0 minutes
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order qty - finished units) x std. time 	0 minutes 0 minutes
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order qty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = min[(min(unoccupied,30)),required] = 	0 minutes 0 minutes 0 units
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order qty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = minf(min(unoccupied.30)), required] = 46. complete output = lowest output of all work elements 	O minutes O minutes O units O minutes 14 units
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order qty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = min[(min(unoccupied,30)),required] = 	O minutes O minutes O units O minutes
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order qty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = minf(min(unoccupied.30)), required] = 46. complete output = lowest output of all work elements 	O minutes O minutes O units O minutes 14 units
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = mint(min(unoccupied.30)),required) = 46. complete output = lowest output of all work elements 47. complete output = order quantity 48. check if output > 0 from this round 	O minutes O minutes O units O minutes 14 units No No
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = min[(min(unoccupied, 30)), required] = 46. complete output = lowest output of all work elements 47. complete output = order quantity 48. check if output > 0 from this round vii: 49. assign work element to each m/c untill 100% capacity 	o minutes O minutes O units <i>o minutes</i> 14 units No No E F C
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = mint(min(unoccupied.30)),required) = 46. complete output = lowest output of all work elements 47. complete output = order quantity 48. check if output > 0 from this round 	O minutes O minutes O units O minutes 14 units No No E F C 30 60 26
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = min[(min(unoccupied.30)),required] = 46. complete output = lowest output of all work elements 47. complete output = order quantity 48. check if output > 0 from this round vii: 49. assign work element to each m/c untill 100% capacity time used time available 	O minutes O minutes O units O minutes 14 units No No E F C 30 60 26 il 60 60 120
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = min[(min(unoccupied.30)),required] = 46. complete output = lowest output of all work elements 47. complete output = order quantity 48. check if output > 0 from this round vii: 49. assign work element to each m/c untill 100% capacity time used time used time associated with available capacity of m/c 	$\begin{array}{c} 0 \text{ minutes} \\ 0 \text{ minutes} \\ 0 \text{ units} \\ 0 \text{ minutes} \\ 14 \text{ units} \\ No \\ No \\ E F C \\ 30 60 26 \\ il. 60 60 120 \\ C1 \end{array}$
 42. Iidentify machine associated with that work element 43. retrieve unoccupied minutes 44. calculate required time = (order q'ty - finished units) x std. time 45. calculate possible output = allocated time / std. time allocated time = min[(min(unoccupied.30)),required] = 46. complete output = lowest output of all work elements 47. complete output = order quantity 48. check if output > 0 from this round vii: 49. assign work element to each m/c untill 100% capacity time used time available 50. find work element associated with available capacity of m/c 51. Iidentify machine associated with that work element 	E = F = C $30 = 60 = 60$ $E = F = C$ $30 = 60 = 26$ $E = 10$ $C1 = 10$
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Assemble & Welding Sub-Process I	
1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (prior output x std. time)/no. of teams avail.	198 minutes
3. calculate possible output = allocated time x no. of teams avail./ std. time	4 units
allocated time = min(unoccupied time, required time) =	60 minutes
4. record allocated time into plan	60 minutes
5. complete sub-process?	No (output q'ty \neq order q'ty)
6. go to the next available hour	
Painting I:	
1. retrieve unoccupied minutes within 1 hour period	60 minutes
2. calculate required time = (prior output x std. time)/no. of teams avail.	1 minutes
3. calculate possible output = allocated time x no. of teams avail./ std. time	4 units
allocated time = min(unoccupied time, required time) =	1 minutes
4. record allocated time into plan	1 minutes

5. complete sub-process?

6. go to the next available hour

iii: 1. find work element with the lowest output	C4
2. Identify machine associated with that work element	F
3. retrieve unoccupied minutes	60 minutes
4. calculate required time = (order q'ty - finished units) x std. time	16 minutes
5. calculate possible output = allocated time / std. time	6 units
allocated time = min[(min(unoccupied,30)),required] =	16 minutes
6. complete output = lowest output of all work elements	6 units
7. complete output = order quantity?	Yes
8. Mark this sub-process complete	
9. check if output > 0 from this round	Yes
10. complete output $=$ lowest output of all work elements	6 units
11. go to the next avaiable hour	



No (output q'ty \neq order q'ty)

2) Summary Plan

20 March 2009

Cutting S	ub-Proce	ess																
	30 1	ninutes -	I	H1	- 30 minute	es		30 min	utes	H2	3	30 minute	es					
C1	C2	C3	C4	C1	C2		C4 Ci	1 C2			C1 C2	2 C3	C4					
0	0	0	0	ł		iv:			viii:	6								
: 15 ii:	0 20	0	0 0	į		v: vi:				į								
п.	20 iii:	20	0	5	vii:	vi.	0			ł								
Assy&W														1				
			Н	[1						H2				H3		H6		H7
							As	sembly&V	Welding	: HS418,	4units, 6	50 min		$ \longrightarrow $		bly&Wekling V: 4units, 60 min		
										~			-	v				
Painting	Sub-Proc	ess																
			Н	11						H2				H3				H7
														Painting I: HS418, 4units, 1min	-	$\neg \land \lor$	Painting V	/: HS418, 4units, 1min
																v		
														Painting I: HS418, 4units, 1mm		- \/	Painting	/: HS418, 4units, 1mi

3) Summary Result

The order on 20 March, 2009 to manufacture HS 418, 20 units is finish on the seventh hour of the same day, 20 March 2009.

6.2 The Development and User Interface of Information System for ABC's Order Receiving Process

The developed data storage, data flow, and the logical model are integrated to develop the information system for ABC's order receiving process using Visual Basic-base Excel Macro. Step by step, this thesis explains, starting from calling the information system as a first step to the delivery date estimation as a final step.

6.2.1 Calling the Information System

Opening the information system gives the start up page as figure 6.4.



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Figure 6.4: The Information System; Start Up Page

6.2.2 Inventory Update

Since the quantity of each inventory is calculated to give the result of product availability channels, it is necessary to update the inventory before running the information system. The steps in inventory update are as follow:

Step1: Go to "inventory" data storage sheet, click on "update" button. The "update inventory" window appears as in figure 6.5.

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	tem	Product Code	Product	Inventory 03	Inventory 00	Booked Order	Livetheliatie	Update						
	1	114-0102	Jack Base BB-40	8,637	3,383	0		Reset		1				
	2	114-0103	Jack Base BB-60	23,189	6,168	0		Zero						
	3	114-0202	U-Head Jack BU-40	6.345	6.039	0		2010						
3	4	114-0203	U+Head Jack BU-60	Update fevent	and the second s			x						
1	5	112-0401	Waking Panel HS-418	Optimite married	ana c									
1	6	213-2304	Walking Panel HS-518		1.00									
	7	213-2315	Steel Planky LPO-40 (210+4000)	Product	t i				1					
	8	112-0501	Steel Stairs SSE-17		7.00		in the second							
1	9	112-0106	Vertical Frame TFT-1205						-					
	10	112-0103	Vertical Frame TFT-1215											
E.	11	112-0102	Vertical Frame TFT-1217											
1	- 12	213-0106	Vertical Frame TFT-1217 Gal.		Update	e .	Current							
1	13	112-0301	Harizontal Frame YFT-1218											
1	14	112-2202	Square Pipe 50x50x1500	Inventory 00		1								
1	15	112-2205	Siguine Pipe 50x50x3000	Inventory at	State -									
	16	112-2211	Square Pipe 50x50x6000											
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1	23	112-2404	Square Pipe 100 x 100 x 2500											
1	24	112-2405	Siguare Pipe 100 x 100 x 3000		Update		xe							
	25	112-2407	Square Pipe 100 x 100 x 4000											
	26	112-2400	Square Pipe 100 x 100 x 4500	-										
	27	112-2409	Square Pipe 100 x 100 x 5000	473	274	0	A CONTRACTOR							
1	29	112-2411	Siguare Pipe 100 x 100 x 6000	168	3,628	0								
1	29	112-2101	Round Pipe 48.6x1000 Round Pipe 48.6x1500 Gal.	1,578	6,159	0								

Figure 6.5: The Information System; Inventory Update Data Storage Sheet

Step2: Select the product to be updated, fill in each inventory quantity and book order quantity, and click on "update" button.

To help understand the developed information system, the example of Metal Form 600x1200, TFT1205, and HS418 described in the design of information system (see section 6.1, chapter 6) is also used in this section.

	Inv	ventory Status (Uni	its)	Customer Order
Product	Finished Product Inventory	Waiting-for- Repair Items	Booked Order	(Units)
Metal Form 600x1200	20	100	0	120
TFT1205	20	100	0 💽	120
HS418		0	9/60	2 20

The inventory update of Metal Form 600x1200 as an example is depicted in figure 6.6.

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hem	Code	Product	83	as as	Booked Order	Lottiladore	Update														
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	108-0202	Urtrad Jack (KU 40	12.1%	11,228							_						-				
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	20,2304	Walking Planet H1, 558	4.942	2 784		100 Photo 100	Update	a lanva sha	1977							×		1			
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	10.000	Ventical Flame TFT 4006	2,819	2,428				brochurt.	Matsi Tr	rm 600x1	200					1000					
	12.003	Ventual Frame T/FT-426	L799				1 3		hourse a c				_								
	1 10-0102	Ventical Frame TFT-5257	257	1,944		AL STREET				Sec. 2	Sec. 2	643 F									
	213-0906	Versial Frame TFT-627 Gal.	80.962	4,040		10.19.19.10.			33901-922.12	roduct Code	114-01	104									
	92-8301 92-2292	Hotootal Frank UFT-CH Enviro Pipe Shiftlefol	4)	2,895		and the second second															
	10-2215	Square Pipe Studia 200	1,006	1,00																	
	10-228	Equary Pige ShiShelioto	1.80	- 282								- 10					-	+	-	-	
	10.2507	Equart Pipe 50x100x4000	400	174		and the second se				pdate			- Da	rrent			-		-	-	
	10.258	Equare Pige Shift0x6000	190	4,363																	
	10-200	Square Pipe 75 x 75 x 2000	228	- 65		A Contraction of the local division of the l			1		0				Contract 1						
	12-2305	Bguars Fige 75 x 75 x 0000	421	+06		and the second second	Inver	story 83			NH ()				1060						
	1,10-2401	Equare Pipe 100 + 100 + 1000	630	4,704		Contraction of the local division of the loc	1														
	10.2400	Square Pipe 50 x 60 x 2000	247	794					100												
	12-2404	Sq14++ Pge 100 x 100 x 2500	373	86				10000			0				\$75		-	-		_	
	10.2405	Boyers Pipe 200 x 200 x 2000	0	10		2144.00	Inve	story 00							aca			-		_	
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	10.2409	Desart Pipe 100 x 100 x 1000	475	214		No. II			-	_	-								-	-	
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	184-5305	Matal Form 200x800		801																	

Figure 6.6: The Information System; Updating Inventory Data

Step 3: After updating all products data, click on "done" button to finish this section. The latest updated date is recorded and shown in the page as well. Example of updated Metal Form 600x1200, TFT1205, and HS418 inventory results are in figure 6.7.

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	10.2401	Sigure Pige 300 x 300 x 3000		100				_													
	10.0407	Square Pige 800 x 905 x 4000	294	802																	
	102-2406	Square Pige 800 x 100 x 4500	46	25				_							-						
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Figure 6.7: The Information System; Updated Inventory Result

6.2.3 Customer Order Information Input

In this step, users input the company internal reference information and customer order information. The steps of customer order information input are as follows:

Step1: Go to "this order" data storage sheet (see figure 6.8).

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Figure 6.8: The Information System: This Order Data Storage Sheet

Step2: Click "new order" button to input the company internal reference information, customer detail, customer request product delivery date, and estimated product return date.

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Figure 6.9: The Information System: Internal Reference and Customer Detail Input

Step3: After all required information in step 2 are completely filled, click "add order" button, and then "order edit" window shows up. Users input each order product and its order quantity by clicking "add item" box. If customers inform estimated return date of each product, mark "estimated return by item", and fill in the informed date. After finish all information are input, click "done" button to finish customer order information input step. The examples of order input are in figure 6.9 and 6.10.

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Figure 6.10: The Information System: Order Product Input

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Figure 6.11: The Information System: Customer Order Information Input Result

6.2.4 Estimate Delivery Date and Product Availability Channels

This step is a continuous step from previous step (Customer Order Information Input). After finish customer order information input step, click "calculate" button. Then the information system calculates for the estimate product delivery date and availability channels as described in the information system logical model.

From the example of Metal Form 600x1200, TFT1205, and HS418, the results are depicted in figure 6.12.

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Figure 6.12: The Information System: Estimate Product Delivery Date and Product Availability Channel Result

From figure 6.12, the 20 units from total order of 120 units of Metal Form 600x1200 and TFT1205 are delivered through the finished product inventory whereas the remains are to be repaired. The result of repairing metal form 600x1200, 100 units and TFT 1205, 100 units is finish on the third hour and the second hour of the same day of order date which is the same result with the example given in repairing logical model section (see section 6.1, chapter 6). For HS418, since there is none left in the inventory, the total 20 units order are from the manufacturing process. Finally, the estimate delivery date which will be promised to customer is received from the latest date of getting each product.

Users can see this order's production schedules which are repairing process plan, manufacturing process plan, and painting sub-process plant in the "repair plan" data storage sheet (see figure 6.13), "manufacture plan" data storage sheet (see figure 6.14), and "paint plan" data storage (see figure 6.15) respectively. The schedules are given with the format as depicted in the figures.

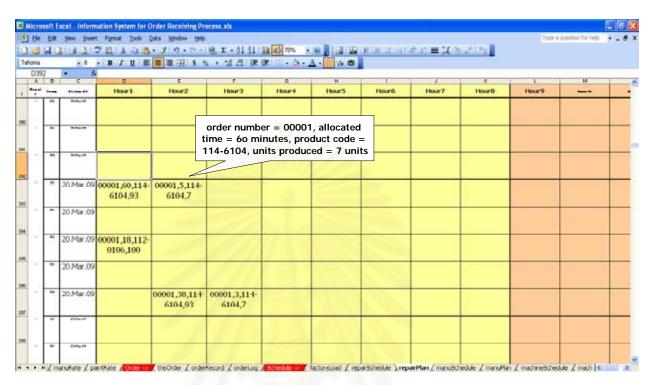


Figure 6.13: The Information System: Repairing Process Plan Result

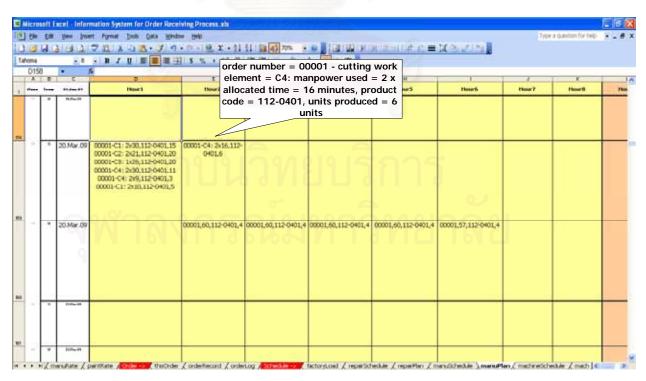


Figure 6.14: The Information System: Manufacturing Process Plan Result

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Figure 6.15: The Information System: Painting Sub-Process Plan Result

Upon the current order is finish, click "complete order" to start the next order process.

6.2.5 Editing the Order Information

To edit the order, click "edit order" button, and then the "order edit" appears as in figure 6.16. After editing order information is finished, click "done" button.

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Figure 6.16: The Information System: Editing Order Information

6.2.6 Retrieving the Past Order

To retrieve the past order, the steps are as follows:

Step 1: Go to "this order" data storage sheet (see figure 6.8).

Step 2: Click "retrieve order" button and the "import past order" window appears as in figure 6.17. Select the order needed to be retrieved, click "OK" button, then the "retrieve order complete" window shows up as in figure 6.18.

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Figure 6.17: The Information System: Import the Past Order Selection

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Figure 6.18: The Information System: Import the Past Order Finish

Step 3: If users would like to edit the retrieved order, click "edit order" button and follow the steps described in section 6.2.5.

6.2.7 Outsource Notification

In case of outsource is required as explained in assumption 1 of the information system logic (section 6.1, chapter6), "outsource required" is display after calculation is finished. Figures 6.19 shows an example of customer order TFT1205, 100 units when both finished product inventory and waiting-for-repair items are empty and outsource is required.

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Figure 6.19: The Information System: Estimate Product Delivery Date and Product Availability Channel Result - Outsource Notification

The newly developed information system for ABC's order receiving process consists of adequate required information in order to support marketing department in proactively negotiating and promising more accurate product deliverable date and quantity. Numbers of products available through each channel and production detail of both production process sectors are also provided. In addition, expected returned date from customers which has never been asked for customers is recorded for future analysis of ABC Company.

After the information system has been developed, it is evaluated for its validation to ABC's order receiving process by top management and marketing department staffs based on its purpose and objective of improving this process by providing adequate information to be able to designate more accurate product

available-to-promise date and proactively negotiate with customers. Moreover, the preliminary evaluation result based on historical data is also described to shows the improving trend of on time delivery.

6.3 The Validation of the Information System to ABC Company

Currently marketing department process customers order based on 2 data of inventory in paper sheet; quantity of finished products and quantity of waiting-forrepair items. With the production capacity information determined by production staff's experience, then, marketing department promise product available-to-promise date based on their experience which at times can be inaccurate.

In order to improve ABC's order receiving process by providing adequate information for marketing department to process customer orders, the information system is developed with sufficient required data to be logically calculated to support marketing department in designating more accurate product available-to-promise date to customers. In stead of paper sheet, the inventory is recorded in the information system which can be more easily to process. The standard time of both production process sectors; repairing process and manufacturing process, is studied and developed at 95.45% confidence and accuracy of 5% error margin. In addition, the expected return date from customer is also recorded for further analysis by ABC of expecting the returned products which costs less than relying more on manufacturing.

The newly developed information system's validation to order receiving process of ABC's is assessed by top managements and marketing department. According to them, the newly developed information system is accepted and considered as a prototype consisting of sufficient required data and accepted logical model for order receiving process which will be further exploited to cover all products available in ABC. Moreover, it is also accepted for its contributions to the company's ability in achieving the 3 key indicators of on time delivery, fully utilize capacity, and maximum repairing process by several ways. First, in stead of pushing the orders to production department to finish products within timeline given to customers where the historical delay delivery record indicates that several orders can not be finished on time, the information system can support marketing department with the adequate information in order to designate more accurate available-to-promise date and proactively negotiate with customers. As a consequence, it can improve late delivery

which could lead to customer dissatisfaction or, more importantly, losing customers trusts which are big threats to the company.

Second, the established standard time of both production process sectors is utilized as a standard working time of ABC's which not only helps top managements in analyzing actual productivity and standard productivity for further improvement but also in monitoring and evaluating operation workers performance by top management themselves instead of totally being informed and based on production department staff.

The detail and % load of production plan provided in the newly developed information system also helps further improvement of production capacity allocation in the future. In addition, it also helps both top managements and production department in monitoring the production results, early detecting for late delivery possibility, adjusting the production schedule, or informing to marketing department to renegotiate with customers prior to the lateness in delivery or job cancellation occurs.

Finally, currently ABC has never asked for product rental period from each customer and recorded; thus the expected actual return date is likely impossible. Therefore, the estimated return date to be recorded in the newly developed information system is useful and supportive to top managements' decisions in terms of maximizing product through repairing process which costs less.

6.4 Preliminary Evaluation of the Information System

The preliminary evaluation of the newly developed information system is also conducted based on historical data to show the improving trend of on time delivery. However, this evaluation result doest not entirely indicate the efficiency of the information system due to some limitations and conditions of inputting evaluating data which can be different from the real situation at that time. Those limitations and conditions are:

- 1. There is no unfinished product left in the process prior to the start evaluation date.
- 2. The order is run by first-in first-out according to its order date. There is no interrupt of urgent order.
- 3. The production works on 100% capacity.

- 4. If there is not enough quantity in finished product inventory, the left order quantity is either repaired or manufactured.
- 5. Lead time used in preparing delivery vehicle is minimum value; 1 day.

The preliminary evaluation result is based on 2 indicators; reduction of units late and %error in available-to-promise date. Unit late is calculated from number of products which actual delivery date is after promised date. Whereas, % error in available-to-promise date is calculated from number of orders which its actual delivery date is after promised date. The preliminary evaluation result is the comparison between the result of ABC's current order receiving process and the result of the newly developed information system (see table 6.1)

Table 6.1: The Preliminary Evaluation Result of the Information System

Source of Product Availability Information	Total Order Quantity (units)	Total Number of Orders	Units Late	% Units Late	No. of Error Available-to-Promise Date Orders	% Error Available-to- Promise Date	Average No. of Delay Days
Current ABC's System	53541	498	16077	30	109	22	8
Newly Developed Information System	55541	498	13288	25	99	20	6

The result indicates that under the limitations and conditions of the preliminary evaluation, the newly developed information system results in an improving trend of on time delivery by the reduction of 2,789 units late or 5% and 10 numbers of error available-to-promised date orders or 2%. In addition, average numbers of delay days also improve from 8 days to 6 days. To be criticized, around 57% of units late and 64% of error available-to-promise date from the developed information system are in the range of 1 -2 delay days late whereas around 38% of units late and 52% of error available-to-promise date from current ABC's system are within that range. With the information supported by ABC Company, the 2,789 units save from job cancellation due to late delivery can be converted to approximately 250,000 baht – 420,000 baht.

From this improving trend of on time delivery, the fully implemented of the newly developed information system is believed to result in more reduction in unit late and % error available-to-promise date since the limitations and conditions are synchronized with the real situation; for example, the production plan that has to be shifted due to machine breakdown, or there is an interrupt of urgent order which has to be fulfill first.



CHAPTER VII CONCLUSION AND RECOMMENDATION

The company studied in this thesis, ABC Company, is the scaffolding and accessories manufacturer in Thailand. The business model of ABC is quite complex as the majority of products, approximately 80% are to be rented whereas the remaining 20% is where customer decide to purchase. As a consequence, it has resulted in the complexity of production process and inventory. To be able to compete in the rental business and go beyond competitors, ABC aims to achieve on time delivery, fully-utilized production capacity (both repairing process and manufacturing process), and maximum available products through repairing process. Successful achievement of those 3 indicators requires adequate information to be analyzed in order receiving process which is the responsibility of marketing department. In spite of the facts that various type of products are being produced, the processes are becoming more sophisticated as business grows, and more necessary data and information should be provided, still there is no information system support marketing department in order receiving process which leads to lateness in delivery and job cancellation problems due to ineffective and inefficient of designated product deliverable date and quantity to customers.

The purpose of this thesis is to develop the information system to improve ABC Company's order receiving process by providing sufficient data in order to reduce lateness in delivery due to ineffective and inefficient designated product available-to-promise date. Currently designated product available-to-promise date and quantity is based on 2 paper sheets of inventory and marketing staff's experience which at times can be inaccurate. In addition, production process capacity of both repairing process and manufacturing process is based on human experience. Also, the expected returned date has never been asked from customer which makes the overall decision in production process more difficult. Therefore, the information system is developed to improve ABC's order receiving process.

7.1 The Information System Development Methodology

In this thesis, the development methodology and steps of the information system for order receiving process are summarized as follows:

- 1. Study current order receiving process. Analyze which information customers require from marketing department once they orders and which information marketing department must have to response their orders.
- 2. Examine the problems and the causes of problems. Identify the developed information system's objective and scope to improve current order receiving process.
- 3. Analyze and collect required data in order receiving process to be input in the information system. Identify which required data is already existed and which one is necessary to be studied and developed. Then, identify which department is responsible for each data collection. Also, analyze which information should be provided as the output from the information system.
- 4. Study both production process sectors and develop both process sectors' standard time using time study technique.
- 5. Design the logical model of the information system under the determined assumptions to generate the required output. Then, develop the information system using Visual Basic-based Excel Macro.
- 6. Evaluate the information system's validation by ABC's top management and marketing department. Also, perform preliminary evaluation based on historical data.

After the information system for ABC's order receiving process is developed and evaluated, the evaluation result of both validation and preliminary evaluation results are summarized.

7.2 Result of Study

The newly developed information system is accepted and conformed to ABC's top managements' and marketing department's requirements since it consists of sufficient data and logical model which are required for ABC's order receiving process improvement in terms of marketing department can designate more accurate available-to-promise date and proactively negotiate to customers. Its preliminary evaluation result under some limitations and conditions of inputting the historical data also indicates the improving trend of on time delivery by the reduction of % units late, % error available-to-promise date, and numbers of delay days and yet it is believed to

improve more once the information system is fully implemented. In addition, according to the top managements, this accepted newly developed information system will also be used as a prototype for all other available products in ABC for further improvement of those products' order receiving process as well.

Moreover, the newly developed information system is also accepted by ABC's top managements for its contributions for other aspects' improvement as well. First, the developed standard time can enhance the ability of top management in evaluating and analyzing the actual productivity comparing with standard productivity for further improvement. It also enhances the ability to detect the possibility of late delivery and be able to prevent such a problem before it occurs since the hourly detail of production plan is provided. Finally, the expected returned date from customer recorded in the information system can support top managements' decisions in order to maximizing products available through repairing process.

7.3 Future Implementation Plan

Since the developed information system will be implemented in ABC in the future, this section describes the implementation plan and the information system interface with other system in the company.

7.3.1 Information System Implementation Plan

Although the developed information system in this thesis does not cover all products available in ABC, input of the remain products and development of their standard time using time study technique are all necessary for implementation the developed information system. Figure 7.1 explains the implementation steps for implementing the information system for order receiving process developed in this thesis.

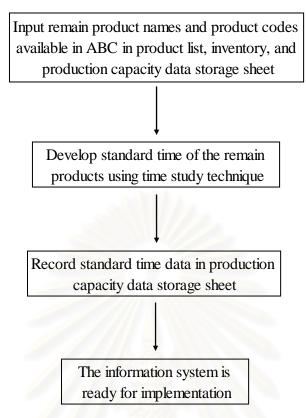


Figure 7.1: Implementation Steps of the Information System

7.3.2 Information System Interface with Other ABC's System

In the near future, ABC's will implement Enterprise Resource Planning (ERP) which is now under developing the system. To help understanding the boundary of the developed information system and its interface with ERP system, the data flow diagram is depicted in figure 7.2.

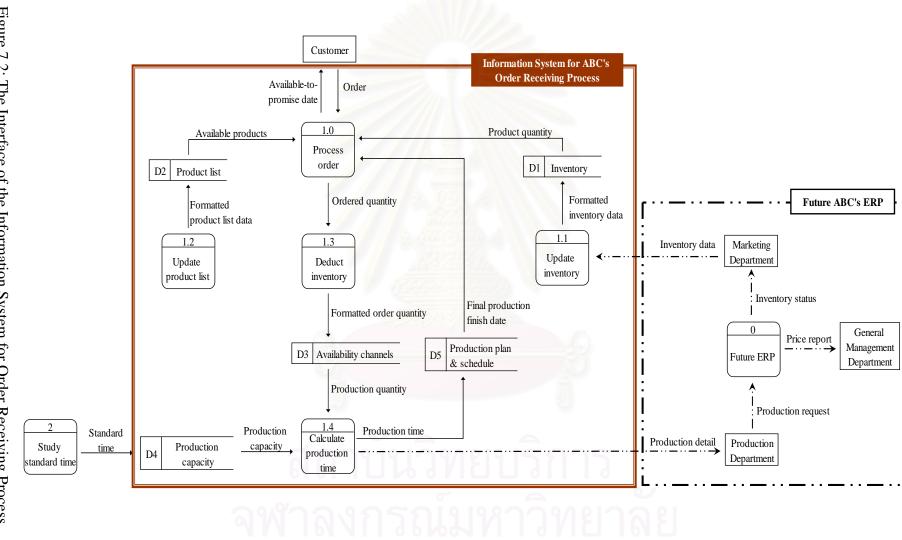


Figure 7.2: The Interface of the Information System for Order Receiving Process

7.4 Recommendation

7.4.1 Information System Synchronization with Actual Production

The newly developed information system aims to improve order receiving process by providing marketing department with more accurate product available-topromise date. At the same time, it also provides the department with the production plan of both process sectors (repairing process and manufacturing process). The information system can be continuously run with the normal user interface steps (as explained in section 6.2, chapter 6) if the production plan provided in the information system is synchronized with actual production result. However, if the actual production result is different from the plan in the information system, the adjustment of the production plan is necessary for maintaining the estimate available-to-promise date accuracy. With the agreement with ABC's top managements, the author propose to adjust the production plan in the information system to be synchronized with the actual production result when end of day is reached.

7.4.2 Returned Product Receiving Improvement

Currently upon production department receives returned products from customers, the products are transferred to waiting-for-repair items inventory where they are waiting to be repaired. To assign staff as a repair difficulty level evaluator who is able to see the production plan would be helpful for early repair time assessment and possibility of finished repair date reconsideration.

7.4.3 Authenticity of Product Delivery Recorded Data Improvement

- Improvement Objective: To generate more accurate recorded data for further analysis of late delivery by both ABC or future researcher.
- Current Status: Order date, requested date, and delivery date are incorrectly recorded. With the same order number, requested date or delivery date are found to be early than order date. According to ABC Company, the order date will be automatically run with the current system whereas the other 2 dates are input by marketing department; therefore, this problem could be occurred by human error.
- Improvement Suggestion: To prevent error data input, the automatically alert in the system should be utilized. The information system developed in the thesis involves with the 2 dates of order date and requested date. For preventive action of the error, it will remind users when such error happens by

the emphasized red date's characters. However, ABC can further improve this problem with the system that prohibits further process if the error data of any date are found.

7.4.4 Authenticity of Return Characteristic Recorded Data Improvement

- Improvement Objective: To help in future research of product return characteristic.
- Current Status: Many of data were found incorrectly recorded. Those data are
 - return quantity: With the same order number, return quantity is higher than ordered or rental quantity. The possible reason for this matter, given by ABC Company, is that if customer does not return all rental products together at one time, the return quantity that is left from the first return time will be recorded into another order number.
 - return date: Return date in some records is early than delivery date which is impossible. Moreover, in some cases, those two dates are the same date, which are also unlikely to be happening, without any remark such as order cancellation.
- Improvement Suggestion: The authenticity of these 2 data can be improved with the implementation of new procedure of data recording or with the automatically alert in the data recording system that ABC is currently using. The new procedure should suggest in the way that the final information receive from the record tell the future researcher of rental customer, project used, product delivery date, delivery quantity, return date, and return quantity per 1 order.

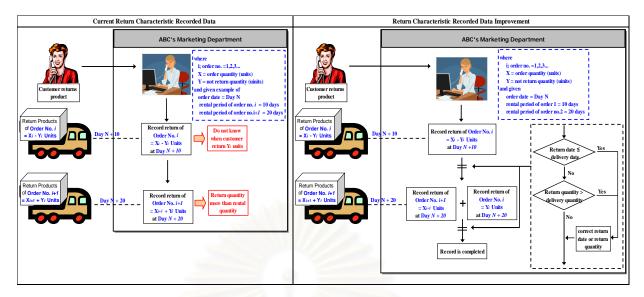


Figure 7.3: Proposed Return Characteristic Recorded Data Improvement Flow

7.4.5 Separation of On Time Indicators

Currently the customer requested date and promised date of product delivery is recorded in the same date as product available-to-promised date. According to ABC, there are cases that customers request for delivery date which the company knows that this order can not be delivered on time. Therefore, to support future analysis of % on time delivery, the 2 indicators of % on time to customer requested date and % on time to company promised date separated should be useful for the company to analyzed whether the lateness in delivery comes from factors in the company such as the delay of production or not.

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APPENDICES



Allowance Percentage: Re	pairing Proc	855			
Allowance	Sanding Sub-	Rep	airing Sub-Pro	cess	Painting Sub-
	Process	Scaffolding R1 and R2 Sub- Group	Scaffolding R3 Sub-Group	Scaffolding R4 Sub-Group	Process
Personal Allowance	1	3	3	4	4
Fatigue Allowance	0	5	3	5	2
Noise	0	2	1	2	1
Use of Force	0	2	1	2	0
Machine Breakdown/Maintenance	2	0	0	0	0
Total (%)	3	12	8	13	7

Allowance Percentage: Repairing Process

Table A2: Allowance Factor of Manufacturing Process

Allowance Percentage: Re	pairing Proc	ess	
Allowance	Cutting Sub- Process	Assembly&W elding Sub- Proces	Painting Sub- Process
Personal Allowance	3	3	4
Fatigue Allowance	2	4	2
Noise	1	1	1
Use of Force	1	1	0
Machine Breakdown/Maintenance	7	4	0
Total (%)	14	13	7

Table A3: Repairing Process: Repairing Sub-Process Time Study Result: BB40

Repa		Sub-I BB40	Process	No. of Study Units	%	6 Distrib	ution	Standar (minu			d Average me (minutes
	Low	Difficu	lty	24		73		0.3	32	0	.39
N	1ediur	n Diffi	culty	6		18		0.4	47		
	High	Difficu	llty	3		9		0.8	35		
Тс	otal S	Study	Units	33							
					L	_ow Di	fficult	y			
		R Tim		Average WR Time	n'	n	Nor	mal Time	Allowance	e Standard Time	I Standard Time
Ti	1	1	e/team					1	Factor		
no.	min	sec	total sec	total sec			Rating	g total sec	;	total sec	minute
1	0	15	15	16.66666667	24	23.36	1	16.6667	0.12	18.93939	0.32
2	0	15	15								
3	0	14	14								
4	0	17	17								_
5	0	19	19								
6	0	16	16								
7	0	18	18								
8	0	20	20								
9	0	15	15			1					
10	0	17	17								
11	0	17	17			10					
12	0	16	16								
13	0	18	18			Sale.					
14	0	23	23								
15	0	16	16			1010	101				
16	0	14	14		4	610	3.11				
17	0	17	17		177	1111					1
18	0	15	15								1
19	0	17	17			111.					1
20	0	18	18								
21	0	16	16								-
22	0	14	14								-1
23	0	16	16	9/1							-1
24	0	17	17							1	-1
- 1	-										
					Me	dium	Diffic	ulty			
		/R Tin		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	Time/	1piec	e/team					-	Factor		
no.	min	sec	total sec	total sec		2	Rating	total sec		total sec	minute
1	0	24	24	25	6	5.97	1	25 🖉	0.12	28.40909	0.47
2	0	24	24	1.951	X		10	2	ησηρ	55	0
3	0	27	27							6	
4	0	23	23								
5	0	27	27								
6	0	25	25								
						ligh D					

Repairing Process: Repairing Sub-Process Time Study Result: BB40

	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	47	47	44.666667	3	2.32	1	44.6667	0.12	50.75758	0.85
2	0	43	43								
3	0	44	44								

Table A4: Repairing Process: Repairing Sub-Process Time Study Result: BB60

Repa	-	Sub- BB60	Process	No. of Study Units		% Distrib	oution	Standar (mini		Weighted Average Standard Time (minutes		
	Low	Diffic	ulty	16		73		0.32		0.	39	
Ν	Mediu	m Diff	iculty	4		18		0.47				
	High	Diffic	ulty	2		9		0.8	37			
Т	otal S	Study	Units	22								
						Low Di	fficulty	y	_			
WR Time				Average WR Time	n'	n	Norm	al Time	Allowance	e Standard Time	Standard Time	
Time/1piece/team									Factor			
no.	min	sec	total sec	total sec		3	Rating	total sec		total sec	minute	
1	0	16	16	16.8125	16	15.01	1	16.8125	0.12	19.10511	0.32	
2	0	19	19									
3	0	17	17							1	1	
4	0	14	14								1	
5	0	18	18			12.20					1	
6	0	17	17								1	
7	0	20	20		-	3.100					1	
8	0	16	16		-	657	1			_	1	
9	0	14	14		-	100					1	
10	0	18	18								1	
10	0	16	16		-	1	-			_	1	
12	0	18	18		110	a state	1000				1	
12	0	16	16			-					1	
13	0	15	15		-	-					1	
14	0	17	15							-	1	
											1	
16	0	18	18						20		l	
				J.	М	edium	Difficu	lty				
WR Time			ne	Average WR Time	n'	n	Normal Time		Allowance	Standard Time	Standard Time	
Т	īme/1	Ipiec	e/team	21119	91	797	191	15	Factor			
no.	1	4 1	total sec	total sec		dV	Rating	total sec		total sec	minute	
1	0	27	27	25	4	3.84	1	25	0.12	28.40909	0.47	
2	0	25	25	ລ. ເຄ	5	shig	193	00	9/P	200		
3	0	24	24		4	6 00		6	112	1611		
4	0	24	24									
				LI			L	I	I		I	
						High D	ifficult	у				
WR Time			ne	Average WR Time	n'	n	Normal Time		Allowance	Standard Time	Standard Time	
Time/1piece/team no. min sec total sec				total sec			Rating	total sec	Factor	total sec	minute	
1	0	45	45	46	2	0.76	1 1	46	0.12	52.272727	0.87	
2	0	43	45	UT	2	0.70	· ·	-0	0.12	52.212121	0.07	
	1 U	1 71										

