Application of Material Requirements Planning (MRP) in the Raw Material Department of Bangkok Glass Industry Co., Ltd.

by

Ms. Aruni Dharincharoen

A Final Report of the Three - Credit Course
CE 6998 Project

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
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Project Title	Application of Material Requirements Planning (MRP) in the Raw Material Department of Bangkok Glass Industry Co., Ltd.
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The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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ABSTRACT

In manufacturing, the best inventory position must be found, where the potential for material shortages is well-balanced with the need to minimize on-hand inventories and minimize lead times. The Material Requirements Planning (MRP) System is one of the alternatives to control these activities. In order to make MRP more efficient, the computer based information system is used to keep all material related information. Currently, Bangkok Glass Industry Co., Ltd., the glass containers manufacturer, is faced with the limitations of the existing software which is controlled by Microsoft Excel.

This project is proposed since the existing system does not support the planner very well. This current system requires a lot of time for preparing the monthly report, and the information is not accurate because the planner does not reschedule the plan when the plan was changed. Thus, the proposed system is developed and the author is the designer of this proposed system and the programmer that supports software coding.

According to the limitations, the proposed software is developed to make the MRP report more accurate. This software is called Glass Containers's MRP Software Application which is designed to solve or minimize the current problems. The proposed software controls the material with more efficient and more accurate information. It records and updates the information with Microsoft access in order to share the database. It generates required reports for the planner in order to produce a timely plan. Data redundancy is reduced and the duplication of work is eliminated. Also, it reduces time in searching for the required data.

The result of the system evaluation concludes that the system responds to the planner's needs and objectives and solves the current problems of the existing system. All the screens and reports are generated to be easy to use and understand.

ACKNOWLEDGEMENTS

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Most importantly, the author would first like to acknowledge the tireless project, dedication, and encouragement of Mr. Smith Tungkasmit without whose help this project would have remained a dream. Mr. Smith is the project advisor for suggestion, advice, correction, who helped the most to complete the report.

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Moreover, the author wishes to thank the other project committee members of the Graduate School of Assumption University for their advocating, understanding and support throughout her graduate study.

Finally, she would like to convey special thanks to the author's family who supported her all the time and all her friends who helped and encouraged her to finish this project.

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I. INTRODUCTION

Today's business environment is constantly changing, and companies are looking for ways to cut costs while at the same time increasing quality and thereby increasing profit. Few manufacturing organizations will survive in a competitive environment without Material Requirements Planning (MRP). One of the new methods to increase factory efficiency is by using MRP. Material Requirements Planning has been officially around since the 1960's, with the advent of the use of computers in the manufacturing environment, though the basic principles involved in MRP are an integral part of the manufacturing process itself. However, by defining what MRP is, companies and software vendors are able to adapt a standardized set of methods by which they can schedule delivery of raw materials against the manufacturing schedule, thus keeping their assembly lines moving while at the same time minimizing the amount of inventory on-hand.

In the past, the ideal adaptation of the MRP process has been considered to be a `just in time' scenario, when raw materials arrive just as they are required on the assembly line. Obviously, a system like this has the potential of being thrown 'out of balance' by even the slightest problems; therefore, manufacturers build in 'safety stock' or 'lead time' factors to prevent material shortages from ever causing a 'line stop'. But safety stock and long lead times increase on-hand inventory, requiring larger warehouses to store raw materials, or even work in process, with no immediate benefit. Plus, it ties up the company's liquid capital in non-liquid inventory, which typically depreciates, gets damaged, spoils, and/or becomes obsolete within a relatively short period of time.

Increasingly, the Bangkok Glass Industry requires tools to support the new manufacturing methods and have found limitations in their existing system. The existing system can handle some of the requirements. New requirements which are not addressed by the current system are being handled by external technologies, such as software packages so we will propose the MRP software for the Raw Material Department of Bangkok Glass Industry in order to make the raw material plan more accurate and effective. We develop MRP database software based on Microsoft Windows for glass containers manufacturing company. The software is called Glass Container's MRP software application. This software minimizes inventory costs while maximizing customer commitments. It is easy-to-use and effective MRP.

II. LITERATURE REVIEW

2.1 Introduction of MRP

Material Requirements Planning (MRP)

Material Requirements Planning (MRP) establishes a schedule (priority plan) showing the components required at each level of the assembly and, on the basis of lead times, calculates the time when these components will be needed.

"MRP" is an approach to stocks and scheduling that is widely employed in situations where demand is dependent, where demand can be planned or predicted on the basis of a known program of future activity. The low level code is calculated for each part number in all bills of material. All parts without bills appearing in the customer orders or forecast are 0 level independent demands. Dependent demands for each part number are calculated discretely down to the low level for the part and combined with the independent demands. The supplies, consisting of uncommitted inventory, open manufacturing order lines, and open purchase order lines, are applied to the demands in priority sequence, and the unfulfilled demands becomes dependent demands for the parts lower in the bill of materials. The objective of MRP is "to provide the right part at the right time" to meet the Master Production Schedule (MPS), by providing formal plans for each part number without excess inventory, labor, overtime, or other resources.

This MRP approach was pioneered by Joseph Orlicky, who is the father of modern MRP and described the approach as follows:

"A Material Requirements Planning System, narrowly defined, consists of a set of logically related procedures, decision rules and records designed to translate a master production schedule into time-phase 'net requirements,' and the planned 'coverage' of

such requirements for each component inventory item needed to implement this schedule.... An MRP system replans net requirements and coverage as a result of changes in either the master production schedule, inventory status or product composition."

MRP begins with knowledge of how many end products are desired and when they are needed. This information is broken down into the timing and quantity details for each component part or sub-assembly.

Basically MRP is most suited to a large manufacturing organization which produces some components in-house, buys other components from suppliers and ultimately assembles them all into a fairly complicated finished product. Examples are the manufacture of cars, tractors, electricity generators, rifles, radio and television sets, washing machines and domestic cookers, to mention only a few.

The concept of the system is that production control and inventory management are integrated. This is done in such a way as to ensure that raw materials and components are only made available when they are actually required, and not before. At the same time a similar principle is applied to work in progress in the production areas. Each operation on a component is managed so that when completed, the next part of the production line will be ready to receive it and put it through the next operation without delay, and also without accumulating large quantities of work in progress between operations. Naturally, if this is well done, the amount of capital required to finance stocks of materials and work in progress will be minimized.

It is possible to operate a system with most of the features of the MRP approach manually, but this is only practicable if the product is a simple one, without too many individual components or production operations involved. True MRP systems generally

depend on the use of computers, in view of the large amounts of data which must be stored, retrieved and manipulated.

2.2 Nature of Demand

There are two types of demand, independent and dependent. Independent demand is not related to the demand for any other product. For example if a company makes wooden tables, the demand for the tables is independent. Master production schedule (MPS) items are independent demand items.

The demand for the sides, ends, legs, and top depends on the demand for the tables, and these are dependent demand items.

Figure 2.1 is a product tree that shows the relationship between independent and dependent demand items. The figures in parentheses show the required quantities of each component.

Since independent demand is not related to the demand for any other assemblies or products, it must be forecast. Items shown on an MPS are independent demand. However, since dependent demand is derived or directly related to the demand for higher level assemblies or products, it can be calculated. Material requirements planning is designed to do this calculation.

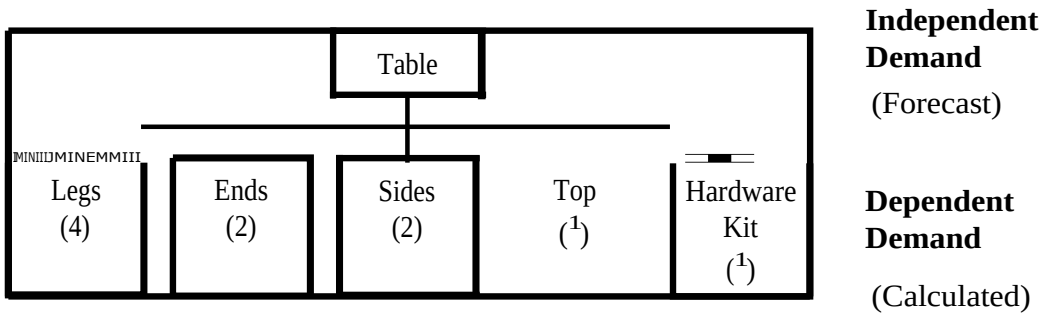

Figure 2.1. Product Tree.

An item can have both a dependent and an independent demand. A service or replacement part has both. The manufacturer of vacuum cleaners uses flexible hoses in the assembly of the units. In the assembly of the vacuums the hose is a dependent demand item. However, the hose has a nasty habit of breaking and the manufacturer must have replacement hoses available. Demand for replacement hoses is independent since demand for them does not depend directly upon the number of vacuums manufactured.

2.3 **Objectives of MRP**

Material requirements planning has two major objectives: determine requirements and keep priorities current.

(1) Determine requirements.

The main objective of any manufacturing planning and control system is to have the right materials in the right quantities available at the right time to meet the demand for the firm's products. The MRP's objective is to determine what components are needed in order to meet the master production schedule and, on the basis of lead time, to calculate the time

periods when the components must be available. It must then determine the following:

(a) What to order.

(b) How much to order.

(c) When to order.

(d) When to schedule delivery.

(2) Keep priorities current.