Repairing Process: Repairing Sub-Process Time Study Result: BB60

Repa		Sub BU4	-Process 0	No. of Study Units	%	Sub-Process Tim % Distribution			dard 1 ninute		Weighted Average Standard Time (minutes)		
	Low	Diffic	ulty	40		80)	0.33			0.3	8	
			ficulty	8		16		0.50					
т	<u> </u>	Diffic	ulty / Units	2 50		4			0.88				
-	otar	siduy	onits	50	_	F							
					L	_ow L	Difficult	ÿ					
	w	R Tin	ne	Average WR Time	n'	n	No	ormal T	Time	Allowance	Ce Standard Time	Standard Time	
Time/1piece/team				Time						Factor			
no.			total sec	total sec			Rati		alsec		total sec	minute	
1	0	21	21	17.225	40	39.4	98 1	17	7.225	0.12	19.57386	0.33	
2	0	16 13	16 13									-	
4	0	17	17										
5	0	16	16										
6	0	13	13										
7	0	19 22	19 22									-	
9	0	15	15			-						-	
10	0	19	19										
11	0	14	14										
12 13	0	12 17	12 17									-	
13	0	17	17								_	1	
15	0	13	13			-	12 18					1	
16	0	16	16										
17 18	0	16 20	16 20						_			-	
18 19	0	20 18	18				-					-	
20	0	13	13			3	-					1	
21	0	18	18										
22	0	17	17										
23 24	0	17 17	17									-	
25	0	18	18									-	
26	0	20	20										
27	0	16	16										
28 29	0	15 17	15 17									-	
30	0	17	17			-						-	
31	0	22	22										
32	0	18	18										
33 34	0	23 17	23 17									-	
35	0	19	17							771		-	
36	0	20	20									-	
37	0	19	19	9									
38	0	14	14									-	
39 40	0	22 17	22 17				-				_	-	
	. <u> </u>						7-2-						
			b		Me	dium	Difficu	ulty	0		0		
	w	R Tir	ne	Average WR		n	Norm	al Tim	e Al	lowance		tandard	
			e/team	Time	~			0.00	filmen (h)	Factor	Time	Time	
no.			total sec	total sec			Rating	total s			total sec	minute	
1	0	26	26	26.25	8	7.98	1	26.2		0.12	29.82955	0.50	
2	0	25	25										
3	0	30 25	30 25				.						
5	0	25	25										
6	0	27	27										
7	0	24	24										
8	0	28	28			I	I	l					
					F	liah r	Difficult	tv					
							meul	. y			Standard Standard	andard	
	w	R Tin	ne	Average WR Time	n'	n	Norma	Normal Time		wance	Time	Time	
_	1		e/team							actor			
no. min sec total sec 1 0 45 45				total sec 46.5	2	1.66	Rating 1	total se 46.5			total sec	minute 0.88	
			45	-0.0	~	1.00		-0.0		U.14 I	12.04031	0.00	

Table A5: Repairing Process: Repairing Sub-Process Time Study Result: BU40

lepa		Sub- BU60	Process)	No. of Study Units	ġ	∕₀Distri	bution	Standar (minu			ted Average Time (minutes
	Low		-	44		8		0.3			0.38
N	1ediur High			8		1		0.5			
т			Units	54				0.1			
							Difficult	v			
				Average WR			-	-		Standar	d Standard
		R Tin		Time	n'	n	Norm	al Time	Allowance	e Time	Time
<u>T</u> no.	<u>ime/1</u> min		e/team total sec	total sec			Pating	total sec	Factor	total se	c minute
1	0	23	23	17.6363636	44	43.04	-	17.6364	0.12	20.0413	
2	0	14	14								
3	0	14	14								
4	0	18 24	18 24								
6	0	20	20								
7	0	13	13								
8	0	19	19								
9 10	0	13 22	13 22								
11	0	22 18	18								
12	0	15	15								
13	0	21	21								
14 15	0	19 19	19 19				-				
16	0	13	19								
17	0	18	18							1	
18	0	17	17								
19 20	0	20 14	20 14								
20	0	16	14								
22	0	13	13					7			
23	0	14	14				1111				
24 25	0	20 19	20 19								
26	0	14	14				-				
27	0	20	20								
28	0	22	22	-							
29 30	0	18 14	18								
31	0	17	17								
32	0	19	19								
33	0	21	21								
34 35	0	16 18	16 18								
36	0	15	15							1	
37	0	20	20							1	
38	0	18 20	18 20								
39 40	0	20 18	20 18								
41	0	17	17								
42	0	20	20		Q L	00	101	016	90		
43 44	0	16 17	16 17								
++	0	17	17			19.1	1				
					M	ediun	n Difficu	ilty			
	w	R Tin	ne	Average WR Time	n'	n	Norma	Time A	llowance	Standard Time	Standard Time
			e/team						Factor		
no.	_	_	total sec	total sec 26.25	~	6.00	Rating to		0.10	total sec 29.82955	minute
1	0	25 30	25 30	20.20	8	6.82	1	26.25	0.12	29.02955	0.50
3	0	25	25								
4	0	25	25								
5	0	28 26	28 26								
7	0	25	25								
8	0	26	26								
					I	ligh l	Difficult	y			
		·	_	Average WR					Aller	Standa	ard Standard
		Tim	e	Time	n'	n	Nori	mal Time	Allowand	ce Time	
-	me/1 min		total sec	total sec			Ratin	total see	Factor	total s	ec minute
								,			

Table A6: Repairing Process: Repairing Sub-Process Time Study Result: BU60

Table A7: Repairing Process: Repairing Sub-Process Time Study Result: HS418

Repa	_	Sub HS4 ⁻	-Process I8	No. of Study Units	a	% Distri	bution		rd Time nutes)		l Average me (minutes)
	Low	Diffic	ulty	5		2	5	0	.62	1.	.10
Ν	Aediu	m Dif	ficulty	11		5	5	1	.10		
		Diffic	-	4		2	0	1	.72		
То	otal S	Study	Units	20							
						Low [Difficul	ty			
		/R Ti		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
<u> </u>			ce/team						Factor		
no.	-	_	total sec		_		- ·	total sec		total sec	minute
1	0	31	31	32.6	5	3.97	1	32.6	0.12	37.045455	0.62
2	0	34	34								
3	0	31	31								
4	0	32	32				4.8				
5	0	35	35			_					
					M	ediun	n Diffic	ulty			
		R Tin		Average WR Time	n'	n	Nor	mal Time	Allowanc	e Standard Time	Standard Time
			e/team			2024			Factor		
no.		_	total sec	total sec	1126	Section 1	Ratin	g total se		total sec	
1	0	60	60	58.2727273	11	10.9	7 1	58.272	7 0.12	66.219008	8 1.10
2	1	4	64								
3	1	1	61	3		_					
4	0	52	52								_
5	0	63	63	T					70		
6	0	58	58								
7	0	51	51			1			_		_
8	0	58	58				_	12			
9	1	6	66	6 11	11		18				
10	0	55	55				_			1	_
11	0	53	53		_				-		
		9		61711	9	High I	Difficu	lty	WE	161	0
	W	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
			4						Factor		
Ti	ime/1	lpiec	e/team				Dating	total sec		total and	
Ti no.			total sec	total sec			Raung	iolai sec		total sec	minute
				total sec 91	4	3.38	1	91	0.12	103.40909	1.72
no.	min	sec	total sec		4	3.38	-		0.12		
no. 1	min 1	sec 27	total sec 87		4	3.38	-		0.12		

Repairing Process: Repairing Sub-Process Time Study Result: HS418

Table A8: Repairing Process: Repairing Sub-Process Time Study Result: HS518

Repa		Sub HS5	-Process 18	No. of Study Units	9	6 Distrib	ution	Standaro (minu		Weighted Average Standard Time (minutes)	
	Low	Diffic	culty	12		40		0.5	57	0.9	9
I			ficulty	14		47		1.1	0		
	-	Diffic	-	4		13		1.	9		
Т	otal	Study	/ Units	30							
						Low Di	fficult	у			
	w	R Tir	ne	Average WR Time	n'	n	Nori	mal Time	Allowanc	e Standard Time	Standard Time
Ţ	īme/′	l piec	e/team						Factor		
no.	min		total sec	total sec				total see		total sec	minute
1	0	27	27	29.8333333	12	11.64	1	29.8333	0.12	33.90152	0.57
2	0	26	26				-				
3	0	36	36								
4	0	28	28								
5	0	29	29								-
6	0	32	32								
7	0	31	31			-					-
8	0	29	29								-
9	0	32	32								
10	0	30	30								
11	0	29	29			100					
12	0	29	29								J
	w	D Tin		Average WR		dium			Allowana	Standard	Standard
		R Tin		Average WR Time	Me n'	edium n		ulty nal Time	Allowance	Standard Time	Standard Time
-	ime/1	piec	e/team	Time			Norm	nal Time	Allowance Factor	Time	Time
no.	ime/1 min	piec sec	<u>e/team</u> total sec	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	minute
no. 1	ime/1 min 1	piec sec 9	e/team total sec 69	Time			Norm	nal Time		Time	Time minute
no. 1 2	ime/1 min 1 1	piec sec 9 2	e/team total sec 69 62	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3	ime/1 min 1 0	piec sec 9 2 53	e/team total sec 69 62 53	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4	ime/1 min 1 0 1	piec sec 9 2 53 3	e/team total sec 69 62 53 63	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5	ime/1 min 1 0 1 0	piec sec 9 2 53 3 51	e/team total sec 69 62 53 63 51	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4	ime/1 min 1 0 1	piec sec 9 2 53 3	e/team total sec 69 62 53 63 51 49	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7	ime/1 min 1 0 1 0 0 1	piec sec 9 2 53 3 51 49 1	e/team total sec 69 62 53 63 51 49 61	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6	ime/1 min 1 0 1 0 0	piec sec 9 2 53 3 51 49	e/team total sec 69 62 53 63 51 49	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8	ime/1 min 1 0 1 0 0 1 0	piec sec 9 2 53 3 51 49 1 56	e/team total sec 69 62 53 63 51 49 61 56	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8 9	ime/1 min 1 0 1 0 1 0 1 0 1	piec sec 9 2 53 3 51 49 1 56 0	e/team total sec 69 62 53 63 51 49 61 56 60	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8 9 10	ime/1 min 1 0 1 0 1 0 1 0 1 0	piec sec 9 2 53 3 51 49 1 56 0 54	e/team total sec 69 62 53 63 51 49 61 56 60 54	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8 9 10 11	ime/1 min 1 0 1 0 1 0 1 0 0 0	piec sec 9 2 53 3 51 49 1 56 0 54 53	e/team total sec 69 62 53 63 51 49 61 56 60 54 53	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8 9 10 11 12 12	ime/1 min 1 0 1 0 1 0 1 0 0 1 0 0 1	piec sec 9 2 53 3 51 49 1 56 0 53 0	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8 9 10 11 12 13	ime/1 min 1 0 1 0 0 1 0 1 0 0 1 1 0 0 1 1	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62	Time total sec	n' 14	n 13.45	Norm	total sec 58	Factor	total sec	Time minute
no. 1 2 3 4 5 6 7 8 9 10 11 12 13	ime/1 min 1 1 0 1 0 0 1 1 0 0 1 1 0 0 1 1 0 0	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62 59	Time total sec 58	n' 14	n	Norm	total sec 58	Factor	Time total sec 65.909091	Time minute 1.10
no. 1 2 3 4 5 6 7 8 9 10 11 12 13 14	ime/1 min 1 0 1 0 1 0 1 0 1 1 0 0 1 1 1 0 0 0 1 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2 59 8 R Tir	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62 59	Time total sec 58	n' 14 14	n 13.45	Norm	total sec 58	Factor	Time total sec 65.909091	Time minute 1.10
no. 1 2 3 4 5 6 7 8 9 10 11 12 13 14	ime/1 min 1 1 0 1 0 1 0 1 0 1 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2 59 R Tir Ipiec	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62 59 ne e/team	Time total sec 58	n' 14 14	n 13.45	Norm	total sec 58	Allowance	Time total sec 65.909091	Time minute 1.10
no. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 14	ime/1 min 1 1 0 1 0 1 0 1 0 1 1 0 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2 59 R Tir Ipiec	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62 59 79	Time total sec 58	n' 14 14	n 13.45	Norm	al Time	Allowance	Time total sec 65.909091	Time minute 1.10
no. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 14 10 10 10 10 10 10 10 10 10 10	ime/1 min 1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 0 1 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 0 0 0 0 0 1 0	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2 59 8 R Tir piec sec	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62 59 60 62 59 79	Time total sec 58 4 58 58 58 58 58 58 58 58 58 58	n' 14	n 13.45	Norm Rating	al Time	Factor 0.12	Time total sec 65.909091 -	Time minute 1.10 1.10 Standard Time
no. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 14 10 11 12 13 14 11 12 13 14 11 12 13 14 10 10 10 10 10 10 10 10 10 10	ime/1 min 1 1 0 1 0 1 0 1 0 1 0 1 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 0 0 1 0 0 0 1 1 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 1 0	piec sec 9 2 53 3 51 49 1 56 0 54 53 0 2 59 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	e/team total sec 69 62 53 63 51 49 61 56 60 54 53 60 62 59 60 62 59 79 8 8 8 8 9 8 9 8 9 8 9 8 9 8 9 8 9 8	Time total sec 58 4 58 58 58 58 58 58 58 58 58 58	n' 14	n 13.45	Norm Rating	al Time	Factor 0.12	Time total sec 65.909091 -	Time minute 1.10 1.10 Standard Time

Repairing Process: Repairing Sub-Process Time Study Result: HS518

Repairing Sub-Process No. of Study Standard Time Weighted Average % Distribution of LPO40 Units Standard Time (minutes) (minutes) Low Difficulty 9 27 1.20 2 24 Medium Difficulty 20 61 2.37 High Difficulty 4 12 3.97 **Total Study Units** 33 Low Difficulty Average WR Standard Standard WR Time n' n Normal Time Allowance Time Time Time Time/1piece/team Factor min sec total sec total sec Rating total sec total sec minute no. 10 63.11111111 9 8.34 63.1111 0.12 71.717172 1.20 1 70 1 2 58 0 58 3 1 9 69 1 5 4 65 5 1 7 67 6 0 59 59 0 58 7 58 8 1 3 63 59 59 9 0 **Medium Difficulty** Average WR Standard Standard WR Time n' Normal Time Allowance n Time Time Time Time/1piece/team Factor min sec total sec total sec Rating total sec total sec minute no. 2 16 136 125.3 20 20 125.3 0.12 142.38636 2.37 1 2 1 51 111 3 2 13 133 4 1 39 99 5 2 3 123 2 8 128 6 2 7 10 130 8 2 18 138 52 112 9 1 1 58 118 11 2 1 121 12 53 113 1 2 9 129 23 143 14 2 40 160 15 2 2 16 2 122 17 2 24 144 18 1 57 117 19 2 0 120 20 1 49 109 **High Difficulty** Standard Average WR Standard WR Time n' Normal Time n Allowance Time Time Time Time/1piece/team Factor min sec total sec total sec Rating total sec total sec minute no. 3 33 213 209.75 4 3.44 209.75 0.12 238.3523 3.97 1 3 29 209 222 3 42 3 15 Δ 195

Table A9: Repairing Process: Repairing Sub-Process Time Study Result: LPO40

Repairing Process: Repairing Sub-Process Time Study Result: LPO40

Table A10: Repairing Process: Repairing Sub-Process Time Study Result: SSE17

Repairing Process:	Repairing Su	ub-Process T	ime Study Re	sult: SSE17

	Repairing Sub-Process of SSE17 Low Difficulty Medium Difficulty			No. of Study Units		6 Distrib		Standard (minu	l Time	Weighted Standard Tin	Average
			-	12		32		1.9		3.3	30
N			-	14		37		3.2			
-	, i		-	12		32		4.73	3		
	otal	Stua	y Units	38							
					L	.ow Di	ifficult	У			
	w	R Tin	ne	Average WR Time	n'	n	Norr	nal Time	Allowan	ce Standard Time	Standard Time
<u></u>	ime/1	piec	e/team						Factor	-	
no.	min			total sec			Rating			total sec	minute
1	1	44	104	104.25	12	11.27	1	104.25	0.12	118.4659	1.97
2	1	41	101								
3	1	50	110								
4	1	53	113				_				
5	1	32	92								
6	1	34	94								
7	2	3	123								
8	1	39	99		_						
9	1	44	104								
10	1	43	103			3.46					
11	1	53	113								
12	1	35	95]
					Me	dium	Difficu	ltv			
					inic	aiaiii	Bintoa	lity -			
		R Tin		Average WR Time	n'	n	Norn	nal Time	Allowand	Time	Standard Time
 			e/team total sec	total a co		212	Rating	total aca	Factor		minute
1	2	5ec	177	total sec 170.142857	14	12.77		total sec 170.143	0.12	total sec 193.3442	3.22
2	2	57 17	137	170.142057	14	12.77	-	170.143	0.12	193.3442	3.22
2	2	57	137								
3	2	2	182		1-21	4120					
	2	2 57	177		22	224					
5	2									-	
6 7	2	21 28	201 148							-	
8	3	20	148								
9	2	2 49	169								
10	2	55	175	22							
11	2	36	175								
12	2	44	164	~							
12	2	44	164								
13	2	47 50	170	201		<u> </u>	1.01	15			-
	-			_							
					H	ligh D	ifficult	у		0.5	
	10	R Tir		Average WR Time	n'	n	Norm	al Time	Allowand	Ce Standard Time	Standard Time
т: Т	ime/1		e/team		db	100		C	Factor	61	
1			total sec	total sec			Rating	total sec		total sec	minute
no.	_										
no. 1	4	20	260	250	12	2.64	1	250	0.12	284.0909	4.73
no. 1 2	4 4	20 30	260 270		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3	4 4 4	20 30 3	260 270 243		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3 4	4 4 4 3	20 30 3 53	260 270 243 233		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3 4 5	4 4 4 3 4	20 30 3 53 16	260 270 243 233 256		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3 4 5 6	4 4 3 4 4	20 30 3 53 16 10	260 270 243 233 256 250		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3 4 5	4 4 3 4 4 4	20 30 3 53 16	260 270 243 233 256		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3 4 5 6	4 4 3 4 4	20 30 3 53 16 10	260 270 243 233 256 250		12	2.64	1	250	0.12	284.0909	4.73
no. 1 2 3 4 5 6 7	4 4 3 4 4 4	20 30 53 16 10 21	260 270 243 233 256 250 261		12	2.64			0.12	284.0909	4.73
no. 1 2 3 4 5 6 7 8	4 4 3 4 4 4 4 4	20 30 3 53 16 10 21 8	260 270 243 233 256 250 261 248		12	2.64			0.12	284.0909	4.73
no. 1 2 3 4 5 6 7 8 9	4 4 3 4 4 4 4 3	20 30 53 16 10 21 8 59	260 270 243 233 256 250 261 248 239		12	2.64	1		0.12	284.0909	4.73

Table A11: Repairing Process: Repairing Sub-Process Time Study Result: TFT1205

Repa		Sub STT12	-Process 205	No. of Study Units	9	% Distributio		Standaro (minu		Weighted Average Standard Time (minutes	
	Low	Diffic	ulty	9		43		1.7	7	2.3	3
	Mediu	m Dif	ficulty	8		38		2.3	3		
	High	Diffic	ulty	4		19		3.5	8		
Т	otal	Study	v Units	21							
					I	Low D	ifficult	у			
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
<u>T</u>	ime/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	1	23	83	93.6666667	9	8.63	1	93.6667	0.12	106.4394	1.77
2	1	33	93								
3	1	41	101								
4	1	43	103								
5	1	35	95			. 7					
6	1	30	90				_ ~ ~				
7	1	40	100								
8	1	35	95			10	1.10				
		22	83		_	597	775				
9	1	23	03								
9	1	23	03		23	1110	1150				
9	1	23	03		Me	edium	Difficu	ılty			
9		R Tin		Average WR Time	Me n'	edium n		ulty al Time	Allowance	Standard Time	Standard Time
	W ïme/1	R Tin	ne e/team	_	_		Norm	al Time	Allowance Factor		
	W ïme/1	R Tin	ne	_	_		Norm				
<u></u>	W ïme/1	R Tin	ne e/team	Time	_		Norm	al Time		Time	Time
<u>T</u> no.	W ime/1 min	R Tin pieco sec	n e e/team total sec	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
<u>T</u> no. 1	W ime/1 min 2	R Tin pieco sec 2	ne e/team total sec 122	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
<u>T</u> no. 1 2	W ime/1 min 2 2	R Tin pieco sec 2 17	ne e/team total sec 122 137	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
T no. 1 2 3	W ime/1 min 2 2 2	R Tin pieco sec 2 17 14	ne e/team total sec 122 137 134	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
T no. 1 2 3 4	W ime/1 min 2 2 2 2	R Tin pieco sec 2 17 14 1	ne e/team total sec 122 137 134 121	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
T no. 1 2 3 4 5	W ime/1 min 2 2 2 2 1	R Tin pieco sec 2 17 14 1 59	ne e/team total sec 122 137 134 121 119	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
T no. 1 2 3 4 5 6	W ime/1 min 2 2 2 2 1 1	R Tin pieco sec 2 17 14 1 59 53	ne e/team total sec 122 137 134 121 119 113 113	Time total sec	n'	n	Norm Rating	al Time	Factor	total sec	Time minute
T no. 1 2 3 4 5 6 7	W ime/1 min 2 2 2 2 1 1 1	R Tin piecc 2 17 14 1 59 53 59	ne e/team total sec 122 137 134 121 119 113 119	Time total sec	n'	n 6.34	Norm	al Time total sec 122.875	Factor	total sec	Time minute
T no. 1 2 3 4 5 6 7	W ime/1 min 2 2 2 2 1 1 1	R Tin piecc 2 17 14 1 59 53 59	ne e/team total sec 122 137 134 121 119 113 119	Time total sec 122.875	n'	n 6.34	Norm Rating	al Time total sec 122.875	Factor	Time total sec 139.6307	Time minute 2.33
T no. 1 2 3 4 5 6 7 8	W ime/1 2 2 2 2 1 1 1 1 1 1 8 W	R Tin piecc 2 17 14 1 59 53 59 58 R Tir	ne e/team total sec 122 137 134 121 119 113 119 118 ne	Time total sec	n'	n 6.34	Norm	al Time total sec 122.875	Factor 0.12	Time total sec 139.6307	Time minute 2.33
T no. 1 2 3 4 5 6 7 8	W ime/1 2 2 2 2 1 1 1 1 1 1 8 W	R Tin piecc 2 17 14 1 59 53 59 58 R Tir	ne total sec 122 137 134 121 119 113 119 118	Time total sec 122.875	n' 8	n 6.34 High D	Norm	total sec 122.875	Factor	Time total sec 139.6307	Time minute 2.33
T no. 1 2 3 4 5 6 7 8	W ime/1 2 2 2 2 1 1 1 1 1 1 1 0 W	R Tin piecc 2 17 14 1 59 53 59 58 8 R Tin	ne e/team total sec 122 137 134 121 119 113 119 118 ne	Time total sec 122.875	n' 8	n 6.34 High D	Norm	total sec 122.875	Factor 0.12 Allowar Facto	Time total sec 139.6307 139.6307	Time minute 2.33
T no. 1 2 3 4 5 6 7 8	W ime/1 2 2 2 2 1 1 1 1 1 1 1 0 W	R Tin piecc 2 17 14 1 59 53 59 58 8 R Tin	ne e/team total sec 122 137 134 121 119 113 119 118 ne e/team	Time total sec 122.875	n' 8	n 6.34 High D	Norm	total sec 122.875	Factor 0.12	Time total sec 139.6307 139.6307	Time minute 2.33 Standard Time minute
<u>Т</u> no. 1 2 3 4 5 6 7 8 8 7 8	W ime/1 min 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1	R Tin piecc 2 2 17 14 1 59 53 59 58 58 R Tir piecc sec	ne e/team total sec 122 137 134 121 119 113 119 118 ne e/team total sec	Time total sec 122.875	n' 8	n 6.34 High D	Norm	al Time total sec 122.875	Factor 0.12 Allowar Facto	Time total sec 139.6307 139.6307	Time 2.33 2.33 Standard Time minute
T no. 1 2 3 4 5 6 7 8 8 7 8 7 8 7 7 8 7 7 8	W ime/1 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1	R Tin piecc 2 17 14 1 59 53 59 58 8 R Tin piecc 21	ne e/team total sec 122 137 134 121 119 113 119 118 ne e/team total sec 201	Time total sec 122.875	n' 8	n 6.34 High D	Norm	al Time total sec 122.875	Factor 0.12 Allowar Facto	Time total sec 139.6307 139.6307	Time 2.33 2.33 Standard Time minute

Repairing Process: Repairing Sub-Process Time Study Result: TFT1205

Table A12: Repairing Process: Repairing Sub-Process Time Study Result: TFT1215

Rep		g Sub FFT1	o-Process 215	No. of Study Units	,	% Distrib	ution	Standaro (minu		Weighted Standard Tin	me (minutes)	
	Low	Diffi	culty	4		17		1.8	5	3.1	4	
	Mediu	m Di	fficulty	16		67		2.9	7			
	High	n Diffi	culty	4		17		5.1	2			
	Fotal :	Stud	y Units	24								
				-								
						Low Di	fficulty	/				
	w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	e Standard Time	Standard Time	
Ţ	ïme/1	piec	e/team						Factor			
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute	
1	1	40	100	97.5	4	3.24	1	97.5	0.12	110.7955	1.85	
2	1	30	90									
3	1	39	99									
4	1	41	101									
					_							
					N	ledium	Difficu	Ity				
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time	
Ţ	ime/1	piec	e/team			202/23	14		Factor			
no.	min	sec	total sec	total sec		16.0)	Rating	total sec		total sec	minute	
1	2	16	136	157	16	15	1	157	0.12	178.40909	2.97	
2	2	47	167		4							
3	2	17	137			S. S. C. S.	1120					
4	2	59	179		_							
5	2	31	151		15	2 1 2 1						
6	2	44	164									
7	2	30	150									
8	3	0	180						2			
9	2	33	153									
10	2	51	171									
11	2	44	164									
12	2	25	145			1						
13	2	31	151		1	51197		In i				
14	2	47	167			101						
15	2	50	170			o *						
16	2	7	127	ลงก	5	<u>919</u>	19.8	22	9/161	0.00		
				NNI	d	6 10 d		d	ИO	161 C		
		9				High Di	fficulty	y				
	WR Time		ne	Average WR Time	n	n	Norm	nal Time	Allowan	ce Standard Time	Standard Time	
	vv	Time/1piece/team							Factor			
		piec	e/leam							4-4-1	minute	
<u>1</u> no.	īme/1		total sec	total sec			Rating	total sec	;	total sec	minute	
_	īme/1			total sec 270.5	4	3.504	-	270.5	0.12	307.3864	5.12	
no.	īme/1 min	sec	total sec	-	4	3.504	-					
no. 1	īme/1 min 4	sec 17	total sec 257	-	4	3.504	-					

Repairing Process: Repairing Sub-Process Time Study Result: TFT1215

	epairing Process									Result: TFT1217	
Repa				No. of Study Units	9	6 Distribu	ution	Standard (minu		Weighted Standard Tim	
		Diffi	-	18		35		0.9		1.7	4
ſ		m Di Diffi	fficulty	19 15		37 29		1.9			
т			y Units	15 52		29		2.5			
				-	L	_ow Di	fficult	y			
	w	R Tir	ne	Average WR Time	n'	n	1	nal Time	Allowance	Standard Time	Standard Time
_			e/team						Factor		
no. 1	min 0	sec 46	total sec 46	total sec 47.3888889	18	17.9	Rating 1	total sec 47.3889	0.12	total sec 53.85101	minute 0.90
2	0	51	51	47.3000009	10	17.5		47.3009	0.12	55.85101	0.90
3	0	38	38								
4	0	42	42								
5	0	47 51	47 51								
7	0	49	49								
8	0	48	48								
9	0	51	51								
10	0	47 53	47 53								
12	0	49	49								
13	0	43	43								
14	1	0	60								
15 16	0	44 50	44 50			-					
17	0	43	43								
18	0	41	41								
					Me	edium l	Difficu	lty			
	w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
_			e/team			1661	1223		Factor		
no.	min			total sec	10	18.04	Rating 1		0.12	total sec	minute
1	1	55 49	115 109	101.578947	19	18.04	1	101.579	0.12	115.4306	1.92
3	1	50	110		11.	5.000	1111				
4	1	47	107								
5	1	31 43	91 103		_						
7	1	38	98								
8	1	44	104								
9	1	34	94								
10	1	51	111								
11 12	1	52 23	112 83								
13	1	51	111	510							
14	1	38	98	-							
15	1	54	114								
16 17	1	16 27	76 87	<u> </u>							
-		46									
18	1	40	106	21111							
18 19	1 1	40	106 101								
		_		61 11		ligh Di	fficult	y		0.7	
	1	_	101	Average WR Time	h n'	ligh Di		y al Time	Allowance	Standard Time	Standard Time
19 <u>T</u>	1 Wi	41 R Tin piec	101 ne e/team	Time			Norm	al Time	Allowance Factor	Time	Time
19 <u>Ti</u> no.	1 Wi ime/1 min	41 R Tin piec sec	101 ne e/team total sec	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 <u>Ti</u> no. 1	1 wine/1 min 2	41 R Tin piec sec 8	101 ne e/team total sec 128	Time			Norm	al Time		Time	Time
19 <u>Ti</u> no.	1 Wi ime/1 min	41 R Tin piec sec	101 ne e/team total sec	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 Ti no. 1 2 3 4	1 wi ime/1 2 2 2 2 2	41 R Tin piec sec 8 5 4 16	101 ne total sec 128 125 124 136	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 Ti no. 1 2 3 4 5	1 mine/1 2 2 2 2 2 2	41 R Tin <u>piec</u> sec 8 5 4 16 4	101 ne total sec 128 125 124 136 124	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 Ti no. 1 2 3 4	1 wi ime/1 2 2 2 2 2 2 2 2 2	41 R Tin piec sec 8 5 4 16 4 23	101 ne e/team total sec 128 125 124 136 124 143	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 no. 1 2 3 4 5 6	1 mine/1 2 2 2 2 2 2	41 R Tin <u>piec</u> sec 8 5 4 16 4	101 ne total sec 128 125 124 136 124	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 no. 1 2 3 4 5 6 7 8 9	1 mine/1 2 2 2 2 2 2 2 2 2 2 2 2 1	41 R Tin piec sec 8 5 4 16 4 23 7 27 52	101 ne total sec 128 125 124 136 124 143 127 147 112	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 Tr no. 1 2 3 4 5 6 7 8 9 10	1 mine/1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	41 R Tin piec sec 8 5 4 16 4 23 7 27 52 17	101 e/team total sec 128 125 124 136 124 143 127 147 112 137	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 Ti no. 1 2 3 4 5 6 7 8 9 10 11	1 ime/1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	41 R Tin piec sec 8 5 4 16 4 23 7 27 52 17 10	101 ne e/team total sec 128 125 124 136 124 143 127 147 112 137 130	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 Tr no. 1 2 3 4 5 6 7 8 9 10	1 mine/1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	41 R Tin piec sec 8 5 4 16 4 23 7 27 52 17	101 e/team total sec 128 125 124 136 124 143 127 147 112 137	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 no. 1 2 3 4 5 6 7 8 9 9 10 11 12 13 14	1 ime/1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	41 R Tin piec sec 8 5 4 16 4 23 7 27 52 17 10 4 12 19	101 ne e/team total sec 128 125 124 136 124 143 127 147 112 137 130 124 132 139	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute
19 no. 1 2 3 4 5 6 7 8 9 10 11 12 13	1 me/1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	41 Piec sec 8 5 4 16 4 23 7 27 52 17 10 4 12	101 ne e/team total sec 128 125 124 136 124 143 127 147 112 137 130 124 132	Time total sec	n'		Norm Rating	total sec	Factor	Time total sec	Time minute

Table A12: Repairing Process: Repairing Sub-Process Time Study Result: TFT1217

Table A13: Repairing	Process: Repairing	Sub-Process Time	e Study Result:

TFT1217Galvanized

Repairing Sub-Process of TFT1217G	No. of Stud Units	iy %I	Distrik	oution		dard Tim ninutes)	e We Stand	eighted Ave dard Time (erage (minutes)												
Low Difficulty	52		51			0.95		1.50													
Medium Difficulty	37		37			1.80	_														
High Difficulty	12 101		12			2.92															
Total Study Units	101																				
		L	_ow	Difficu	ulty				1						Me	dium	Difficu	ılty			
WR Time		age WR ïme	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time			/R Tin		Average WR Time	n'	n	Norr	nal Time	Allowance	Standard Time	Standar Time
no. min sec converted to	al coc tot	al sec			Pating	total sec	Factor	total sec	minute	no.			e/team total sec	total sec			Rating	total sec	Factor	total sec	minute
			52	51.63	0.9	49.9154	0.12	56.722028	0.95	1	1	51	111	105.513514	37	34.07	0.9	94.9622	0.12	107.9115	1.80
2 1 0 1	60									2		11 12	131 132					<u> </u>			
	53									4	1	41	101					ļ			
4 0 51 0.85 5 0 42 0.7	51 42		_			_				5	_	23 20	83 80				 				1
6 0 50 0.83333	50									7	1	40	100								1
7 0 59 0.98333	59							-		8	1	23 24	83 84				-				ł
8 0 47 0.78333 9 1 1 1.01667	47 61			-				21-12		10	1	38	98								1
10 0 53 0.88333	53									11	1	57 1	117 121								
1 0 49 0.81667	49									13		58	118								1
2 0 47 0.78333 3 0 55 0.91667	47 55									14	-	26	86					ļ			
4 0 55 0.91667	55									15 16		37 39	97 99				 				1
5 1 0 1	60									17	2	6	126	1							1
6 0 48 0.8	48									18 19	-	55 50	115 110								
7 0 39 0.65 8 0 49 0.81667	39 49									20	1	28	88								
19 0 48 0.8	48									21 22	1	26 45	86 105					ļ			
20 0 50 0.83333	50									23		43	103								
21 0 57 0.95 22 0 55 0.91667	57 55			_		15				24 25		42 52	102 112								
23 0 42 0.7	42									25		50	112								
24 1 3 1.05	63									27	1	30	90								
25 0 49 0.81667	49 62	_	_							28 29	-	6 5	126 125								
26 1 2 1.03333 27 0 46 0.76667	46		-							30	1	46	106								1
28 1 4 1.06667	64									31 32		31 44	91 104								
29 0 40 0.66667	40								ļ	33	1	50	110					<u> </u>			1
30 0 43 0.71667 31 1 3 1.05	43 63				0	/				34 35		25 13	85 133								1
32 0 56 0.93333	56	5			9	19		971	919	36	2	4	133	5							1
33 0 40 0.66667	40			_						37	1	52	112								<u> </u>
34 0 44 0.73333 35 0 40 0.666667	44 40														H	ligh D	ifficult	y			
36 1 5 1.08333	65 60			9	6	5	2	19	98		W	R Tim	e	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standar Time
	53					0	01/	00R		Г	lime/1	piece	/team	Time	b	-	-		Factor	Inte	rine
39 0 46 0.76667 40 1 1 1.01667	46 61								ł				total sec	total sec			Rating	total sec		total sec	minute
	56									1		35	155	171.333333	12	11.35	0.9	154.2	0.12	175.22727	2.92
12 1 11 1.18333	71								1	2	2		171								
	72 67				L				ļ	3	2	31 44	151 164								
	51									5	2		171								
46 1 10 1.16667	70								1	6	2	45	165								
	67]	7	3	0	180								
	78 61									8	3		197								
	76									9 10	2	53 5	173 185								
	59								1				185								
	76									11	2	321	152								

	airing		-Process	No. of Study Units		Distribut		Standard (minu	d Time	Weighted Standard Tin	Average
		Diffic		24		43		0.5	-	1.3	
Ν	Vediu	n Dif	ficulty	16		29		1.3	5		
т	High		ulty Units	16 56		29		2.3	3		
	otart	lady	onits	30	_		6 au 14				
				A		.ow Dif	licuity			64	Charalant
	w	R Tir	ne	Average WR Time	n'	n	Nor	nal Time	Allowar	Standard Time	Standard Time
-			e/team				-		Facto		
no .	min 0	sec 31	total sec 31	total sec 30.8333333	24	22.53	Rating	total se 30.833		total sec 35.03788	
2	0	31	31	30.0333333	24	22.55		30.833	0.12	33.03700	0.00
З	0	29	29								-
4	0	21 33	21 33			-					
6	0	38	38			-					
7	0	31	31								
8	0	28	28								
9 10	0	31 29	31 29								-
11	0	30	30			1			-		-
12	0	29	29								
13 14	0	30 28	30 28								-
15	0	36	20 36			-					-
16	0	33	33			1405					
17	0	28	28								
18 19	0	31 28	31 28								-
20	0	33	33								
21	0	40	40	<u> </u>							
22 23	0	32 31	32 31					_			
24	0	29	29								-
					Ma	dium D	ifficu	4.			
				Average WR	Ivie	alamE	meu	Ly		Standard	Standard
ті		R Tim	e/team	Time	n'	n	Norm	al Time	Allowance Factor	Time	Time
no.	min	sec	total sec	total sec	-		Rating	total sec		total sec	minute
1	1	4	64 73	71.3125	16	14.78	1	71.3125	0.12	81.036932	1.35
3	1	11	71								
4	1	19	79								
5	0	59 17	59 77								
7	1	21	81								
8	1	7	67								
9 10	1	7 18	67 78								
11	1	15	75								
12	1	20	80	<u> </u>							
13	0	58	58	\sim	0.14	- 9.4			99	5	
14	1	13	73								
15	1	9	69							d	
				5	4	d /				4	
15	1	9	69	<u>51 IL</u>	н	ligh Dif	ficulty				
15	1	9	69 70	Average WR Time	H	ligh Dif		/ nal Time	Allowand	e Standard Time	Standard Time
15 16 <u>Ti</u>	1 1 WF me/1	9 10 R Tim	69 70	Time	100 M		Norm	al Time	Factor	^{ie} Time	Time
15 16 <u>Ti</u> no.	1 1 WF me/1 min	9 10 R Tim piece sec	69 70 e /team total sec	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 <u>Ti</u>	1 1 WF me/1	9 10 R Tim	69 70	Time	100 M		Norm	al Time	Factor	^{ie} Time	Time
15 16 <u>Ti</u> no. 1 2 3	1 1 wr me/1 2 1 2	9 10 R Tim piece sec 0 58 2	69 70 he total sec 120 118 122	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4	1 1 wr me/1 2 1 2 1	9 10 R Tim piece sec 0 58 2 40	69 70 ee e/team total sec 120 118 122 100	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 <u>Ti</u> no. 1 2 3	1 1 wr me/1 2 1 2	9 10 R Tim piece sec 0 58 2	69 70 he total sec 120 118 122	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4 5 6 7	1 1 me/1 2 1 2 1 2 2 2 2	9 10 R Tim piece sec 0 58 2 40 10 21 5	69 70 a b b c c c c c c c c	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4 5 6 7 8	1 1 me/1 2 1 2 2 2 2 2	9 10 R Tim piecessec 0 58 2 40 10 21 5 1	69 70 be content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content content cont	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4 5 6 7	1 1 me/1 2 1 2 1 2 2 2 2	9 10 R Tim piece sec 0 58 2 40 10 21 5	69 70 a b b c c c c c c c c	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4 5 6 7 8 9 10 11	1 1 me/1 2 1 2 1 2 2 2 2 2 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 1 2 2 2 1 2	9 10 R Tim piece sec 0 58 2 40 10 21 5 5 1 7 5 2 30	69 70 b /team total sec 120 118 122 100 130 141 125 121 127 112 150	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 no. 1 2 3 4 5 6 7 8 9 10 11 12	1 1 me/1 2 1 2 1 2 2 2 2 2 2 1 2 2 1 2 2 1 2 1	9 10 R Tim piecesec 0 58 2 40 10 21 5 7 7 52 30 59	69 70 2/team total sec 120 118 122 100 130 141 125 121 127 112 150 119	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4 5 6 7 8 9 10 11	1 1 me/1 2 1 2 1 2 2 2 2 2 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 1 2 2 2 1 2	9 10 R Tim piece sec 0 58 2 40 10 21 5 5 1 7 5 2 30	69 70 b /team total sec 120 118 122 100 130 141 125 121 127 112 150	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute
15 16 Ti no. 1 2 3 4 5 6 7 8 9 10 11 12 13	1 1 1 mme/1 2 1 2 2 2 2 2 2 2 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 1 2 2 2 2 2 1 2 2 2 2 2 2 2 2 1 2 1 1 2 1 1 1 1 2 1	9 10 R Tim piece sec 0 58 2 40 10 21 5 5 1 1 7 52 30 59 15	69 70 70 70 70 70 70 70 70 70 70 70 70 70	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute

Table A14: Repairing Process: Repairing Sub-Process Time Study Result: YFT1218

Table A15: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 50x50x1500

			o-Process 0x1500	No. of Study Units		% Distrib	oution	Standaro (minu		Weighted Average Standard Time (minutes)	
	Low	Diffic	culty	4		22		0.5	3	0.9	2
I			ficulty	10		56		0.7	7		
		Diffic	-	4		22		1.	7		
Τ	otal	Study	y Units	18							
						Low D	ifficult	ty			
		R Tir	-	Average WR Time	n'	n	Nor	mal Time	Allowance	Standard Time	Standard Time
<u>T</u>	1	1	e/team			1			Factor		
no.			total sec	total sec		1	Rating			total sec	minute
1	0	28	28	29.5	4	2.3	1	29.5	0.08	32.06522	0.53
2	0	29	29								
3	0	31	31			-					
4	0	30	30			12.20					l
							-				
				- ////	M	edium	Diffici	ulty			
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ti	me/1	piec	e/team		1	Tar	100 L		Factor		
no.	min	sec	total sec	total sec	4	Nale.	Rating	total sec		total sec	minute
1	0	39	39	42.3	10	9.67	1	42.3	0.08	45.978261	0.77
2	0	44	44								
3	0	40	40	-	15/			1			
4	0	45	45								
5	0	38	38	100							
6	0	49	49	24							
7	0	42	42								
8	0	45	45						<u> </u>		
9 10	0	39 42	39 42								
ΙU	U	42	42	21210							
			6	6	K	ligh D	ifficul	ty			
	w	R Tir	ne	Average WR Time	n'	n	Nori	mal Time	Allowance	Standard Time	Standard Time
T	ime/1	piec	e/team		6	00			Factor	1612	
no.	min	sec	total sec	total sec			Rating	total sec	:	total sec	minute
1	1	31	91	94	4	3.8	1	94	0.08	102.1739	1.70
2	1	41	101								
3	1	29	89]
4	1	35	95]
											-

Repairing Process: Repairing Sub-Process Time Study Result: SQ50x50x1500

Table A16: Repairing Process: Repairing Sub-Process Time Study Result: SquarePipe 50x50x3000

			o-Process 0x3000	No. of Study Units	,	%	Distril	bution		rd Time nutes)	Weighted Standard Tir	•
		Diffic		4			22	2	0	.73	1.	10
	Mediu	ım Di	fficulty	10			56	6	0	.95		
	-	n Diffi	-	4			22	2	1	.83		
Т	otal	Stud	y Units	18			\sim	54 J.				
						Lo	ow D	oifficul	ty			
		R Tir	-	Average WR Time	n	·	n	Nor	mal Time	Allowand	Ce Standard Time	Standard Time
<u>T</u>			e/team							Factor		
no.	_		total sec	total sec				Ratin	-		total sec	minute
1	0	41	41	40.5	4	1	3.17	1	40.5	0.08	44.02174	0.73
2	0	38	38									1
3	0	43	43	<u> </u>			-	_				-
4	0	40	40				2.6	7				
	W	R Tin	ne	Average WR Time	n'	1	n	Norm	nal Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piec	e/team				1210	100		Factor		
no.	min	sec	total sec	total sec		4	Val.	Rating	total sec	:	total sec	minute
1	0	58	58	52.2	10		9.61	1	52.2	0.08	56.73913	0.95
2	0	52	52									
3	0	49	49		19	2						
4	0	51	51									
5	0	52	52									
6	1	0	60									
7	0	47	47							711		
8	0	55	55	22						1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -		
9	0	48	48									
10	0	50	50	<u> </u>								
			6	6 11	L	Hi	gh D	Difficu	ty			
	w	R Tin	ne	Average WR Time	n'		n	Norm	al Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piec	e/team							Factor		
no.	min	sec	total sec	total sec	0		20	Rating	total sec		total sec	minute
1	1	39	99	101.25	4	3	3.31	1	101.25	0.08	110.05435	1.83
2	1	49	109									
3	1	37	97									
4	1	40	100									
		·										

Repairing Process: Repairing Sub-Process Time Study Result: SQ50x50x3000

Table A17: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 50x50x6000

			-Process 0x6000	No. of Study Units	%	Distrib	ution	Standaro (minu		Weighted Standard Tin	
		Diffic	-	10		29		1.0		1.6	69
1			ficulty	20		57		1.8			
-	-	Diffic	-	5		14		2.2	5		
	otal	Study	/ Units	35							
					L	ow Di	ifficult	у			
		R Tir		Average WR Time	n'	n	Norm	nal Time	Allowanc	e Standard Time	Standard Time
			e/team total sec	total a a a			Detine		Factor	total ana	minuto
no. 1	1	0	60	total sec 56.6	10	9.51	Rating	total sec 56.6	0.08	total sec 61.52174	minute 1.03
2	0	54	54	50.0	10	3.51		50.0	0.00	01.52174	1.05
3	0	55	55								-
4	0	59	59								1
5	1	4	64								1
6	0	51	51								1
7	0	49	49								1
8	0	57	57								1
9	1	1	61								1
10	0	56	56								1
						I	I				
					Me	dium	Difficu	ulty			
		R Tin	-	Average WR Time	n'	n	Nor	mal Time	Allowanc	e Standard Time	Standard Time
_	<u>Time/1piece/team</u> no. min sec total se					1212	201		Factor		
no.				total sec		121.0		g total sec		total sec	minute
1	1	50	110	103.55	20	19.99	1	103.55	0.08	112.5543	1.88
2	1	41	101								
3	1	30	90		223	1111					_
4	1	20	80		22	2200					_
5	1	42	102					_			_
6	1	40	100				_	_			_
7	1	22	82								_
8	1	51	111					_			_
9	1	27	87								_
10	1	52	112								_
11	1	41	101								_
12	1	49	109	9							1
13	1	49	109	2041	9.17	50	4.01	1	00		4
14	1	51	111								4
15	1	45	105	· · · · •					<u> </u>		4
16	1	52	112					_			4
17	2	1	121	0.00			10		9.9.9	60	Ð I
18	10	55	115								
19	1	33	93							101	
	~	0	120			I			.I		1
20	2										
	2				Н	igh D	ifficult	V			
				Average WR			ifficult		Alleurer	Standard	Standard
20	w	R Tin	-	Average WR Time	H n'	igh D n		t y nal Time	Allowance	Standard Time	Standard Time
20 <u>T</u>	W ïme/1	piec	e/team	Time			Norm	nal Time	Allowance Factor	Time	Time
20 <u>T</u> no.	W ime/1 min	piec sec	e/team total sec	Time total sec	n'	n	Norm Rating	total sec	Factor	Time total sec	Time minute
20 <u>T</u> no. 1	W ime/1 min 2	piec sec 4	e/team total sec 124	Time			Norm	nal Time		Time	Time
20 <u>T</u> no. 1 2	W ime/1 min 2 1	piec sec 4 52	e/team total sec 124 112	Time total sec	n'	n	Norm Rating	total sec	Factor	Time total sec	Time minute
20 T no. 1 2 3	W ime/1 2 1 2	piec sec 4 52 11	e/team total sec 124 112 131	Time total sec	n'	n	Norm Rating	total sec	Factor	Time total sec	Time minute
20 <u>T</u> no. 1 2	W ime/1 min 2 1	piec sec 4 52	e/team total sec 124 112	Time total sec	n'	n	Norm Rating	total sec	Factor	Time total sec	Time minute

Repairing Process: Repairing Sub-Process Time Study Result: SQ50x50x6000

Table A18: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 50x100x4000

			o-Process 0x4000	No. of Study Units	/ %	6 Distribu	tion	Standard (minut		Weighted / tandard Tim													
	Lov	w Diffic	culty	16		22		0.65		1.5	6												
			fficulty	40		56		1.73															
	_	h Diffi		16		22		2.02															
	Total	Stud	y Units	72																			
					L	.ow Dif	ficulty										Me	dium	Difficu	lty			
		/R Tin	-	Average WR Time	n'	n	Norn	al Time	Allowance	Standard Time	Standard Time	_		R Tin	ne e/team	Average WR Time	n'	n	Norm	al Time	Allowance Factor	Standard Time	Standard Time
			e/team	total a co			Detter		Factor	to to La const	and and a	no.			total sec	total sec			Rating	total sec	Factor	total sec	minute
no.	_	-	total sec	total sec		10.50		total sec		total sec	minute	1	1	44	104	95.3	40	38	1	95.3	0.08	103.587	1.73
1	0	39	39	35.6875	16	12.52	1	35.6875	0.08	38.79076	0.65	2	0	40	40								
2	0	36	36					ļ				3	1	32	92								1
3	0	40 38	40 38									4	1	29	89								
5	0	30	30								-	5	1	31	91								
5	0	34	34 35									6	1	33	93								
7	0	29	29									7	1	33	93								
8	0	37	37									8	1	55	115								
9	0	39	39									9	1	37	97								
10	0	33	39									10	1	50	110								ļ
11	0	31	32									11 12	1	41 28	101 88								ł
12	0	35	35									13	2	0	120								
13	0	37	37									14	1	39	99								ł
14	0	40	40								10	15	1	28	88								ł
15	0	33	33									16	1	35	95								1
16	0	36	36									17	1	44	104								
10		00	00									18	1	20	80								
					H	ligh Di	ficulty			12.44		19	1	33	93								
-					-			_		a		20	1	28	88								
	۷	VR Ti	me	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time	21	1	40	100								
-	Time	/1pied	ce/team	Time				-	Factor	Time	Time	22	1	37	97								
no.		1	total sec	total sec			Rating	total sec		total sec	minute	23	1	29	89								
1	2	_	120	111.375	16	15.33	1	111.375	0.08	121.0598	2.02	24 25	1	33 48	93 48								ł
2	1	-	89						136		2.27	25	1	40	40								1
3	2	_	123	l								27	1	24	84		<u> </u>						1
4	1	55	115		1					1		28	1	36	96								1
5	1	59	119	· · · ·								29	1	38	98								1
6	2	0	120									30	2	0	120	1					1		
7	1	41	101									31	1	41	101								
8	1	49	109									32	1	39	99]
9	1	- t	112									33	1	44	104]
10	1	44	104									34	1	51	111								
11	1	48	108					_			1	35	1	48	108								
12	1	57	117									36	1	33	93		L						
13	1	59	119					20	10		Q A	37	1	39	99	6	<u>.</u>	~			·		
14	1	44	104				· · · ·					38	1	33	93		_						
15	2	-	130							0 0		39 40	1	42 37	102 97								4
16	1	32	92									40		51	91			l			I		<u> </u>

Repairing Process: Repairing Sub-Process Time Study Result: SQ50x100x4000

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Table A19: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 50x100x6000

WR Time Time n' n Normal Time Allowance Time/1 piece/team no. min sec total sec Rating total sec total sec 1 0 40 40 38.75 4 3.93 1 38.75 0.08 42 2 0 36 36 -				-Process 0x6000	No. of Study Units	%	Distrib	ution	Standard (minu		Weighted A Standard Tim	•
High Difficulty 4 22 2.35 Total Study Units 18 Low Difficulty WR Time Average WR Time n' no. n Normal Time Allowance St Time/1piece/team no. min sec total sec total sec Rating total sec factor total total sec 1 0 40 40 38.75 4 3.93 1 38.75 0.08 4/2 2 0 36 36 2 1 38.75 0.08 4/2 4 0 38 38 2 1 38.75 0.08 4/2 2 0 36 36 2 1 38.75 0.08 4/2 4 0 38 38 1 1 Normal Time Allowance St 1 12.2 0 9.6 1 112.2 0.08 12 2 1 39 9 2 2 2 <td></td> <td>Low</td> <td>Diffic</td> <td>ulty</td> <td>4</td> <td></td> <td>22</td> <td></td> <td>0.7</td> <td>0</td> <td>1.8</td> <td>1</td>		Low	Diffic	ulty	4		22		0.7	0	1.8	1
Total Study Units 18 Low Difficulty WR Time Average WR Time n' total sec n Normal Time Rating total sec Allowance Factor St total sec 1 0 40 40 38.75 4 3.93 1 38.75 0.08 4////////////////////////////////////	I	Mediu	m Diff	ficulty	10		56		2.0	3		
WR Time Average WR Time n' n Normal Time Rating Allowance factor St 1 0 40 40 38.75 4 3.93 1 38.75 0.08 42 2 0 36 36 4 3.93 1 38.75 0.08 42 2 0 36 36 4 3.93 1 38.75 0.08 42 2 0 36 36 4 3.93 1 38.75 0.08 42 4 0 38 38 4 4 4 6 4 4 6 4 4 6 4 4 6 4 6 4 6 6 6 6 6 6 6 6 6 6 7 7 6 7 6 1 112.2 0.08 12 2 1 39 99 4 6 1 1		-			4		22		2.3	5		
WR Time Average WR Time n' n' no. n Normal Time Allowance Factor St Factor 1 0 40 40 38.75 4 3.93 1 38.75 0.08 42 2 0 36 36 - <td>Т</td> <td>otal S</td> <td>Study</td> <td>Units</td> <td>18</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Т	otal S	Study	Units	18							
WR Time Time n n Normal Time Allowance Time/1pice/team total sec Rating total sec Factor total sec 1 0 40 40 38.75 4 3.93 1 38.75 0.08 42 2 0 36 36 -						L	ow Di	fficult	y			
no. min sec total sec total sec Rating total sec total 1 0 40 40 38.75 4 3.93 1 38.75 0.08 42 2 0 36 36 -					-	n'	n	Norr	mal Time	Allowand	e Standard Time	Standard Time
1 0 40 40 38.75 4 3.93 1 38.75 0.08 42 2 0 36 36 36 36 36 36 36 36 36 37 1 38.75 0.08 42 3 0 41	Ţ	<u>ime/1</u>	piec	e/team			-			Factor		
2 0 36 36	no.	min	sec	total sec	total sec		11.	Rating	total sec		total sec	minute
3 0 41 41 1 <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<>	1	0	40	40	38.75	4	3.93	1	38.75	0.08	42.11957	0.70
4 0 38 38 Medium Difficulty Medium Difficulty WR Time Average WR Time n' n Normal Time Allowance State Time/1piece/team total sec n' n Normal Time Allowance State 1 2 0 120 112.2 10 9.6 1 112.2 0.08 12 2 1 39 99 - <t< td=""><td>2</td><td>0</td><td>36</td><td>36</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	2	0	36	36								
WR Time Average WR Time n' n' total sec n n' Rating Normal Time total sec Allowance Factor State total sec 1 2 0 120 112.2 10 9.6 1 112.2 0.08 12 2 1 39 99 -	3	0	41	41			. 7					
WR Time Average WR Time n' n' total sec n Normal Time Allowance State Factor Image: Time/1piece/team no. min sec total sec n' total sec n Rating total sec Factor total total sec factor fact	4	0	38	38								1
WR Time Average WR Time n' n' total sec n Normal Time Allowance State Factor Image: Time/1piece/team no. min sec total sec n' total sec n Rating total sec Factor total total sec factor fact												
Time In Normal Time Allowance Time/Tpiece/team no. min sec total sec factor footal sec total sec total sec total sec footal sec footal sec total sec total sec footal sec <td< td=""><td></td><td></td><td></td><td></td><td></td><td>Ме</td><td>dium</td><td>Diffic</td><td>ulty</td><td></td><td></td><td></td></td<>						Ме	dium	Diffic	ulty			
no. min sec total sec total sec Rating total sec		w	R Tin	ne	_	n'	n	Norn	nal Time	Allowanc	e Standard Time	Standard Time
1 2 0 120 112.2 10 9.6 1 112.2 0.08 12 2 1 39 99	T	Time/1piece/team					Visio	1001		Factor		
2 1 39 99	no.	min	sec	total sec	total sec	3	Stalla.	Rating	total sec		total sec	minute
3 2 9 129	1	2	0	120	112.2	10	9.6	1	112.2	0.08	121.9565	2.03
4 1 50 110 Image: constraint of the second s	2	1	39	99								
5 1 39 99	3	2	9	129		3	22		1			
6 1 57 117 Image: constraint of the second s	-											
7 1 49 109 Image: constraint of the second s	5				1 Section 1							
8 1 51 111										2		
9 1 51 111										711		
10 1 57 117 Image: High Difficulty High Difficulty WR Time Average WR Time n' n Normal Time Allowance Sta 1 Time/1piece/team Image: High Difficulty Image: High Difficulty Image: High Difficulty Image: High Difficulty									ļ	1999 1997		
High Difficulty WR Time Average WR Time n' n Normal Time Allowance Sta 1 Time/1piece/team I I I I Factor I	_				0						_	
WR Time Average WR Time n' n Normal Time Allowance Sta T Time/1piece/team Factor	10	1	57	117								
Time In In Normal Time Allowance I Time/1piece/team Factor Factor				6	61 I U	Н	igh D	ifficul	ty		3	
						n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
no min sec total sec total sec total sec					6111	99	10			Factor	6	
	no.	_	_		total sec			Rating			total sec	minute
	1	2	-	129	129.75	4	4.01	1	129.75	0.08	141.0326	2.35
2 2 18 138	2	2		138								
3 2 12 132	3	2	12	132								
4 2 0 120	4	2	0	120								

Repairing Process: Repairing Sub-Process Time Study Result: SQ50x100x6000

Table A20: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 75x75x2000

-	-		-Process x2000	No. of Study Units		% Distrib	oution	Standaro (minu		Weighted Standard Tim	•
	Low	Diffic	ulty	4		22		0.5	3	1.2	21
	Mediu	m Dif	ficulty	10		56		1.3	32		
	High	Diffic	ulty	4		22		1.6	63		
1	fotal S	Study	Units	18			<u> </u>				
						Low Di	ifficult	у			
	w	R Tin	ie	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	ime/1	piece	e/team			4			Factor		
no.	min	sec	total sec	total sec		2	Rating	total sec		total sec	minute
1	0	28	28	29	4	2.85	1	29	0.08	31.52174	0.53
2	0	29	29								
3	0	28	28			-					
4	0	31	31			3.10	2 4				
						1					
					M	edium	Difficu	ulty			
WR Time				Average WR Time	n'	n	Norm	nal Time	Allowance	e Standard Time	Standard Time
Time/1piece/team					1	MIG	1000		Factor		
no.	min	sec	total sec	total sec		1210	Rating	total sec		total sec	minute
1	1	10	70	73.1	10	9.73	1	73.1	0.08	79.45652	1.32
2	1	20	80								
3	1	13	73		152						
4	1	17	77								
5	1	10	70								
6	1	18	78						2		
7	1	15	75						711		
8	1	12	72								
9	0	59	59								
10	1	17	77								
			6	ถาบ	U	ligh D	ifficult	y		9	
	WR Time			Average WR	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
	w	R Tim	le	Time							
<u>T</u>		\neg	e/team	Time	ភា			-	Factor		
<u>T</u> no.	ïme/1	piece		Time total sec	51	1	Rating	total sec	Factor	total sec	minute
_	ïme/1	piece	e/team		4	3.87	Rating 1	total sec 90.25	Factor	total sec 98.097826	minute 1.63
no.	ïme/1 min	piece sec	e <u>/team</u> total sec	total sec	4	3.87	-				
no. 1	ïme/1 min 1	piece sec 37	e/team total sec 97	total sec	4	3.87	-				

Repairing Process: Repairing Sub-Process Time Study Result: SQ75x75x2000

Table A21: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 75x75x3000

			-Process ix3000	No. of Study Units		% Distribu	ution	Standard (minut		Weighted / Standard Tim	
	Low	Diffic	ulty	5		20		0.58	3	1.5	6
I			ficulty	15		60		1.75	;		
		Diffic	-	5		20		1.98	3		
Т	otal	Study	/ Units	25							
						Low Di	fficult	у			
		R Tir		Average WR Time	n'	n	Norn	n <mark>al Time</mark>	Allowanc	e Standard Time	Standard Time
	1		e/team			0			Factor		
no.			total sec	total sec		Ť	-	total sec		total sec	minute
1	0	31	31	31.8	5	4.68	1	31.8	0.08	34.56522	0.58
2	0	31	31								
3	0	35	35								
4	0	32	32								
5	0	30	30			2.20			_		
					M	edium I	Difficu	ulty			
	w	R Tin	ne	Average WR Time	n'	n	Nori	mal Time	Allowand	Ce Standard Time	Standard Time
Ti	ime/1	piec	e/team	61048	家	66.5-1	12.8		Factor		
no.	min	sec	total sec	total sec		1212	Rating	total sec		total sec	minute
1	1	37	97	96.3333333	15	13.16	1	96.3333	0.08	104.7101	1.75
2	1	40	100		1126	19 18 18 18 18 18 18 18 18 18 18 18 18 18	1199				
3	1	29	89								
4	1	33	93								
5	1	51	111								
6	1	38	98								
7	1	29	89								
8	1	32	92								
9	1	51	111								
10	1	29	89			1					
11	1	40	100	0							
12	1	30	90	221		10/	01		30	4	
13	1	50	110	5	1						
14	1	36	96		-						
15	1	20	80								
-	-										2
					0	ligh Di	fficult	y O	VIC	J 161	
	WR Time			Average WR Time	n'	n	Nori	nal Time	Allowan	ce Standard Time	Standard Time
Т	ime/	Ipiec	e/team						Factor	r	
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	1	50	110	109.4	5	5.01	1	109.4	0.08	118.913	1.98
2	1	48	108								
3	1	41	101								
4	1	48	108								
5	2	0	120								

Repairing Process: Repairing Sub-Process Time Study Result: SQ75x75x3000

Table A22: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 100x100x1000

Repairing Sub-Process of SQ100x100x1000 Low Difficulty				No. of Study Units	%	Distrib	ution	Standaro (minu		Weighted Standard Tin	•
	Low	Diffic	ulty	4		22		0.8	35	1.4	2
I	Mediu	m Dif	ficulty	10		56		1.2	28		
	High	Diffic	ulty	4		22		2.3	33		
Т	otal S	Study	Units	18			- A -				
					L	ow Di	fficulty	У			
		R Tin		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
<u>T</u>	ime/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	47	47	46.75	4	4.53	1	46.75	0.08	50.81522	0.85
2	0	50	50								
3	0	47	47]
4	0	43	43			2.40]
					Mo	dium	Difficu	ulty			
					Mic	ululli	Dinica	iity			
	WR Time			Average WR Time	n'	n	Norm	nal Time	Allowance	e Standard Time	Standard Time
Ţ	Time/1piece/team					VIIO	1000		Factor		
no.	min	sec	total sec	total sec		1310	Rating	total sec		total sec	minute
1	1	9	69	70.8	10	6.5	1	70.8	0.08	76.95652	1.28
2	1	10	70								
3	1	0	60		3	2.200	3315	1			
4	1	11	71								
5	1	13	73								
6	1	13	73								
7	1	18	78						711		
8	1	9	69	22					100		1
9	1	10	70								1
10	1	15	75]
			6		Н	igh D	ifficult	у		6	
	WR Time			Average WR Time	n'	n	Norma	al Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team		9 6	10			Factor	6/1	
	min	sec	total sec	total sec			Rating	total sec		total sec	minute
no.		1	121	128.5	4	2.45	1	128.5	0.08	139.67391	2.33
no. 1	2										
	2 2	12	132								
1											

Repairing Process: Repairing Sub-Process Time Study Result: SQ10x100x1000

Table A23: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 100x100x2000

-	Repairing Sub-Process of SQ100x100x2000 Low Difficulty			No. of Study Units	%	Distribu	ution	Standard (minut		Weighted A Standard Time	
	Low	Diffic	ulty	6		33		1.17	7	1.53	3
I	Mediu	m Dif	ficulty	9		50		1.52	2		
	High	Diffic	ulty	3		17		2.32	2		
Т	otal S	Study	v Units	18		- A. A.					
					L	ow Di	fficul	ty			
	w	'R Ti	me	Average WR Time	n'	n	Nor	mal Time	Allowand	ce Standard Time	Standard Time
<u> </u>	īme/	1pied	ce/team			9			Factor		
no.	min	sec	total sec	total sec		T	Ratin	g total sec	;	total sec	minute
1	1	5	65	64.3333333	6	4.6	1	64.3333	0.08	69.92754	1.17
2	1	2	62								
3	1	3	63								
4	1	8	68								
5	0	59	59								
6	1	9	69								
		-			Ma	al l'access					
					we	dium	DITTIC	uity			
	WR Time			Average WR Time	n'	n	Norr	nal Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piec	e/team	1 1 h	-	Kala.			Factor		
no.	min	sec	total sec	total sec	T.L.	243 (3	Rating	total sec		total sec	minute
1	1	27	87	83.66666667	9	8.99	1	83.6667	0.08	90.942029	1.52
2	1	24	84		12)	2153					
3	1	19	79				7				
4	1	27	87								
5	1	29	89	50							
6	1	21	81						- Cont		
7	1	18	78								
8	1	13	73								
9	1	35	95	6							
			ส	กาบ	Η	igh Di	ifficul	ty	กา	ร	
	WR Time			Average WR Time	n'	n	Nor	mal Time	Allowand	ce Standard Time	Standard Time
T			e/team	0.921	55	19	9	200	Factor	na(
no.	min	sec	total sec	total sec	<u>d b</u>	100	Ratin	g total sec	VIC	total sec	minute
1	2	13	133	128.333333	3	2.68	1	128.333	0.08	139.4928	2.32
2	2	11	131								
3	2	1	121								1
											•

Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x200

Table A24: Repairing Process: Repairing Sub-Process Time Study Result: SquarePipe 100x100x2500

Repairing Sub-Process of SQ100x100x2500	No. of Study Units	% Distribution	Standard Time (minutes)	Weighted Average Standard Time (minutes)
Low Difficulty	7	35	1.18	1.56
Medium Difficulty	10	50	1.65	
High Difficulty	3	15	2.13	
Total Study Units	20		1	

Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x2500

Low Difficulty Average WB Standard Standard														
W	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time				
ïme/1	piec	e/team			111			Factor						
min	sec	total sec	total sec		11	Rating	total sec		total sec	minute				
1	10	70	65.2857143	7	6.83	1	65.2857	0.08	70.96273	1.18				
1	4	64			. 7									
1	2	62			1 - 17	- 31								
1	13	73												
1	5	65			100	1/21								
1	3	63				20								
1	0	60		22.1	10	11320								
	ime/1	ime/1piec min sec 1 10 1 4 1 2 1 13 1 5 1 3	1 10 70 1 4 64 1 2 62 1 13 73 1 5 65 1 3 63	Wk line Time ime/1piece/team total sec min sec total sec 1 10 70 65.2857143 1 4 664	Writing Average WR Time n' ime/Time total sec n' ime/Time total sec total sec min sec total sec total sec 1 10 70 65.2857143 7 1 4 64 1 1 1 2 62 1 1 1 3 73 1 1 1 5 655 1 1 1 3 633 1 1	WR Time Average WR Time n' n ime/Tpiece/team total sec total sec a 1 10 70 65.2857143 7 6.83 1 4 644 a a a 1 2 62 a a a 1 3 73 a a a a 1 3 633 a a a a	WR Time Average WR Time n' n Norm ime/Tpiece/team total sec total sec Rating 1 10 70 65.2857143 7 6.83 1 1 4 64 <	WR Time Average WR Time n' n Normal Time ime/Tpiece/team total sec min sec total sec Rating total sec 1 10 70 65.2857143 7 6.83 1 65.2857 1 4 64 - <td>WR TimeAverage WR Timen'nNormal TimeAllowance Factorime/Tpiece/team mintotal sectotal secFactor1107065.285714376.83165.28570.0814641262113731565513633</td> <td>WR TimeAverage WR Timen'nNormal TimeAllowance FactorStandard Timeime/Tpiece/team mintotal sectotal secaaaaaaa1107065.285714376.83165.28570.0870.962731464aaaaaaaa1262aaaaaaaa11373aaaaaaaaaa13633aaaaaaaaaaa</td>	WR TimeAverage WR Timen'nNormal TimeAllowance Factorime/Tpiece/team mintotal sectotal secFactor1107065.285714376.83165.28570.0814641262113731565513633	WR TimeAverage WR Timen'nNormal TimeAllowance FactorStandard Timeime/Tpiece/team mintotal sectotal secaaaaaaa1107065.285714376.83165.28570.0870.962731464aaaaaaaa1262aaaaaaaa11373aaaaaaaaaa13633aaaaaaaaaaa				

Medium Difficulty

	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
]	īme/1	piec	e/team		15/2	22	S S S	L'	Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	1	17	77	90.9	10	8.73	1	90.9	0.08	98.80435	1.65
2	1	33	93								
3	1	23	83								
4	1	29	89	22					S.		
5	1	41	101								
6	1	31	91								
7	1	32	92			19	T K T				
8	1	40	100		10	0.1		0.0		7	
9	1	31	91			5				6	
10	1	32	92	2.00				200	0/0	200	

High Difficulty

	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
1	Time/1	Ipiec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	1	57	117	117.666667	3	2.8	1	117.667	0.08	127.8986	2.13
2	2	4	124								
3	1	52	112								

Table A25: Repairing Process: Repairing Sub-Process Time Study Result: SquarePipe 100x100x3000

			Process 0x3000	No. of Study Units	%	Distrib	ution	Standard (minut		Weighted / Standard Tim	
	Low	Diffic	ulty	7		35		1.22	2	1.6	0
1	Mediu		,	10		50		1.65	5		
	Ū	Diffic	,	3		15		2.32	2		
Т	otal S	Study	Units	20		and the	A				
					L	ow Di	fficult	у			
	w	R Tin	ne	Average WR Time	n'	n	Norr	nal Time	Allowanc	e Standard Time	Standard Time
<u></u>	-		e/team			9			Factor		
no.	min	sec	total sec	total sec		T	,	total sec		total sec	minute
1	1	0	60	67.5714286	7	6.39	1	67.5714	0.08	73.4472	1.22
2	1	9	69								
3	1	13	73								
4	1	11	71								
5	1	7	67								
6	1	10	70								
7	1	3	63								
					Me	dium	Diffici	iltv			
								are y			
	w	R Tin	ne	Average WR Time	n'	n Norma		nal Time	Allowance	e Standard Time	Standard Time
<u>T</u>			e/team			14.210		1. Carl	Factor		
no.			total sec	total sec			Rating	total sec		total sec	minute
1	1	45	105	90.9	10	9.27	1	90.9	0.08	98.80435	1.65
2	1	28	88								
3	1	27	87	2					-22		
4	1	19	79	S.A.					1		
5	1	40	100	THE					771		
6	1	27	87								
7	1	29	89								
8	1	29	89	0	6	2					
9	1	34	94	221		9	101	915	ചെ	ST	
10	1	31	91			d /		LL d		J	
					Н	igh Di	fficult	y 👝		0	
	6	R Tin	ne	Average WR Time	n'	n	Nori	nal Time	Allowand	ce Standard Time	Standard Time
		-							Factor		
<u>T</u>	ime/1		e/team				Rating total sec				
<u>T</u> no.	ïme/1 min	sec	total sec	total sec			Rating	, 		total sec	minute
_	ime/1	sec 2		total sec 128.333333	3	2.74	Rating 1	total sec 128.333		total sec 139.4928	minute 2.32
no.	ïme/1 min	sec	total sec		3	2.74	· · · ·	, 			

Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x3000

Table A26: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 100x100x4000

of			Process 0x4000	No. of Study Units	%	Distrib	ution	Standard (minu		Weighted Standard Tin	
	Low	Diffic	ulty	8		33		1.2	2	1.6	66
Ν	Mediur	n Diff	iculty	12		50		1.7	5		
	High			4		17		2.2	7		
Т	otal S	tudy	Units	24		the de					
						.ow Di	fficulty	у			
	W	R Tin	ne	Average WR Time	n'	n	Norn	nal Time	Allowance	Standard Time	Standard Time
Ţ			e/team			ý.			Factor		
no.	min	sec	total sec	total sec		T	Rating	total sec		total sec	minute
1	1	11	71	67.25	8	7.76	1	67.25	0.08	73.09783	1.22
2	1	7	67								
3	1	4	64								
4	1	12	72			- 1-					
5	1	15	75								
6	1	2	62								
7	1	6	66								
8	1	1	61								
					22.0	571.0	1.50				
					Me	dium	Difficu	lty			
		R Tin		Average WR Time	n'	n Norm		nal Time Allowand		Standard Time	Standard Time
_			e/team		1200	1153			Factor		
no.			total sec	total sec	10	7.00	Rating		0.00	total sec	minute
1	1	38	98	96.6666667	12	7.66	1	96.6667	0.08	105.0725	1.75
2	1	28	88								
3	1	43	103								
4	1	41	101								
_		50	440								
5	1	50	110	~~							
6	1	37	97	~ ~							
6 7	1	37 30	97 90	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~							
6 7 8	1 1 1	37 30 29	97 90 89	ล้ายไ		<u>.</u> 19/	181	15	การ		
6 7 8 9	1 1 1 1	37 30 29 31	97 90 89 91	้าาบ	Ľ	ÌV	ម	บริ	11		
6 7 8 9 10	1 1 1 1 1	37 30 29 31 44	97 90 89 91 104	มาบ	IJ			U S O	11		
6 7 8 9 10 11	1 1 1 1 1 1	 37 30 29 31 44 38 	97 90 89 91 104 98	มาบ มาบ	Ĩ.		12		111 94 6		2
6 7 8 9 10	1 1 1 1 1	37 30 29 31 44	97 90 89 91 104	สาม ลาม			EI V		11 1) วิลิ	2
6 7 8 9 10 11	1 1 1 1 1 1	 37 30 29 31 44 38 	97 90 89 91 104 98	ดาาบ ลงก		ligh Di	ifficult	y	111 Me) ວິ ີ ລີ	2
6 7 8 9 10 11	1 1 1 1 1 1	 37 30 29 31 44 38 31 	97 90 89 91 104 98 91	Average WR				-	Allowance	Standard	Standard
6 7 8 9 10 11 12	1 1 1 1 1 1 1 1 1	37 30 29 31 44 38 31 31 R Tin	97 90 89 91 104 98 91	Average WR Time	H n'	ligh Di		y nal Time		Standard Time	Standard Time
6 7 8 9 10 11 12	1 1 1 1 1 1 1 1 1 1 1 1 1	37 30 29 31 44 38 31 31 R Tin piecc	97 90 89 91 104 98 91 91 he	Time			Norm	nal Time	Allowance	Time	Time
6 7 8 9 10 11 12 <u>T</u> no.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	37 30 29 31 44 38 31 31 R Tin piecc sec	97 90 89 91 104 98 91 91 ne e/team total sec	Time total sec	n'	n	Norm Rating	total sec	Factor	Time total sec	Time minute
6 7 8 9 10 11 12 12 T no . 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	37 30 29 31 44 38 31 31 R Tin piecc sec 5	97 90 89 91 104 98 91 91 104 98 91	Time			Norm	nal Time		Time	Time
6 7 8 9 10 11 12 <u>T</u> no.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	37 30 29 31 44 38 31 31 R Tin piecc sec	97 90 89 91 104 98 91 91 ne e/team total sec	Time total sec	n'	n	Norm Rating	total sec	Factor	Time total sec	Time minute

Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x4000

Table A27: Repairing Process: Repairing Sub-Process Time Study Result: Square Pipe 100x100x4500

			-Process 00x4500	No. of Study Units	%	Distrib	ution	Standard (minut		Weighted A Standard Time	e (minutes)
		Diffic	-	14		35		1.30		1.79	9
r			ficulty	20		50		1.97			
_	High		-	6		15		2.35	6		
1	otal	Study	/ Units	40							
					L	ow Di	fficult	y			
				Average WR						Standard	Standard
	w	R Tin	ne	Time	n'	n	Norr	nal Time	Allowand	Time	Time
T	ime/1	piec	e/team				177	1	Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	1	14	74	71.5714286	14	6.99	1	71.5714	0.08	77.79503	1.30
2	1	9	69								
3	1	10	70								
4	1	7	67								
5	1	21	81								
6	1	3	63								
7	1	18	78								
8	1	12	72								
9	1	17	77								
10	1	9	69								
11	1	11	71								
12	1	11	71								
13	1	6	66								
14	1	14	74								
					Me	dium	Diffici	iltv			
						1	-		-		
	w	R Tir	ne	Average WR Time	n'	n	Nor	rmal Time	Allowar	Standard Time	Standard Time
Ţ	ime/1	piec	e/team		17	113/2		2	Facto	r	
no.	min	sec	total sec	total sec	12926	1200	Ratin	g total see		total sec	minute
1	1	51	111	108.55	20	17.62	2 1	108.55	0.08	117.989	1.97
											-
2	1	48	108		2						
3	1	44	104		Ŋ						
3 4	1 1	44 39	104 99		Š						
3 4 5	1 1 1	44 39 52	104 99 112		j.						
3 4 5 6	1 1 1 1	44 39 52 40	104 99 112 100								
3 4 5 6 7	1 1 1 1 1	44 39 52 40 41	104 99 112 100 101								
3 4 5 6 7 8	1 1 1 1 1 1	 44 39 52 40 41 38 	104 99 112 100 101 98								
3 4 5 6 7 8 9	1 1 1 1 1 1 2	 44 39 52 40 41 38 12 	104 99 112 100 101 98 132								
3 4 5 6 7 8 9 10	1 1 1 1 1 1 2 1	 44 39 52 40 41 38 12 39 	104 99 112 100 101 98 132 99								
3 4 5 6 7 8 9 10 11	1 1 1 1 1 2 1 1	 44 39 52 40 41 38 12 39 50 	104 99 112 100 101 98 132 99 110								
3 4 5 6 7 8 9 10 11 12	1 1 1 1 1 1 2 1 1 1 1	 44 39 52 40 41 38 12 39 50 54 	104 99 112 100 101 98 132 99 110 114								
3 4 5 6 7 8 9 10 11 12 13	1 1 1 1 1 2 1 1 1 2	 44 39 52 40 41 38 12 39 50 54 23 	104 99 112 100 101 98 132 99 110 114 143								
3 4 5 6 7 8 9 10 11 12 13 14	1 1 1 1 1 1 2 1 1 1 2 1 2 1	 44 39 52 40 41 38 12 39 50 54 23 41 	104 99 112 100 101 98 132 99 110 114 143 101								
3 4 5 6 7 8 9 10 11 12 13 14 15	1 1 1 1 1 1 2 1 1 1 2 1 1 2 1 1	 44 39 52 40 41 38 12 39 50 54 23 41 38 	104 99 112 100 101 98 132 99 110 114 143 101 98								
3 4 5 6 7 8 9 10 11 12 13 14 15 16	1 1 1 1 1 1 2 1 1 1 2 1 1 1 1 1 1	 44 39 52 40 41 38 12 39 50 54 23 41 38 45 	104 99 112 100 101 98 132 99 110 114 143 101 98 105								
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	1 1 1 1 1 2 1 1 1 2 1 1 1 1 1 1 1 1 1 1	 44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110								
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1	 44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118								2
3 4 5 6 7 8 9 9 10 11 12 13 14 15 16 17 18 19	1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99								2
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18	1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1	 44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118								2
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	1 1 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99			igh Di					2
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39 49	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109	Average WR						Standard	Standard
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39 49 R Tir	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109	Average WR Time		igh Di			Allowanc	Standard	8
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39 49 R Tir	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109							Standard	Standard
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39 49 R Tir piec	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109					ty nal Time	Allowanc	Standard	Standard
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 58 39 49 R Tir piec	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109	Time			Norr	ty nal Time	Allowanc	e Standard Time	Standard Time
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 17 18 19 20 7 no. 1 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 54 23 41 38 45 50 8 9 9 9 9 8 7 8 8 8 9 9 9 9 9 9 9 7 8 8 8 9 9 7 2 8 8 8 9 9 7 8 9 9 7 9 9 9 7 9 9 9 9 9 9	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109 109	Time total sec	n'	n	Norr Rating	ty nal Time	Allowance	Pe Standard Time total sec	Standard Time
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 T no. 1 2 3	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 54 23 41 38 45 50 8 9 9 9 9 9 9 7 7 8 8 7 8 8 9 9 7 7 8 8 8 9 9 7 7 7 8 8 8 7 7 8 7 7 7 7	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109 109 109	Time total sec	n'	n	Norr Rating	ty nal Time	Allowance	Pe Standard Time total sec	Standard Time
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 20 T no. 1 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	44 39 52 40 41 38 12 39 50 54 23 41 38 45 50 54 23 41 38 45 50 8 9 9 9 9 8 7 8 8 8 9 9 9 9 9 9 9 7 8 8 8 9 9 7 2 8 8 8 9 9 7 8 9 9 7 9 9 9 7 9 9 9 9 9 9	104 99 112 100 101 98 132 99 110 114 143 101 98 105 110 118 99 109 109	Time total sec	n'	n	Norr Rating	ty nal Time	Allowance	Pe Standard Time total sec	Standard Time

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Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x4500

Table A28: Repairing Process: Repairing Sub-Process Time Study Result: SquarePipe 100x100x5000

Repa	airing	Sub-	Process 0x5000	No. of Study Units		Distribu		Standard (minut	Time	Weighted A Standard Tim	Average
	Low	Diffic	ulty	7		20		1.32	2	1.9	1
N	Aediu		-	21		60		1.83			
-	-	Diffic	-	7 35		20		2.75			
1	otal S	study	Units	პნ							
					L	ow Dif	ficul	t y			
		R Tin		Average WR Time	n'	n	Nor	mal Time	Allowan	Time	Standard Time
_	1	1 1	<u>e/team</u>			22316	Detin	-	Factor		an investor
no.	1 min	sec 21	total sec 81	total sec 73	7	6.78	Ratin 1	g total sec 73	0.08	total sec 79.34783	minute 1.32
2	1	9	69	, ,		0.70		/0	0.00	10.04100	1.02
3	1	10	70								
4	1	17	77			//					
5	1	6	66								1
6	1	13	73								1
7	1	15	75]
					Ma	dium [1414			
					we	aium L	JIIIC	uity	-		
	w	R Tin	ne	Average WR Time	n'	n	No	mal Time	Allowan	ce Standard Time	Standard Time
_	<u>Time/1piece/team</u> c. min sec total sec					17723	2		Factor		
no.				total sec		10.01		g total sec		total sec	minute
1	1	48	108	100.952381	21	19.61	1	100.952	0.08	109.7308	1.83
2		55	115								
3	1	41	101								1
4	1	43 57	103		11.26556		11101				1
6	1	46	106								1
7	1	29	89								1
8	1	33	93				_				1
9	2	0	120								1
10	1	21	81								1
11	1	38	98								
12	1	41	101								1
13	1	49	109								1
14	1	52	112			1			1		1
15	1	38	98	0	6	1					1
16	1	31	91	2291		19/		914	5	4]
17	1	51	111]
18	1	47	107								
19	1	29	89			5				9	
20	1	20	80	1.9.9.4	3		10	200	010	100	PI
21	1	31	91		dh	6					
		9			Н	igh Di	fficul	ty			
	w	R Tin	ne	Average WR Time	n'	n	Nori	nal Time	Allowanc	e Standard Time	Standard Time
T	ïme/1	lpiec	e/team						Factor		
no.			total sec	total sec			Rating			total sec	minute
1	2	44	164	151.714286	7	6.89	1	151.714	80.0	164.9068	2.75
2	2	21	141								
3	2	34	154								
4	2	31	151								
5	2	14	134								
6	2	38	158								
7	2	40	160					1			

Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x5000

Table A29: Repairing Process: Repairing Sub-Process Time Study Result: SquarePipe 100x100x6000

			-Process 00x6000	No. of Study Units	%	Distribu	ition	Standard (minute		Weighted Average Standard Time (minutes)	
	Low	Diffic	culty	4		14		1.25		1.8	9
	Mediu	m Dif	ficulty	12		43		1.78			
	High	Diffic	culty	12		43		2.20			
Т	fotal \$	Study	/ Units	28							
					L	ow Di	fficulty	y			
		R Tir		Average WR Time	n'	n	Norm	nal Time	Allowand	Ce Standard Time	Standard Time
<u>T</u>	ime/1	piec	e/team						Factor		
no.	_	-	total sec	total sec			Rating	_		total sec	minute
1	1	7	67	62.75	4	3.73	1.1	69.025	0.08	75.02717	1.25
2	1	4	64								
3	1	1	61								
4	0	59	59								
					Me	dium [Difficu	lty			
				Average WR		-		-		Standard	Standard
	w	R Tin	ne	Time	n'	n	Norm	nal Time	Allowance	Time	Time
Ţ	Time/1piece/team								Factor		
no.			total sec	total sec		and day	Rating total sec			total sec	minute
1	1	41	101	98.1666667	12	11.15	1	98.1667	0.08	106.7029	1.78
2	1	33	93								
3	1	34	94					-			
4	1	40	100		1255	1. C.					
5	1	45	105								
6	1	39	99		50	1000	220				
7	1	41	101								
8	1	35	95								
9	2	0	120								
10	1	32	92	1					ind.		
11	1	28	88								
12	1	30	90								
				0							
			- 4	000	н	igh Di	fficult	у	00		
		R Tin	le	Average WR Time	n'	n	Norm	nal Time	Allowanc	e Standard Time	Standard Time
			e/team			0			Factor		
no.	_	_	total sec	total sec	10	40.00	Ŭ	total sec	0.00	total sec	minute
1	2	2	122	121.666667	12	10.98	1	121.667	0.08	132.2464	2.20
2	2	0 45	120								1
3	1		105								1
4	2	11	131								1
	2	1	121								1
6	2	17	137								
7	2	1	121								
0	2	0	120								
8		9	129								
9	2		104								
9 10	2	11	131								
9			131 123 100								

Repairing Process: Repairing Sub-Process Time Study Result: SQ100x100x6000

Table A30: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x1000

	iring f RO 4		Process 1000	No. of Study Units	%	Distribu	ution	Standard (minu		Weighted Standard Tin	
	Low	Difficu	ulty	20		83		0.4	2	0.4	47
N	1ediur	n Diffi	culty	4		17		0.7	5		
Т	otal S	tudy	Units	24							
					L	.ow Di	fficult	у			
	w	R Tin	ne	Average WR Time	n'	n	Nori	mal Time	Allowanc	e Standard Time	Standard Time
Ţ	īme/1	lpiec	e/team	-					Factor		
no.	min	sec	total sec	total sec		3	Rating	total sec		total sec	minute
1	0	25	25	26.05	20	19.92	0.9	23.445	0.08	25.4837	0.42
2	0	27	27								
3	0	30	30								1
4	0	29	29								1
5	0	25	25								1
6	0	22	22								1
7	0	24	24		2	10					1
8	0	23	23								1
9	0	21	21								
10	0	30	30		1	1990					1
11	0	27	27			1.1.1.	2/1				1
12	0	31	31		1.77	1000				2	
13	0	25	25								1
14	0	27	27		125	015-0	1.11				1
15	0	27	27								1
16	0	26	26								1
17	0	30	30								
18	0	25	25								1
19	0	21	21								1
20	0	26	26								1
	·	· · · · ·	_	~~~~	Ме	ı dium l	Difficu				
	W	R Tin	ne Ol	Average WR Time	n'	n		nal Time	Allowance	Standard Time	Standard Time
Т	ime/1	piece	e/team						Factor		
			total sec	total sec			Ratina	total sec	9/12	total sec	minute
1	0	43	43	46	4	3.4	0.9	41.4	0.08	45	0.75
2	0	46	46								
3	0	46	46								
4	0	49	49								
								L			1

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x1000

Table A31: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x1500Galvanized

Rep	Repairing Sub-Process of RO 48.6x1500 G. Low Difficulty			f No. of Stud Units	ly	% Distri	bution	(minutes)		Weighted Average Standard Time (minutes	
	Lov	<i>N</i> Diffi	culty	20		8	3	0.4	48	0.	54
	Medi	um D	ifficulty	4		1	7	0.8	80		
	Total	Stud	y Units	24							
						Low Di	fficulty	/			
	w	R Tin	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec		0	Rating	total sec		total sec	minute
1	0	24	24	26.7	20	17.3	1	26.7	0.08	29.02174	0.48
2	0	29	29			100					
3	0	31	31]
4	0	26	26								
5	0	31	31			1-2					
6	0	26	26								1
7	0	21	21								1
8	0	30	30			3 10					1
9	0	27	27			652					1
10	0	25	25			176					1
11	0	25	25		1						
12	0	31	31			16/6	814				1
13	0	26	26								1
14	0	26	26								1
15	0	30	30		12	1133	1.501				
16	0	25	25				~~~~				1
17	0	23	23								1
18	0	27	27								
19	0	27	27						1		
20	0	24	24]
					Μ	edium	Difficu	lty		-	-
	WR Time Average WR Time					n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	43	43	44	4	3.72	1	44	0.08	47.82609	0.80
2	0	46	46		0	01200				101	
3	0	46	46			1					
4	0	41	41								

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x1500Gal.

Table A32: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x2000

Repa	-		Process of 2000	No. of Stud Units	у	% Distrib	oution	Standard (minu		Weighted Standard Tin	Average ne (minutes)
	Lov	v Diffi	culty	16		80		0.3	3	0.4	2
			fficulty	4		20		0.7	5		
	Total	Stud	y Units	20							
						Low Dif	fficulty	1			
		R Tin		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	ïme/1	piec	e/team	-					Factor		
no.	min	sec	total sec	total sec		9	Rating	total sec		total sec	minute
1	0	17	17	15.3125	16	12.55	1.2	18.375	0.08	19.97283	0.33
2	0	15	15								
3	0 16 16										1
4	0 14 14]
5	0 15 15					1 2. 200					1
6	0	14	14			_					1
7	0	17	17			10					1
8	0	15	15								
9	0	14	14				14				1
10	0	16	16			1 200					
11	0	17	17			100	210				1
12	0	16	16			0					1
13	0	15	15			10 X X X Y Y					1
14	0	15	15		12	1111	1.1.1.5				1
15	0	12	12								5
16	0	17	17								
				25	M	edium [Difficu	lty	Ber -		
	w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	ime/1	piec	e/team	0				6	Factor		
no.	min	sec	total sec	total sec		00	Rating	total sec	225	total sec	minute
1	0	37	37	34.5	4	3.02	1.2	41.4	0.08	45	0.75
2	0	34	34							0.4	
3	0	33	33		~		10.4		0.0.0.		
4	0	34	34						7151		
	å				0					1011	

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x2000

Table A33: Repairing Process: Repairing Sub-Process Time Study Result: Round Pipe 48.6x2000G

Repa	airing RO 4	Sub- 8.6x2	Process of 2000G	No. of Stud Units	у	% Distri	bution		rd Time lutes)	Weighted Standard Tir	
	Lov	v Diffi	culty	20		8	3	0.	.33	0.4	42
	Medi	um Di	ifficulty	4		17	7	0.	.83		
	Total	Stud	y Units	24							
						Low Di	fficulty	/			
	w	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowar	Standard Time	Standard Time
<u>T</u>	ime/1	piec	e/team						Facto	r	
no.	min	sec	total sec	total sec			Ratin	g total se	ec	total sec	minute
1	0	14	14	15.35	20	17.8	4 1.2	18.42	2 0.08	20.0217	0.33
2	0	17	17								
3	0	17	17								
4	0	16	16								1
5	0	18	18			1					1
6	0	14	14								1
7	0	15	15								
8	0	17	17								1
9	0	18	18			170	-				1
10	0	16	16				1				1
11	0	14	14			1.010	7				1
12	0	13	13		182	2.44	1 2 10 1				1
13	0	15	15		-						1
14	0	18	18		157	100					1
15	0	15	15								1
16	0	14	14				-				1
17	0	14	14								-
											-
18	0	13	13								-
19	0	14	14								-1
20	0	14	14	0							1
		_	2	<u>ถาย</u>	M	edium	Difficu	lty	21	<u>s</u>	
	WR Time			Average WR Time	n'	n>	Norm	al Time	Allowanc	e Standard Time	Standard Time
Ţ	ime/1	piec	e/team	1981			19/		Factor	121	
no.	min	sec	total sec	total sec	0	D DOC	Rating	total sec		total sec	minute
1	0	38	38	38	4	3.88	1.2	45.6	0.08	49.56522	0.83
2	0	35	35								
3	0	40	40								
4	0	39	39								

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x2000Gal.

Table A34: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x3000

lepa			Process of	No. of Stud Units	ly	% Distrib	ution	Standard (minut		Weighted A Standard Tim	
	Lov	v Diffi	culty	20		80		0.40)	0.5	0
	Medi	um D	ifficulty	5		20		0.88	3		
	Total	Stud	y Units	25							
					L	.ow Dif	ficulty	1			
	w	R Tin	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time
T	ime/1	piec	e/team						Factor		
10.	min	sec	total sec	total sec		0	Rating	total sec		total sec	minute
1	0	24	24	22.2	20	17.08	1	22.2	0.08	24.13043	0.40
2	0	19	19								
3	0	21	21								
4	0	20	20								
5	0	24	24								
6	0	21	21			2.401					
7	0	27	27								
8	0	19	19			10					
9	0	22	22								
10	0	25	25			102/04	14				
11	0	23	23		2.1	C. ()	11.8				
12	0	24	24								
13	0	20	20								
14	0	25	25			100					
15	0	21	21								
16	0	19	19		19/2	113.4	1315				
17	0	24	24								
18	0	22	22								
19	0	22	22								
20	0	24	24								
	U	20	20							<u> </u>	
					Ме	dium D	Difficu	lty			
		R Tir	- 617	Average WR Time	n'	n	Norm	nal Time	Allowanc	e Standard Time	Standaro Time
Т	ïme/	lpiec	e/team		1	5 V		U d	Factor		
10.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	45	45	48.4	5	3.99	1	48.4	0.08	52.6087	0.88
2	0	50	50								
3	0	47	47		0.0					101	
4	0	48	48			1		1			1
5	0	52	52								-

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x3000

Table A35: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x4000

Repa			Process of 4000	No. of Stud Units	у	% Distri	bution		rd Time utes)	Weighted Standard Tir	
	Lov	v Diffi	culty	18		7	5	0.	47	0.	59
	Medi	um Di	ifficulty	6		2	5	0.	95		
	Total	Stud	y Units	24							
						Low D	ifficult	y			
	w	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowanc	e Standard Time	Standard Time
T	ïme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Ratin	g total see		total sec	minute
1	0	24	24	26.1111111	18	17.7	1	26.1111	0.08	28.38164	0.47
2	0	26	26								
3	0	25	25								
4	0	28	28								
5	0	21	21								
6	0	24	24			1.20					1
7			31								1
8	0	27	27		-	16					1
9	0	24	24		1	1					
10	0	30	30			1114	4				1
11	0	21	21		1	668	12.8				1
12	0	27	27			1212					1
13	0	30	30								
14	0	28	28			6.013	11/2/2				
15	0	25	25								
16	0	26	26	-	5						
17	0	25	25								
18	0	28	28								
				14						-	
					M	edium	Difficu	ulty			
		R Tin		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
_			e/team		h L	50	0.0	010	Factor	~	
no.			total sec	total sec			Rating	total sec		total sec	minute
1	0	52	52	52.3333333	6	5.58	1	52.3333	0.08	56.88406	0.95
2	0	56	56			5		6		0	
3	0	50	50	9.9.91	1		19	201	19/10	120	61
4	0	54	54		d		51			Ц. Ц. Ы	C
5	0	55	55								
6	0	47	47								

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x4000

Table A36: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x4500

Repa	epairing Sub-Process of RO 48.6x4500 Low Difficulty			f No. of Stud Units	у	% Distri	bution		urd Time nutes)	Weighted Standard Tir	
	Lov	v Diffi	culty	20		7	7	0	.58	0.0	69
	Medi	um D	ifficulty	6		2	3	1	.05		
	Total	Stud	ly Units	26							
						Low D	ifficult	у			
	W	R Tin	ne	Average WR Time	n'	n	No	rmal Time	e Allowar	nce Standard Time	Standard Time
Ţ	ime/1	piec	e/team			1			Facto	or	
no.	min	sec	total sec	total sec			Ratin	ng total s	ec	total sec	minute
1	0	29	29	31.8	20	18.2	9 1	31.8	0.08	34.56522	0.58
2	0	31	31								
3	0	30	30								
4	0	27	27								
5	0	35	35			1.7					
6	0	32	32								
7	0	38	38								
8	0	37	37								
9	0	29	29			132	81				
10	0	34	34		-	170		7			
11	0	27	27				-				
12	0	36	36			100	18/1				
13	0	30	30	· · · · · · · · · · · · · · · · · · ·							-
14	0	29	29								
15	0	33	33		200	1. 7/1	11 11	-			
16	0	31	31		20		22				
17	0	28	28								1
18	0	34	34								
19	0	37	37								1
20	0	29	29								1
									1		-
				~	M	edium	Difficu	lty			
		R Tir		Average WR Time	n'	n	Norm	al Time	Allowanc	e Standard Time	Standard Time
		1 I	e/team		1	- v			Factor		
no.	min		total sec	total sec		5	Rating	total sec		total sec	minute
1	0	55	55	57.83333333	6	5.97	1	57.8333	0.08	62.86232	1.05
2	1	3	63						0110	101	
3	0	58	58								
4	0	5 9	59								
5	1	0	60								
6	0	52	52								

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x4500

Table A37: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x5000

Repa			Process of 5000	No. of Study Units	y ,	% Distrib	oution	Standard (minu		Weighted A Standard Tim			
	Lov	v Diffi	culty	20		77		0.4	8	0.61			
	Medi	um D	ifficulty	6		23		1.0	5				
	Total	Stud	y Units	26									
					L	ow Di	fficulty	/					
	WR Time		-	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time		
<u>T</u>	<u>ime/1</u>	lpiec	e/team	-					Factor				
no.	min	sec	total sec	total sec		3	Rating	total sec		total sec	minute		
1	0	30	30	26.65	20	18.99	1	26.65	0.08	28.96739	0.48		
2	0	26	26										
3	0	21	21										
4	0	31	31										
5	0	26	26										
6	0	28	28										
7	0	27	27			10							
8	0	30	30		-								
9	0	24	24								1		
10	0	27	27		~	6613	11.3						
11	0	25	25										
12	0	25	25			1.1.2		2					
13	0	29	29			5 . S. S. S.							
14	0	30	30			1015-0	111						
15	0	23	23				222						
16	0	26	26										
17	0	24	24										
18	0	28	28						-				
19	0	22	22										
20	0	31	31										
				e	Ме	dium	Difficu	lty 🦳	-				
				Average WR			121		22	Standard	Standard		
	w	'R Tii	me 🔍	Time	n'	On V	Norm	al Time	Allowance	Time	Time		
<u>T</u>	1	1	ce/team	-	~				Factor				
no.		-	total sec	total sec	17		Rating	total sec	4/16	total sec	minute		
1	0	57	57	58.1666667	6	4.32	1	58.1667	0.08	63.22464	1.05		
2	0	54	54										
3	1	0	60										
4	1	2	62							1			

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0 55

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55 61

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x5000

Table A38: Repairing Process: Repairing Sub-Process Time Study Result: RoundPipe 48.6x6000

Repairing Sub-Process of RO 48.6x6000			No. of Stud Units	% Distrib	ution	Standard Time (minutes)			Weighted Average Standard Time (minutes)				
	Lov	v Diffi	culty	16		80			0.50			0.62	2
	Medi	um Di	fficulty	4		20			1.10)			
	Total	Stud	y Units	20									
						Low Dif	ficulty	/					
	w	R Tin	ne	Average WR Time	'n	n	Nor	mal Time		Allowan	ce	Standard Time	Standard Time
Time/1piece/team			e/team							Facto	r		
no.	min	sec	total sec	total sec			Ratin	g total	sec			total sec	minute
1	0	25	25	24.875	16	15.47	1.1	27.3	625	0.08		29.74185	0.50
2	0	26	26										
3	0	22	22										
4	0	24	24										
5	0	26	26			1 5 6							
6	0	27	27										
7	0	25	25										
8	0	29	29			1							
9	0	28	28			141 Cal.							
10	0	22	22		2	(66 (C))	2.8						
11	0	19	19			122							
12	0	23	23										
13	0	25	25		114	556 - 552 1-27	122						
14	0	24	24										
15	0	27	27			2.2.2.2.2							
16	0	26	26										

Repairing Process: Repairing Sub-Process Time Study Result: RO48.6x6000

	Medium Difficulty														
	WR Time		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time					
T	ïme/1	piec	e/team	0					Factor						
no.	min	sec	total sec	total sec		50/	Rating	total sec	000	total sec	minute				
1	0	51	51	55	4	3.438	1.1	60.5	0.08	65.76087	1.10				
2	0	55	55												
3	0	56	56			0									
1	0	58	58	ลงรา	55	119	193		9/101	121					

Table A39: Repairing Process: Repairing Sub-Process Time Study Result: Pipe

Modification

٧		w	R Tin	ne	Average WR Time	n'	n	Normal Time		Allowance	Standard Time	Standard Time	
Product	Process	Ī	ïme/1	piec	e/team						Factor		
Name		no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
SQ50x100xlength	Repairing Sub-Process	1	0	39	39	41.2	5	3.92	1	41.2	0.08	44.78261	0.75
	(Pipe Modification)	2	0	45	45								
		3	0	40	40								
		4	0	41	41								
		5	0	41	41								
V	Nork Detail		w	/R Tir	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time
Product	Process	1	lime/	1piec	ce/team						Factor		
Name		no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
SQ75x100xlength	Repairing Sub-Process	1	0	44	44	41.5555556	9	4.55	1	41.5556	0.08	45.16908	0.75
	(Pipe Modification)	2	0	41	41								
		3	0	39	39	-							
		4	0	43	43								
		5	0	45	45								1
		6	0	41	41								
		7	0	38	38								l
		8	0	40	40								1
		9	0	43	43								l
	Nork Detail	-		/D Ti		Average WR		n	-	nal Timo	Allowanc	Standard	Standard

Work Detail			w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Product	Process	Ī	Time/1piece/team			The second has					Factor		
Name		no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
SQ100x100xlength	Repairing Sub-Process	1	0	47	47	50	4	4.16	1	50	0.08	54.34783	0.91
	(Pipe Modification)	2	0	54	54								
		3	0	49	49								
		4	0	50	50								

Wor		w	R Tir	ne	Average WR Time	n'	n	Normal Time		Allowance	Standard Time	Standard Time	
Product	Process	1	īme/′	1 piec	e/team						Factor		
Name		no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
Round Pipe 48.6xlength	Repairing Sub-Process	1	0	27	27	28.6666667	6	5.6247	1	28.6667	0.08	31.15942	0.52
	(Pipe Modification)	2	0	29	29								
		3	0	29	29								
		4	0	31	31					_			
		5	0	26	26								
		6	0	30	30								

สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย Table A40.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 200x1200

	tal Fo 0x120	-	No. of Study Units	% [Distribu	ition	Standard (minut	-	Weighted Average Standard Time (minutes)			
spe	eed 8	30	2		20		0.27	7	0.21			
spe	ed 9	0	4		40		0.23	3				
spe	ed 10	00	4		40		0.17	7				
otal S	tudy	Units	10			N. A						
					Spe	ed 80						
W	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowanc	e Standard Time	Standard Time		
me/1	piec	e/team						Factor				
min	sec	total sec	total sec			Rating	total sec		total sec	minute		
0	15	15	15.5	2	1.66	1	15.5	0.03	15.97938	0.27		
0	16	16			////							
					Spe	ed 90				-		
WR Time			Average WR Time	n'	n	Norn	nal Time	Allowanc	e Standard Time	Standard Time		
me/1	piec	e/team		3	S 69	1 13		Factor				
min	sec	total sec	total sec		SA/	Rating	total sec	;	total sec	minute		
0	14	14	13.5	4	2.19	1	13.5	0.03	13.91753	0.23		
0	13	13			101	1000						
0	14	14		_	1010	1011						
0	13	13		166		1999						
				33)	Spe	ed 100				•		
WF	R Tim	ie	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
me/1	piece	e/team	Series -					Factor				
min	sec	total sec	total sec	-		Rating	total sec	111	total sec	minute		
0	9	9	9.75	4	3.16	1	9.75	0.03	10.051546	0.17		
0	10	10										
0	10	10		_	9							
0	10	10	51114	4	14	1 2	415	51111				
	spe spe spe spe wtal S W me/1 min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	speed 8 speed 9 speed 10 tal Study WR Tin me/1piec min sec 0 15 0 15 0 16 WR Tin me/1piec min sec 0 0 13 0 14 0 13 0 14 0 13 WR Tim me/1piec min sec 0 0 13 0 14 0 13 0 14 0 13 0 14 0 13 0 14 0 13 0 14 0 13	0 15 15 0 16 16 WR Time me/1piece/team min sec total sec 0 14 14 0 13 13 0 14 14 0 13 13 0 13 13 wR Time me/1piece/team min sec total sec 0 9 9 9 0 10 10 10	200x1200 2 speed 80 2 speed 100 4 watal Study Units 10 werage WR Time me/1piece/team total sec 0 14 14 0 13 13 0 14 14 0 13 13 0 13 13 0 13 13 0 13 13 0 14 14 0 13 13 0 14 14 0 13 13	200x1200 Units speed 80 2 speed 90 4 speed 100 4 watal Study Units 10 watal Study Units 10 speed 100 4 speed 100 15 speed 100 16 speed 101 5 speed 101 6 speed 101 6 speed 101 6 <tr< td=""><td>200x1200 Units 2 20 speed 80 2 20 speed 90 4 40 speed 100 4 Average WR Time n' n me/1piece/team ni< sec n n n me/1piece/team total sec 0 14 14 13.5 4 2.19 0 13 13 2 2 2 0 14 14 3.5 4 2.19 0 13 13 2 2 2 WR Time</td><td>200x 1200 Units 2 20 speed 80 2 20 4 speed 100 4 40 40 speed 100 4 40 10 speed 100 Average WR n' n Norm me/1piece/team min sec total sec 1 1 0 14 14 13.5 4 2.19 1 0 13 13 1 1 1 1 0 13 13 1 1 1 1 0 13 13 1</td><td>200x 1200 Units (minut speed 80 2 20 0.27 speed 90 4 40 0.27 speed 100 4 40 0.17 speed 100 Average WR Time n' n Normal Time me/1piece/team Average WR Time n' n Normal Time min sec total sec n' n Normal Time min sec total sec n' n Normal Time min sec total sec n' n Normal Time min sec <thtotal sec<="" th=""> <thtotal sec<="" th=""> <</thtotal></thtotal></td><td>200x 1200 Units (minutes) s speed 80 2 20 0.27 speed 90 4 40 0.23 speed 100 4 40 0.23 speed 10 4 40 0.23 speed 10 10</td><td>200x 1200 Units (minutes) Standard Time speed 80 2 20 0.27 0.21 speed 90 4 40 0.23 0.21 speed 100 4 40 0.23 0.21 Speed 80 Speed 80 WR Time Average WR Time n' n Normal Time Rating total sec Allowance factor Standard Time Time me/1pice/team Average WR Time n' n Normal Time Rating total sec Allowance factor Standard Time Time me/1pice/team Average WR Time n' n Normal Time Rating total sec Allowance factor Standard Time Time me/1pice/team Average WR Time n' n Normal Time Rating total sec Allowance f</td></tr<>	200x1200 Units 2 20 speed 80 2 20 speed 90 4 40 speed 100 4 Average WR Time n' n me/1piece/team ni< sec n n n me/1piece/team total sec 0 14 14 13.5 4 2.19 0 13 13 2 2 2 0 14 14 3.5 4 2.19 0 13 13 2 2 2 WR Time	200x 1200 Units 2 20 speed 80 2 20 4 speed 100 4 40 40 speed 100 4 40 10 speed 100 Average WR n' n Norm me/1piece/team min sec total sec 1 1 0 14 14 13.5 4 2.19 1 0 13 13 1 1 1 1 0 13 13 1 1 1 1 0 13 13 1	200x 1200 Units (minut speed 80 2 20 0.27 speed 90 4 40 0.27 speed 100 4 40 0.17 speed 100 Average WR Time n' n Normal Time me/1piece/team Average WR Time n' n Normal Time min sec total sec n' n Normal Time min sec total sec n' n Normal Time min sec total sec n' n Normal Time min sec <thtotal sec<="" th=""> <thtotal sec<="" th=""> <</thtotal></thtotal>	200x 1200 Units (minutes) s speed 80 2 20 0.27 speed 90 4 40 0.23 speed 100 4 40 0.23 speed 10 4 40 0.23 speed 10 10	200x 1200 Units (minutes) Standard Time speed 80 2 20 0.27 0.21 speed 90 4 40 0.23 0.21 speed 100 4 40 0.23 0.21 Speed 80 Speed 80 WR Time Average WR Time n' n Normal Time Rating total sec Allowance factor Standard Time Time me/1pice/team Average WR Time n' n Normal Time Rating total sec Allowance factor Standard Time Time me/1pice/team Average WR Time n' n Normal Time Rating total sec Allowance factor Standard Time Time me/1pice/team Average WR Time n' n Normal Time Rating total sec Allowance f		

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 200x1200

จุฬาลงกรณ์มหาวิทยาลัย

Table A40.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 200x1200

Repairing Sub- Process of Metal Form 200x1200 Low Difficulty			al Form	No. of Study Units	%	Distribut	ion	Standard (minute	es) Si	Weighted Average Standard Time (minutes)		
			-	12		35		1.83		2.7	3	
r	Vediur		-	18		53		3.12				
т		Diffic	Units	4		12		3.62				
-	otar e	luuy	onits	54	-							
						Low	Diffic	ulty				
		R Tin		Average WR Time	n'	n	Nor	mal Time	Allowance	Standard Time	Standard Time	
<u>T</u> no.	<u>ime/1</u> min	1	<u>e/team</u> total sec	total sec			Ratin	total sec	Factor	total sec	minute	
1	1	37	97	95.58333333	12	11.63	1	95.5833		109.8659	1.83	
2	1	28	88									
3	1	41	101									
4	1	27	87								-	
5	1	31	91								1	
6	1	38	98]	
7	1	5 0	110									
8	1	35	95]	
9	1	41	101									
10	1	38	98									
11	1	43	103									
12	1	18	78		_	667				I	J	
					-	Mart	- D'//	i a u lite e	_			
						Mediur	n Diff	icuity				
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time	
Т	īme/1	piece	e/team		1	et et et a	21218	1123	Factor			
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute	
1	2	31	151	162.666667	18	14.32	1	162.667	0.13	186.97318	3.12	
2	3	11	191						1			
3	2	38	158							2		
4	2	49	169									
5 6	2	44 24	164 144						0.00			
7	2	33	153									
8	2	57	177									
9	2	38	158									
10	2	14	134		1.0			10.1				
	2	40	160				7					
	-		148			0.0			011	10		
	2	28		1								
11 12		28 51	171									
11 12 13	2		171 177		_		<u> </u>			0101		
11 12 13 14	2 2	51		2017	15		91	20	711	2177	190	
11 12 13 14 15 16	2 2 2 3 2	51 57 4 20	177 184 140	ลงก	ĥ	a	IJ		JN	<u>धन</u> (าย	
11 12 13 14 15 16 17	2 2 2 3 2 2 2 2 2	51 57 4 20 51	177 184 140 171	<u> </u>	R		1		311	<u>ยา(</u>	18	
11 12 13 14 15 16 17	2 2 2 3 2	51 57 4 20	177 184 140	941	ĥ	<u>a</u> l	1	<u>A</u>	311	<u>ยา</u> (1 B R	
11 12 13 14 15 16	2 2 2 3 2 2 2 2 2	51 57 4 20 51	177 184 140 171	<u>9</u> 11	ß	High	Diffic	ulty	311	ยาเ	18	
11 12 13 14 15 16 17	2 2 3 2 2 2 2 2	51 57 4 20 51 58	177 184 140 171 178	Average WR	17					Standard	Standard	
11 12 13 14 15 16 17	2 2 3 2 2 2 2 2	51 57 4 20 51	177 184 140 171 178	Average WR Time	n'	High		ulty nal Time	Allowance	Standard Time	Standard Time	
11 12 13 14 15 16 17 18	2 2 3 2 2 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0	51 57 4 20 51 58 R Tin	177 184 140 171 178 ne e/team	Time	n'				Allowance Factor	Time		
11 12 13 14 15 16 17 18	2 2 3 2 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0 0	51 57 4 20 51 58 R Tir 1piec sec	177 184 140 171 178 ne e/team total sec	total sec		n	Norn Rating	total sec	Factor	Time total sec	Time minute	
11 12 13 14 15 16 17 18	2 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	51 57 4 20 51 58 R Tir 1piec sec 16	177 184 140 171 178 ne e/team total sec 196	Time	n' 4	n	Norn	nal Time		Time	Time	
11 12 13 14 15 16 17 18 17 18	2 2 3 2 2 2 2 2 2 2 7 0 7 0 7 0 7 0 7 0 7 0 7	51 57 4 20 51 58 R Tir I piec sec 16 20	177 184 140 171 178 ne e/team total sec 196 200	total sec		n	Norn Rating	total sec	Factor	Time total sec	Time minute	
11 12 13 14 15 16 17 18 <u>1</u> no. 1	2 2 3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	51 57 4 20 51 58 R Tir 1piec sec 16	177 184 140 171 178 ne e/team total sec 196	total sec		n	Norn Rating	total sec	Factor	Time total sec	Time minute	