The demand for and supply of components change daily. Customers enter or change orders. Components get used up, vendors are late with delivery, scrap occurs, orders are completed, and machines break down. In this ever-changing world, MRP must be able to reorganize priorities to keep plans current. It must be able to add and delete, expedite, delay, and change orders.

2.4 Linkages to Other Manufacturing Planning and Control (MPC) Functions

The MRP is driven by the MPS. The MRP is a priority plan for the components needed to make the products in the MPS. It will be a valid plan if the capacity is available when needed to make the components. It must be checked against capacity. The process of doing so is called capacity requirements planning.

Material requirements planning in turn drives, or is input to, Production Activity Control (PAC) and purchasing. It plans the release and receipt dates for orders. It is the job of PAC and purchasing to plan and control the performance of the orders to meet the due dates.

Figure 2.2 shows a diagram of the production planning and control system.

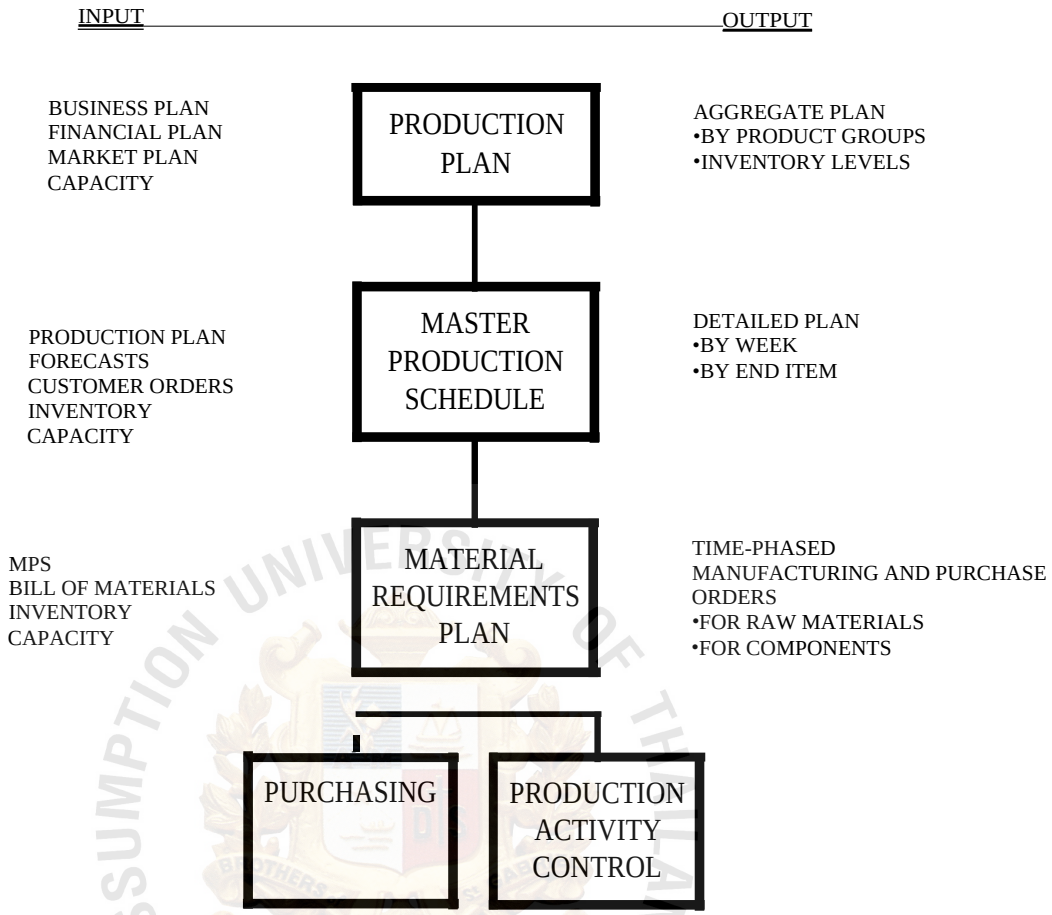

Figure 2.2. Manufacturing Planning and Control System.

2.5 The Computer

If a company makes a small number of simple products, it might be possible to perform material requirements planning manually. However, most companies need to keep track of thousands of components in a world of changing demand, supply, and capacity.

In the days before computers it was necessary to maintain extensive manual systems and to have large inventories and long lead times. These were needed as a cushion due to the lack of accurate and up-to-date information and the inability to

perform the necessary calculations quickly. Somehow, someone in the organization figured out what was required sooner, or very often later, than needed. "Get it early and get lots of it" was a good rule then.

Computers are incredibly fast and accurate and ideally suited for the job at hand. With their ability to store and manipulate data and produce information rapidly, manufacturing now has a tool to use modern manufacturing planning and control systems properly. There are many application programs available that will perform the calculations needed in MRP systems.

2.6 Inputs to the MRP System

There are three inputs to MRP systems:

(1) Master production schedule.

(2) Inventory records.

(3) Bills of material.

The Master Production Schedule (MPS)

The master production schedule is a statement of which end items are to be produced, the quantity of each, and the dates they are to be completed. It drives the entire MRP system by providing the initial input as to what components are required so the MRP system can produce orders for manufactured and purchased parts and raw materials. The MPS is based on sales forecasts or customer orders, production capacity and the prioritization of work. It is a matter of some complexity and difficulty to get the MPS right, yet right it must be, as the whole planning process is based on this document.

The MPS provides information on what, when, and how much will be produced. Using forecasts, orders, and capacity constraints, the planner "interactively" builds

master production schedules that meet the business goals. The MPS logic supports make to stock, assemble to order, or finish to order environments.

The MPS report shows the different demands, the production schedule and projects inventory balances and available promise. Once the MPS is released, MRP uses the schedules as input to the material planning process.

Inventory Record

A major input to the MRP system is inventory. When a calculation is made to find out how many are needed, the quantities on hand must be taken into account.

There are two kinds of information needed. The first is called planning factors and includes information such as order quantities, lead times, safety stock, and scrap. This information does not change often but is needed to help plan the quantities to order and when to order so delivery is made on time.

The second kind of information needed is on the status of each item. The MRP system needs to know how much is on hand, how much is allocated, and how much is available for future demand. This type of information is dynamic and changes with every transaction that takes place.

These data are maintained in an inventory record file, also called a part master file or item master file. Each item has a record and all the records together form the file.

The Bills of Material (BOM)

This is a list showing all the raw materials or components required to make the final product. Usually it is a very complicated and formidable document. Bill of Materials explodes finished goods requirements into raw material and component needs. The BOM must be translated into a "levelled" BOM where each item is given a planning level. The end item is level 0, the immediate components are in level 1. However, when an item occurs in several levels, it is given the planning level equal to

its lowest occurrence. The item master file includes the usage level, the scheduled receipts, the beginning balance, the lot sizing rule, and the safety stock and safety lead time requirements.

Bills of materials are used extensively in the manufacturing process, to assist with material requirements, and to detail the exact formula or recipe for the finished goods. Some manufacturing industries simple use the bill of materials to provide a benchmark to which production is compared, some use the bill of materials for exact manufacturing instructions where component quantities and mixtures are critical such as the health industries.

The most important part of a computerized manufacturing process and MRP is the bill of materials. Accuracy of the formula/recipe is crucial for material requirements planning and accurately projecting costings.

Some computer systems extend the bill of materials by adding specific manufacturing details, scrap percentages and packaging/labeling methods. Most provide the ability to add routings to the bill of materials. Routings are often referred to as work centers or equipment areas. These routings are used to assist with scheduling the manufacturing processes, adding labor and equipment costs, and even adding start-up and overheads to the bill of materials.

Most manufacturers use either sales orders, inventory minimums or forecasting (MRP) to trigger the manufacturing. Some manufacturers just decide they want to make something and that triggers manufacturing directly. Whichever method is used to trigger manufacturing, they all use the bill of materials to break down each routing into scheduled jobs. Raw material, equipment and labor requirements are then made available to the production managers, purchasing departments and the entire information system.

If we think about a tractor, we can see that it must be so because there are thousands of components. We can analyze parts of an imaginary Bill of Materials for a tractor, just to show how the document is constructed. It is arranged as follows:

(1) The complete tractor is divided into major assemblies-say chassis, engine, transmission, steering, suspension, gearbox, electrical harness, etc.

(2) The major assemblies are split up into sub-assemblies. In the case of the engine, for example, that major assembly will be divided into sub-assemblies for crankshaft, engine block, cylinder head, engine gear and so on.

(3) The sub-assemblies are again split into minor assemblies. Taking the crankshaft assembly as our example, one of the minor assemblies would be the piston.

(4) Having arrived at the piston minor assembly, that is then detailed into individual components, such as the piston head, compression ring, scraper ring, small-end pin, connection rod, big-end bearing, big-end nut and bolt, and tab washer. Thus we arrive at the final details of the individual components which either have to be made in the firm's own production areas or bought from suppliers. In this instance the piston head and connecting rod would be manufactured internally and all the other components bought from an external source.

These aspects of a Bill of Materials are shown in Figure 2.3.