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 200x1200

Table A41.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 300x1200

			ocess of 0x1200	No. of Study Units	%	Distrib	ution	Standard Time (minutes)		Weighted Average Standard Time (minutes	
	spe	eed 8	80	2		29		0.2	7	0.2	5
	spe	eed 9	0	2		29		0.2	5		
	spe	ed 10	0	3		43		0.23	3		
Т	otal S	tudy	Units	7							
					ed 80						
	w	R Tin	ne	Average WR Time	n'	n	Norn	nal Time	Allowance	Standard Time	Standard Time
Time/1piece/team							Factor				
no. min sec total sec		total sec			Rating	total sec		total sec	minute		
1	0	16	16	16	2	0	1	16	0.03	16.49485	0.27
2	0	16	16								
						Spee	ed 90				
	w	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowand	e Standard Time	Standard Time
Т	ime/1	piec	e/team			100	1.1		Factor		
no.	min	sec	total sec	total sec		100	Ratin	total sec		total sec	minute
1	0	14	14	14.5	2	1.9	1	14.5	0.03	14.94845	0.25
2	0	15	15		1						
						18/6	1810				-
					124	Spee	d 100	2.9			
	W	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ime/1	piec	e/team	2					Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	14	14	13.3333333	3	2	1	13.3333	0.03	13.7457	0.23
2	0	13	13								
3	0	13	13								

Renairing Process: Sandin	a Sub-Process Time Stud	y Result: Metal Form 300x1200
Repairing Frocess. Sanuin	y Sub-Frocess fille Sluu	

สถาบนวิทยบริการ จฬาลงกรณ์มหาวิทยาลัย Table A41.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 300x1200

		-	al Form	No. of Study Units	%	Distribu	ution	Standard (minu	-	Weighted Average Standard Time (minutes)		
	Low	Diffic	ulty	12		50		2.43	3	3.13	3	
Ν	Nediur			8		33		3.4	2			
	High			4		17		4.6	2			
Т	otal S	itudy	Units	24								
						Low D	ifficult	y	-	-		
	W	R Tin	ne	Average WR Time	n'	n	Norn	nal Time	Allowanc	e Standard Time	Standard Time	
<u>T</u>	ime/1	piec	e/team	-					Factor			
no.	min		total sec	total sec			Rating	total sec		total sec	minute	
1	2	15	135	126.8333333	12	7.71	1	126.833	0.13	145.78544	2.43	
2	2	6	126									
3	2	0	120									
4	2	12	132									
5	2	14	134			3.40						
6	2	7	127									
7	2	21	141			10						
8	1	49	109		1							
9	2	3	123			1994						
10	1	54	114		1	16613	112.3					
11	2	13	133			121/	12.1					
12	2	8	128									
					M	edium	Diffic	ulty				
	w	R Tii	ne	Average WR Time	n'	n	Norr	nal Time	Allowand	ce Standard Time	Standard Time	
Ţ	īme/	Ipied	e/team	- 3,					Factor			
no.	min	sec	total sec	total sec			Rating	total sec	;	total sec	minute	
1	3	8	188	178.75	8	6.39	1	178.75	0.13	205.4598	3.42	
2	2	37	157						CTAN 1			
3	2	53	173									
4	3	2	182									
5	3	10	190			19	161	115		5		
0	2	48	168			0.7		0		0		
6	2	-	192			6	1	6	5	0		
6 7	3	12	152									
		12 0	180	0.00	ĭ			200				
7	3			<u>a</u> .		ligh D) ifficul	ty			U	
7	3		180	Average WR	n'	ligh C n		ty nal Time	Allowance	Standard	Standard Time	
7	3 3 W	0 R Tin	180 ne	Average WR Time				-		Standard Time	Standard Time	
7 8 <u>T</u>	3 3 W	0 R Tin piec	180 ne e/team	Time			Norm	al Time	Allowance Factor	Time	Time	
7 8 <u>T</u> no.	3 3 W ïme/1 min	0 R Tin piec sec	180 ne e/team total sec	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute	
7 8 <u>T</u> no. 1	3 3 W ïme/1 min 4	0 R Tin piec sec 0	180 ne e/team total sec 240	Time			Norm	al Time		Time	Time	
7 8 <u>T</u> no.	3 3 W ïme/1 min	0 R Tin piec sec 0 43	180 ne e/team total sec 240 223	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute	
7 8 <u>T</u> no. 1 2	3 3 W ime/1 min 4 3	0 R Tin piec sec 0	180 ne e/team total sec 240	Time total sec	n'	n	Norm Rating	total sec	Factor	total sec	Time minute	

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 300x1200

Table A42.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 400x1200

|--|

Sanding Sub-Process of Metal Form 400x1200	No. of Study Units	% Distribution	Standard Time (minutes)	Weighted Average Standard Time (minutes)
speeed 80	9	50	0.33	0.31
speed 90	6	33	0.28	
speed 100	3	17	0.27	
Total Study Units	18			

						Spe	ed 80	6			
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	ïme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	19	19	19	9	4.92	1	19	0.03	19.58763	0.33
2	0	21	21								
3	0	18	18			////					
4	0	19	19								
5	0	20	20			3.4	26				
6	0	18	18								
7	0	20	20		1	10					
8	0	18	18			1					
9	0	18	18			-	-111				

Speed 90

							124 1 1				
	w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Т	īme/1	lpiec	e/team						Factor		
no.	min	sec	total sec	total sec	3	123	Rating	total sec		total sec	minute
1	0	17	17	16.5	6	5.39	1	16.5	0.03	17.01031	0.28
2	0	18	18								
3	0	15	15	24							
4	0	16	16	1					770		
5	0	16	16								
6	0	17	17								
	A	-						å			

Speed 100

	w	R Tin	ne 6	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team			9		D	Factor	6	
no.	min	sec	total sec	total sec	55	19	Rating	total sec	9761	total sec	minute
1	0	15	15	15.6666667	3	1.45	1	15.6667	0.03	16.1512	0.27
2	0	16	16								
3	0	16	16								

Table A42.2: Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 400x1200

			al Form	No. of Study Units	% D	istribu	tion	St	andard Ti (minutes			/eighted Av idard Time	
	Low [Difficu	llty	4		13			2.70			3.95	
M	ledium	n Diffi	culty	16		50			3.80				
	High I	Difficu	ulty	12		38			4.57				
То	otal St	tudy	Units	32									
					L	.ow D	ifficu	lty					
	w	R Tin	ne	Average WR Time	n'	n	No	rma	l Time	Allowand	e	Standard Time	Standard Time
Ţ	ime/1	piec	e/team			1.1.1.1			19-1	Factor			
no.	min	sec	total sec	total sec			Rati	ng	total sec			total sec	minute
1	2	21	141	141	4	3.74	1	-	141	0.13		162.069	2.70
2	2	10	130					-		0.1.0			2 0
3	2	25	145				_						
											_		
4	2	28	148										
					Me	dium	Diffi	cult	y				
	w	R Tir	ne	Average WR	n'	n	N	orm	al Time	Allowar	nce	Standard	Standard
	im o /1	niaa	a /ta a m	Time	_					Fasta		Time	Time
-			<u>e/team</u>	total and		10	D	line	total	Facto	"	total car	minute
no.			total sec		40	45.4		ting				total sec	minute
1	3	13	193	198.375	16	15.1	2	1	198.375	0.13		228.0172	3.80
2	3	31	211			77.0							
3	3	50	230										
4	3	0	180										
5	3	27	207		177								1
6	2	40	160										
7	3	21	201										1
8	3	33	213		1975								1
9	3	31	211										1
10	3	20	200										
11	2	57	177										
12	3	31	211										
13	3	40	220										
14	2	41	161										
	2		202				_						{
15		22				-	_						1
16	3	17	197			I	1			L		L	l
			6	6 IU	Ц	ligh D	oifficu	ılty					
	w	R Tir	ne	Average WR Time	n'	n	Nor	rma	l Time	Allowanc	e	Standard Time	Standard Time
Т	ime/1	piec	e/team		77					Factor			
no.	min	sec	total sec	total sec	d b	100	Ratin	ng t	otal sec		-1	total sec	minute
1	4	9	249	238.666667	12	9.91	1	2	238.667	0.13		274.3295	4.57
1		12	252										
1	4			1									
	4	33	213										
2		33 7	213 247										
2	3							+			+		
2 3 4	3 4	7	247					+					
2 3 4 5	3 4 4	7 0	247 240										
2 3 4 5 6	3 4 4 3	7 0 48 15	247 240 228 255										
2 3 4 5 6 7 8	3 4 4 3 4 4	7 0 48 15 1	247 240 228 255 241										
2 3 4 5 6 7 8 9	3 4 4 3 4 4 3	7 0 48 15 1 55	247 240 228 255 241 235										
2 3 4 5 6 7 8	3 4 4 3 4 4	7 0 48 15 1	247 240 228 255 241										

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 400x1200

Table A43.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 500x1200

	•		Process of 600x1200	No. of Study Units	9	∕₀Distril	bution	Standard Time (minutes) S		Weighted Average Standard Time (minutes)	
	sp	eeed	80	8		50)	0.52	2	0.43	3
	s	peed	90	4		25	5	0.37	7		
	sp	eed 1	00	4		25	5	0.3			
	Total	Study	/ Units	16							
						Spe	ed 80				
	w	R Tin	ne	Average WR Time	n'	n	Norr	mal Time	Allowance	Standard Time	Standard Time
<u>T</u>	Time/1	piec	e/team					Facto			
no.				total sec				total sec		total sec	minute
1	0	29	29	30	8	4	1	30	0.03	30.92784	0.52
2	0	31	31								
3	0	28	28								
4	0	28	28			=					
5	0	32	32			2.40	1				1
6	0	30	30								-
7	0	30	30								-
8	0	32	32								
				- ////	32.4	Spe	ed 90	8			
	\A/I	R Tim	ne	Average WR Time	n'	n Normal Time			Allowanc	e Standard Time	Standard Time
	VVI					1.1.		7.0		Time	11110
T			e/team		1352	eletre.	1	1	Factor	Time	
<u>T</u> no.	ïme/1	piece		total sec			Ratin	g total sec		total sec	minute
_	ïme/1	piece	e/team		4	2.6		g total sec 21.5			
no.	ïme/1 min	piece sec	e/team total sec	total sec	4	2.6		-	;	total sec	minute
no. 1	ïme/1 min 0	piece sec 21	e/team total sec 21	total sec	4	2.6		-	;	total sec	minute
no. 1 2	ïme/1 min 0 0	piece sec 21 23	e/team total sec 21 23	total sec	4	2.6		-	;	total sec	minute
no. 1 2 3	ïme/1 min 0 0	pieco sec 21 23 21	e/team total sec 21 23 21	total sec	4			-	;	total sec	minute
no. 1 2 3 4	ime/1 min 0 0 0	piece sec 21 23 21 21 21 R Tim	e/team total sec 21 23 21 21 21	total sec	4 n'		1 ed 100	21.5	;	total sec	minute
no. 1 2 3 4	ime/1 min 0 0 0	piece sec 21 23 21 21 21 R Tim	e/team total sec 21 23 21 21	total sec 21.5 Average WR		Spee	1 ed 100	21.5	0.03	total sec 22.1649 Standard	0.37
no. 1 2 3 4	ime/1 min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	piece sec 21 23 21 21 21 R Tim	e/team total sec 21 23 21 21 21	total sec 21.5 Average WR		Spee	1 ed 100	21.5	0.03	total sec 22.1649 Standard	minute 0.37
no. 1 2 3 4	ime/1 min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	piece sec 21 23 21 21 21 R Tim	e/team total sec 21 23 21 21 21 e	total sec 21.5 Average WR Time		Spee	1 ed 100	al Time	0.03	total sec 22.1649 Standard Time	minute 0.37 Standard Time
no. 1 2 3 4 Ti no.	ime/1 min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	piecc sec 21 23 21 21 21 R Tim piecc sec	e/team total sec 21 23 21 21 21 21 ee e/team total sec	total sec 21.5 Average WR Time total sec	n'	Spee	ed 100 Norma	al Time /	Allowance Factor	total sec 22.1649 Standard Time total sec	Minute 0.37 Standard Time minute
no. 1 2 3 4 <u>Ti</u> no. 1	ime/1 min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	piecce 21 23 21 21 21 21 21 21 21 21 21 21 21 21 21	e/team total sec 21 23 21 21 21 21 e e total sec 16	total sec 21.5 Average WR Time total sec	n'	Spee	ed 100 Norma	al Time /	Allowance Factor	total sec 22.1649 Standard Time total sec	Standard Time

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 500x1200

Table A43.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 500x1200

R	Repai ess of	ring Met	Sub- al Form	No. of Study Units		Distribu		Standard (minu	Time	Weighted Standard Tim	
	Low	x 120		8		18		2.7	-	4.0	· · ·
M	lediun		-	32		73		4.28			
	High	Diffic	ulty	4		9		4.80)		
Тс	otal S	tudy	Units	44							
					L	Low D	oifficul	ty			
1				Average WR	-				1	Standard	Standard
	w	R Ti	me	Time	n'	n	Norr	nal Time	Allowan	Ce Time	Time
Т	īme/′	1 piec	ce/team				11/		Factor	-	
no.		sec		-			Rating			total sec	minute
1	2	14	134	141.75	8	7.82	1	141.75	0.13	162.931	2.72
2	2	31 40	151 160								-
4	2	27	147								-
5	2	9	129					-			-
6	2	21	141								-
7	2	11	131								
8	2	21	141								
					Me	edium	Diffic	ulty			
				Average WR	_		-			Standard	Standard
		R Tir		Time	n'	n	Nor	mal Time	Allowand	Time	Time
	1		e/team			. (6	1.1		Factor		
no.	min 4	sec	total sec 253	total sec 223.625	32	30	Rating	g total sec 223.625	0.13	total sec 257.0402	minute 4.28
2	2	4	124	220.020	52	50	-	223.023	0.15	237.0402	4.20
3	3	51	231								
4	3	44	224			0317					
5	4	8 0	248 240								-
7	3	25	240								-
8	4	11	251								-
9	3	50	230			111					-
10	3	52 6	232 246								-
12	4	12	240				-				-
13	4	3	243								
14	2	49	169								
15 16	4	5 57	245 237								-
17	3	51	237								-
18	3	49	229								
19	4	4	244	e.							1
20 21	4	0 51	240 231	<u></u>	<u></u>					47	4
21	2	24	144							-	1
23	4	9	249		~~~						1
24	4	3	243			0				\sim	4
25 26	3	30 17	210 197		54		9.19	100	919		2
20	3	21	201		- 0 0	10					
28	4	7	247								
29	3	37	217								4
30 31	3	28 3	208 243				-				-
31	4	3 12	192				1				1
I			-							1	-
					ŀ	ligh C	Difficu	ty			
	w	R Tir	ne	Average WR	n'	n	Norr	nal Time	Allowanc	e Standard	Standard
Т			e/team	Time					Factor	Time	Time
no.			total sec	total sec			Rating	total sec		total sec	minute
1	3	57	237	250.5	4	3.55	1	250.5	0.13	287.931	4.80
2	4	28 3	268 243							_	
4	4	3 14	243							-	
<u> </u>				I			I				

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 500x1200

Table A44.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 600x1200

	ing S	ub-P	rocess of 00x1200	No. of Study Units	%	Distribu	ution	Standard (minute	Time	Weighted A Standard Time	
		eed t		12		30		0.70		0.64	l .
		eed 9 eed 10		20		50 20		0.63			
Т	-		Units	40		20		0.56	·		
						Sno	od 90				
						Spe	ed 80		I.		
	w	R Tir	ne	Average WR Time	n'	n	Norn	nal Time	Allowar	nce Standard Time	Standard Time
Т	ime/1	piec	e/team				177		Facto		
no.			total sec	total sec			Rating			total sec	minute
1 2	0	40	40 44	41	12	3.33	1	41	0.03	42.26804	0.70
3	0	40	40								
4	0	40	40								
5	0	39	39								
6	0	45	45 40								
8	0	40	40								
9	0	41	41								
10	0	41	41			5 10					
11	0	43	43								
12	0	39	39								
				~ // //		Spe	ed 90				
		R Tir		Average WR Time	n'	n	Norr	nal Time	Allowar	Time	Standard Time
			<u>e/team</u>						Facto		
no.		_	total sec	total sec	20	6.57	Rating	total sec		total sec	minute
1	0	36 35	36 35	36.9	20	6.57		36.9	0.03	38.04124	0.63
3	0	38	38		1						1
4	0	38	38								1
5	0	40	40		5						1
6	0	35	35								ļ
7	0	35	35							2	
8	0	39 36	39 36								4
10	0	36	36								1
11	0	37	37								1
12	0	31	31								1
13	0	35	35								ļ
14	0	38	38							_	ļ
15 16	0	42 34	42 34					1			1
17	0	38	38							10	1
18	0	38	38			6				0	1
19	0	39	39				10	000	0.0	0 00	
20	0	38	38					4			
		<u>a</u>			<u> </u>	Spee	ed 100				
	w	R Tin	ne	Average WR Time	n'	n	Norm	nal Time	Allowan	Ce Standard Time	Standard Time
Ti	me/1	piec	e/team						Facto	r	
_		_	total sec	total sec			Rating			total sec	minute
1	0	34	34	33.5	8	4.99	1	33.5	0.03	34.53608	0.58
2	0	29	29								
3	0	33 33	33								
		JJJ	33								1
4	0		34					1			
4 5 6	0 0 0	34 35	34 35								
5	0	34									

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 600x1200

Table A44.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 600x1200

	Repai :ess o	ring	Sub- al Form	No. of Study Units		Distribut		Standard (minute	Time	Weighted Av andard Time	erage
		Diffic	-	6		18		3.37		5.68	
r	Mediu		-	18		53		5.27			
		Diffic	Units	10 34		29		7.82			
	otal c	biuuy	Units	34							
						Low D	ifficu	ilty			
		'R Tir		Average WR Time	n'	n	No	rmal Time	Allowanc	e Standard Time	Standard Time
 	1	sec	<u>total sec</u>	total sec			Ratir	ng total see	Factor	total sec	minute
1	2	45	165	176	6	2.91	1	176	0.13	202.2989	3.37
2	3	0	180								
3	3	0	180								1
4	3	7	187								1
5	2	56	176								
6	2	48	168								J
						-	Diff				
					M	edium	Diffi	culty			
		R Tin		Average WR Time	n'	n	No	ormal Time	Allowand	Ce Standard Time	Standard Time
			e/team			500			Factor		
no.			total sec	total sec	10	45.5		ng total se		total sec	minute
1	4	41 32	281 212	275.333333	18	15.5	1	275.33	3 0.13	316.4751	5.27
3	4	9	249		-						-
4	4	30	270		1144	2.00					-
5	4	0	240								-
6	5	3	303		3.0)	2/183	1.50				-
7	4	51	291								
8	4	6	246								_
9	4	38	278								_
10	4	54 1	294 301								-
11	5 4	23	263				-				-
13	5	21	321								-
14	4	30	270	0							
15	5	5	305		0.1	50	0.0	1010]
16	4	12	252								
17	4	40	280		P U	0.1				2	
18	5	0	300			- 62					
	-	39	1XT	ลงก	51	ligh D	oifficu	ulty	19/16	172	2
	w	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowance	Standard Time	Standard Time
Ţ	1		e/team						Factor		
no.	-	-	total sec		40		Rating		0.10	total sec	minute
1	7	03	420 423	408.1	10	9.13	1	408.1	0.13	469.08046	7.82
3	5	49	349								
4	6	21	381								
5	6	50	410								
6	7	11	431								
7	6	58	418								
8	7	30 14	450 434								
10	6	5	365								
	I. ~		- • •								

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 600x1200

Table A45.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 800x1200

			Process of 800x1200	No. of Stud Units	у	% Distri	bution	Standar (min		Weighted Standard Tir	
	s	beeed	80	6		5	0	0.9	92	0.0	36
	S	peed	90	3		2	5	0.8	37		
		peed 1		3		2	5	0.1	73		
	Total	Study	y Units	12							
						Spee	ed 80				
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	īme/1	piece	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	54	54	53.8333333	6	1.55	1	53.8333	0.03	55.49828	0.92
2	0	54	54		1						
3	0	57	57		1						
4	0	52	52								
5	0	54	54								
6	0	52	52								
						3 10		-			
						Spee	ed 90				
	w	R Tin	ne	Average WR Time	n	n	Normal Time		Allowance	Standard Time	Standard Time
Ţ	īme/′	Ipiec	e/team		1	12 la			Factor		
no.	min	sec	total sec	total sec	7	1111	Rating	total sec		total sec	minute
1	0	50	50	50.66666667	3	1.8	1	50.6667	0.03	52.23368	0.87
2	0	53	53			1	1.5.1.1.5				
3	0	49	49								
			1	9		Spee	d 100				
	w	R Tin	ne	Average WR Time	n	' n	Norm	al Time	Allowance	e Standard Time	Standard Time
T	ïme/1	piec	e/team				1		Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	41	41	42.6666667	3	1.37	1	42.6667	0.03	43.98625	0.73
2	0	44	44								
~								1			-1
3	0	43	43		· · · ·						

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 800x1200

Table A45.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 800x1200

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 800x1200

R	Repairing Process: Repairing Sub- Process of Metal Form 800x1200 Low Difficulty			No. of Study Units % Distribution					andard Tir (minutes)	me V	Veighted Ave ndard Time (r	rage	
	Low [Difficu	ılty	5			14			3.85		5.54	
	ledium			20			57			4.90			
	High I		-	10			29			7.65			
Тс	otal S	tudy	Units	35									
						L	_ow D	Diffic	ulty	/			
		R Tin		Averag Tin		n'	n	N	orma	al Time	Allowance	Standard Time	Standard Time
			e/team							1	Factor		
no.	min	sec	total see	c total	sec			Rat	ing	total sec		total sec	minute
1	3	21	201	200	0.8	5	4.88	1		200.8	0.13	230.8046	3.85
2	3	12	192										
3	3	8	188										
4	3	23	203										
5	3	40	220										
									-				-
					///	Me	dium	n Dif	ficu	lty			
				Average	e WR	_			_			Standard	Standard
	W	R Tin	ne	Tim		n'	n		Nori	mal Time	Allowand	Time	Time
T	ime/1	piec	e/team			1.9	160	1	19		Factor		
no.	min	sec	total sec	total :	sec		N.Y.	R	ating	total se	с	total sec	minute
1	4	50	290	255.	.85	20	19.	6	1	255.85	0.13	294.0805	4.90
2	3	27	207			1	66.1	20					
3	4	3	243				121/	313					-
4	4	16	256										
5	4	51	291			181	111	-					1
6	4	42	282										-
7	3	29	209			-							1
8	4	14	254			2/2		/		-			1
9	4	5	245										
10	4	24	264										
11	5	0	300										1
12	4	19	259										
13	4	32	272										
14	4	41	281										
15	3	10	190										
16	4	15	255		0								
17	4	31	271		0.1								
18	4	15	255										
19	4	21	261	D I I		10	0			0		0	
20	3	52	232									0	
	0	0	20		0	~	ligh [Diffic	culty	Y C	000		01
	0				Aug				-			Ctow day 1	Chemological
		WF	R Time	OI N	Averag Tim		n'	n	No	ormal Time	e Allowan	ce Standard Time	Standard Time
	Tir	ne/1	piece/tear	n			-				Facto		TINC
no.			onverted	total sec	total	sec			Rati	ng total s		total sec	minute
1	_	39	6.65	399	399		10	5.39	1	0		459.1954	
2		12	7.2	432		-					0.10		
3		51	6.85	411									-
4			6.73333	404									-
5		57	6.95	417									-
6			5.81667	349									-
7	5 6	49 9	6.15	369									-
8		_		309									-
			6.51667										-
9 10		48 55	6.8	408 415									-
10	6	50	6.91667	410									

Table A46.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 200x1500

	-		rocess of 00x1500	No. of Study Units % Distribu			ution	Standar (minu		Weighted Standard Tim	
	sp	eeed	80	12		67		0.2	27	0.2	24
	sp	beed s	90	3		17		0.2	20		
	sp	eed 1	00	3		17		0.1	17		
Т	otal S	Study	/ Units	18			5. A.				
						Spe	ed 80				
		R Tin		Average WR Time	n'	n	Norr	mal Time	Allowanc	e Standard Time	Standard Time
<u> </u>			e/team	_					Factor		
no.	_		total sec	total sec				total sec		total sec	minute
1	0	15	15	16	12	11.46	1	16	0.03	16.494845	0.27
2	0	14	14				_				
3	0	18	18								
4	0	18	18								ļ
5	0	16	16				-				ļ
6	0	14	14		_						
7	0	18	18								
8	0	16	16		_	637					
9	0	16	16			1740					
10	0	16	16								
11	0	15 16	15 16		-	44044					
12	0	10	10		- 114						l
					AB.	Spe	ed 90				
		R Tin		Average WR Time	n'	n	Norma	al Time	Allowance	Standard Time	Standard Time
<u><u> </u></u>			e/team						Factor		
no.		sec		total sec				total sec	177	total sec	minute
1	0	11	11	11.6666667	3	2.61	1	11.6667	0.03	12.027491	0.20
2	0	12	12								1
3	0	12	12	0							
			a	2114	١	Spee	ed 100	117			
	_	R Tir		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
	1	L 1	e/team	61471					Factor		
no.	min		total sec	-	0	0 100	-	total sec		total sec	minute
1	0	10	10	10	3	0	1	10	0.03	10.309278	0.17
2	0	10	10								
and the second se											

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 200x1500

Table A46.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 200x1500

			al Form	No. of Study Units		% Distrib	ution		rd Time utes)		Weighted Average andard Time (minutes)	
	Low	Diffic	ulty	10		27			40	3.7	2	
N	1ediur		-	20		54			17			
_	High		-	7	_	19		4.	35			
т	otal S	tudy	Units	37								
						Low [Difficul	ty				
	w	R Tin	ne	Average WR Time	n'	n	Norma	al Time	Allowance	Standard Time	Standard Time	
T	ïme/1	piec	e/team						Factor			
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute	
1	2	6	126	125.3	10	9.499	1	125.3	0.13	144.0229885	2.40	
2	2	0	120									
3	2	1	121									
4	2	14	134									
5	2	23	143									
6	2	11	131									
7	1	56	116									
8	2	13 1	133 121		_							
9	2	48	121			1000						
10		40	108									
					I	Mediun	n Diffic	ulty				
	w	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowand	e Standard Time	Standard Time	
Т	ime/1	piec	e/team		1	3.20%		2	Factor			
no.	min	sec	total sec	total sec		131	Ratin	g total se	ec	total sec	minute	
1	3	51	231	217.9	20	17.41	1	217.9	0.13	250.45977	4.17	
2	3	29	209		61	E ELG	3 47.750					
3	4	0	240								1	
4	3	33	213		6173	2 34/15	1.00				1	
5	3	50	230			222]	
6	3	29	209]	
7	3	37	217]	
8	4	9	249									
9	3	17	197									
10	4	20	260									
11	3	17	197									
12	3	20	200								1	
13	3	41	221	9							1	
14	3	17	197	000	0	0	40	b 14		12		
15	2	56	176									
16	3	32	212	· · · · ·							-	
17	3	22	202						_	0		
18	3	39	219	<u></u>	~		9-1-9	10	<u>- 00 0</u>		D I	
19	4	31	271					4				
20	3	28	208			4 10				- 101		
						High I	Difficu	lty				
	w	R Tir	ne	Average WR Time	n'	n	Norn	nal Time	Allowanc	e Standard Time	Standard Time	
Ţ			e/team						Factor			
no.	min							total se		total sec	minute	
1	3	44	224	226.857143	7	5.89	1	226.85	7 0.13	260.75534	4.35	
2	4	11	251		 			ļ			_	
3	3	34	214		 			ļ				
4	3	39	219									
5	3	51	231		 						-	
6	3	29	209									
7	4	0	240		1						1	

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 200x1500

Table A47.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 400x1500

	_		rocess of 00x1500	No. of Study Units	'	% Distri	bution	Standar (min		Weighted Standard Tin	•
	spe	eeed 8	30	10		50)	0.	35	0.3	33
	sp	eed 9	0	7		35	5	0.	32		
		eed 10		3		15	5	0.	28		
Т	otal S	itudy	Units	20							
						Spe	ed 80				
		R Tin		Average WR Time	n'	n	Nor	mal Time	Allowand	lime	Standard Time
T			e/team						Factor		
no.	min	sec	total sec	total sec			Ratin	g total se	C	total sec	minute
1	0	21	21	20.5	10	4	1	20.5	0.03	21.13402	0.35
2	0	19	19								
3	0	22	22								
4	0	21	21								
5	0	21	21			0.40					
6	0	20	20								
7	0	19	19			10					
8	0	22	22								
9	0	20	20			2014-	- 14				
10	0	20	20		3	1 66.5-	108				
		1	01 DE 191 DE 19			- Eno	ed 90				
				Average WR		Spe				Standard	Standard
		R Tin	ne	Time	n'	n	Norm	al Time	Allowance	Time	Time
Т	īme/1										
			e/team			29V			Factor		
no.	min	sec	total sec	total sec	25/2		Rating			total sec	minute
no. 1	min 0	sec 19	total sec 19	total sec 18.8571429	7	6.98	Rating 1	total sec 18.8571	Factor	total sec 19.440353	minute 0.32
no. 1 2	min 0 0	sec 19 19	total sec 19 19		7	6.98	Ŭ				
no. 1 2 3	min 0 0 0	sec 19 19 16	total sec 19 19 16		7	6.98	Ŭ				
no. 1 2 3 4	min 0 0 0 0	sec 19 19 16 20	total sec 19 19 16 20		7	6.98	Ŭ				
no. 1 2 3 4 5	min 0 0 0 0 0 0	sec 19 19 16 20 19	total sec 19 19 16 20 19		7	6.98	Ŭ				
no. 1 2 3 4 5 6	min 0 0 0 0 0 0 0	 sec 19 19 16 20 19 20 	total sec 19 19 20 19 20		7	6.98	Ŭ				
no. 1 2 3 4 5	min 0 0 0 0 0	sec 19 19 16 20 19	total sec 19 19 16 20 19		7	6.98	Ŭ				
no. 1 2 3 4 5 6	min 0 0 0 0 0 0 0	sec 19 19 16 20 19 20	total sec 19 19 20 19 20		7		Ŭ				
no. 1 2 3 4 5 6 7	min 0 0 0 0 0 0 0 0 0 0	sec 19 19 20 19 20 19 R Tim	total sec 19 19 16 20 19 20 19 19 19		7 		1 1 200 20100		0.03	19.440353	
no. 1 2 3 4 5 6 7	min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	sec 19 19 20 19 20 19 R Tim piece	total sec 19 19 16 20 19 20 19 19 19 19 19 19 19 19 20 19 19 19 20 19 19 20 19 20 19 19 20 20 19 20 19 20 19 20 19 20 19 20 19 20 20 20 19 20 20 20 20 20 20 20 20 20 20	18.8571429	91	Spee	1 2 2 2 2 3 2 3 2 3 3 3 3 3 3 3 3 3 3 3	18.8571	0.03	19.440353	0.32 Standard Time
no. 1 2 3 4 5 6 7	min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	sec 19 19 16 20 19 20 19 20 19 R Tim piecce sec	total sec 19 19 16 20 19 20 19 19 10 19 10 19 10 10 10 10 10 10 10 10 10 10	18.8571429	n'	Spee	1 1 200 20100	18.8571	0.03 Allowance Factor	19.440353	0.32 Standard
no. 1 2 3 4 5 6 7	min 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	sec 19 19 20 19 20 19 R Tim piece	total sec 19 19 16 20 19 20 19 19 19 19 19 19 19 19 20 19 19 19 20 19 19 20 19 20 19 19 20 20 19 20 19 20 19 20 19 20 19 20 19 20 20 20 19 20 20 20 20 20 20 20 20 20 20	18.8571429	91	Spee	1 2 2 2 2 3 2 3 2 3 3 3 3 3 3 3 3 3 3 3	18.8571	0.03	19.440353	0.32 Standard Time

17

3 0 17

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 400x1500

Table A47.2: Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 400x1500

			al Form	No. of Study Units	% [Distribut	tion	Standard (minut	_	Weighted Standard Tir	Average ne (minutes)
	Low [Difficu	llty	3		15		2.98		4.	43
Ν	ledium	n Diffi	culty	10		50		4.37	·		
	High [Difficu	ılty	7		35		5.15			
Тс	otal St	tudy	Units	20							
						.ow Di	fficult	у			
	W	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowar	nce Standar Time	d Standard Time
Т	ïme/1	piec	e/team				1	-	Facto	r	
no.	min	sec	total sec	total sec		1	Ratin	total sec	;	total se	c minute
1	2	29	149	155.6666667	3	1.64	1	155.667		178.927	2 2.98
2	2	37	157								
3	2	41	161								
3	2 41 101		101								
					Me	dium	Diffici	iltv			
					Inte	aram	Dimot	arcy			
	WR Time			Average WR Time	n'	n	Normal Time		Allowand	Ce Standard	Standard Time
Т	Time/1piece/team			Time		AND I W	111		Factor	11110	Time
no.				total sec	32.0	1.66.6-	Rating	total sec		total sec	minute
1	3	<u>50</u>	230	228.2	10	5.05	1	228.2	0.13	262.2989	
2	3	48	228			0.00			0110		
3	3	57	237		1		0				-
4	4	1	241		-						-
5	3	51	231								
6	4	8	248								-
7	- 3	52	240								-
8	3	22	202								-
9	3	40	202						771		-
10	3										-
10	3	33	213								
					Ŀ	ligh Di	ifficult	y and			
	W	R Tin	ne 👌	Average WR Time	n'	n	Norm	al Time	Allowand	e Standard Time	Standard Time
			<u>e/team</u>			or of		-	Factor		
no.			total sec	total sec	22		Rating			total sec	
1	5	0	300	268.5714286	_7_	6.31	1	268.571	0.13	308.7028	5.15
2	4	31	271								-
3	4	29	269								_
4	3	59	239							_	_
5	4	34	274								
6	4	19	259								
	4	28	268					1			

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 400x1500

Table A48.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 450x1500

			Process of 450x1500	No. of Study Units		% Distril	oution	Standar (minu		Weighted Standard Tim	•
	S	peeed	80	10		50		0.4	12	0.3	39
	s	speed	90	7		35		0.3	38		
	S	peed '	100	3		15	i	0.3	32		
	Total	Stud	y Units	20							
						Spee	ed 80				
		R Tim		Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
<u>T</u> no.			e/team_ total sec	total sec			Poting	total sec	Factor	total sec	minuto
_	_	-			10	6.02	-		0.02		minute
1	0	28	28	24.4	10	6.02	1	24.4	0.03	25.154639	0.42
2	0	25	25								
3	0	24	24								
4	0	24	24		_						
5	0	25	25			2.20					
6	0	23	23			_					
7	0	24	24			10					
		22	22								
8	0										
	0	24	24			and the	114				
8					2	Spec	ad 90				
8 9	0	24	24 25	Average WR Time	n'	Spee	ed 90 Norm	al Time	Allowance	Standard Time	Standard Time
8 9 10	0 0 W	24 25 R Tin	24 25	-	n'			al Time	Allowance Factor	2	
8 9 10	0 0 W	24 25 R Tin	24 25	-	n'			al Time		total sec	
8 9 10	0 0 W	24 25 R Tin	24 25	Time	n' 7		Norm			Time	Time
8 9 10 <u>T</u> no.	0 0 W ïime/′	24 25 R Tin 1piec sec	24 25 ne e/team total sec	Time total sec	29	n	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 <u>T</u> no. 1	0 0 w ïime/′ min 0	24 25 R Tin 1piec sec 24	24 25 ne e/team total sec 24	Time total sec	29	n	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 <u>T</u> no. 1 2	0 0 w ime/ ⁷ min 0 0	24 25 R Tin 1piec sec 24 21	24 25 ne e/team total sec 24 21	Time total sec	29	n	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 <u>T</u> no. 1 2 3	0 0 w ime/″ min 0 0 0	24 25 R Tin 1piec 24 21 21	24 25 ne e/team total sec 24 21 21	Time total sec	29	n	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 <u>T</u> no. 1 2 3 4 5 6	0 0 w ime/′ min 0 0 0 0	24 25 R Tin 1piec 24 21 21 21 24 21 22	24 25 ne e/team total sec 24 21 21 21 24 21 22	Time total sec	29	n	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 T no. 1 2 3 4 5	0 0 w ime/* 0 0 0 0 0 0	24 25 R Tin 1piec 24 21 21 21 24 21	24 25 ne e/team total sec 24 21 21 21 24 21	Time total sec	29	n	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 <u>T</u> no. 1 2 3 4 5 6	0 0 w ime/' 0 0 0 0 0 0 0	24 25 R Tin 1piec 24 21 21 21 24 21 22	24 25 ne e/team total sec 24 21 21 21 24 21 22	Time total sec	29	n 5.06	Norm Rating	total sec	Factor	total sec	Time minute
8 9 10 <u>T</u> no. 1 2 3 4 5 6	0 0 ww ime/' 0 0 0 0 0 0 0 0	24 25 R Tin 1piec 24 21 21 21 24 21 22	24 25 ne e/team total sec 24 21 21 21 24 21 22 22	Time total sec	29	n 5.06	Norm	total sec	Factor	Time total sec 22.82769	Time minute
8 9 10 <u>T</u> no. 1 2 3 4 5 6 7	0 0 w ime// 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24 25 R Tim piecc 24 21 21 21 21 22 22 22 R Tim	24 25 ne e/team total sec 24 21 21 21 24 21 22 22	Time total sec 22.1428571	7	n 5.06	Norm	total sec 22.1429	Factor	Time total sec 22.82769	Time minute 0.38
8 9 10 <u>T</u> no. 1 2 3 4 5 6 7	0 0 w ime// 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24 25 R Tim 1piecc 24 21 21 21 21 22 22 22 R Tim piecce	24 25 ne e/team total sec 24 21 21 21 24 21 22 22 22	Time total sec 22.1428571	7	n 5.06	Norm	total sec 22.1429	Allowance	Time total sec 22.82769	Time minute 0.38
8 9 10 10 1 2 3 4 5 6 7 7	0 0 w ime// 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24 25 R Tim 1piecc 24 21 21 21 21 22 22 22 R Tim piecce	24 25 ne e/team total sec 24 21 21 21 22 22 22 22 22	Time total sec 22.1428571	7	n 5.06	Norm	total sec 22.1429	Allowance	Time total sec 22.82769	Time 0.38 Standard Time
8 9 10 10 1 2 3 4 5 6 7 7 7 1 2 3 4 5 6 7 7	0 0 w ime/' 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	24 25 R Tin 5ec 24 21 21 21 22 22 22 R Tin 5ec 24 21 21 22 22 22	24 25 ne e/team total sec 24 21 21 21 21 21 22 22 22 22 ne e/team total sec	Time total sec 22.1428571 2.1428571	7 	n 5.06	Norm	total sec	Factor 0.03 Allowance Factor	Time total sec 22.82769 22.82769 2007 2007 2007 2007 2007 2007 2007 200	Time 0.38 Standard Time

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 450x1500

Table A48.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 450x1500

	Repairing Sub- Process of Metal Form 450x1500 Low Difficulty			No. of Study Units	%	Distribut	tion	Standard (minute		Weighted A Standard Time	
				10		36		3.27		4.69	9
N	Aediur			10		36		4.83			
-	High		ulty Units	8		29		6.30			
- 10	otal S	luay	Units	20							
					I	.ow Di	fficulty	/			
		R Tin	-	Average WR Time	n'	n	Norm	al Time	Allowand	Standard Time	Standard Time
<u>1</u> no.			<u>e/team</u> total sec	total sec			Poting	total sec	Factor	total sec	minute
1	3	10	190	170.9	10	9.033	1	170.9	0.13	196.4368	3.27
2	2	27	147	110.0		0.000			0.10	100.1000	0.21
3	3	1	181								1
4	2	40	160								
5	2	42	162								1
6	2	55	175			3.10					1
7	3	4	184								1
8	3	0	180								1
9	2	39	159								1
10	2	51	171]
					Me	dium	Difficu	ltv			-
						arann		,			
	WR Time			Average WR Time	n'	n	Normal Time		Allowand	e Standard Time	Standard Time
T				1 and		Total a	211212		Factor		
no.	min	_	total sec	total sec			Rating	total sec		total sec	minute
1	4	12	252	251.9	10	5.54	1	251.9	0.13	289.5402	4.83
2	3	57	237								
3	4	3	243								
4	4	43	283								
5	3	59	239	111							
6	4	18	258								
7	4	22	262								
8	4	0	240	0							
9	3	57	237	000	9.14	20/	101		99		
10	4	28	268		4						
					ŀ	ligh Di	ifficult			v	
	-			Average WR	17	Ť	197		971 8	Standard	Standard
	w	R Tir	ne	Time	n'	n	Norn	nal Time	Allowan	Time	Time
	īme/	Ipiec	e/team						Facto	r	
Т	11110/	-	total sec	total sec			Rating	total sec	;	total sec	minute
<u>T</u> no.	-	sec					1	000.075	0.13	378.0172	6.30
	-	sec 46	346	328.875	8	5.91		328.875	0.15		
no.	min				8	5.91		328.875	0.15		
no. 1	min 5	46	346 341		8	5.91		328.875	0.13		
no. 1 2	min 5 5	46 41	346 341 281		8	5.91		328.875	0.13		
no. 1 2 3 4	min 5 5 4 5	46 41 41 28	346 341 281 328		8	5.91		328.875	0.13		
no. 1 2 3 4 5	min 5 5 4 5 5 5 5	46 41 41 28 18	346 341 281 328 318		8	5.91		328.875	0.13		
no. 1 2 3 4 5 6	min 5 5 4 5 5 5 5 5	46 41 41 28 18 37	346 341 281 328 318 337		8	5.91		328.875			
no. 1 2 3 4 5	min 5 5 4 5 5 5 5	46 41 41 28 18	346 341 281 328 318		8	5.91		328.875	0.13		

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 450x1500

Table A49.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 500x1500

			rocess of 00x1500	No. of Study Units	%	6 Distrib	oution	Standar (min		Weighted Standard Tin	
	spe	eed	80	7		33		0.	55	0.4	18
	sp	eed S	00	7		33		0.4	47		
	spe	ed 1	00	7		33		0.4	43		
Т	otal S	Study	Units	21							
						Spe	ed 80	6			
	w	R Tin	ne	Average WR Time	n'	n	Norm	nal Time	Allowand	e Standard Time	Standard Time
Ti	ime/1	piec	e/team			1			Factor		
no.	min	sec	total sec	total sec			Rating	total see	C	total sec	minute
1	0	35	35	32.14285714	7	6.38	1	32.1429	0.03	33.13697	0.55
2	0	33	33							1	
3	0	31	31							1	1
4	0	30	30							1	1
5	0	33	33			1				-	1
6	0	34	34							-	-
7	0	29	29							-	1
1	v	23	2 3								1
							1.00				
					24	Spe	ed 90	2			
	WR Time		ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
			e/team			The Starte	242		Factor		
no.	min	_	total sec	total sec	105	della -	Rating	total sec		total sec	minute
1	0	29	29	27.28571429	7	5.96	1	27.2857	0.03	28.129602	0.47
2	0	26	26								
3	0	29	29								
4	0	27	27								
5	0	24	24								
6	0	28	28	22							
			5	000		Spee	ed 100		600	5	
	W	R Tin	ie	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piece	e/team		~ .		10		Factor		0.1
no.	min	sec	total sec	total sec	11		Rating	total sec		total sec	minute
1	0	22	22	25	7	6.58	<u> </u>	25	0.03	25.7732	0.43
0	0	25	25								
2		25	25								
2	0					1		1	1		
	0 0	27	27								
3			27 27								
3 4	0	27									

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 500x1500

Table A49.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 500x1500

Mi To To 1 2 3	High tal S W me/1 min 2	n Diffic Diffic itudy R Tir	iculty ulty Units	4 24 4 32		13 75 13		3.03		4.72	2
To To 1 2 3	High tal S W me/1 min 2	Diffic Study	ulty Units	4		-					
To Tir no. 1 2 3	W me/1 min 2	itudy R Tir	Units			13					
Tir no. 1 2 3	W me/1 min 2	R Tir		32				7.02			
no. 1 2 3	me/1 min 2				Low Difficulty						
no. 1 2 3	me/1 min 2		ne		L	ow Di	fficult	ty			
no. 1 2 3	min 2	piec		Average WR Time	n'	n	Nor	mal Time	Allowand	e Standard Time	Standard Time
1 2 3	2	min sec total se							Factor		
2		_					Ratin	<u> </u>		total sec	minute
3		40	160	158	4	3.11	1	158	0.13	181.6092	3.03
	2	29	149								
	2	35	155								
4	2	48	168								
					Me	dium	Diffic	ulty			
	w/r	R Tin		Average WR	n'	n	Normal Time		Allowance	Standard	Standard
				Time						Time	Time
	1		e/team		1 3	(0)	D		Factor	4.4.4.1	
	_	_	total sec	total sec	0.1	00.55		g total sec	0.10	total sec	minute
1	4	29	269	241.041667	24	20.55	1	241.042	0.13	277.05939	4.62
2	3	41	221								
3	3	39	219								
4	3	55	235		-						
5	4	21	261		a faire	1910	1				
6	4	7	247								
7	4	29	269		222	113-2					
8	3	52	232								
9	4	13	253								
10	4	17 40	257 280								
12	4	40	280								
12	4	47	167								
13	2	47 8	188					_			
14	3	• 21	261				l				
15	4	21 9	201	J.							
17	4	9 40	249	224	9-1-4		191	4-5-	224		
17	4	40 21	260	6 U		0-1					
19	4	48	201							0.7	
20	3	40 57	228		~				0.0.0		
20	4	2	242						4/19		
22	3	46	242		0.0						
23	3	20	200								
24	4	12	252								
			202								l
					_	l igh D i	ifficul	ty			
		R Tir		Average WR Time	n'	n	Nor	mal Time	Allowand	e Standard Time	Standard Time
			e/team						Factor		
			total sec					g total sec		total sec	minute
1	6	31	391	366.5	4	3.47	1	366.5	0.13	421.2644	7.02
2	6 5	12 45	372 345							_	1
3	5 5	45 58	345 358								

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 500x1500

Table A50.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 600x1500

	of Met			No. of Study Units	% C	Distribu	ition	Standard (minut	-	Weighted A Standard Tim	
	spe	eed 8	60	4		20		0.75	5	0.6	8
	spe	ed 90	0	10		50		0.68	3		
	spe	ed 10	0	6		30		0.63	3		
Тс	otal S	tudy	Units	20							
						Spe	ed 80				
	W	R Tin	ne	Average WR Time	n'	n	Nor	mal Time	Allowan	Standard Time	Standard Time
Т	ïme/1	piec	e/team						Facto	r	
no.	min	sec	total sec	total sec		-	Ratin	total sec	;	total sec	minute
1	0	41	41	43.5	4	2.75	1	43.5	0.03	44.84536	0.75
2	0	46	46								
3	0	44	44								1
4	0	43	43								-
-	Ŭ	-10	-10		-	Spor	ed 90				<u> </u>
						Spec	eu 90				
		R Tir		Average WR Time	n'	n	Nor	mal Time	Allowan	lime	Standard Time
<u>I</u> no.	1		e/team total sec	total sec	32.6	160	Ratin	total sec	Facto	r total sec	minute
1	0	39	39	39.3	10	8.09	1	<u>39.3</u>	0.03	40.51546	0.68
2	0	33	33	00.0	10	0.00		00.0	0.00	40.01040	0.00
3	0	43	43								
					-						-
4	0	39	39		528	1123					4
5	0	38	38								4
6	0	42	42	-							4
7	0	39	39								1
8	0	39	39	TTT					777		
9	0	43	43								
10	0	38	38								1
			3		12	Spee	ed 100			6	-
	w	R Tin	ne	Average WR Time	n'	n		nal Time	Allowanc	e Standard Time	Standard Time
Т	ime/1	piece	e/team	TIME					Factor	Time	Time
no.			total sec	total sec	58		Ratino	total sec	1 00101	total sec	minute
1	0	37	37	36.5	6	3.1	1	36.5	0.03	37.62887	0.63
2	0	35	35	-							
3	0	35	35								
4	0	39	39								
4	0	38	39								
6	0	35	35					1		1	

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 600x1500

Table A50.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 600x1500

	lepair ess of	ing	Sub- al Form	No. of Study Units		6 Distrib		Standard (minu	Time	Weighted	d Average me (minutes)
	Low [-	6		15		3.6		6	.36
	ledium		-	28		68		6.2			
	High I			7		17		9.3	7		
10	otal S	tudy	Units	41							
						Low D	oifficult	y			
	w	R Tin	ne	Average WR Time	n'	n	Norma	Time A	lowance	Standard Time	Standard Time
			e/team						Factor		
no.	_		total sec	total sec			Rating to		0.10	total sec	minute
1	2	58	178	190.6666667	6	5.6	1 1	90.667	0.13	219.157088	3.65
2	3	4 12	184 192								
4	3	29	209		_						
5	3	23	203		-						
6	3	0	180								
							-				
					M	edium	Difficu	пту			
		R Tin		Average WR Time	n'	n	Nori	nal Time	Allowan	Time	Standard Time
<u>no.</u>	Time/1piece/team no. min sec total sec			total sec			Ratin	total sec	Facto	r total sec	minute
1	5	18	318	324.428571	28	27.5		324.429		372.9064	
2	6	3	363								
3	4	14	254								-
4	5	55	355	/ / /							-
5	5	12	312	<u> </u>	34	1465-			1		
6	5	9	309			-	1				
7	4	14	254								
8	5	55	355			_					
9	6	17	377			1.	11/19/19				
10	4	59	299								
11	5	13	313		22						
12 13	6 5	12 31	372 331								
14	4	26	266								
15	5	57	357								
16	6	3	363								
17	6	21	381								
18	4	49	289								
19	6	6	366								_
20	4	43	283								
21	5	44	344	Ş							_
22	6	20	380	001	Q I	47.0	101	115	00	<u> </u>	_
23	4	56	296								
24 25	4	8 12	248 372					<u> </u>			
25	6 4	12 28	268			- 0		-	ł		-
27	5	1	301			Ch E		00	0/10		
28	5	58	358				1 V		1/17		
		1				High [Difficult	У			
							Norr	nal Time	Allowar	nce Standar	d Standard Time
	w	R Tir	ne	Average WR Time	n'	n	NOT				
T			ne :e/team_		n'	n	NOT		Facto		
T no.	ïme/1	piec		Time	n'	n		total sec			
no. 1	ïme/1 min 8	piec sec 59	total sec 539	Time	n' 7	3.67	Rating	total sec 488.857	;	r total see	c minute
no.	ïme/1 min	piec sec	total sec	Time total sec	n		Rating		;	r total see	c minute
no. 1	ïme/1 min 8	piec sec 59	total sec 539 492 484	Time total sec	n		Rating		;	r total see	c minute
no. 1 2 3 4	ïme/1 min 8 8	piec sec 59 12	total sec 539 492 484 467	Time total sec	n		Rating		;	r total see	c minute
no. 1 2 3 4 5	<u>ime/1</u> min 8 8 8 7 8	piec sec 59 12 4 47 0	e/team total sec 539 492 484 467 480	Time total sec	n		Rating		;	r total see	c minute
no. 1 2 3 4	ime/1 min 8 8 8 7	piec sec 59 12 4 47	total sec 539 492 484 467	Time total sec	n		Rating		;	r total see	c minute

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 600x1500

Table A51.1: Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 800x1500

			-Process of 800x1500	No. of St Units		% Di	stributio	ור	lard Time linutes)		d Average me (minutes)
	:	speee	d 80	9			38		0.92	0	.86
		speed	1 90	6			25		0.90		
		speed	100	9			38		0.77		
	Tota	I Stu	dy Units	24							
						Spe	ed 80				
	w	R Tin	ne	Average WR Time	n'	n	Norn	nal Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piece	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec	;	total sec	minute
1	0	55	55	53.77777778	9	3.05	1	53.7778	0.03	55.44101	0.92
2	0	50	50								
3	0	55	55								
4	0	57	57								l
5	0	53	53			1.7					l
6	0	53	53								
7	0	56	56]
8	0	50	50			16					
9	0	55	55]
						Spe	ed 90	4			-
	w	R Tim	ie	Avera <mark>ge WR</mark> Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piece	e/team			E. C.	i felizio	it ha	Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	50	50	52.1666667	6	3.22	1	52.1667	0.03	53.780069	0.90
2	0	49	49								
3	0	51	51	<u></u>							
4	0	53	53								
5	0	55	55						122		
6	0	55	55								
_						Spe	ed 100				
	w	R Tin	ne	Average WR Time	n'	n		al Time	Allowance	Standard Time	Standard Time
Т	ïme/1	piec	e/team		10	d	ΠŪ		Factor	0	
	1	1 1	total sec	total sec			Rating	total sec		total sec	minute
no.		46	46	44.8888889	9	8.37	1	44.8889	0.03	46.277205	0.77
1	0							r f			71
no. 1		-	47								
no. 1 2	0	47	47								
no. 1 2 3	0	47 47	47								
no. 1 2 3 4	0 0 0	47 47 36	47 36								
no. 1 2 3 4 5	0 0 0	47 47 36 45	47 36 45								
no. 1 2 3 4 5 6	0 0 0 0	47 47 36 45 45	47 36 45 45								
no. 1 2 3 4 5 6 7	0 0 0 0 0 0	47 47 36 45 45 45	47 36 45 45 45 45								
no. 1 2 3 4 5 6	0 0 0 0	47 47 36 45 45	47 36 45 45								

Repairing Process: Sanding Sub-Process Time Study Result: Metal Form 800x1500

Table A51.2: Repairing Process: Repairing Sub-Process Time Study Result: MetalForm 800x1500

Repairing Process: Repairing Sub-Process Time Study Result: Metal Form 800x1500

Me	Repairing Sub-Process of Metal Form 800x1500 Low Difficulty			No. of Study Units	G	% Distrib	oution	(minutes)		Weighted Average Standard Time (minutes)		
			-	12		50		4.8	_	6.0	1	
	edium		-	9		38		6.2				
	High D		,	3 24		13		10.2	22			
lot	ai St	uay	Units	24								
						Low D	ifficult	у				
	WR			Average WR Time	n'	' n Nor		al Time	Allowance	Standard Time	Standard Time	
			e/team						Factor			
	_		total sec	total sec	10		Rating		0.10	total sec	minute	
1		24	264	250.333333	12	6.38	1	250.333	0.13	287.7395	4.80	
		30	210									
	4	0	240									
		30	270									
-		27	267 251		_	-	-					
_	· -	11 58	251		_	-						
	3	3	238		_							
	4	3 8	243									
		6 55	240									
		55 12	255									
		12	252		_							
12	-		200		-							
					М	edium	Difficu	ılty				
	WR			Average WR Time	n'	n	Nor	mal Time	Allowand	Ce Standard Time	Standard Time	
Tim	<u>1e/1p</u>	iece	e/team						Factor			
no. m		-	total sec	total sec			Rating	g total sec	;	total sec	minute	
1	5	27	327	325.1111111	9	7.69	1	325.111	0.13	373.6909	6.23	
2	5	12	312									
		2	362									
4	5	51	351	0.7								
5	5 4	47	347			1						
6	5	19	319									
7	4	48	288		1	0.1		0		0		
8	5	13	313			6				0		
9	5	7	307	0.994			010	900	9/10	00	P I	
					0 9	High D	ifficult	y		191	9	
	WR	Tim	ie	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time	
	ne/1p	iece	e/team				l –		Factor			
Tim			total sec	total sec			Rating	total sec		total sec	minute	
	nin s	ec	10121 300									
no. m	_	58	538	533.333333	3	2.05	1	533.333	0.13	613.0268	10.22	
no. m	8	_			3	2.05	1	533.333	0.13	613.0268		

	p		e l	٦											σ											
	Standard Time	minut		1.32											Standard Time		minute	2.62								
	Standard Time	totol c.00	total sec	79.4186											Standard Time		total sec	156.9767								
	Alowance	Factor	:	0.14											Allowance	Factor		0.14								
			al sec	68.3								^					sec	135	+	+	+			\vdash		
33	Normal Time	100 101	Kating total sec	9	_	_						_	_	4	Normal Time		Rating total sec		_	+	+			-		
Cutting 3	N L	Č	_	4.12	-	-						_	_	Cutting 4	n Nc		Rati	1.47 1	_	+	+			-		
Ū	'n			10										Ō	n' r			10 1.4	+	+	+			+		
	VR		8								7				/R		0		+	+	+	+		-		
	Average WR Time	totol c.o.	total sec	68.3	4							2			Average WR Time		total sec	135								
		team	min sec total sec	2	67	68	73	61	65	70	<mark>66</mark>	71	72			eam	no. min sec total sec	131	138	120	129	135	139	137	142	
	WR Time	piece/t	sec II	2	~	80	13	-	5	10	9	7	12		WR Time	piece/t	sec to	11	2 <u>0</u>	<u>v</u> ç	2 თ	15	19	17	3	!
	WF	Time/1piece/team	Ē	-	-	-	-	-	-	1	+	-	-		WF	Time/1piece/team	min		~ ~	ч с	2 0		~	~	~	
			o L	-	2	e	4	2	9	6	8	6	10				no.	~		0 <	1 10	9	\succ	$^{\circ\circ}$	0	
	<mark>Standard</mark> Time	ation of the second		1.90									300 7/1		Standard Time		minute	1.05								
	Standard Time		total sec	113./209											Standard Time		total sec	63.25581								
		÷	-	- I		-						_								+	-	1	1	T		Í
	Nowance	Factor		0.14		J									Alowance	Factor		0.14								L
	Time Allowance	Factor		0.14		J		٥							Time Allowance	Factor	al sec									
1		Factor						0	7 0				4	12		Factor	ating total sec	1 54.4 0.14	7	2 1						
Cutting 1	n Normal Time Allowance	Factor	Kaing total sec	1 97.8 0.14	6.0		1						4	Cutting 2	n Normal Time Allowance	Factor	Rating total sec	1 54.4	1	N d						
Cutting 1	Normal Time	Factor	kaung total sec	1.16 1 97.8 0.14									4	Cutting 2	Normal Time	Factor	Rating total sec	54.4	1							
Cutting 1	n' Normal Time	Potion http://	Kaung total sec	1 97.8 0.14									9	Cutting 2	n' n Normal Time	Factor		5.54 1 54.4	Ì				0			
Cutting 1	n Normal Time	Factor	total sec Kating total sec	1.16 1 97.8 0.14									9	Cutting 2	n Normal Time	Factor	total sec	5.54 1 54.4	ľ							
Cutting 1	Average WR n' n Normal Time Time	Factor	total sec Kating total sec	97.8 10 1.16 1 97.8 0.14	88	97 Te	86	103	66	92 92	86		94	Cutting 2	Average WR n' n Normal Time		total sec	54.4 10 5.54 1 54.4	2 20		55 32	54	28	09	20	
Cutting 1	Average WR n' n Normal Time Time	Factor	total sec Kating total sec	95 97.8 10 1.16 1 97.8 0.14	38 38	37 97	38 98	43 103	39 99	35 95	38 98	41 101	34 94	Cutting 2	Average WR n' n Normal Time		total sec	57 54.4 10 5.54 1 54.4	2 20		55 55 55 55				56 56	
Cutting 1	n' Normal Time	Factor	total sec total sec Kaung total sec	95 97.8 10 1.16 1 97.8 0.14										Cutting 2	n' n Normal Time	Time/1 piece/team Factor		57 57 54.4 10 5.54 1 54.4	202	5 S		54	28			

Table A52.1: Manufacturing Process: Cutting Sub-Process Time Study Result: HS418

Table A52.2: Manufacturing Process: Welding Sub-Process Time Study Result: HS418

	w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ī	īme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	24	21	1461	1425	10	0.42	1	1425	0.16	1696.429	28.27
2	23	39	1419								
3	23	42	1422								
4	23	51	1431								
5	24	1	1441								
6	23	42	1422			9					
7	23	13	1393								
8	24	11	1451			//					
9	23	0	1380								
10	23	50	1430								

Manufacturing Process: Welding Sub-Process Time Study Result: HS418



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Table A53:	Painting	Sub-Process	Time Study R	esult: HS418

Painting Sub-Process Time Study Result: HS418

Painting Sub-Process of HS418	Standard Time (minutes)
Painting	0.15
Packing	0.08
Marking	0.2
Total Standard Time (minutes)	0.43

						Pair	nting				
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	Time/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	8	8	8.428571429	7	5.52	1	8.42857	0.07	9.06298	0.15
2	0	8	8								
3	0	8	8			///					
4	0	9	9								
5	0	9	9			_					
6	0	9	9			3. 6					
7	0	8	8								
				· · · · · · · · · · · · · · · · · · ·							
					1.2	Pac	king				
	w	R Tin		Average WR		10000					
			ne	Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time
<u> 1</u>	Time/1	piec	e/team	-	n'	n	Norm	nal Time	Allowance Factor		
<u> </u> no.	1		-	-	n'	n	Norm Rating		Factor		
	1		e/team	Time	n' 8	n 7.36			Factor	Time	Time
no.	min	sec	e/team_ total sec	Time total sec			Rating	total sec	Factor	Time total sec	Time minute
no.	min 0	sec 5	e/team total sec 5	Time total sec			Rating	total sec	Factor	Time total sec	Time minute
no. 1 2	min 0 0	sec 5 5	e/team total sec 5 5	Time total sec			Rating	total sec	Factor	Time total sec	Time minute
no. 1 2 3	min 0 0 0	sec 5 5 4	e/team total sec 5 5 4	Time total sec			Rating	total sec	Factor	Time total sec	Time minute
no. 1 2 3 4	min 0 0 0 0	sec 5 4 5	e/team total sec 5 5 4 5	Time total sec			Rating	total sec	Factor	Time total sec	Time minute
no. 1 2 3 4 5	min 0 0 0 0 0 0	sec 5 4 5 5	e/team total sec 5 5 4 5 5 5	Time total sec			Rating	total sec	Factor	Time total sec	Time minute

	ar				
IV/I	Эr	~	n	n	
	a	NI		u.	

					_		9				
	w	R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ime/1	Ipiec	e/team			6		D	Factor	e e	
no.	min	sec	total sec	total sec	5		Rating	total sec	9/16	total sec	minute
1	0	11	11	11.75	4	2.2	1	11.75	0	11.75	0.20
2	0	12	12								
3	0	12	12								
4	0	12	12								
	-	· · · · ·						5			2

Painting Sub-Process Time Study Result: SSE17

Painting Sub-Process of SSE17	Standard Time (minutes)
Painting	0.20
Packing	0.12
Marking	0.2
Total Standard Time (minutes)	0.52

Painting											
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec		0	Rating	total sec		total sec	minute
1	0	11	11	11.25	4	2.37	1	11.25	0.07	12.09677	0.20
2	0	12	12			11					
3	0	11	11			////					
4	0	11	11								
	Packing										
	w	R Tin	ne	Average WR Time	n'	n	Norma	al Time	Allowance	Standard Time	Standard Time

		W	R Tin	ne	Time	n'	n	Normal Time		Allowance	Time	Time
Ĩ	T	ime/1	piec	e/team			200 La	1112		Factor		
	no.	min	sec	total sec	total sec		66.6-	Rating	total sec		total sec	minute
ľ	1	0	7	7	7	2	0	1	7	0	7	0.12
	2	0	7	7		1						

Marking

WR Time				Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Time/1piece/team							Factor				
no.	min	sec	total sec	total sec			Rating	total sec	2	total sec	minute
1	0	11	11	11.75	4	2.17	1	11.75	0	11.75	0.20
2	0	12	12								
3	0	12	12	0.1							
4	0	12	12	001	5.12	5.0/	0.010	12	000		

จุฬาลงกรณ์มหาวิทยาลย

Table A55: Painting Sub-Process Time Study Result: TFT1205

Painting Sub-Process Time Study Result: TFT1205

Painting Sub-Process of TFT1205	Standard Time (minutes)
Painting	0.07
Packing	0.08
Marking	0.20
Total Standard Time (minutes)	0.35

						Pain	ting					
	w	R Tin	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time	
Т	ïme/1	piec	e/team			18.8.8			Factor			
no.	min	sec	total sec	total sec			Rating	total sec	:	total sec	minute	
1	0	4	4	4	3	0	1	4	0.07	4.301075	0.07	
2	0	4	4									
3	0	4	4									
	Packing											
WR Time				Average WR Time	n'	n	Normal Time		Allowance	Standard Time	Standard Time	
Ţ			e/team			10			Factor			
no.			total sec	total sec	1 33		0	total sec		total sec	minute	
1	0	5	5	5	3	0	1	5	0	5	0.08	
2	0	5 5	5									
5	U	5	3									
						Mar	king					
WR Time				Average WR Time	n'	n	Norn	nal Time	Allowance	Standard Time	Standard Time	
Ţ	īme/1	Ipiec	e/team		1	12.1	S VA	and the second s	Factor			
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute	
1	0	11	11	11.75	4	2.17	1	11.75	0	11.75	0.20	
2	0	12	12						13	1		
3	0	12	12							1		
4	0	12	12	-22/					C		1	

สถาบนวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย Table A56: Painting Sub-Process Time Study Result: TFT1215

Painting Sub-Process of TFT1215	Standard Time (minutes)								
Painting	0.10								
Packing	0.08								
Marking	0.20								
Total Standard Time (minutes)	0.38								

Painting Sub-Process Time Study Result: TFT1215

	Painting										
	w	R Tin	ne	Average WR Time n'n Normal Tim				al Time	Allowance	Standard Time	Standard Time
T	ime/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute
1	0	6	6	5.8	10	7.61	1	5.8	0.07	6.236559	0.10
2	0	6	6								
3	0	5	5								
4	0	6	6								
5	0	6	6								
6	0	5	5			. 7					
7	0	6	6			1. 2.1.1					
8	0	6	6								
9	0	6	6			(6	1.1.1				
10	0	6	6								
	Packing										
	W	R Tim	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time
Ti	ime/1	piece	e/team	//		1. C. C.	1123	13	Factor		
no.		_	total sec	total sec			ÿ	total sec		total sec	minute
1	0	5	5	5	3	0	1	5	0	5	0.08
2	0	5 5	5 5								
3	0	S	S					J			
						Mar	king				
	w	R Tir	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time
T	ime/1	piec	e/team						Factor		
no.	min	sec	total sec	total sec	6		Rating	total sec	>	total sec	minute
1	0	11	11	11.75	4	2.17	1	11.75	0	11.75	0.20
2	0	12	12		2	0 1		0			
	-	12	12							0.1	1
3	0	12									
3 4	0	12	12				10		0.0.0	00	0.1

Pa	ainti	ng S	Sub-Proc	ess of TFT12	217	Standard Time (minutes)							
	Painting						0.10						
			Packi	na			0.08						
			Marki	0			0.20						
-	Tota	l Sta		ime (minute	s)			0.38					
					-,	Pair	nting	0.00					
				Average W/P			l			Standard	Standard		
		R Tir		Average WR Time	n'	n	Norr	nal Time	Allowance	Time	Time		
_			<u>e/team</u>						Factor				
_			total sec	total sec				total sec		total sec	minute		
1	0	6	6	5.8	10	7.61	1	5.8	0.07	6.236559	0.10		
2	0	6	6										
3	0	6	6										
4	0	6	6										
5	0	6	6										
6	0	6	6										
7	0	5	5				_						
8	0	6	6										
9	0	5	5				-						
10	0	6	6			537	124						
					1 miles	Pac	king						
	w	R Tir	ne	Average WR Time	n'	n	Normal Time		Allowance	Standard Time	Standard Time		
<u></u>	ime/1	piec	e/team		Sector.	101000			Factor				
no.	min	sec	total sec	total sec	125	1150	Rating	total sec		total sec	minute		
1	0	5	5	5	3	0	1	5	0	5	0.08		
2	0	5	5										
3	0	5	5						X				
						Mar	king						
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
Ti	ime/1	piec	e/team		a 12	5	0.01	010	Factor	~			
no.	min	sec	total sec	total sec		14/	Rating	total sec		total sec	minute		
1	0	11	11	11.75	4	2.17	1	11.75	0	11.75	0.20		
2	0	12	12			0		6		$\overline{\mathcal{O}}$			
3	0	12	12	างก	55		19,	800	9/1.6	12	61		
4	0	12	12		db	100			5 7 I C	161	C		
4	0	12	12		00								

Table A57: Painting Sub-Process Time Study Result: TFT1217

Painting Sub-Process Time Study Result: TFT1217

Table A58: Painting Sub-Process	Time Study Result: YFT1218
---------------------------------	----------------------------

Failling Sub-Frocess Time Sludy	Result IFIIZIO
Painting Sub-Process of YFT1218	Standard Time (minutes)
Painting	0.13
Packing	0.10
Marking	0.20
Total Standard Time (minutes)	0.43

Painting Sub-Process Time Study Result: YFT1218

						Pair	nting						
	w	R Tir	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time		
Ţ	ïme/1	piec	e/team						Factor				
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute		
1	0	7	7	7	3	0	1	7	0.07	7.526882	0.13		
2	0	7	7										
3	0	7	7								1		
	Packing												
	WR Time Average WR Time n' n Normal Time Allowance Standard Time Time												
Ţ	ime/1	piec	e/team		2	6	14		Factor				
no.				total sec	12	100	Rating	total sec	:	total sec	minute		
1	0	6	6	5.875	8	5.07	1	5.875	0	5.875	0.10		
2	0	6	6										
3	0	5	5			26							
4	0	6	6		150	100							
5	0	6	6										
6	0	6	6		123	213							
7	0	6	6										
8	0	6	6	2									
						Mar	king						
	w	R Tiı	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
Ţ	ïme/1	piec	ce/team	0					Factor				
no.	min	sec	total sec	total sec			Rating	total sec	004	total sec	minute		
1	0	11	11	11.75	4	2.17	1	11.75	0	11.75	0.20		
2	0	12	12							0.7			
3	0	12	12		~		10		0.00	<u> </u>	6.1		
4	0	12	12		7						¥.		