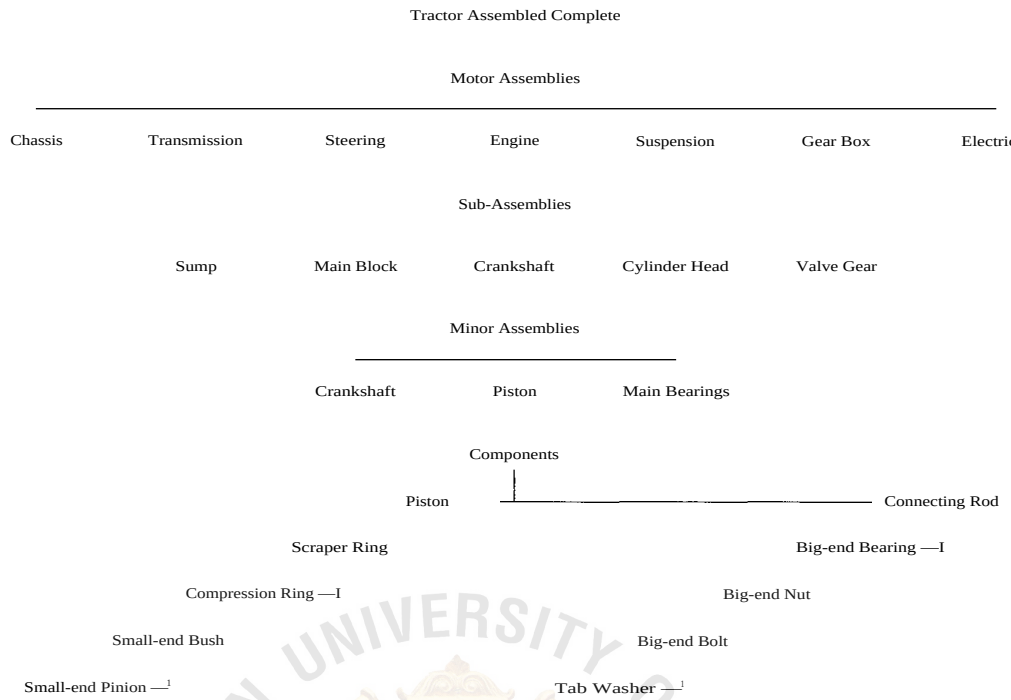

Figure 2.3. Bill of Materials.

The process of breaking down a production into a list of the various component parts, giving their quantities is called 'explosion'.

Now the essential principle of MRP is that raw materials or components are to be made available only when required, not before, and certainly not later! In pursuit of this principle, the manufacture or purchase of all these components must be coordinated to see that they are on hand when the minor assemblies are to be produced. In turn, the minor assemblies are only required to be ready when the sub-assemblies are to be done. They in turn follow the requirements of the major assemblies and they follow the pattern of production of the final assembly-the complete tractor. So in theory, the provision of the smallest component is ultimately linked through the chain of assemblies to the number of complete tractors rolling off the end of the production line. This calls for a tight production control of what is made in the filin's own facilities. As

regards raw materials and bought components, there must be a program of scheduled deliveries from suppliers to match the needs of the production units.

The important issue here is the time of delivery. This must be emphasized because if delivery is too soon, stocks will accumulate and expenses will rise, but if goods arrive too late, production lines may be slowed down or even stopped-again with increased costs. It is a finely balanced process to get it right.

2.7 Bill of Material

If we want to make something, the first question to ask is "What is it made of?" To bake a cake, we need a recipe. To mix chemicals together, we need a formula. To assemble a wheelbarrow, we need a parts list. Even though the names are different, recipes, formulas, and parts lists tell us what is needed to make the end product. All of these are bills of material.

A bill of material is a listing of all the components and parts required to make one of an assembly. Table 2.1 shows a simplified bill of material.

There are two important points:

(1) The bill of material shows all the parts required to make one of the items.

(2) Each part or item has only one part number. A particular number is unique to one part and is not assigned to any other part. Thus, if a particular number appears on two different bills of material, then the part so identified is the same.

Table 2.1. Simplified Bill of Material.

Description: TABLE **Part Number:** 100		
Part Number	**Description**	**Quantity Required**
203	Wooden Leg	4
411	Wooden Ends	2
622	Wooden Sides	2
023	Table Top	1
722	Hardware Kit	1

The bill of material can more conveniently be shown as a product tree (sometimes called a family tree). Figure 2.1 shows the tree for the bill of material shown in Table 2.1.

The bill of material is one of the most widely used documents in a manufacturing company. Some of the major uses are as follows:

(1) Product definition. The bill specifies the components needed to make the product.

(2) Engineering change control. Product design engineers sometimes change the design of a product and the components that are used. These changes must be recorded and controlled. The bill provides the method for doing so.

(3) Service parts. Replacement parts needed to repair a broken component are determined from the bill of material.

(4) Planning. Bills of material define what materials have to be scheduled to make the end product. They define what components have to be purchased and made to satisfy the master production schedule.

(5) Order entry. Where a product has a very large number of options (e.g., cars), the order entry system very often configures the end product bill of materials. The bill can also be used to price the product.

(6) Manufacturing. The bill provides a list of the parts needed to make or assemble a product.

(7) Costing. Product cost is usually broken down into direct material, direct labor, and overhead. The bill provides not only a method of determining direct material but also a structure for recording direct labor and distributing overhead.

This list is not complete, but it shows the extensive use that is made of the bill of material in manufacturing. There is hardly a department of the company that will not make some use of the bill at some time. Maintaining bills of material and their accuracy is extremely important. Again the computer is an excellent tool for centrally maintaining bills and for updating them.

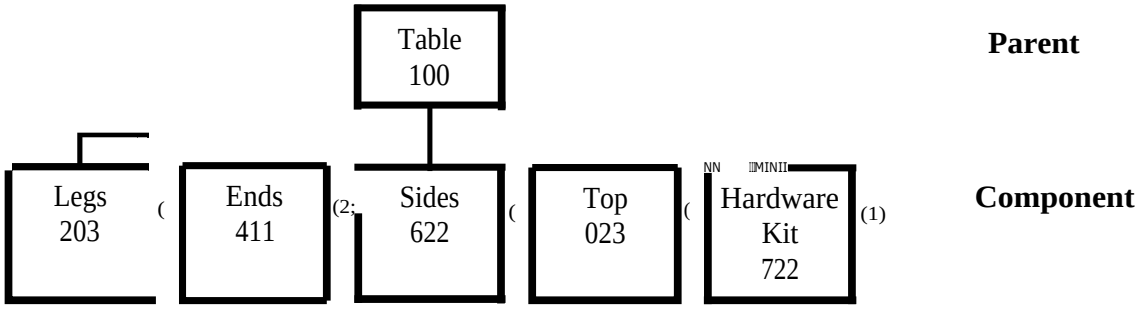

Figure 2.4. Parent-Component Relationship.

Parent-Component Relationship

The bill of material and the product tree shown in Figure 2.1 and Table 2.1 are called single-level structures. All assemblies are considered to be a parent, and the items that make up the assembly are called its component items. Figure 2.4 shows the parent-component relationship of the table. Unique part numbers have also been assigned to each part. This makes identification of the part absolute.

Types of Bills of Material

(1) Parts list

It lists all the parts that are needed to make one of the assemblies. The parts list is produced by the product design engineer and does not necessarily reflect the way the parts go together or any subassemblies that might be made.

(2) Multilevel BOM

This BOM reflects the way in which the product will be manufactured. It shows the grouping of parts into subassemblies and components. It is the responsibility of manufacturing engineering to decide how the product is to be made: the operations to be performed, their sequence, and their grouping. One convention used with bills of material is that the last items on the tree are all purchased items. As a general rule, a bill of material is not complete until all legs of the product structure chains end in a purchased part.

(3) Indented bill of material

A multilevel bill of material can also be shown as an indented bill of material. This bill uses indentations as a way of differentiating parents from components.

(4) Single-level BOM

A single-level bill of material contains only the parent and its immediate components, which is why it is called a single-level bill. For example, the single-level product tree shown in Figure 2.5. The table has two immediate components, the base and the top. The base and the top will have their own single-level bills.

In addition, if a single-level bill has to be changed for any reason, then only one set of data has to be updated regardless of the number of assemblies in which the part is used. This system improves accuracy, reduces the work in maintaining bills of material, and minimizes the computer storage needed. According to this project, we use this type of bill of material.

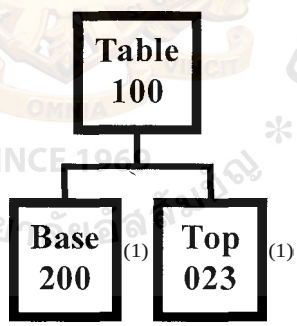

Figure 2.5. Single-Level Bill of Material.

(5) Where-Used and Pegging Report

Where-used report

A component may be used in making several parents. Wheels on an automobile, for example, might be used on several models of cars. A listing

of all the parents in which a component is used is called a where-used report. This has several uses, such as in implementing an engineering change, or when materials are scarce, or in costing a product.

Pegging report

A pegging report is similar to a where-used report. However, while the where-used report shows all parents for a component, the pegging report shows only those parents for which there is an existing requirement. The report shows the parents creating the demand for the components, the quantities needed, and when they are needed. Pegging keeps track of the origin of the demand.

2.8 Material Requirements Planning Process

Each component shown on the bill of material is planned for by the material requirements planning system. For convenience it is assumed that each component will go into inventory and be accounted for. Whether the components actually go into a physical inventory or not is not important. However, it is important to realize that planning and control take place for each component as they appear on the bill. Raw material may go through several operations before it is processed and ready for assembly, or there may be several assembly operations between components and parent. These operations are planned for, and controlled, by production activity control and not material requirements planning.