Table A59: Painting Sub-Process Time Study Result: Round Pipe 48.6x1000

				nting					0.05				
				cking			0.03						
	τ.			rking	1)								
	10	otal	Standard	l Time (minu	tes)				0.28				
						Pair	nting						
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
T			e/team				177	-	Factor				
no.	min		total sec	total sec			Rating	total sec		total sec	minute		
1							1	3	0.07	3.225806	0.05		
2													
3	3 0 3 3												
	Packing												
	w	'R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
Ī	īme/′	1piec	e/team			200			Factor				
no.	_	sec		total sec			Rating	total sec		total sec	minute		
1	0	2	2	2	2	0	1	2	0	2	0.03		
2	0	2	2			652							
					14	Mar	king						
	w	R Tin	ne	Average WR Time	n'	n	Norm	nal Time	Allowance	Standard Time	Standard Time		
T	Time/1piece/team								Factor				
no.				total sec	1203	1133	Rating		:	total sec	minute		
1	0	11	11	11.75	4	2.17	1	11.75	0	11.75	0.20		
2	0	12	12										
3	0	12	12										
4	0	12	12						1		J		
									30				

Painting Sub-Process Time Study Result: RO48.6x1000

Painting Sub-Process of RO48.6x1000

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Standard Time (minutes)

Table A60: Painting Sub-Process Time Study Result: Round Pipe 48.6x2000

	y Nesali. NO40.0X2000
Painting Sub-Process of RO48.6x2000	Standard Time (minutes)
Painting	0.07
Packing	0.03
Total Standard Time (minutes)	0.10

Painting Sub-Process Time Study Result: RO48.6x2000

	Painting											
	w	R Tir	ne	Average WR Time	Norm	al Time	Allowance	Standard Time	Standard Time			
T	Time/1piece/team					Factor						
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute	
1	0	4	4	4	3	0	1	4	0.07	4.301075	0.07	
2	0	4	4									
3	0	4	4									
						. 7						
Packing												
						Pac	king					
	W	R Tin	ne	Average WR Time	n'	Pac n		nal Time	Allowance	Standard Time	Standard Time	
			ne e/team	•	n'	1001		al Time	Allowance Factor			
<u>T</u> no.	ime/1	piec		•	n'	1001		total sec	Factor			
_	ime/1	piec	e/team	Time	n' 2	1001	Norm		Factor	Time	Time	



Failing Sub-Frocess Time Study Kes	Suil. R046.6X3000
Painting Sub-Process of RO48.6x3000	Standard Time (minutes)
Painting	0.07
Packing	0.03
Total Standard Time (minutes)	0.10

Table A56: Painting Sub-Process Time Study Result: Round Pipe 48.6x3000

Painting Sub-Process Time Study Result: RO48.6x3000

Painting

	· ····································											
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time	
T	ïme/1	piec	e/team						Factor			
no.	min	sec	total sec	total sec			Rating	Rating total sec		total sec	minute	
1	0	3	3	3.9	10	9.47	1	3.9	0.07	4.193548	0.07	
2	0	4	4									
3	0	4	4									
4	0	4	4									
5	0	4	4									
6	0	4	4									
7	0	4	4									
8	0	4	4									
9	0	4	4									
10	0	4	4			2.20						
						Pac	king					
WR Time Average WR Time Normal Time									Allowance	Standard Time	Standard Time	
T	Time/1piece/team				1	77.0	1150		Factor			
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute	
1	0	2	2	2	2	0	1	2	0	2	0.03	
				and the second se								

Table A61: Painting Sub-Process Time Study Result: Round Pipe 48.6x4000

Painting Sub-Process Time Study Result: RO48.6x4000

Ра	intin	g Su	b-Proces	s of RO48.6x	4000		Stan	dard Tin	ne (minute	s)	
			Painti	ing							
			Packi	ing				0.0)3		
	Tota	al St	andard T	ime (minutes	5)			0.1	0		
				e e	6	Pain	ting				
	w	'R Tir	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
-	Time/1piece/team								Factor	0.1	
no.	no. min sec total sec t		total sec		0	Rating	total sec		total sec	minute	
1	0	4	4	4	3	0	1	4	0.07	4.301075	0.07
2	0	4	4		d b	100	7				
3	0	4	4]
						Pac	king				
	W	R Tim	e	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
Ţ	Time/1piece/team								Factor		
no.	b. min sec total sec total sec						Rating	total sec		total sec	minute
1	1 0 2 2 2 2 2					0	1	2	0	2	0.03
2	0	2	2								

Painting Sub-Process of RO48.6x4500	Standard Time (minutes)
Painting	0.08
Packing	0.03
Total Standard Time (minutes)	0.12

Table A62: Painting Sub-Process Time Study Result: Round Pipe 48.6x4500

<u>Pain</u>

	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
<u>T</u> no.			<u>e/team</u> total sec	total sec			Rating	total sec	Factor	total sec	minute
1	0	4	4	4.2	15	14.51	1	4.2	0.07	4.516129	0.08
2	0	4	4								
3	0	4	4								
4	0	5	5								
5	0	4	4								
6	0	4	4			L 1					
7	0	4	4								
8	0	4	4								
9	0	4	4								
10	0	4	4								
11	0	4	4			- 7-					
12	0	5	5			1					
13	0	5	5								
14	0	4	4			10					
15	0	4	4								
						Pac	king				
	w	R Tin	ne	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time
T	ïme/1	piec	e/team					4	Factor		
no.	min	sec	total sec	total sec	1136	Sel China	Rating	total sec		total sec	minute
1	0	2	2	2	2	0	1	2	0	2	0.03
2	0	2	2		120	1153					

Painting

				0.00						
	ainting			0.08						
Pa	acking			0.03						
Total Standar	d Time (minu	ites)		0.12						
			nting							
WR Time	Average WR Time	n'	n	Nor	mal Time	Allowance	Standard Time	Standard Time		
Time/1piece/team				11		Factor				
no. min sec total sec	total sec				g total se		total sec	minute		
1 0 5 5	4.2	15	14.51	1 1	4.2	0.07	4.516129	0.08		
2 0 5 5										
3 0 4 4										
4 0 4 4										
5 0 4 4										
6 0 4 4										
7 0 4 4										
8 0 4 4										
9 0 4 4				12						
10 0 4 4										
11 0 4 4			10					_		
12 0 4 4			100	0						
13 0 5 5				-	4					
14 0 4 4		100	6612	1230						
15 0 4 4								_		
		15 Col	Pac	king	ZA V					
WR Time	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
<u>Time/1piece/team</u>						Factor				
no. min sec total sec	total sec			-	total sec		total sec	minute		
1 0 2 2	2	2	0	1	2	0	2	0.03		
	2 0 2 2									

Table A63: Painting Sub-Process Time Study Result: Round Pipe 48.6x5000

Painting Sub-Process Time Study Result: RO48.6x5000

Painting Sub-Process of RO48.6x5000

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Standard Time (minutes)

			Pa	inting			0.08						
				icking			0.03						
	_			-									
		ota	Standar	d Time (minut	es)		0.12						
						Pain	ting						
	w	R Tir	ne	Average WR Time n'		n	Normal Time		Allowance	Standard Time	Standard Time		
Ti	ime/1	piec	e/team				1//	1	Factor				
no.	min	sec	total sec	total sec			Rating	total sec		total sec	minute		
1	0	5	5	4.69565217	23	21.7	1	4.69565	0.07	5.049088	0.08		
2	0	3	3										
3	0	4	4			-							
4	0	4	4										
5	0	5	5										
6	0	4	4										
7	0	4	4										
8	0	5	5			16							
9	0	4	4				-						
	10 0 5 5												
11	0	5	5										
12	0	5	5				1						
13	0	5	5			-							
14	0	5	5										
15	0	5	5			24	1211						
16	0	5	5										
17	0	5	5		1000	1212	2122						
18	0	5	5										
19	0	5	5		215		5315						
20	0	5	5										
21	0	5	5										
22	0	5	5 5										
23	0	5	0	-									
						Pac	king						
		R Tir	- 6	Average WR Time	n'	n	Norm	al Time	Allowance	Standard Time	Standard Time		
<u>Ti</u> no.			e/team total sec	total sec	Ь	JV	Rating	total sec	Factor	total sec	minute		
1	0	2	2	2	2	0	1	2	0	2	0.03		
2	0	2	2	N.9 614	55	119	192		9/16	12	2		

Table A64: Painting Sub-Process Time Study Result: Round Pipe 48.6x6000

Painting Sub-Process Time Study Result: RO48.6x6000

Painting Sub-Process of RO48.6x6000

Standard Time (minutes)

Appendix B: The Information System Preliminary Evaluation Result

สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย

Order Number	Item	Order QTY	Order Date	ABC's Promised Date	Actual Delivery Date	Estimate Delivery Date from IS	Estimate Delivery Date from IS+min 1day logistic
DR011772_Y	114-0203	200	15.มี.ค08	15.มี.ค08	15.มี.ค08	15.มี.ค08	16.มี.ค08
DR011774_Y	112-2403	150	15.มี.ค08	15.มี.ค08	15.มี.ค08	15.มี.ค08	16.มี.ค08
DR011776_Y	112-0102	150	15.มี.ค08	15.มี.ค08	15.มี.ค08	15.มี.ค08	16.มี.ค08
DR036701	112-0102	100	15.มี.ค08	17.มี.ค08	16.มี.ค08	15.มี.ค08	16.มี.ค08
DR036701	112-0102	100	15.มี.ค08 15 ชี ๑09	17.มี.ค08 16.มี.ค08	16.มี.ค08 1(มี ค09	15.มี.ค08 15 สี อ09	16.มี.ค08 14 มี ค.ค.ค
DR036702 DR036701	213-2304 112-2411	200 50	15.มี.ค08 15.มี.ค08	16.ม.ค08 17.มี.ค08	16.มี.ค08 16.มี.ค08	15.มี.ค08 15.มี.ค08	16.มี.ค08 16.มี.ค08
DR036701	112-2411	50	15.มี.ค08	17.มี.ค08	17.มี.ค08	15.มี.ค08	16.มี.ค08
DR036701	112-0102	200	15.มี.ค08	17.มี.ค08	17.มี.ค08	15.มี.ค08	16.มี.ค08
DR036701	114-0203	100	15.มี.ค08	17.มี.ค08	17.มี.ค08	15.มี.ค08	16.มี.ค08
DR036700	112-0401	12	15.มี.ค08	17.มี.ค08	17.มี.ค08	15.มี.ค08	16.มี.ค08
DR036695	112-2407	10	15. <mark>มี.ค08</mark>	17.มี.ค08	18.มี.ค08	15.มี.ค08	16.มี.ค08
DR036695	112-2411	10	15.มี.ค08	17.มี.ค08	18.มี.ค08	15.มี.ค08	16.มี.ค08
DR036705	112-0401	30	15.มี.ค08 15.มี.ค08	16.มี.ค08 16 มี ค08	18.มี.ค08 19 มี ค09	15.มี.ค08 15 สี ฉ09	16.มี.ค08 16 มี ค08
DR036705 DR036705	213-2304 114-0203	320 132	าร.ม.ค08 15.มี.ค08	16.มี.ค08 16.มี.ค08	18.มี.ค08 18.มี.ค08	15.มี.ค08 15.มี.ค08	16.มี.ค08 16.มี.ค08
DR036705	114-0203	280	15.มี.ค08	16.มี.ค08	19.มี.ค08	17.มี.ค08	18.มี.ค08
DR036705	114-0203	100	15.มี.ค08	16.มี.ค08	19.มี.ค08	15.มี.ค08	16.มี.ค08
DR036705	112-2106	377	15.มี.ค08	16.มี.ค08	19.มี.ค08	17.มี.ค08	18.มี.ค08
DR036705	112-0401	40	15.มี.ค08	16.มี.ค08	20.มี.ค08	17.มี.ค08	18.มี.ค08
DR036705	112-0501	100	15.มี.ค08	16. <mark>มี.</mark> ค08	20.มี.ค08	17.มี.ค08	18.มี.ค08
DR036705	112-0501	20	15.มี.ค08	16.มี.ค08	21.มี.ค08	17.มี.ค08	18.มี.ค08
DR036707	213-2304	200	15.มี.ค08	15.มี.ค08	23.มี.ค08	17.มี.ค08	18.มี.ค08
DR036707	112-0401	200	15.มี.ค08 16.มี.ค08	15.มี.ค08 1/ ชื่อ 09	26.มี.ค08 1(มี.ค09	17.มี.ค08 17 มี ค09	18.มี.ค08 19 สี ค.ค.ค
DR011779_Y DR036712	112-2407 112-0102	20 50	16.ม.ค08 17.มี.ค08	16.มี.ค08 17.มี.ค08	16.มี.ค08 17.มี.ค08	17.มี.ค08 17.มี.ค08	18.มี.ค08 18.มี.ค08
DR011782_Y	112-0102	52	17.ม.ศ. 08 17.มี.ค. 08	17.ม.ศ08 17.มี.ค08	17.ม.ค08 17.มี.ค08	17.ม.ศ08 17.มี.ค08	18.มี.ค08
DR011787_Y	112-0102	300	17.มี.ค08	17.มี.ค08	17.มี.ค08	17.มี.ค08	18.มี.ค08
 DR011793_Y	114-5704	100	17.มี.ค08	17.มี.ค08	17. <mark>มี.ค</mark> 08	17.มี.ค08	18.มี.ค08
DR036716	213-2304	20	17.มี.ค08	18.มี.ค08	18.มี.ค08	17.มี.ค08	18.มี.ค08
DR036715	112-0401	20	17.มี.ค08	18.มี.ค08	18.มี.ค08	17.มี.ค08	18.มี.ค08
DR036715	213-2304	60	17.มี.ค08	18.มี.ค08	18.มี.ค08	17.มี.ค08	18.มี.ค08
DR036714	112-0102	252	17.มี.ค08	18.มี.ค08	18.มี.ค08	18.มี.ค08	19.มี.ค08
DR036731 DR036731	112-0102 112-0401	60 20	17.มี.ค08 17.มี.ค08	18.มี.ค08 18.มี.ค08	18.มี.ค08 18.มี.ค08	18.มี.ค08 18.มี.ค08	19.มี.ค08 19.มี.ค08
DR036729	213-2304	100	17.ม.ค08 17.มี.ค08	19.มี.ค08	19.มี.ค08	18.มี.ค08	19.มี.ค08
DR036728	213-2304	80	17.มี.ค08	18.มี.ค08	20.มี.ค08	18.มี.ค08	19.มี.ค08
DR036723	114-0202	1200	17.มี.ค08	18.มี.ค08	20.มี.ค08	17.มี.ค08	18.มี.ค08
DR036723	114-5904	50	17.มี.ค08	18.มี.ค08	20.มี.ค08	17.มี.ค08	18.มี.ค08
DR036732	213-2304	30	17.มี.ค08	17.มี.ค08	24.มี.ค08	18.มี.ค08	19.มี.ค08
DR011807_Y	112-0102	300	18.มี.ค08	18.มี.ค08	18.มี.ค08	18.มี.ค08	19.มี.ค08
DR011813_Y	112-0102	40	18.มี.ค08 10 ส 00	18.มี.ค08 10 คื - 00	18.มี.ค08 10 สี - 00	18.มี.ค08	19.มี.ค08 10 สี - 00
DR011813_Y DR011815_Y	213-2304 114-0203	5 300	18.มี.ค08 18.มี.ค08	18.มี.ค08 18.มี.ค08	18.มี.ค08 18.มี.ค08	18.มี.ค08 18.มี.ค08	19.มี.ค08 19.มี.ค08
DR011817_Y	112-0102	48	18.มี.ค08	18.มี.ค08	18.มี.ค08	18.มี.ค08	19.มี.ค08
DR011820_Y	114-0203	300	18.มี.ค08	18.มี.ค08	18.มี.ค08	18.มี.ค08	19.มี.ค08
DR011825_Y	112-0401	48	18.มี.ค08	18.มี.ค08	18.มี.ค08	18.มี.ค08	19.มี.ค08
DR036748	112-0401	96	18.มี.ค08	19.มี.ค08	19.มี.ค08	18.มี.ค08	19.มี.ค08
DR036748	112-2403	48	18.มี.ค08	19.มี.ค08	19.มี.ค08	18.มี.ค08	19.มี.ค08
DR036748	114-0203	96	18.มี.ค08	19.มี.ค08	19.มี.ค08	18.มี.ค08	19.มี.ค08
DR036748	112-0102	192	18.มี.ค08	19.มี.ค08 19.สี - 00	19.มี.ค08	19.มี.ค08	20.มี.ค08
DR036747	213-2304	50	18.มี.ค08 19 มี ค09	19.มี.ค08 10 ชี ๑09	19.มี.ค08 10 มี ค09	18.มี.ค08	19.มี.ค08 20 สี ค. 09
DR036739 DR036739	112-0102 213-2304	190 80	18.มี.ค08 18.มี.ค08	19.มี.ค08 19.มี.ค08	19.มี.ค08 19.มี.ค08	19.มี.ค08 19.มี.ค08	20.มี.ค08 20.มี.ค08
DR036739 DR036739	213-2304 112-2403	80 50	าช.ม.ค08 18.มี.ค08	19.ม.ค08 19.มี.ค08	19.ม.ค08 19.มี.ค08	19.ม.ค08 18.มี.ค08	20.ม.ค08 19.มี.ค08
DR036737	112-0401	30	18.มี.ค08	19.มี.ค08	19.มี.ค08	19.มี.ค08	20.มี.ค08
DR036744	112-0102	40	18.มี.ค08	19.มี.ค08	20.มี.ค08	19.มี.ค08	20.มี.ค08
DR036744	112-0401	20	18.มี.ค08	19.มี.ค08	20.มี.ค08	19.มี.ค08	20.มี.ค08
DR036741	114-5904	40	18.มี.ค08	19.มี.ค08	22.มี.ค08	18.มี.ค08	19.มี.ค08
DR036758	112-2205	200	19.มี.ค08	19.มี.ค08	19.มี.ค08 19.ที่ - 00	19.มี.ค08	20.มี.ค08
DR036758	112-2409	50	19.มี.ค08 10 สี ค.00	19.มี.ค08 10 ชื่อ 00	19.มี.ค08 10 ชี ๑09	19.มี.ค08 10 สี อ09	20.มี.ค08 20 มี ค09
DR036767 DR011826_Y	112-0102 112-2112	8 60	19.มี.ค08 19.มี.ค08	19.มี.ค08 19.มี.ค08	19.มี.ค08 19.มี.ค08	19.มี.ค08 19.มี.ค08	20.มี.ค08 20.มี.ค08
DR011828_Y	112-2112	141	19.ม.ค08 19.มี.ค08	19.ม.ค08 19.มี.ค08	19.ม.ค08 19.มี.ค08	19.ม.ศ. 08 19.มี.ค. 08	20.ม.ศ. 08 20.มี.ค. 08

						Estimate	
Order	Item	Order	Order Date	ABC's Promised	Actual Delivery	Estimate Delivery	Delivery Date
Number	Item	Ω ΤΥ		Date	Delivery	Date from IS	from IS+min
							1day logistic
DR011831_Y	213-2304	40	19.มี.ค08	19.มี.ค08	19.มี.ค08	19.มี.ค08	20.มี.ค08
DR011832_Y	112-0102	50	19.มี.ค08	19.มี.ค08	19.มี.ค08	19.มี.ค08	20.มี.ค08
DR011833_Y	112-2409	20	19.มี.ค08	19.มี.ค08	19.มี.ค08	19.มี.ค08	20.มี.ค08
DR011834_Y	112-0102	250	19.มี.ค08	19.มี.ค08	19.มี.ค08	19.มี.ค08	20.มี.ค08
DR011836_Y	112-2403	199	19.มี.ค08	19.มี.ค08	19.มี.ค08	20.มี.ค08	21.มี.ค08
DR036762	112-2106	100	19.มี.ค08	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08
DR036762	112-2405	98	19.มี.ค08	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08
DR036780	112-0102	300	19.มี.ค08	23.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08
DR036780	112-0102	400	19.มี.ค08	23.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08
DR036756	112-2112	200	19.มี.ค08	20.มี.ค08 22 สี - 02	20.มี.ค08	20.มี.ค08	21.มี.ค08 21.สี - 00
DR036780	112-0102	300	19.มี.ค08 10 มี ค09	23.มี.ค08 20 ชี ค. 00	20.มี.ค08	20.มี.ค08	21.มี.ค08 21 ซี อ09
DR036774 DR036777	112-2106 112-0102	120 80	19.มี.ค08 19.มี.ค08	20.มี.ค08 20.มี.ค08	20.มี.ค08 20.มี.ค08	20.มี.ค08 20.มี.ค08	21.มี.ค08 21.มี.ค08
DR036777 DR036777	112-0102	80 40	19.ม.ค08 19.มี.ค08	20.ม.ค08 20.มี.ค08	20.ม.ค08 20.มี.ค08	20.ม.ศ08 20.มี.ค08	21.ม.ศ08 21.มี.ค08
DR036757	112-2112	500	19.มี.ค08	20.ม.ศ. 08 20.มี.ค. 08	20.ม.ศ00 20.มี.ค08	20.ม.ศ08 21.มี.ค08	22.มี.ค08
DR036770	112-2112	100	19.มี.ค08	20.มี.ค08	20.มี.ค08	19.มี.ค08	20.มี.ค08
DR036771	112-2112	50	19.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR036771	112-2405	60	19.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR036771	112-2411	15	19.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR036771	114-0203	100	19.มี.ค08	20.มี.ค08	20.มี.ค08	19.มี.ค08	20.มี.ค08
DR036783	112-0401	90	19.มี.ค08	21.มี.ค08	21.มี.ค08	20.มี.ค08	21.มี.ค08
DR036783	112-0501	86	19.มี.ค08	21.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08
DR036783	112-2112	250	19.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036776	112-2112	80	<mark>19.มี.ค</mark> 08	20.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036776	112-2411	100	19. <mark>มี</mark> .ค08	20.มี.ค08	2 <mark>1.มี</mark> .ค08	22.มี.ค08	23.มี.ค08
DR036774	112-2112	180	19.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036776	112-0401	10 <mark>0</mark>	<mark>19</mark> .มี.ค08	20.มี.ค08	22.มี.ค08	21.มี.ค08	22.มี.ค08
DR036776	112-0401	149	19.มี.ค08	20.มี.ค08	24.มี. <mark>ค</mark> 08	21.มี.ค08	22.มี.ค08
DR036776	213-2304	400	19.มี.ค08	20.มี.ค08	24.มี.ค08	21.มี.ค08	22.มี.ค08
DR011848_Y	112-0401	5	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR011848_Y	213-2304	25	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR011849_Y	112-0102	30	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR011851_Y	213-2304	100	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR011852_Y	112-0102	30	20.มี.ค08	20.มี.ค08	20.มี.ค08	21.มี.ค08	22.มี.ค08
DR011853_Y	112-0501	18	20.มี.ค08 20 สี - 00	20.มี.ค08 20 สี - 00	20.มี.ค08 20 สี - 00	21.มี.ค08	22.มี.ค08 วา.ศ 00
DR011853_Y	213-2304	18	20.มี.ค08 20 สี - 00	20.มี.ค08 20 สี - 00	20.มี.ค08 20.มี - 00	21.มี.ค08	22.มี.ค08 วา.ศ 00
DR011856_Y	112-0401	100	20.มี.ค08 20 คือ 00	20.มี.ค08 21 ฉี ค09	20.มี.ค08 21 มี ค09	21.มี.ค08 วา.ศ. ค.ค.	22.มี.ค08 วา.ส.ค.00
DR036802 DR036790	112-2411 213-2304	40 140	20.มี.ค08 20.มี.ค08	21.มี.ค08 21.มี.ค08	21.มี.ค08 21.มี.ค08	22.มี.ค08 21.มี.ค08	23.มี.ค08 22.มี.ค08
DR036790	112-0102	40	20.ม.ศ. 08 20.มี.ค. 08	21.ม.ศ08 21.มี.ค08	21.ม.ศ. 08 21.มี.ค. 08	21.ม.ศ. 08 21.มี.ค. 08	22.ม.ศ. 08 22.มี.ค. 08
DR036791	112-0102	12	20.ม.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036784	114-5904	102	20.มี.ค08	20.มี.ค08	21.มี.ค08	20.มี.ค08	21.มี.ค08
DR036800	112-0102	100	20.มี.ค08	21.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08
DR036797	112-0401	100	20.มี.ค08	21.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08
DR036797	112-0501	20	20.มี.ค08	21.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08
DR036793	112-2108	160	20.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036797	112-0102	200	20.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036801	112-2411	39	20.มี.ค08	22.มี.ค08	22.มี.ค08	22.มี.ค08	23.มี.ค08
DR036800	112-0102	100	20.มี.ค08	21.มี.ค08	22.มี.ค08	22.มี.ค08	23.มี.ค08
DR036800	112-0401	60	20.มี.ค08	21.มี.ค08	22.มี.ค08	22.มี.ค08	23.มี.ค08
DR036814	112-2409	35	20.มี.ค08	21.มี.ค08	23.มี.ค08	24.มี.ค08	25.มี.ค08
DR036806	213-2304	15	20.มี.ค08	24.มี.ค08	24.มี.ค08	21.มี.ค08	22.มี.ค08
DR036809	112-2211	240	20.มี.ค08	24.มี.ค08	24.มี.ค08	24.มี.ค08	25.มี.ค08
DR036814	112-2411	35	20.มี.ค08	21.มี.ค08	24.มี.ค08	24.มี.ค08	25.มี.ค08
DR036811	112-0102	16	20.มี.ค08	24.มี.ค08	24.มี.ค08	22.มี.ค08	23.มี.ค08
DR036811	112-0401	10	20.มี.ค08	24.มี.ค08	24.มี.ค08	22.มี.ค08	23.มี.ค08
DR036798	112-2112	640	20.มี.ค08	20.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR036798	112-2408	46	20.มี.ค08	20.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR036793	112-2108	240	20.มี.ค08	21.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR036798	112-2409	50	20.มี.ค08	20.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08

Order Number	Item	Order QTY	Order Date	ABC's Promised Date	Actual Delivery Date	Estimate Delivery Date from IS	Estimate Delivery Date from IS+min 1day logistic
DR036793	112-2108	240	20.มี.ค08	21.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR036798	112-2408	50	20.มี.ค08	20.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR036793	112-2108	300	20.มี.ค08 20 สี ค09	21.มี.ค08 20 คือ 09	26.มี.ค08 24 คือ 09	26.มี.ค08 26 มี ค08	27.มี.ค08 27 มี ค.ค.
DR036798 DR036798	112-2112 112-2109	400 500	20.มี.ค08 20.มี.ค08	20.มี.ค08 20.มี.ค08	26.มี.ค08 26.มี.ค08	26.มี.ค08 26.มี.ค08	27.มี.ค08 27.มี.ค08
DR036793	112-2109	275	20.มี.ค08 20.มี.ค08	20.ม.ค08 21.มี.ค08	20.ม.ค08 27.มี.ค08	27.มี.ค08	28.มี.ค08
DR036793	112-2112	160	20.มี.ค08	21.มี.ค08	27.มี.ค08	27.มี.ค08	28.มี.ค08
DR036798	112-2112	260	20.มี.ค08	20.มี.ค08	27.มี.ค08	27.มี.ค08	28.มี.ค08
DR036798	112-2112	226	20.มี.ค08	20.มี.ค08	27.มี.ค08	27.มี.ค08	28.มี.ค08
DR036793	112-2112	220	20.มี.ค08	21.มี.ค08	28.มี.ค08	28.มี.ค08	29.มี.ค08
DR036803	112-2108	40	20.มี.ค08 21 สี - 00	21.มี.ค08	28.มี.ค08	28.มี.ค08	29.มี.ค08
DR036817 DR011869_Y	112-2112 112-2404	40 14	21.มี.ค08 21.มี.ค08	21.มี.ค08 21.มี.ค08	21.มี.ค08 21.มี.ค08	28.มี.ค08 28.มี.ค08	29.มี.ค08 29.มี.ค08
DR011809_1	112-2404	200	21.ม.ศ. 08 21.มี.ค. 08	21.ม.ศ. 08 21.มี.ค. 08	21.ม.ศ. 08 21.มี.ค. 08	28.มี.ค08	29.มี.ค08 29.มี.ค08
DR011878_Y	112-2112	120	21.มี.ค08	21.มี.ค08	21.มี.ค08	28.มี.ค08	29.มี.ค08
DR011879_Y	112-0401	2	21.มี.ค08	21.มี.ค08	21.มี.ค08	22.มี.ค08	23.มี.ค08
DR036818	112-2112	48	21.มี.ค08	22.มี.ค08	22.มี.ค08	28.มี.ค08	29.มี.ค08
DR036826	112-2112	200	21.มี.ค08	22.มี.ค08	22.มี.ค08	29.มี.ค08	30.มี.ค08
DR036828	112-0401	10	21.มี.ค08	22.มี.ค08	22.มี.ค08	22.มี.ค08	23.มี.ค08
DR036831	112-0401	20	21.มี.ค08	22.มี.ค08	22.มี.ค08	22.มี.ค08	23.มี.ค08
DR036827	112-0401	20	21.มี.ค08 21 มี ค. 09	22.มี.ค08 22.มี.ค08	22.มี.ค08 22.มี.ค08	22.มี.ค08 20 มี ค08	23.มี.ค08 20 คือ 09
DR036827 DR036829	112-2112 112-0401	40 99	21.มี.ค08 21.มี.ค08	22.มี.ค08 24.มี.ค08	22.มี.ค08 24.มี.ค08	29.มี.ค08 22.มี.ค08	30.มี.ค08 23.มี.ค08
DR036829	112-0501	20	21.มี.ค08 21.มี.ค08	24.มี.ค08	24.มี.ค08	22.มี.ค08	23.มี.ค08
DR036831	112-2112	24	21.มี.ค08	22.มี.ค08	24.มี.ค08	29.มี.ค08	30.มี.ค08
DR036829	112-0401	60	21.ม <mark>ี.</mark> ค08	24.มี.ค08	25.มี.ค08	22.มี.ค08	23.มี.ค08
DR036829	213-2304	160	21 <mark>.ม</mark> ี.ค08	24.มี.ค08	25. <mark>มี</mark> .ค08	22.มี.ค08	23.มี.ค08
DR036824	112-2511	300	21.มี.ค08	25.มี.ค08	25.มี.ค08	29.มี.ค08	30.มี.ค08
DR036816	112-2112	300	21.มี.ค08	24.มี.ค08	25.มี.ค08	31.มี.ค08	01.เม.ย08
DR036816	112-2112	200	21.มี.ค08	24.มี.ค08	27.มี.ค08	31.มี.ค08	01.เม.ย08
DR036833 DR036878	213-2304 114-0202	10 200	22.มี.ค08 25.มี.ค08	22.มี.ค08 25.มี.ค08	22.มี.ค08 25.มี.ค08	22.มี.ค08 25.มี.ค08	23.มี.ค08 26.มี.ค08
DR036882	112-0102	200	25.มี.ค08 25.มี.ค08	25.ม.ศ. 08 25.มี.ค. 08	25.มี.ค08	25.มี.ค08 25.มี.ค08	26.มี.ค08 26.มี.ค08
DR011905_Y	112-0401	15	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR011905_Y	112-0501	10	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR011909_Y	114-5504	88	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR011912_Y	114-0202	100	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR011913_Y	112-0102	12	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR011913_Y	213-2304	3	25.มี.ค08 วร.ชื่อ 09	25.มี.ค08 วร.ชื่อ 08	25.มี.ค08 วร.ชื่อ 09	25.มี.ค08	26.มี.ค08 26 มี ค.ค.
DR011915_Y DR011916_Y	112-0102 112-0102	300 250	25.มี.ค08 25.มี.ค08	25.มี.ค08 25.มี.ค08	25.มี.ค08 25.มี.ค08	25.มี.ค08 25.มี.ค08	26.มี.ค08 26.มี.ค08
DR011918_Y	112-0102	300	25.มี.ค08 25.มี.ค08	25.มี.ค08	25.มี.ค08	31.มี.ค08	01.เม.ย08
DR011919_Y	114-5304	200	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
 DR011926_Y	114-5904	23	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR011923_Y	112-0102	100	25.มี.ค08	25.มี.ค08	25.มี.ค08	25.มี.ค08	26.มี.ค08
DR036888	112-0102	40	25.มี.ค08	26.มี.ค08	26.มี.ค08	25.มี.ค08	26.มี.ค08
DR036883	114-5504	20	25.มี.ค08	25.มี.ค08	26.มี.ค08	25.มี.ค08	26.มี.ค08
DR036881	112-2407	12	25.มี.ค08 วร.ชื่อ 09	26.มี.ค08 24 มี ค08	26.มี.ค08 24 มี ค09	31.มี.ค08 วร.ชื่อ 09	01.เม.ย08 ว.ศ. ค. ค.
DR036881 DR036885	114-0202 112-0102	64 200	25.มี.ค08 25.มี.ค08	26.มี.ค08 26.มี.ค08	26.มี.ค08 26.มี.ค08	25.มี.ค08 26.มี.ค08	26.มี.ค08 27.มี.ค08
DR036884	112-0102	200	25.มี.ค08 25.มี.ค08	26.มี.ค08	26.มี.ค08	25.มี.ค08	26.มี.ค08
DR036894	114-5504	27	25.มี.ค08	27.มี.ค08	27.มี.ค08	25.มี.ค08	26.มี.ค08
DR036894	213-2304	50	25.มี.ค08	27.มี.ค08	27.มี.ค08	25.มี.ค08	26.มี.ค08
DR036891	112-2407	100	25.มี.ค08	27.มี.ค08	27.มี.ค08	31.มี.ค08	01.เม.ย08
DR036893	112-2407	15	25.มี.ค08	30.มี.ค08	29.มี.ค08	31.มี.ค08	01.เม.ย08
DR036909	213-2304	1	26.มี.ค08	26.มี.ค08	26.มี.ค08	26.มี.ค08	27.มี.ค08
DR011924_Y	213-2315	60	26.มี.ค08 ว(ส.ค.00	26.มี.ค08 2(สี ค09	26.มี.ค08 2(ส.ค.00	26.มี.ค08	27.มี.ค08
DR011936_Y	112-2108	320	26.มี.ค08 26 ปี ค. 08	26.มี.ค08 26 ปี ค.08	26.มี.ค08 26 ปี ค.08	01.เม.ย08 01.เม.ย. 08	02.เม.ย08
DR011939_Y DR036904	112-2112 213-2304	240 50	26.มี.ค08 26.มี.ค08	26.มี.ค08 27.มี.ค08	26.มี.ค08 27.มี.ค08	01.เม.ย08 26.มี.ค08	02.เม.ย08 27.มี.ค08
DR036904 DR036917	213-2304	60	26.ม.ค08 26.มี.ค08	27.ม.ศ. 08 27.มี.ค. 08	27.ม.ค08 27.มี.ค08	26.มี.ค08 26.มี.ค08	27.ม.ศ. 08 27.มี.ค. 08
DR036911	112-2511	20	26.มี.ค08	28.มี.ค08	29.มี.ค08	01.เม.ย08	02.เม.ย08
DR036911	112-2112	300	26.มี.ค08	28.มี.ค08	01.เม.ย08	01.เม.ย08	02.เม.ย08
DR011944_Y	213-2304	68	27.มี.ค08	27.มี.ค08	27.มี.ค08	27.มี.ค08	28.มี.ค08
DR011946_Y	213-2304	3	27.มี.ค08	27.มี.ค08	27.มี.ค08	27.มี.ค08	28.มี.ค08

				A DCla	Actual	Estimato	Estimate
Order	Item	Order	Order Date	ABC's Promised	Actual Delivery	Estimate Delivery	Delivery Date
Number	nem	Ω ΤΥ	order bate	Date	Date	Date from IS	from IS+min
							1day logistic
DR011949_Y	112-2112	4	27.มี.ค08	27.มี.ค08	27.มี.ค08	01.เม.ย08	02.เม.ย08
DR011951_Y	114-0202	1000	27.มี.ค08	27.มี.ค08	27.มี.ค08	27.มี.ค08	28.มี.ค08
DR011953_Y	112-2112	240	27.มี.ค08	27.มี.ค08	27.มี.ค08	01.เม.ย08	02.เม.ย08
DR011954_Y	112-2112	80	27.มี.ค08	27.มี.ค08	27.มี.ค08	01.เม.ย08	02.เม.ย08
DR011955_Y	114-1304	140	27.มี.ค08	27.มี.ค08	27.มี.ค08	01.เม.ย08	02.เม.ย08
DR036928	213-2304	1	27.มี.ค08	28.มี.ค08	28.มี.ค08	27.มี.ค08	28.มี.ค08
DR036933	213-2304	150	27.มี.ค08	28.มี.ค08	28.มี.ค08	27.มี.ค08	28.มี.ค08
DR036938	112-2101	400	27.มี.ค08	28.มี.ค08	28.มี.ค08	02.เม.ย08	03.เม.ย08
DR036933	213-2304	50	27.มี.ค08	28.มี.ค08	28.มี.ค08	27.มี.ค08	28.มี.ค08
DR036924	112-2409	60	27.มี.ค08	29.มี.ค08	29.มี.ค08	02.เม.ย08	03.เม.ย08
DR036928	213-2304	60	27.มี.ค08	28.มี.ค08	03.เม.ย08	27.มี.ค08	28.มี.ค08
DR036945	213-2304	20	28.มี.ค08	29.มี.ค08	28.มี.ค08	28.มี.ค08	29.มี.ค08
DR011958_Y	213-2304	30	28.มี.ค08	28.มี.ค08	28.มี.ค08	28.มี.ค08	29.มี.ค08
DR011965_Y	213-2304	50	28.มี.ค08	28.มี.ค08	28.มี.ค08	28.มี.ค08	29.มี.ค08
DR011966_Y	112-2108	220	28.มี.ค08	28.มี.ค08	28.มี.ค08	02.เม.ย08	03.เม.ย08
DR036964	112-2112	250	28.มี.ค08	29.มี.ค08	29.มี.ค08	02.เม.ย08	03.เม.ย08
DR036943	112-2112	50	28.มี.ค08	29.มี.ค08	29.มี.ค08	02.เม.ย08	03.เม.ย08
DR036953	112-2112	40	28.มี.ค08	29.มี.ค08	29.มี.ค08	03.เม.ย08	04.เม.ย08
DR036949	112-0501	9	28.มี.ค08 29 มี ค.ค9	29.มี.ค08 20 ชี ค. 00	29.มี.ค08 29.มี.ค08	28.มี.ค08	29.มี.ค08 วกศี ค.คว
DR036965	112-0501	10	28.มี.ค08 วง มี ๐.09	29.มี.ค08 20 มี ค. 09		28.มี.ค08	29.มี.ค08 04 เพ.ศ. 08
DR036964 DR036948	112-2101	320	28.มี.ค08 28.มี.ค08	29.มี.ค08 29.มี.ค08	29.มี.ค08 29.มี.ค08	03.เม.ย08 28.มี.ค08	04.เม.ย08 29.มี.ค08
DR036948	112-0501 213-2304	15 10	28.มี.ค08 28.มี.ค08	29.ม.ค08 29.มี.ค08	29.ม.ค08 29.มี.ค08	28.มี.ค08	29.ม.ค08 29.มี.ค08
DR036948 DR036962	213-2304	40	28.มี.ค08 28.มี.ค08	29.ม.ค08 28.มี.ค08	29.ม.ค08 31.มี.ค08	28.มี.ค08	29.ม.ค08 29.มี.ค08
DR036967	213-2304	100	28.ม.ค08 28.มี.ค08	28.ม.ศ. 08 29.มี.ค. 08	02.เม.ย08	28.มี.ค08	29.ม.ค08 29.มี.ค08
DR036969	112-0102	246	20.ม.ศ. 00 29.มี.ค. 08	27.ม.ศ. 08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR036969	112-0102	200	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR036973	114-0202	400	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR036991	112-2112	160	29.มี.ค08	29.มี.ค08	29.มี.ค08	03.เม.ย08	04.เม.ย08
DR011975_Y	112-2112	90	29.มี.ค08	29.มี.ค08	29.มี.ค08	03.เม.ย08	04.เม.ย08
 DR011984_Y	213-2304	110	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
	213-2304	90	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR011986_Y	112-0501	40	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR011987_Y	213-2304	3	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR011989_Y	112-0102	220	29.มี.ค08	29.มี.ค08	29.มี.ค08	29.มี.ค08	30.มี.ค08
DR036982	213-2304	45	29.มี.ค08	30.มี.ค08	30.มี.ค08	29.มี.ค08	30.มี.ค08
DR036977	112-0102	300	29.มี.ค08	31.มี.ค08	31.มี.ค08	29.มี.ค08	30.มี.ค08
DR036977	112-0102	90	29.มี.ค08	31.มี.ค08	31.มี.ค08	29.มี.ค08	30.มี.ค08
DR036978	213-2304	20	29.มี.ค08	31.มี.ค08	31.มี.ค08	29.มี.ค08	30.มี.ค08
DR036985	112-0102	280	29.มี.ค08	01.เม.ย08	01.เม.ย08	29.มี.ค08	30.มี.ค08
DR036985	213-2304	50	29.มี.ค08	01.เม.ย08	01.เม.ย08	29.มี.ค08	30.มี.ค08
DR036977	112-0102	150	29.มี.ค08	31.มี.ค08	04.เม.ย08	31.มี.ค08	01.เม.ย08
DR036996	114-5504	480	31.มี.ค08	31.มี.ค08	31.มี.ค08	31.มี.ค08	01.เม.ย08
DR011993_Y	112-0501	8	31.มี.ค08	31.มี.ค08	31.มี.ค08	31.มี.ค08	01.เม.ย08
DR011996_Y	112-0501	2	31.มี.ค08	31.มี.ค08	31.มี.ค08	31.มี.ค08	01.เม.ย08
DR011999_Y	112-0401	5	31.มี.ค08	31.มี.ค08	31.มี.ค08	31.มี.ค08	01.เม.ย08
DR012000_Y	112-2112	320	31.มี.ค08	31.มี.ค08	31.มี.ค08	04.เม.ย08	05.เม.ย08
DR012001_Y	112-0102	200	31.มี.ค08	31.มี.ค08	31.มี.ค08	31.มี.ค08	01.เม.ย08
DR012005_Y	112-0102	16	31.มี.ค08 วา.ศ 00	31.มี.ค08 01 เม.ย. 00	31.มี.ค08	31.มี.ค08	01.เม.ย08
DR037016	112-0102	100	31.มี.ค08 21 มี ค09	01.เม.ย08 01.เม.ย. 08	01.เม.ย08 01.เม.ย. 08	31.มี.ค08 21 ยื่อ 09	01.เม.ย08 01.เม.ย. 08
DR037024	112-0102	130	31.มี.ค08 21 ขือ 09	01.เม.ย08 01.เม.ย. 08	01.เม.ย08 01.เม.ย. 08	31.มี.ค08 21 ขือ 09	01.เม.ย08 01.เม.ย. 08
DR037024	213-2304 112-0102	30 10	31.มี.ค08 31 มีค.08	01.เม.ย08 01.เม.ย. 08	01.เม.ย08 01.เม.ย. 08	31.มี.ค08 31 ขือ 08	01.เม.ย08 01.เม.ย. 08
DR037009	112-0102 112-0401	10 40	31.มี.ค08 31 มี ค.08	01.เม.ย08 01.เม.ย. 08	01.เม.ย08 01.เม.ย. 08	31.มี.ค08 31 มี ค.08	01.เม.ย08 01.เม.ย. 08
DR037020 DR037020	112-0401 213-2304	40 10	31.มี.ค08 31.มี.ค08	01.เม.ย08 01.เม.ย08	01.เม.ย08 01.เม.ย08	31.มี.ค08 31.มี.ค08	01.เม.ย08 01.เม.ย08
DR037020 DR037017	213-2304 112-0102	40	31.ม.ค08 31.มี.ค08	01.เม.ย08 01.เม.ย08	01.เม.ย08 01.เม.ย08	31.ม.ค08 31.มี.ค08	01.เม.ย08 01.เม.ย08
DR037017 DR037002	112-0102	40 41	31.ม.พ08 01.เม.ย08	01.เม.ย08 02.เม.ย08	01.เม.ย08 01.เม.ย08	31.ม.ศ08 01.เม.ย08	01.เม.ย08 02.เม.ย08
DR037002 DR037002	112-0401	100	01.เม.ย08 01.เม.ย08	02.เม.ย08 02.เม.ย08	01.เม.ย08 01.เม.ย08	01.เม.ย08 04.เม.ย08	02.เม.ย08 05.เม.ย08
DR012007_Y	213-2304	100	01.เม.ย08	02.เม.ย08	01.เม.ย08	01.เม.ย08	02.เม.ย08
DR012010_Y	112-2112	80	01.เม.ย08	01.เม.ย08	01.เม.ย08	04.เม.ย08	05.เม.ย08
		50	5	5	5	5N	00.00.00

Order Number	Item	Order QTY	Order Date	ABC's Promised Date	Actual Delivery Date	Estimate Delivery Date from IS	Estimate Delivery Date from IS+min 1day logistic
DR012013_Y	213-2304	100	01.เม.ย08	01.เม.ย08	01.เม.ย08	01.เม.ย08	02.เม.ย08
DR012085_Y	112-0501	80	01.เม.ย08	01.เม.ย08	01.เม.ย08	01.เม.ย08	02.เม.ย08
DR037029	112-0401	10	01.เม.ย08	02.เม.ย08	02.เม.ย08	01.เม.ย08	02.เม.ย08
DR037029	213-2304	55	01.เม.ย08	02.เม.ย08	02.เม.ย08	01.เม.ย08	02.เม.ย08
DR037029	213-2304	50	01.เม.ย08	02.เม.ย08	02.เม.ย08	01.เม.ย08	02.เม.ย08
DR037043	213-2304	29	01.เม.ย08	02.เม.ย08	02.เม.ย08	01.เม.ย08	02.เม.ย08
DR037042	112-2409	30	01.เม.ย08	02.เม.ย08	02.เม.ย08	04.เม.ย08	05.เม.ย08
DR037025	114-0202	400	01.เม.ย08	02.เม.ย08	02.เม.ย08	01.เม.ย08	02.เม.ย08
DR037041	112-2407	200	01.เม.ย08	02.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08
DR037029	112-0501	109	01.เม.ย08	02.เม.ย08	04.เม.ย08	01.เม.ย08	02.เม.ย08
DR012019_Y DR012025_Y	112-2409 213-2304	50 200	02.เม.ย08	02.เม.ย08 02.เม.ย08	02.เม.ย08 02.เม.ย08	04.เม.ย08 02.เม.ย08	05.เม.ย08 03.เม.ย08
DR012025_1 DR012028_Y	213-2304 213-2304	3	02.เม.ย08 02.เม.ย08	02.เม.ย08 02.เม.ย08	02.เม.ย08 02.เม.ย08	02.เม.ย08 02.เม.ย08	03.เม.ย08 03.เม.ย08
DR012020_1 DR012030_Y	114-0202	400	02.เม.ย08	02.เม.ย08	02.เม.ย08	02.เม.ย08	03.เม.ย08
DR012030_Y	213-2304	100	02.เม.ย08	02.เม.ย08	02.เม.ย08	02.เม.ย08	03.เม.ย08
DR012034_Y	213-2304	4	02.เม.ย08	02.เม.ย08	02.เม.ย08	02.เม.ย08	03.เม.ย08
DR037061	112-0401	20	02.เม.ย08	03.เม.ย08	03.เม.ย08	02.เม.ย08	03.เม.ย08
DR037061	112-2106	200	02.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08	05.เม.ย08
DR037061	112-2112	200	02.เม.ย08	03.เม.ย08	03.เม.ย08	05.เม.ย08	06.เม.ย08
DR037061	213-2304	40	02.เม.ย08	03.เม.ย08	03.เม.ย08	02.เม.ย08	03.เม.ย08
DR037077	213-2304	100	02.เม.ย08	03.เม.ย08	03.เม.ย08	02.เม.ย08	03.เม.ย08
DR037058	112-0401	27	02.เม.ย08	03.เม.ย08	04.เม.ย08	02.เม.ย08	03.เม.ย08
DR037069	213-2304	65	02.เม.ย08	04.เม.ย08	04.เม.ย08	02.เม.ย08	03.เม.ย08
DR037057	213-2304	51	02.ເມ.ຍ08	02.เม.ย08	04.เม.ย08	02.เม.ย08	03.เม.ย08
DR037077	213-2304	240	02.เม.ย08	03.เม.ย08	04.เม.ย08	02.เม.ย08	03.เม.ย08
DR037082	112-0401	50	03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR037083	213-2315	50	03.ເມ.ຍ08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR037088	112-0501	4	03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR012035_Y	213-2304	20	03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR012036_Y	213-2304	40	03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR012038_Y	112-0401	60	03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR012038_Y	112-0501	10	03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08	04.เม.ย08
DR012039_Y	112-0401	8 8	03.เม.ย08	03.เม.ย08 03.เม.ย08	03.เม.ย08 03.เม.ย08	03.เม.ย08	04.เม.ย08
DR012039_Y DR012042_Y	112-0501 112-2112	160	03.เม.ย08 03.เม.ย08	03.เม.ย08	03.เม.ย08	03.เม.ย08 05.เม.ย08	04.เม.ย08 06.เม.ย08
DR012042_1 DR012045_Y	213-2304	180	03.เม.ย08 03.เม.ย08	03.เม.ย08 03.เม.ย08	03.เม.ย08	03.เม.ย08	00.เม.ย08 04.เม.ย08
DR037086	213-2315	14	03.เม.ย08	04.เม.ย08	04.เม.ย08	03.เม.ย08	04.เม.ย08
DR037084	112-2112	100	03.เม.ย08	03.เม.ย08	04.เม.ย08	05.เม.ย08	06.เม.ย08
DR037084	213-2304	50	03.เม.ย08	03.เม.ย08	04.เม.ย08	03.เม.ย08	04.เม.ย08
DR036779	112-2303	510	03.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08	06.เม.ย08
DR037094	112-2112	10	03.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08	06.เม.ย08
DR037094	213-2304	30	03.เม.ย08	04.เม.ย08	04.เม.ย08	03.เม.ย08	04.เม.ย08
DR037095	112-0401	10	03.เม.ย08	04.เม.ย08	04.เม.ย08	03.เม.ย08	04.เม.ย08
DR037090	112-2112	20	03.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08	06.เม.ย08
DR037074	112-2112	40	03.เม.ย08	05.เม.ย08	05.เม.ย08	05.เม.ย08	06.เม.ย08
DR037079	112-2112	7	03.เม.ย08	09.เม.ย08	10.เม.ย08	05.เม.ย08	06.เม.ย08
DR037079	213-2304	35	03.เม.ย08	09.เม.ย08	10.เม.ย08	03.เม.ย08	04.เม.ย08
DR012053_Y	112-0501	50	04.เม.ย08	04.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08
DR012053_Y	213-2304	120	04.เม.ย08	04.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08
DR012054_Y	213-2304	260	04.เม.ย08	04.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08
DR012055_Y	112-0501	8	04.เม.ย08	04.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08
DR012055_Y	213-2304	4	04.เม.ย08	04.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08
DR012057_Y	112-2409	50	04.เม.ย08	04.เม.ย08	04.เม.ย08	05.เม.ย08	06.เม.ย08
DR037103	112-2106	50	04.เม.ย08	05.เม.ย08	05.เม.ย08	05.เม.ย08	06.เม.ย08
DR037104	112-0401	70	04.เม.ย08 04.เม.ย08	04.เม.ย08 05.เม.ย. 08	05.เม.ย08 05.เม.ย. 08	04.เม.ย08	05.เม.ย08 05.เม.ย08
DR037101	213-2304	4	04.เม.ย08 04.เม.ย. 08	05.เม.ย08 05.เม.ย. 08	05.เม.ย08 05.เม.ย. 08	04.เม.ย08	05.เม.ย08 05.เม.ย08
DR037102	112-0401	6	04.เม.ย08 04.เม.ย. 08	05.เม.ย08 05.เม.ย. 08	05.เม.ย08 05.เม.ย. 08	04.เม.ย08 05.เม.ย. 08	05.เม.ย08 06.เม.ย08
DR037099	112-2108 213-2304	20 20	04.เม.ย08 04.เม.ย08	05.เม.ย08 05.เม.ย. 08	05.เม.ย08 05.เม.ย. 08	05.เม.ย08 04 เม.ย. 08	06.เม.ย08 05.เม.ย. 08
DR037109 DR037106	213-2304 112-0401	20 30	04.เม.ย08 04.เม.ย08	05.เม.ย08 05.เม.ย08	05.เม.ย08 05.เม.ย08	04.เม.ย08 04.เม.ย08	05.ເມ.ຍ08 05.ເມ.ຍ08
DR037106 DR037106	112-0401	30 40	04.เม.ย08 04.เม.ย08	05.เม.ย08 05.เม.ย08	05.เม.ย08 05.เม.ย08	04.เม.ย08 05.เม.ย08	05.เม.ย08 06.เม.ย08
DR037100 DR037109	213-2304	280	04.เม.ย08 04.เม.ย08	05.เม.ย08 05.เม.ย08	05.เม.ย08 09.เม.ย08	03.เม.ย08 04.เม.ย08	00.เม.ย08 05.เม.ย08
	112-2104 112-2108	8	04.เม.ย08 04.เม.ย08	05.เม.ย08	10.เม.ย08	04.เม.ย08 05.เม.ย08	05.เม.ย08 06.เม.ย08
DR037097							

Order Number	Item	Order QTY	Order Date	ABC's Promised Date	Actual Delivery Date	Estimate Delivery Date from IS	Estimate Delivery Date from IS+min
				2410	2410	2010 1101110	1day logistic
DR012068_Y	213-2304	8	05.เม.ย08	05.เม.ย08	05.เม.ย08	05.เม.ย08	06.เม.ย08
DR037116	112-0401	100	05.เม.ย08	07.เม.ย08	08.เม.ย08	05.เม.ย08	06.เม.ย08
DR037116	112-0501	100	05.เม.ย08	07.เม.ย08	08.เม.ย08	05.เม.ย08	06.เม.ย08
DR037117	112-0401	21	05.เม.ย08	06.เม.ย08	25.เม.ย08	05.เม.ย08	06.เม.ย08
DR037126	112-0401	150	07.เม.ย08	08.เม.ย08	07.เม.ย08	08.เม.ย08	09.เม.ย08
DR012077_Y	213-2304	15	07.เม.ย08	07.เม.ย08	07.เม.ย08	08.เม.ย08	09.เม.ย08
DR037131	213-2304	100	07.เม.ย08	08.เม.ย08	08.เม.ย08	08.เม.ย08	09.เม.ย08
DR037132	112-2108	40	07.เม.ย08	09.เม.ย08	08.เม.ย08	08.เม.ย08	09.เม.ย08
DR037139	112-0401	18 145	07.เม.ย08 07.เม.ย. 08	08.เม.ย08	08.เม.ย08	08.เม.ย08	09.เม.ย08
DR037138 DR037148	213-2304 112-0401	145 70	07.เม.ย08 08.เม.ย08	11.เม.ย08 08.เม.ย08	11.เม.ย08 08.เม.ย08	08.เม.ย08 08.เม.ย08	09.เม.ย08 09.เม.ย08
DR012081_Y	112-0401	120	08. เม.ย08	08.เม.ย08	08.11.E08	08.เม.ย08	09.เม.ย08 09.เม.ย08
DR012081_1	112-0401	120	08. เม.ย08	08.11.1.08	08.11.E08	08.เม.ย08	09.เม.ย08 09.เม.ย08
DR012081_1	112-0301	20	08. เม.ย08	08.11.E08	08.เม.ย08	08.เม.ย08	09.เม.ย08
DR012090_Y	112-0401	15	08.เม.ย08	08.เม.ย08	08.เม.ย08	08.เม.ย08	09.เม.ย08
DR012091_Y	112-0501	15	08.เม.ย08	08.เม.ย08	08.เม.ย08	08.เม.ย08	09.เม.ย08
DR037176	112-0401	8	08.เม.ย08	09.เม.ย08	09.เม.ย08	08.เม.ย08	09.เม.ย08
DR037149	112-0401	20	08.เม.ย08	09.เม.ย08	09.เม.ย08	08.เม.ย08	09.เม.ย08
DR037149	112-0501	20	08.เม.ย08	09.เม.ย08	09.เม.ย08	08.เม.ย08	09.เม.ย08
DR037144	112-2106	6	08.เม.ย08	08.เม.ย08	09.เม.ย08	08.เม.ย08	09.เม.ย08
DR037151	112-2106	10	08.เม.ย08	08.เม.ย08	10.เม.ย08	08.เม.ย08	09.เม.ย08
DR037177	114-5704	230	08.เม.ย08	09.เม.ย08	11.เม.ย08	08.เม.ย08	09.เม.ย08
DR037177	114-5904	180	08.เม.ย08	09.เม.ย08	11.เม.ย08	08.เม.ย08	09.เม.ย08
DR037145	213-2304	300	<mark>08. ເນ.</mark> ຍ08	18.เม.ย08	18.เม.ย08	08.เม.ย08	09.เม.ย08
DR012093_Y	112-0401	80	09.เม.ย08	09.เม.ย08	09.เม.ย08	09.เม.ย08	10.เม.ย08
DR012093_Y	112-2108	30	09.เม.ย08	09.เม.ย08	09.เม.ย08	09.เม.ย08	10.เม.ย08
DR012094_Y	112-0401	20	09.เม.ย08	09.เม.ย08	09.เม.ย08	09.เม.ย08	10.เม.ย08
DR037189	112-0401	100	09.เม.ย08	10.เม.ย08	10.เม.ย08	09.เม.ย08	10.เม.ย08
DR037187	213-2304	50 500	09.เม.ย08	11.เม.ย08	11.เม.ย08 15 เม.ศ. 09	09.เม.ย08	10.เม.ย08 10.เม.ซ. 08
DR037188 DR037188	114-5704 114-5704	240	09.เม.ย08 09.เม.ย08	11.เม.ย08 11.เม.ย08	15.เม.ย08 19.เม.ย08	09.เม.ย08 10.เม.ย08	10.เม.ย08 11.เม.ย08
DR037188	114-5704	240	09.เม.ย08	11.เม.ย08	24.เม.ย08	10.เม.ย08	11.เม.ย08 11.เม.ย08
DR037188	114-5704	60	09.เม.ย08	11.เม.ย08	25.เม.ย08	10.เม.ย08	11.เม.ย08
DR037193	114-5304	320	10.เม.ย08	10.เม.ย08	10.เม.ย08	10.เม.ย08	11.เม.ย08
DR037200	112-0301	20	10.เม.ย08	10.เม.ย08	10.เม.ย08	10.เม.ย08	11.เม.ย08
DR012099_Y	112-0401	30	10.เม.ย08	10.เม.ย08	10. เม.ย08	10.เม.ย08	11.เม.ย08
DR012105_Y	112-0301	10	10.เม.ย08	10.เม.ย08	10. เม.ย08	10.เม.ย08	11.เม.ย08
DR037192	112-0401	10	10.เม.ย08	11.เม.ย08	11.เม.ย08	10. เม.ย08	11.เม.ย08
DR037191	112-0301	20	10.เม.ย08	11.เม.ย08	11.เม.ย08	10. เม. ย08	11.เม.ย08
DR037202	112-0301	100	10.เม.ย08	11.เม.ย08	11.เม.ย08	10.เม.ย08	11.เม.ย08
DR037194	112-0301	140	10.เม.ย08	19.เม.ย08	20.เม.ย08	10.เม.ย08	11.เม.ย08
DR037194	112-0401	6	10.เม.ย08	19.เม.ย08	20.เม.ย08	10. เม.ย08	11.เม.ย08
DR037215	114-5304	60	11.เม.ย08	11.เม.ย08	19.เม.ย08	11.เม.ย08	12.เม.ย08
DR037218	112-0401	20	18.เม.ย08	18.เม.ย08	18.เม.ย08 10.เม.ย. 00	18.เม.ย08	19.เม.ย08
DR037227	112-0401	40	18.เม.ย08	19.เม.ย. 08	18.เม.ย08 18.เม.ย08	18.เม.ย08	19.เม.ย08
DR012115_Y	112-2409	36	18.เม.ย08 18.เม.ย. 08	18.เม.ย08 19.เม.ย. 09		18.เม.ย08	19.เม.ย08 19.เม.ย08
DR037218 DR037228	112-0401 112-0401	100 84	18.เม.ย08 18.เม.ย08	18.เม.ย08 19.เม.ย08	19.เม.ย08 19.เม.ย08	18.เม.ย08 18.เม.ย08	19.เม.ย08
DR037220	112-0401	10	18.เม.ย08	19.เม.ย08	21.เม.ย08	18.เม.ย08	19.เม.ย08
DR012123_Y	112-0401	40	19.เม.ย08	19.เม.ย08	19.เม.ย08	19.เม.ย08	20.เม.ย08
DR012129_Y	112-2409	30	19.เม.ย08	19.เม.ย08	19.เม.ย08	19.เม.ย08	20.เม.ย08
DR012134_Y	112-0401	5	19.เม.ย08	19.เม.ย08	19.เม.ย08	19.เม.ย08	20.เม.ย08
DR037249	112-0401	40	19.เม.ย08	20.เม.ย08	20. เม.ย08	19.เม.ย08	20.เม.ย08
DR012154_Y	112-2106	100	20.เม.ย08	20.เม.ย08	20. เม.ย 08	21.เม.ย08	22.เม.ย08
DR037254	114-5904	100	21.เม.ย08	21.เม.ย08	21.เม.ย08	21.เม.ย08	22.เม.ย08
DR037275	112-0401	306	21.เม.ย08	22.เม.ย08	25.เม.ย08	21.เม.ย08	22.เม.ย08
DR012156_Y	114-5305	24	22.เม.ย08	22.เม.ย08	22.เม.ย08	22. เม.ย08	23.เม.ย08
DR037300	112-2106	200	22.เม.ย08	23.เม.ย08	23.เม.ย08	22. เม.ย08	23.เม.ย08
DR012184_Y	114-5904	100	23.เม.ย08	23.เม.ย08	23.เม.ย08	23.เม.ย08	24.เม.ย08
DR037340	114-5904	60	23.เม.ย08	25.เม.ย08	25.เม.ย08	23.เม.ย08	24.เม.ย08

Order Number	Item	Order QTY	Order Date	ABC's Promised Date	Actual Delivery Date	Estimate Delivery Date from IS	Estimate Delivery Date from IS+min 1day logistic
DR037352	114-5305	168	24.เม.ย08	25.เม.ย08	26.เม.ย08	24.เม.ย08	25.เม.ย08
DR037428	112-0102	80	28.เม.ย08	29.เม.ย08	29.เม.ย08	28.เม.ย08	29.เม.ย08
DR037415	112-0102	30	28.เม.ย08	29.เม.ย08	29.เม.ย08	28.เม.ย08	29.เม.ย08
DR037426 DR037441	112-0102 114-5305	140 142	28.เม.ย08 29.เม.ย08	29.เม.ย08 29.เม.ย08	29.เม.ย08 29.เม.ย08	28.เม.ย08 29.เม.ย08	29.เม.ย08 30.เม.ย08
DR037441 DR037478	114-5305	24	29.เม.ย08 30.เม.ย08	27.เม.ย08 30.เม.ย08	27.เม.ย08 02.พ.ค08	30.เม.ย08	01.พ.ค08
DR037514	112-0401	50	02.พ.ค08	02.พ.ค08	03.พ.ค08	02.พ.ค08	03.พ.ค08
DR037504	112-0102	260	02.พ.ค08	03.พ.ค08	03.พ.ค08	02.พ.ค08	03.พ.ค08
DR037507	112-0401	20	02.พ.ค08	03.พ.ค08	03.พ.ค08	02.พ.ค08	03.พ.ค08
DR037507	112-0401	60	02.พ.ค08	03.พ.ค08	03.พ.ค08	02.พ.ค08	03.พ.ค08
DR037521	112-0102	40	03.พ.ค08	03.พ.ค08	03.W.A08	03.พ.ค08	04.พ.ค08
DR037527 DR037527	112-0401 112-0102	80 35	03.พ.ค08 03.พ.ค08	04.พ.ค08 04.พ.ค08	03.พ.ค08 03.พ.ค08	03.พ.ค08 03.พ.ค08	04.พ.ค08 04.พ.ค08
DR012277_Y	112-0102	53 52	03. W. A08	03.W.A08	03. W.A08	03.พ.ค08	04.พ.ค08
DR037531	112-0401	50	03.พ.ค08	05. <mark>พ</mark> .ค08	05.พ.ค08	03.พ.ค08	04.พ.ค08
DR037532	114-5305	80	03.พ.ค08	06.พ.ค08	05.พ.ค08	03.พ.ค08	04.พ.ค08
DR037534	112-0102	96	03.พ.ค08	05.พ.ค08	05.พ.ค08	03.พ.ค08	04.พ.ค08
DR037517	114-5704	140	03.พ.ค08	06.พ.ค08	06.พ.ค08	03.พ.ค08	04.พ.ค08
DR037554	112-0401	200	05. W. A 08	05.w.ค08	05.W.A08	06.พ.ค08	07.พ.ค08
DR012291_Y DR037570	112-0102 112-0102	6 80	05.พ.ค08 05.พ.ค08	05.พ.ค08 06.พ.ค08	05.พ.ค08 06.พ.ค08	06.พ.ค08 06.พ.ค08	07.พ.ค08 07.พ.ค08
DR037570	112-0102	240	05.พ.ศ. 08	06. W. A08	06. W. A08	06.w.A08	07.พ.ศ08
DR037553	114-5504	51	05.พ.ค08	05.พ.ค08	06.W.A08	06.พ.ค08	07.พ.ค08
DR037550	112-0401	180	05.พ.ค08	06.พ.ค08	08.พ.ค08	06.พ.ค08	07.พ.ค08
DR037583	112-0401	10	06.พ.ค08	06.พ.ค08	06.พ.ค08	06.พ.ค08	07.พ.ค08
DR037580	112-0401	4	06.พ.ค08	06.พ.ค08	06.พ.ค08	06.พ.ค08	07.พ.ค08
DR037591	112-0401	40	06.พ.ค08	07.พ.ค08	06.พ.ค08	06.พ.ค08	07.พ.ค08
DR012295_Y	114-5304	6	06.W.A08	06.W.A08	06.W.A08	06.พ.ค08	07.พ.ค08
DR012306_Y DR037588	112-0401 112-0401	1 100	06.พ.ค08 06.พ.ค08	06.พ.ค08 07.พ.ค08	06.พ.ค08 07.พ.ค08	06.พ.ค08 06.พ.ค08	07.พ.ค08 07.พ.ค08
DR037588	112-0401	180	06. W. A08	07.พ.ค08	07.พ.ค08	07.พ.ค08	08.พ.ค08
DR037586	112-0401	25	06. w. ค 08	07.พ.ค08	08.พ.ค08	07.พ.ค08	08.พ.ค08
DR012317_Y	114-5305	36	07.พ.ค08	07.พ.ค08	07.พ.ค08	07.พ.ค08	08.พ.ค08
DR037616	112-0401	100	07.พ.ค08	08.พ.ค08	08.พ.ค08	07.พ.ค08	08.พ.ค08
DR037602	112-0401	12	07.พ.ค08	08.W.A08	08.W.A08	07.พ.ค08	08.พ.ค08
DR037609 DR037617	112-0401 114-5305	30 72	07.พ.ค08 07.พ.ค08	09.พ.ค08 15.พ.ค08	09.พ.ค08 15.พ.ค08	07.พ.ค08 07.พ.ค08	08.พ.ค08 08.พ.ค08
DR012325_Y	112-2112	80	08.พ.ค08	08. W. A08	08. W. A08	08.w.ค08	09.พ.ค08
DR012330_Y	112-2112	220	08.พ.ค08	08.พ.ค08	08.พ.ค08	08.พ.ค08	09.พ.ค08
DR037639	112-2112	100	08.พ.ค08	09.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037638	112-0102	100	08.พ.ค08	09.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037638	112-2112	20	08.พ.ค08	09.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037634	112-0102	60 20	08. W. A 08	09.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037634 DR037634	112-0401 112-2112	20 250	08.พ.ค08 08.พ.ค08	09.พ.ค08 09.พ.ค08	09.พ.ค08 09.พ.ค08	08.พ.ค08 08.พ.ค08	09.พ.ค08 09.พ.ค08
DR037653	112-0102	90	08.พ.ค08	08.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037653	112-0401	48	08.พ.ค08	08.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037650	112-0102	20	08.พ.ค08	09.พ.ค08	09.พ.ค08	08.พ.ค08	09.พ.ค08
DR037646	112-2110	50	08.พ.ค08	11.พ.ค08	11.พ.ค08	08.พ.ค08	09.พ.ค08
DR037598	112-0401	226	08.พ.ค08	11.พ.ค08	11.พ.ค08	08.พ.ค08	09.พ.ค08
DR037647	112-0102	300	08.พ.ค08	15.พ.ค08	14.พ.ค08	09.พ.ค08	10.พ.ค08
DR037647	112-0102 112-0401	150	08.พ.ค08 08.พ.ค.08	15.พ.ค08 15.พ.ค08	14.พ.ค08 14 พ.ค. 09	09.พ.ค08 00 พ.ค.08	10.พ.ค08 10 พ.ค. 08
DR037647 DR037649	112-0401	200 250	08.พ.ค08 08.พ.ค08	15.พ.ศ. 08 11.พ.ค. 08	14.พ.ค08 15.พ.ค08	09.พ.ค08 09.พ.ค08	10.พ.ค08 10.พ.ค08
DR037664	112-0401	180	09.พ.ค08	10.พ.ค08	09.พ.ค08	09.พ.ค08	10.พ.ค08
DR037664	112-0401	280	09.พ.ค08	10.พ.ค08	09.พ.ค08	09.พ.ค08	10.พ.ค08
DR012347_Y	112-0401	20	09.พ.ค08	09.พ.ค08	09.พ.ค08	09.พ.ค08	10.พ.ค08
DR037667	112-0401	200	09.พ.ค08	10.พ.ค08	10.พ.ค08	10.พ.ค08	11.พ.ค08
DR037670	112-0401	180	09.พ.ค08	11.พ.ค08	11.พ.ค08	10.พ.ค08	11.พ.ค08
DR037659	112-0401	12	09.พ.ค08 00 พ.ค. 08	12.พ.ค08 12 พ.ค. 09	12.พ.ค08 12 พ.ค. 09	10.พ.ค08 10 พ.ค. 08	11.พ.ค08 11 พ.ค.09
DR037668 DR012365_Y	112-0401 112-0102	9 300	09.พ.ค08 10.พ.ค08	13.พ.ค08 10.พ.ค08	13.พ.ค08 10.พ.ค08	10.พ.ค08 10.พ.ค08	11.พ.ค08 11.พ.ค08
DR012365_1	112-0102	300	10.พ.ศ. 08 10.พ.ค. 08	10.พ.ศ. 08 10.พ.ค. 08	10.พ.ศ. 08 10.พ.ค. 08	10.พ.ศ. 08	11.พ.ศ08 11.พ.ค08
DR012367_Y	112-0102	50	10.พ.ค08	10.พ.ค08	10.พ.ค08	10.พ.ค08	11.พ.ค08
DR012367_Y	112-0401	100	10.พ.ค08	10.พ.ค08	10.พ.ค08	10.พ.ค08	11.พ.ค08

		Ord		ABC's	Actual	Estimate	Estimate
Order Number	Item	Order QTY	Order Date	Promised Date	Delivery Date	Delivery Date from IS	Delivery Date from IS+min 1day logistic
DR012370 Y	112-0102	10	10.พ.ค08	10.พ.ค08	10.พ.ค08	10.พ.ค08	11.พ.ค08
DR012373_Y	112-0102	20	10.พ.ศ. 08	10.พ.ศ. 08	10.พ.ศ. 08	10.พ.ศ. 08	11.พ.ค08
DR012374_Y	112-0401	300	10.พ.ค08	10.พ.ค08	10.พ.ค08	12.พ.ค08	13.พ.ค08
DR037689	112-0102	150	10.พ.ค08	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037686	112-0102	12	10.พ.ค08	13.พ.ค08	14.พ.ค08	12.พ.ค08	13.พ.ค08
DR037678	112-0401	20	10.พ.ค08	10.พ.ค08	15.พ.ค08	12.พ.ค08	13.พ.ค08
DR037693	112-0102	68	12.พ.ค08	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037693	112-0401	176	12.พ.ค08	12.พ.ค08	12.พ.ค08	12. พ. ค 08	13.พ.ค08
DR037693	112-0102	100	12.พ.ค08	<mark>12.พ.ค</mark> 08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037693	112-0401	100	12.พ.ค08	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037693	112-2411	10	12.พ.ค08	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037698	112-0301	192	12.พ.ค08	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037698	112-2411	48	12.พ.ค08	12.w.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037696 DR037696	112-0102 112-0102	80 80	12.พ.ค08 12.พ.ค08	12.พ.ค08 12.พ.ค08	12.พ.ค08 12.พ.ค08	12.พ.ค08 12.พ.ค08	13.พ.ค08 13.พ.ค08
DR037090	112-0102	100	12.พ.ศ. 08 12.พ.ค. 08	12. W. M08	12.พ.ศ. 08 12.พ.ค. 08	12. พ.ศ08	13.พ.ศ. 08
DR037701	112-0102	100	12.พ.ศ. 08	13.พ.ศ. 08 13.พ.ค. 08	12.พ.ศ. 08	12.พ.ศ08 12.พ.ค08	13.พ.ศ. 08
DR012377_Y	112-0102	30	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08	14.พ.ค08
DR012377 Y	112-0301	7	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08	14.พ.ค08
 DR012382_Y	112-0102	66	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08	14.พ.ค08
DR012382_Y	112-0301	12	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08	14.พ.ค08
DR012389_Y	114-6204	150	12.พ.ค08	12.พ.ค08	12.พ.ค08	12.พ.ค08	13.พ.ค08
DR037723	112-0102	20	12.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037723	112-0301	15	<mark>12.พ.ค</mark> 08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037716	112-0401	130	12.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037699	112-0301	100	12.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037724	114-5904	130	12.พ.ค08	13.พ.ค08	13.พ.ค08	12.พ.ค08	13.พ.ค08
DR037720	112-0401	30	12.พ.ค08	13.W.A08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037718	112-0102	10 5	12.W.A08	13.W.A08	13.W.A08	13.พ.ค08 12 พ.ค. 08	14.พ.ค08 14 พ.ค. 08
DR037718 DR037723	112-0401 112-0102	20	12.พ.ค08 12.พ.ค08	13.พ.ค08 13.พ.ค08	13.พ.ค08 13.พ.ค08	13.พ.ค08 13.พ.ค08	14.พ.ค08 14.พ.ค08
DR037723	112-0102	20	12.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037723	112-0102	40	12.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037723	112-0301	25	12.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR037703	112-0102	36	12.พ.ค08	14.พ.ค08	14.พ.ค08	13.พ.ค08	14.พ.ค08
DR037703	112-0401	12	12.พ.ค08	14.พ.ค08	14.พ.ค08	13.พ.ค08	14.พ.ค08
DR037731	112-0102	8	12.พ.ค08	15.พ.ค08	26.พ.ค08	13.พ.ค08	14.พ.ค08
DR037731	112-0301	3	12.พ.ค08	15.พ.ค08	26.พ.ค08	13.พ.ค08	14.พ.ค08
DR037752	112-0102	135	13.พ.ค08	14.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR012391_Y	114-5904	108	13.พ.ค08	13.พ.ค08	13.พ.ค08	13.พ.ค08	14.พ.ค08
DR012393_Y	114-5904	71	13.พ.ค08	13.พ.ค08	13.พ.ค08	13.w.ค08	14.พ.ค08
DR037733 DR037743	112-2403 112-0102	599 20	13.พ.ค08 13.พ.ค08	14.พ.ค08 14.พ.ค08	14.พ.ค08 14.พ.ค08	13.พ.ค08 13.พ.ค08	14.พ.ค08 14.พ.ค08
DR037734	112-0102	8	13.พ.ศ. 08	14.พ.ศ. 08 14.พ.ค. 08	14.พ.ศ. 08 14.พ.ค. 08	13.พ.ศ. 08	14.พ.ศ08
DR037749	112-0102	66	13.พ.ค08	14.พ.ค08	15.พ.ค08	13.พ.ค08	14.พ.ค08
DR037774	114-6204	150	14.พ.ค08	16.พ.ค08	17.พ.ค08	14.พ.ค08	15.พ.ค08
DR037774	114-6204	150	14.พ.ค08	16.พ.ค08	21.พ.ค08	15.พ.ค08	16.พ.ค08
DR037761	114-5904	582	14.พ.ค08	15.พ.ค08	22.พ.ค08	17.พ.ค08	18.พ.ค08
DR037773	114-5305	143	14.พ.ค08	20.พ.ค08	23.พ.ค08	17.พ.ค08	18.พ.ค08
DR012421_Y	112-0301	50	15.พ.ค08	15.พ.ค08	15.พ.ค08	15.พ.ค08	16.พ.ค08
DR012424_Y	112-0401	24	15.พ.ค08	15.พ.ค08	15.พ.ค08	15.พ.ค08	16.พ.ค08
DR012428_Y	112-0301	72	15.พ.ค08	15.พ.ค08	15.พ.ค08	15.พ.ค08	16.พ.ค08
DR012429_Y	112-0301	20	15.พ.ค08	15.พ.ค08	15.พ.ค08	15.พ.ค08	16.พ.ค08
DR037781	114-5305	36	15.พ.ค08	16.พ.ค08 17 พ.ค. 00	16.พ.ค08 17 พ.ค. 00	17.พ.ค08	18.พ.ค08
DR037778	112-2405	100	15.พ.ค08 15 พ.ค. 09	16.พ.ค08 16 พ.ค. 09	16.พ.ค08 16 พ.ค. 09	15.พ.ค08 15 พ.ค. 08	16.พ.ค08 16 พ.ค. 08
DR037800	112-0102	290 10	15.พ.ค08 15 พ.ค. 09	16.พ.ค08 15 พ.ค. 09	16.พ.ค08 16 พ.ค. 09	15.พ.ค08 15 พ.ค. 09	16.พ.ค08 16 พ.ค. 09
DR037798 DR037790	112-0401 112-0401	10 16	15.พ.ค08 15.พ.ค08	15.พ.ค08 16.พ.ค08	16.พ.ค08 16.พ.ค08	15.พ.ค08 15.พ.ค08	16.พ.ค08 16.พ.ค08
DR037790 DR037792	112-0401	300	15.พ.ศ. 08 15.พ.ค. 08	10.พ.ศ. 08 19.พ.ค. 08	10.พ.ศ. 08 20.พ.ค. 08	15.พ.ศ. 08 15.พ.ค. 08	16.พ.ศ. 08
DR037792	112-0102	300	15.พ.ค08	19.พ.ค08	22.พ.ค08	15.พ.ค08	16.พ.ค08

BIOGRAPHY

Miss Poranee Phaspinyo was born on 26 April, 1981 in Bangkok, Thailand. She has obtained her Bachelor degree in Material Science from Chulalongkorn University. While she is working for Toyota Motor Thailand, Co., Ltd, she enrolls for Master degree in Engineering Business Management at Regional Center for Manufacturing System Engineering, Chulalongkorn University and University of Warwick.



สถาบันวิทยบริการ จุฬาลงกรณ์มหาวิทยาลัย