The purpose of material requirements planning is to determine the components needed, their quantities, and when they will be needed so items in the master production schedule are made in time.

2.9 Using the Material Requirements Plan

The MRP software will perform all the calculations. It will net, offset, and explode requirements and create planned order releases. It will keep priorities current for all planned orders according to changes in gross requirements for the part. But it will not issue a purchase or manufacturing order or reschedule open orders. However, it will print action or exception messages suggesting that the planner should act and what kind of action might be appropriate.

It is the planner's responsibility to issue orders and to reschedule existing orders as required. Planners are also responsible for working with other planners, master production schedulers, production activity control, and purchasing to solve problems as they arise.

As the MRP planner, you arrive at work Monday morning and look at the MRP record for part 2876 as shown in Table 2.2.

The computer draws attention to the need to release the planned order for 30 in week 1. You release this order; otherwise, there will be a shortage in week 3.

During the first week the following transactions take place:

(1) Only 25 units of the schedule receipt are received into inventory. The balance is scrapped.

(2) The gross requirement for week 3 is changed to 10.

(3) The gross requirement for week 4 is increased to 50.

(4) The requirement for week 7 is 15.

(5) An inventory count reveals there are 10 more in inventory than the record shows.

(6) The 35 gross requirement for week 1 is issued from inventory.

(7) The planned order release for 30 in week 1 is released and becomes a scheduled receipt in week 3.

Table 2.2. MRP Record.

Order Quantity = 30 Units

Lead Time = 2

		Week					
		1	2	3	4	5	6
Gross Requirements		35	10	15	30	15	20
Scheduled Receipts		30					
Projected Available	20	15	5	20	20	5	15
Planned Order Release		30	30		30		

As these transactions occur during the first week, you must enter these changes in the computer record. At the beginning of the next week the MRP record appears as in Table 2.3.

Table 2.3. Revised MRP Record.

		Week					
		2	3	4	5	6	7
Gross Requirements		10	10	50	15	20	15
Scheduled Receipts			30				
Projected Available	20	10	30	10	25	5	20
Planned Order Release		30	30		30		

The opening on-hand balance for week 2 is 20 (20+25+10-35 = 20). The planned order release originally set in week 4 has shifted to week 3. Another planned order has been created for release in week 5. More important, the scheduled receipt in week 3 will not be needed until week 4. You should reschedule this to week 4. The planned order in week 2 should be released and become a scheduled receipt in week 4.

Order Control

The material planner works with three types of orders as follows:

(1) Planned orders

Planned orders are automatically scheduled and controlled by the computer. As gross requirements, projected available inventory, and scheduled receipts change, the computer will recalculate the timing and quantities of planned order releases. The MRP program will recommend to the planner the release of an order when the order enters the action bucket but will not of itself release the order.

(2) Released orders

Releasing a planned order is the responsibility of the planner. When that is done, the order becomes an open order to the factory or to purchasing and appears on the MRP record as a scheduled receipt. It is under control of the planner, who may expedite, delay, or even cancel the order.

(3) Firm planned orders

The computer-based MRP system automatically recalculates planned orders as the gross requirements change. At times the planner may wish to hold a planned order firm against changes in quantity and time despite what the computer may calculate. This might be necessary because of future availability of material or capacity or to handle special demands on the

system. The planner can tell the computer that the order is not to be changed unless the planner advises the computer to do so. The order is "firmed" against the logic of the computer.

Material Requirements Planner: Typically in the production control, inventory control, and purchasing department. Generally organized around groupings of parts (e.g. metal vs wood). Only wants to review and interpret those requiring action. Steps taken are:

Order launching — release orders when required by system. When orders are completed, convert Scheduled receipts into on-hand inventory. Reflect order size changes, scrap/yield losses, allowances in MRP and inventory records. Process involves checking action bucket for exception codes or messages (diagnostics, problem area), checking availability of the parts or components, create a shop order for the entire or partial order causing the system to allocate the parts to the particular shop order, create picking tickets so the part can be moved to the shop, and adjusting on-hand balances.

Replanning — Reschedule due dates of existing orders when desired. Use pegging data to determine parent schedules affected (bottom-up replanning).

Analyze and update system factors such as lot sizes, lead times, scrap allowances, safety stocks.

Analyze where further enhancements will improve the system. Reconcile errors and eliminate root causes. Find key problem areas and prevent reoccurence.

Material requirements planners must manage the parts for which they are responsible. This means not only releasing orders to purchasing and the factory, rescheduling due dates of open orders, and reconciling differences and inconsistencies but also finding ways to improve the system and removing the causes of potential error.

If the right components are to be in the right place at the right time, then the planner must manage the process.

2.10 MRP Reports

It will be generated by the MRP system which will present information in a format useful to those operating the system. The most important report is obviously the one which indicates how much should be ordered and when, but a variety of others can be generated. See Figure 2.6.

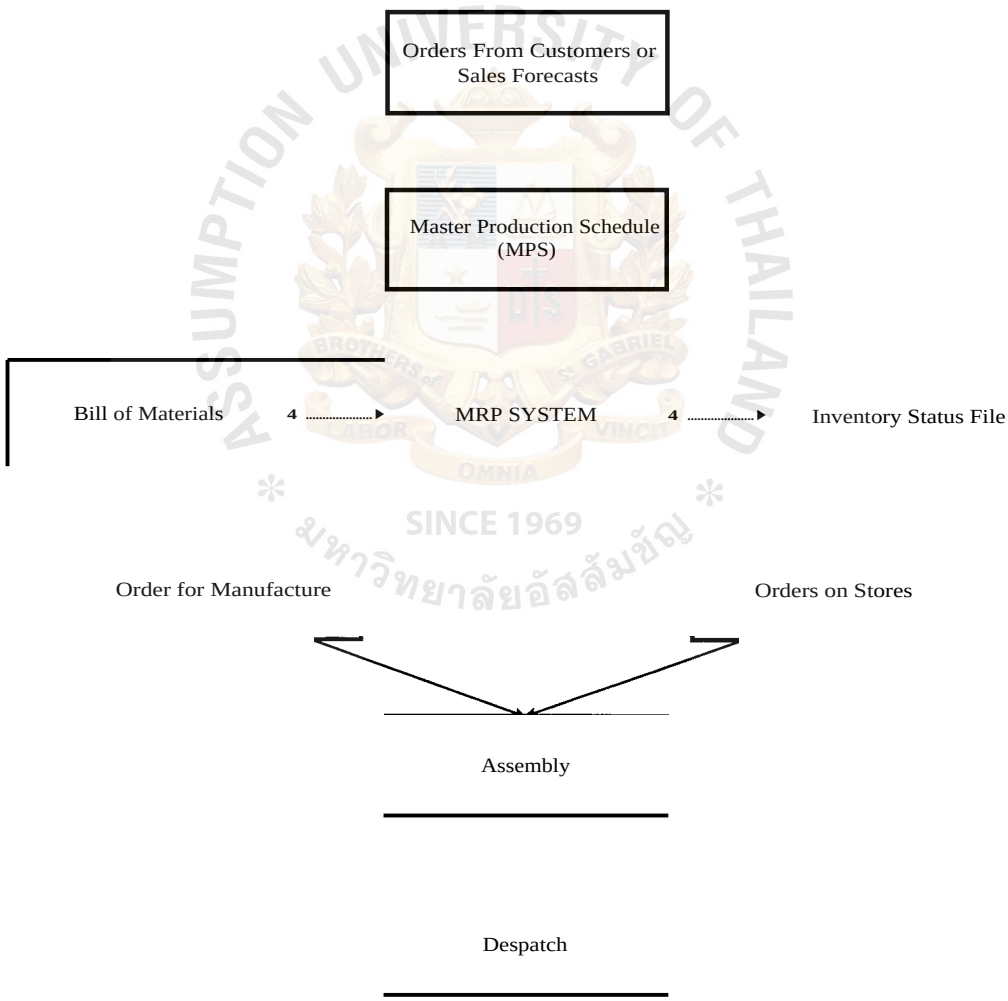

Figure 2.6. Flow of Information (-->) and Materials (4) in a Material Requirements Planning System.

2.11 Benefits of MRP

As a manufacturing becomes more and more efficient in their MRP implementation the following benefits will continuously improve.

(1) Reduced Inventory with fewer (none) shortages

(2) Improved productivity

(3) Improved on-time completions

(4) Reduced Purchasing Cost

(5) Reduced Obsolescence

(6) Reduced Overtime

(7) Accurately predicted delivery times.

(8) Identification and correction of material problems

(9) Direction of dynamic purchasing and capacity planning.

(10) Correct response to volatile changes in customer demand or new product introduction.

(11) Establishment and maintenance of priorities by focusing on valid due dates for work orders and purchase orders.

(12) Provision of data for budgeting

(13) Improvements related to:

  (a) B OM's with many levels

  (b) Larger lot sizes

  (c) Volatility in lead time and demand

III. RESEARCH METHODOLOGY

3.1 Company Profile

Bangkok Glass Industry Co., Ltd. has been established since 1974 and is located at 47/1 Moo 2, Rangsit Nakorn-Nayok Road, Km. 7, Tumbol Bung Yee Tor, Amphur Tanyaburi, Pathumthani 12130. The head office is located at 32nd floor, Ocean Tower 1 Bldg., 170/87 New Rachadaphisek Road, Klong Toey, Bangkok 10110. The company has 26 years of experience in glass containers manufacturing and is one of the largest suppliers of glass containers in Thailand. Most partners are glass-makers and the technical partner is Oberland Glas Gmbh, which is the leader of glass manufacturer in Germany.

At present, the registered Capital of the company is 900,000,000 Bahts. Boonrawd Brewery Co., Ltd. is the major partner, having approximately 2,000 employees. The facility currently has the capacity to produce approximately 1,430 tons per day from 6 furnaces--approximately 4,500,000 bottles per day. The company will set up a 7th furnace and that will increase the production capacity by 1,750 tons per day or 5,000,000 bottles per day. The furnaces operate continuously at 1,600 °C —24hours a day, 7 days a week, approximately 52 weeks a year, with the exception of down time for maintenance, repair and furnace rebuilds. Bottles require extremely high temperatures to melt, refine, and mold the glass that shapes them — often temperatures of at least 1,600 °C.

The company's products are beer bottles, beverage bottles, drug bottles, and a variety of other bottles. The popular customers of the Bangkok Glass Industry include Singha Chaophraya, Regency, Heinz Tomato, Brand's, Singha Water, Soda Singha,

Coca-cola, Gatorade, Sponsor, Pepsi, Green Spot, Coffeemate, and Nguan Cheing.

Figure 3.1. Example of Glass Containers.

Bangkok Glass Industry Co., Ltd. is a quality and reliable supplier of empty glass bottles. The mission is to provide quality goods with a value added service which are still pursuing. Having been established firmly as reliable suppliers, we have also ventured into export markets and look forward to creating a niche for ourselves with our customers' kind support and condition.

The company is making plans to enter the next century with a clear direction of where the company wants to position its operations. Bangkok Glass's strategically focuses on a number of issues including technology and product development, product quality, customer service, and growth. The President states that the strategy is fundamental to the company's future. "Bangkok Glass Industry will remain focused on the glass containers industry, providing a broad line of quality products and services to our diverse group of customers in all segments of the market. We will be the leader of glass container company and the measurement of our success will be our customers' satisfaction. The quality of our products and services are key to our success".

3.2 Glass

Glass has come a long way since the production of the first bottle, some 5000 years ago. It was the Babylonians and the Egyptians who discovered that the melting of sand produces glass; using a primitive form of molding, they were able to make small bottles. The blowing process was discovered in 50 b.c., and the art was developed further, particularly in Venice (beginning in the 17th century) and Bohemia, which became famous for their fine glass decorations and forms. The first mechanical glass-pressing machine was put into service in 1820 in the U.S., and from then on the production and use of glass products increased rapidly. A few figures give an idea of the relative importance of the industry today: In the European Union, about 25 megatons of glass (approximately $30 billion worth) are produced every year; the industry employs more than 200,000 people. The figures for the U.S. are comparable. Two-thirds of all glass produced is used for packaging (jar and bottles). Float glass (used for panes) accounts for one-quarter. The remainder is used for special products like CRTs and fibers. Today, glass is still the preferred package for many products. Food and beverage product managers turn to glass to create a premium image and to differentiate their products on crowded store shelves.

Environmental concerns have also affected the industry. The problem is not so much waste (glass is 100% recyclable, giving it a strong advantage over most of its competitors) as energy consumption — the process by which sand is melted to become liquid glass is the largest cost factor of the product. Governments all over the world are therefore imposing ever-stronger restrictions on the weight and thickness of glass products (in particular those used in packaging). It is obviously that these requirements cannot be pushed too far — bottles and jars need to have a certain durability. (Visitors to champagne wineries hear stories about the risky bottling of the old days: As many as

70% of the bottles shattered, simply breaking if you were lucky but often exploding; not with-out reason, these bottles were and still are quite thick.)

Glass is a product made from many inorganic substances. Small grained sand is the essential element. Raw materials are melted until they become liquid. The liquid is formed by pulling, pressing, or blowing into varied shapes. Then products are annealed and inspected.

Bangkok Glass Industry Co., Ltd. is Thailand's first glass maker which has invested a big amount in establishing a cullet treatment plant. Cullet is treated for cleanliness in order to be used next.

The process of glass treatment is as follows:

Cullet is transported along belt conveyor through a magnet. Iron is discarded. There are staffs picking big rubbish up. Cullet is transported along a belt conveyor to the sorting sieve equipped with the cyclone absorbing system. The sorting sieve absorbs light rubbish. As for heavy rubbish like ceramics, aluminum bottleneck are discarded by K.S.P. (ceramics and metal assorting machine). Then cullet is transported to the mixing and melting section.

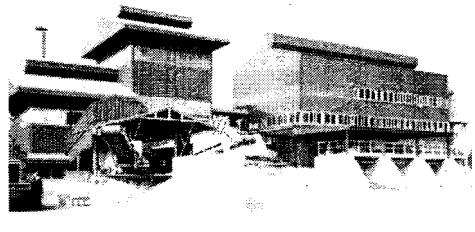

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Figure 3.2. Cullet Treatment Plant.

3.3 Raw Materials in Glass Making

Raw materials in glass making are:

(1) Small grains of sand (essential element)

(2) Natural resources such as Limestone, Feldspar, and Dolomite

(3) Soda Ash

(4) Other chemical substances which must be imported from abroad

Cullet can be reused in order for energy and resource saving. Moreover, our country is deficient because of the need to import chemical substances, and it takes energy, and a lot of it, to produce such high temperatures. The furnaces of the glass industry use large amounts of energy and produce troublesome emissions of nitrogen oxides.

3.4 Glass Making Process

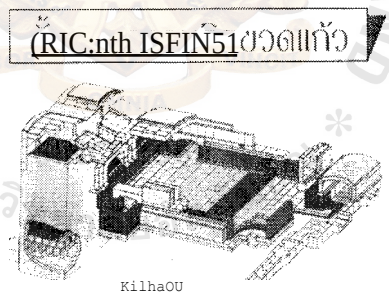


Figure 3.3. Furnace.

The unprocessed raw material (crushed glass, sand and other raw material) is transferred into the building where it is fed into one of the six furnaces. The furnaces are the largest physical components of the Bangkok Glass facility. Raw materials are weighed, mixed, and transported together with cullet to a furnace. The glass is melted in

the furnaces which have temperatures as high as 1600 °C that melts down raw materials and cullet until they become glass liquid. Glass liquid with loaves flowing along a water trough is ready to be produced.

Glass liquid flowing along a water trough is cut into loafs, then injected into the forming machines which are I.S. machines (Individual Section Machine) equipped with the Blow- Blow Process or the Press-Blow Process where compressed air molds the glass into bottles. The bottles are then conveyed from machine to machine which coat, cool and inspect the bottles for quality. Rejected bottles are recycled. The bottles then move into the packaging area where boxes are formed and the bottles are packed into cardboard cases for shipment. The palletizer stacks sealed boxes, which are then transported into the warehouse portion of the building.

The company's flexibility in using "blow-blow" and "press-blow" technologies enables it to develop reduced-weight products benefiting the customer directly by using less energy and less raw material and by reducing transportation costs, and at the same time maintaining the highest quality.

Bangkok Glass Industry's integrated processes include a glass-recycling system. Since glass is 100 % recyclable, this system is used extensively in manufacturing glass containers.

To assure the quality of durability, correct size, and correct shape, glass bottles are inspected as follows:

(1) On-Line Inspection

Glass bottles are inspected by an automatic machine during the transportation from annealing to packing.

(2) Physical Lab Inspection

Samples collected for physical quality are inspected in a physical laboratory.

(3) Visual Inspection

Completeness and appearance inspection are performed by human eyesight.

The organization chart of Bangkok Glass Industry is shown on Figure 3.4 and the organization chart in Raw Material Department is shown on Figure 3.5.

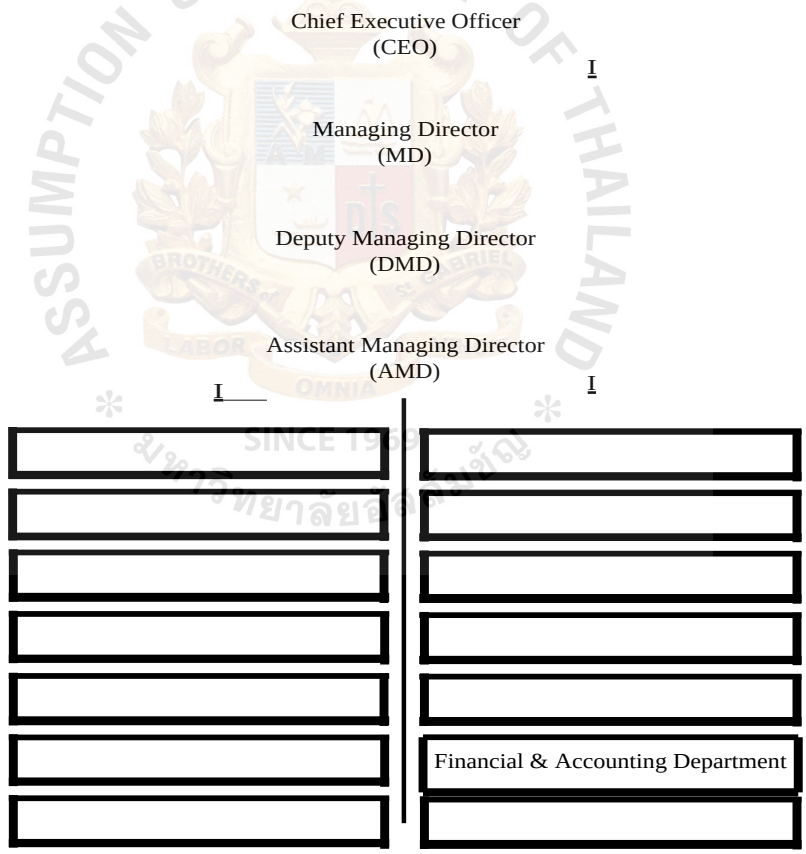


Figure 3.4. Organization Chart of Bangkok Glass Industry Co., Ltd.

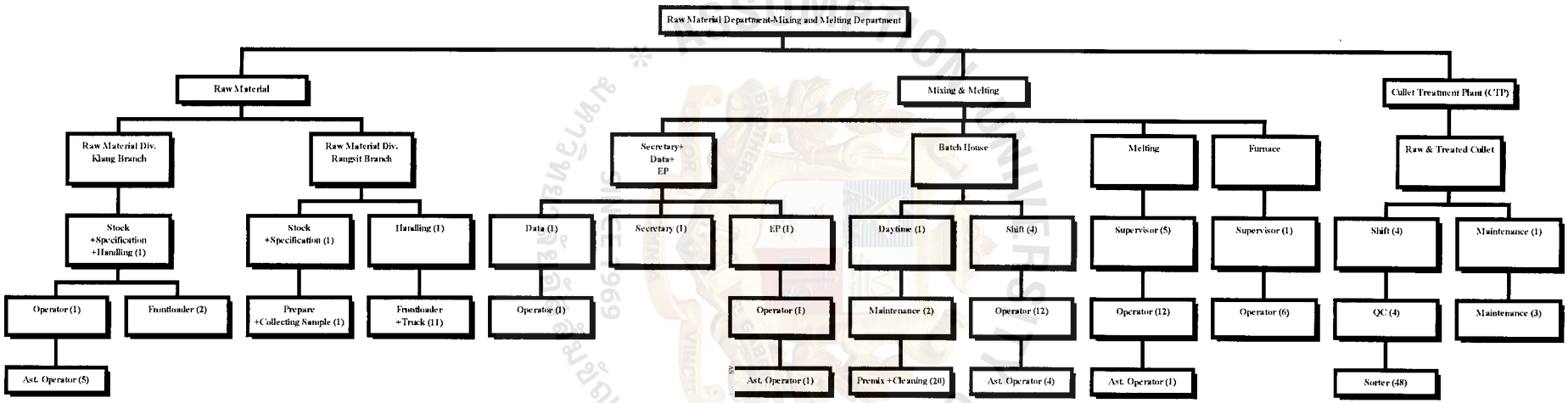


Figure 3.5. Organization Chart in Raw Material Department.

3.5 Objectives of the Project

The objectives of the project are as follows:

(1) To study and analyze the existing system of material planning in order to propose a new system.

(2) To identify and solve the problems of the existing system.

(3) To design a proposed system development of material requirements planning that is suitable for Bangkok Glass Industry Co.,Ltd.

(4) To improve the material requirements planning by using the suitable software application.

(5) To control the correctness of data.

(6) To eliminate data redundancy.

(7) To generate several required reports.

(8) To reduce the time for preparing the material requirement planning report.

3.6 Problem Definitions

The problems of the existing system can be defined in terms of the following problem:

(1) The material requirements planning in each month does not correspond to the actual use of raw materials.

(2) When the material planning report has to be revised, the report is not correct, and the figures are not accurate so it is not up-to-date information. It cannot be used as a reference for the next period.

(3) The monthly material planning report is a hard copy is kept in an individual file. It is not convenient to compare the figures month to month.

(4) The time for preparing material requirements planning is limited so the material planner cannot catch up. He needed around 3 days for preparing

this report. It takes a lot of time for getting the report to management on time.

IV. SYSTEM DEVELOPMENT

The most important input to produce glass containers are the raw materials so we should manage the material effectively and efficiently in order to produce the bottles in time and to save the cost of investment.

The computer-based information system helps planning the use of material in manufacturing; we call this Material Requirements Planning (MRP). To forecast the next period plan, statistical information must be gathered from the monthly material plans and the daily used material. We will develop standard software for the collection and to forecast the material plan for the next period.

4.1 Existing System

The existing system is controlled by Microsoft Excel which may cause some problems as follows:

(1) A lot of time is required to prepare the monthly report

(2) The monthly plan of raw material requirements does not correspond with the actual use of raw materials.

(3) Searching needed information requires a lot of time because the monthly plan was kept in a different file.

(4) Controlling correctness of data is difficult.

(5) The data is redundant.

(6) The updated information is not accurate.

The material planner cannot get the information as soon as needed. It may take a lot of time in gathering and finding information. Sometimes, the information is not correct, because when the forecast doesn't correspond with the actual, the planner

doesn't reschedule the plan. If this case occurs, it will lead to a lot of problems in the future.

Some data are redundant and duplication of work occurred so we will propose to keep the data in the form of a database, that we called Glass Container's MRP software application.

The major raw materials used in productions are sand, Feldspar, Dolomite, Limestone, Soda Ash, Salt Cake, Coke Dust, Iron Oxide, Selenium and Cobalt Oxide. There are 2 types of glass which are flint glass and amber glass. The bills of materials (BOM) of glass containers are shown on Figures 4.1 and 4.2.

Figure 4.1. Bills of Material (Flint Glass).

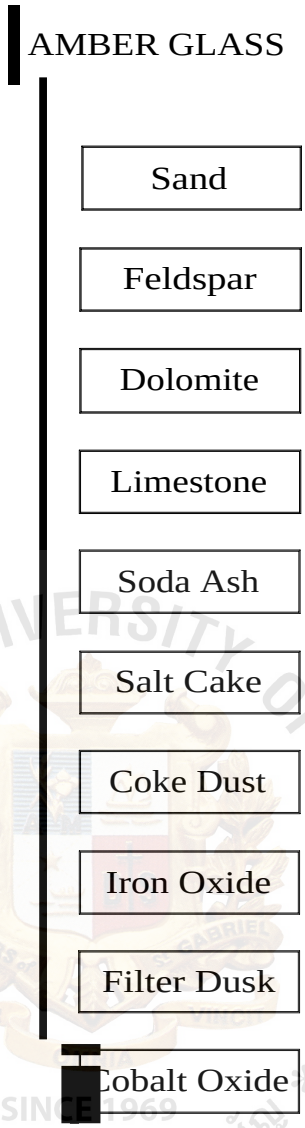
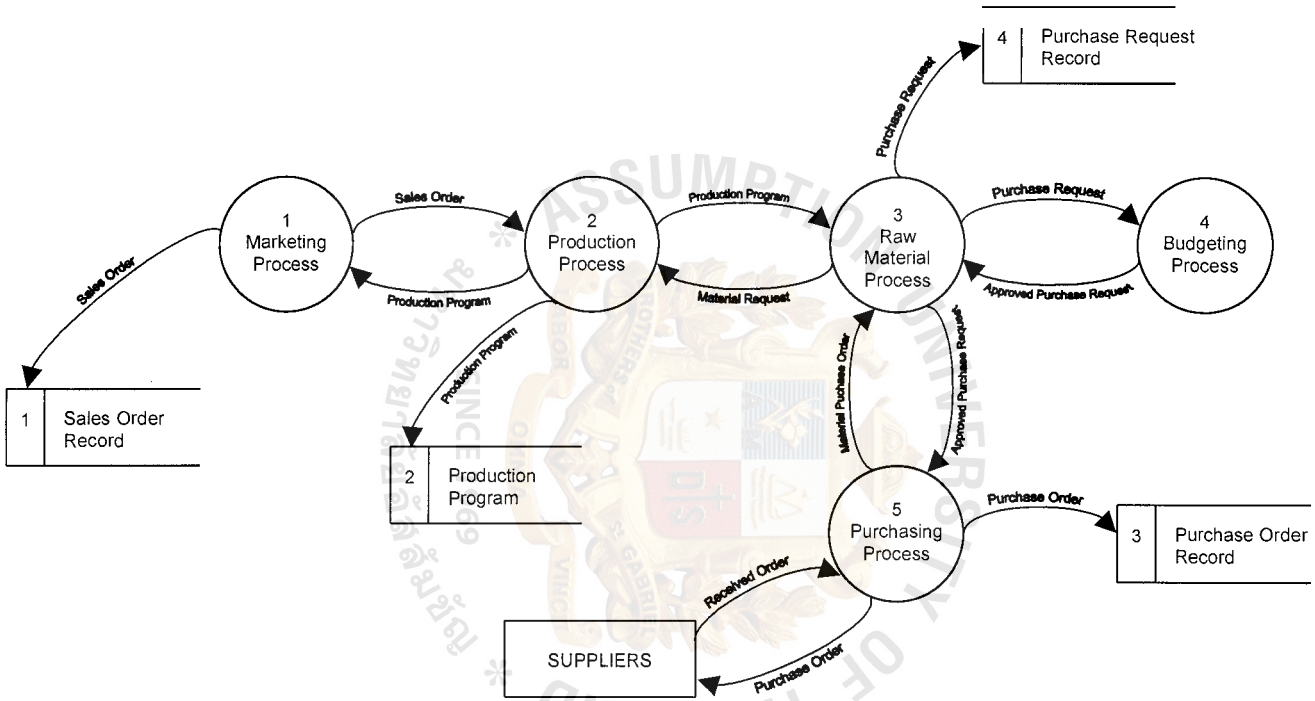


Figure 4.2. Bill of Material (Amber Glass).

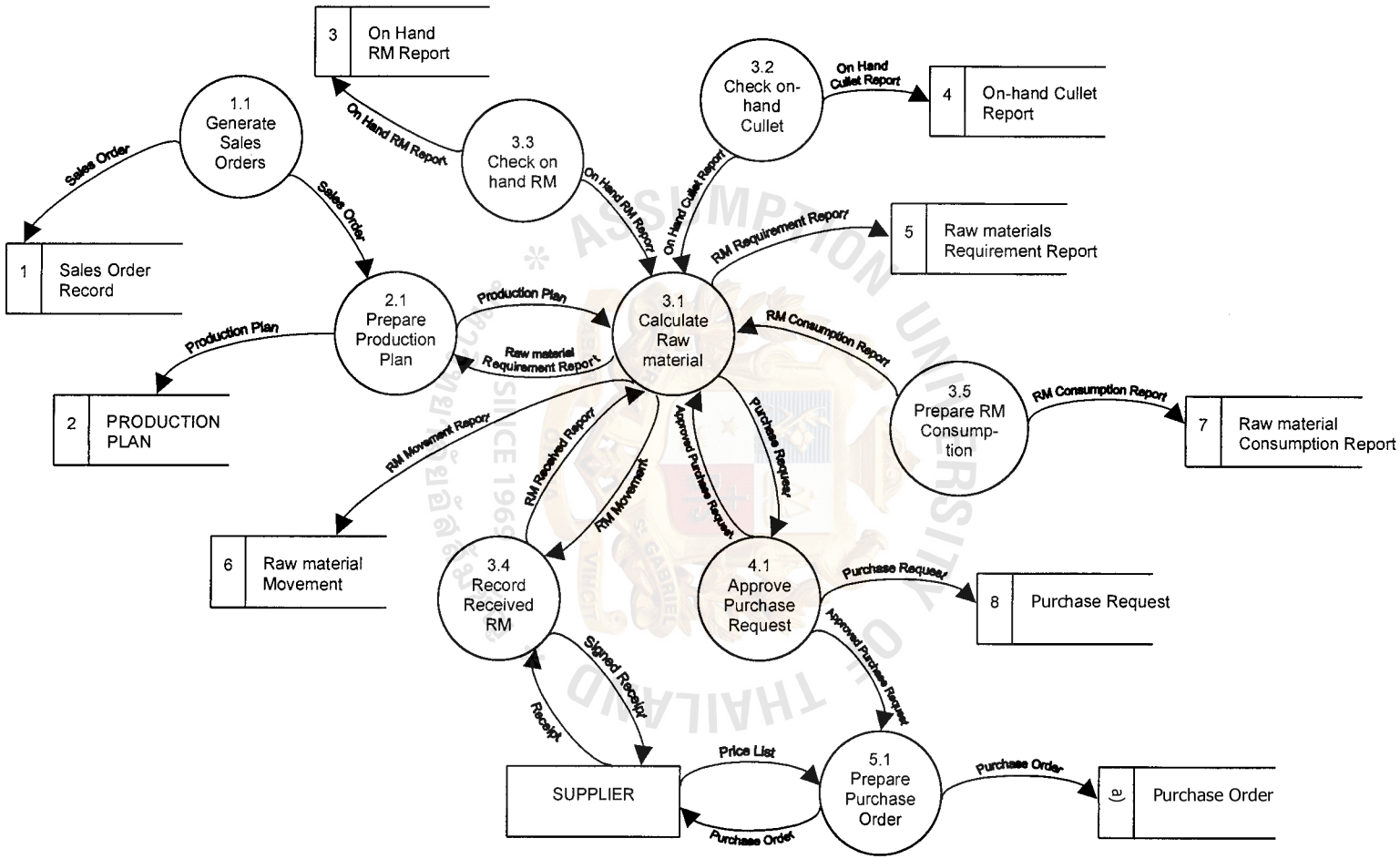
The existing system calculates all major raw materials in a complex format. If someone who is not a planner looks at the raw materials monthly report, he or she may not understand it.

Figures 4.3, 4.4, and 4.5 present the context diagram, the data flow diagrams level 0 and the data flow diagrams level 1 of the existing system, respectively.

Figure 4.3. Context Diagram of Existing System.



Data Flow Diagram Level 0 of Existing System.



รูป 4.5. Data Flow Diagram Level 1 of Existing System.

4.2 Proposed System

According to the existing system, the limitations occur so the proposed system was designed to eliminate and solve the problems of the existing system. A computer-based information system is introduced to help improve the efficiency and productivity of performance in raw material requirements planning.

Glass container's MRP software is able to provide the information in term of reports presented to the manager and the planner for using in problem-solving and decision-making. This software also is able to help in the improvement of regular work performance.

The deliverables of glass container's MRP software are:

(1) Screen Layouts

(2) Reports, such reports are:

- (a) Sales Order Report
- (b) MRP Report
- (c) Receipt Material Report
- (d) Material Consumption Report
- (e) Material Price List Report
- (f) Material I.D. Report
- (g) On Hand Stock Report
- (h) Production Program Report
- (i) Supplier's List Report
- (j) Customer's List Report
- (k) Purchase Order Report
- (l) Forecasting Raw Material Summary Report

The users' requirements and the data flow diagrams of the existing system are used as a basis for the development of the proposed system. Figures 4.6 and 4.7 present the context diagram and the data flow diagrams of the proposed system.

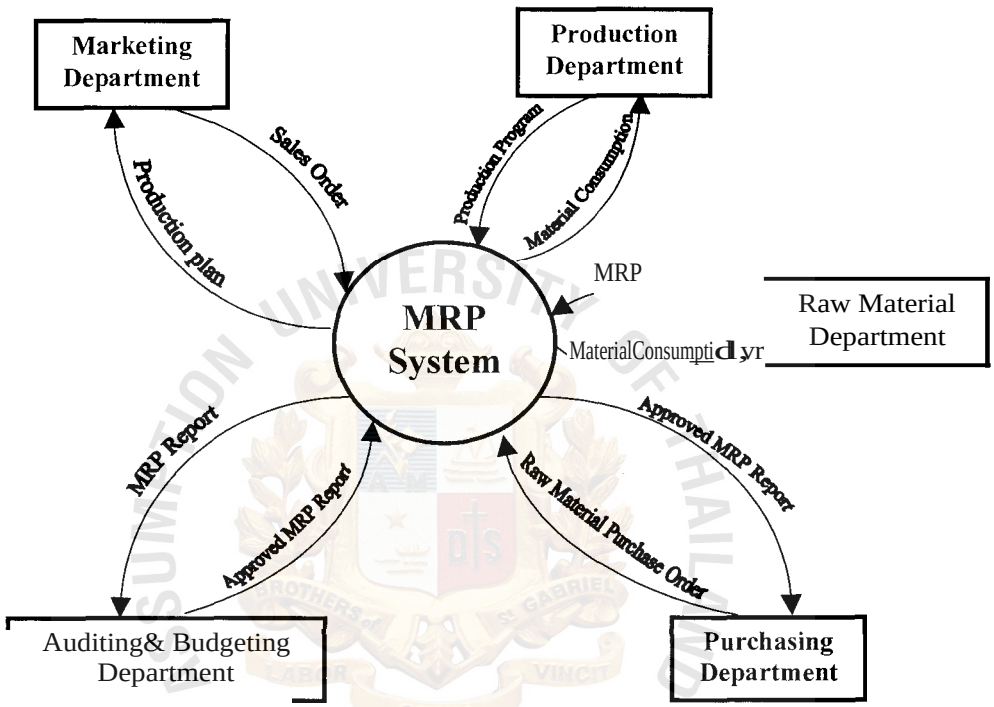


Figure 4.6. Context Diagram of Proposed System.

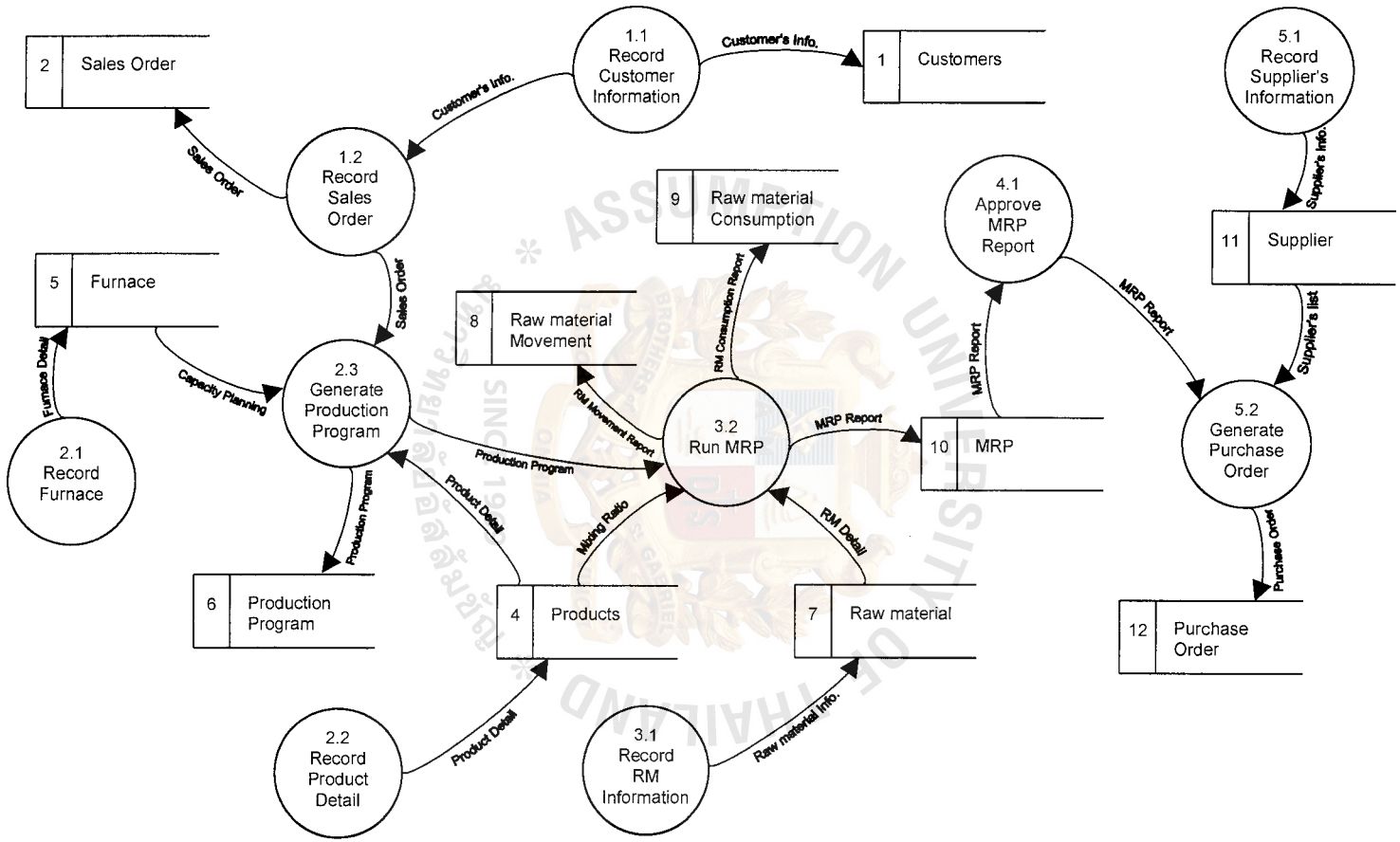


Figure 4.7. Data Flow Diagram of Proposed System.

4.3 Hardware and Software Requirements

(1) Hardware Requirements

The hardware for Material Requirements Planning consists of:

(a) IBM PC or compatible (486 or higher)

(b) VGA adapter and monitor

(c) Memory: 32MB RAM for Windows 95 or Windows 98; 64MB RAM for Windows NT.

(d) Disk Space: At least 20MB available disk space. (Includes reserve space for data)

(e) 10 Base-T Ethernet LAN Card

(f) Uninterruptible Power Supply (UPS)

(g) Printer

(h) Mouse or other pointing device.

(2) Software Requirements

The software for Material Requirements Planning consists of MS Windows 95, Windows 98 or Windows NT 4.0.

The required hardware and the software are currently in use in the existing so that additional hardware and software are not necessary for the proposed system.

V. SYSTEM EVALUATION

One of the most critical and time-consuming aspects of manufacturing is managing the task of maintaining sufficient amounts of materials on hand at all times so in order to make the raw material planning more efficient, this proposed software is designed for Bangkok Glass Industry. The glass container's MRP software is functional and working and it fits more closely with the Bangkok Glass Industry Plants's requirements. A set of functions would be provided on an as used basis.

The proposed system has more advantages than the existing system in many ways as follows:

(1) The needed information coming from the proposed system has a higher degree of accuracy. This can help the managers and the planners perform their tasks effectively.

(2) The amount of time required in gathering and finding data is reduced by the improvement of the MRP system process.

(3) Redundancy of data is reduced.

(4) Duplication of work is eliminated.

(5) Quality information is faster and more accurate. The material planner or management can use it in problem-solving and decision-making process.

(6) Improved efficiency and accuracy of the internal operation in raw material department is achieved.

(7) Managerial control for the raw material planning section is improved. Glass container's MRP software provides accurate and flexible reporting, timely planning and scheduling. The management and the planners can get accurate reports so they can control the process.

(8) The proposed system can help eliminate purchasing and scheduling problems.

(9) It is designed to simplify and speed up the work processes of raw material scheduling, enabling more effective planning.

(10) This software is easy to access and use. This implies that the menu options are readily available. It needs to be easy for any level of planners to locate and quickly access the information specific to their needs. Also, the data can be entered quickly.

(11) The Glass container's MRP software shows visual data display. The data needs to be displayed in a way which allows the planner to visually comprehend the data.

With this software, the planner can produce reports based on action by date to advise the purchasing manager which orders need to be placed, which need to be revised and which need to be canceled. These estimates, combined with sales order information, can suggest when to purchase raw materials and eliminate costly production delays because the necessary material was not in stock or could not be obtained on time. This simplifies the scheduling. The planner can take control of the material purchasing and production planning with the glass container's MRP software.

Salient Features

(1) Do Material Requirement Planning Report: planning the quantity of each raw material for the planning period.

(2) Calculate Material and Capacity Requirement.

(3) Forecast with chart.

(4) Present graphical Gantt Chart presentation format, as shown in Figure C.5.

The features of Glass containers's MRP software are as follows:

(1) Sales Order Integration

When Sales Order is integrated with MRP, the material on a sales order is recognized as part of the "demand" for a raw material.

(2) Bill of Materials

Glass container's MRP software has Bill of Materials capabilities. It explodes glass containers requirements from the Production Program into raw material needs. When Bill of Materials is integrated with MRP, it supplies the detailed database of raw materials for calculating the number of glass containers versus raw materials and gives the necessary material requirement information.

(3) Stock Integration

Integration with the stock module is required to provide MRP with access to the raw material needed to produce glass containers. The on-hand quantities in stock are recognized as a part of the "supply" of raw material. The stock supplies all reorder information and suppliers lead times. Glass container's MRP software can compare future demand versus available stock to predict future shortages. This glass containers MRP's software controls stock by helping to order the right part in the right quantity at the right time.

(4) Purchasing Integration

Glass container's MRP software helps the planner to know exactly what he or she has purchased and how much it cost, and calculates the Purchase Orders needed based in the demand and current stock. The software helps the planner to calculate the quantity of ordered raw materials.

When Purchase Order Processing is integrated with MRP, the material on a purchase order is recognized as a part of the "supply" of a raw material.

(5) Forecasting Integration

Forecasting in MRP is used as a communication mechanism with suppliers for medium-term planning and as input to investment planning decisions. The software generates a statistical forecast. The forecasts can be updated within glass container's MRP software application to provide Material Requirement Plans for the next 3 months. This means future shortages can be foreseen.

(6) Raw Material Deliveries

The glass container's MRP software tracks the scheduled deliveries. The planner can see what is on order and when the planner can expect to receive it.

VI. CONCLUSION

As glass making has evolved into a highly competitive industry, companies have increased their reliance on MRP of several aspects of the raw material planning.

The glass container's MRP software application was specifically designed for Bangkok Glass Industry which would like its production, sales and inventory functions to operate more efficiently. Glass container's MRP software application is a comprehensive package for use in the raw material department. It is suited for the glass containers industry. The available functions include raw material movement and purchase order processing. This program shows how to put proven Material Requirements Planning (MRP) practices to work in the operation so things can get done, at the right time, in the right order, and with the right results.

The purpose of this MRP system project is to analyze the existing system and to design the proposed system for the planner in the raw material department in order to make the raw material plan as close as possible to the actual use of material.

In the existing system, the report is generated by Microsoft Excel which isn't practical in preparing the monthly report. It is also time consuming to search the information because the raw material monthly report is kept in a different file. It is difficult if we want to compare the figures month to month. Based on the analysis of the existing system, it is suggested that a proposed computer system should be used instead of existing system.

In the proposed system, the Glass container's MRP software application are equipped to provide accurate monthly raw material plans and the rescheduling material plan. The programs are coded in Microsoft Access. The input design, screen design, data flow diagram and several reports are included in this proposed project. This

software also provides a forecasting module in order to help the planner forecast the actually used material. This system is designed to serve most of the planner's requirements and the business of the company. All screen and reports are generated to be easy to use and understand.

After consideration of all information concerned with the existing system and the proposed system, the conclusion is that the proposed system has more advantages than the existing system.

The benefits are:

(1) The glass container's MRP software handles all planning, purchasing, production, scheduling and raw material movement functions.

(2) The need for the study was brought about by the planners who have expressed the need for improving computerized output to provide timely, correct and reliable performance information.

(3) The glass container's MRP software can help the planner meet deadlines easily, consistently, with a high-quality report and the information is accurate. This program also helps the planner with better planning and reduced inventories.

(4) The proposed system can help to improve and reduce work process in the raw material department and also increase the efficiency and the effectiveness of the raw material operations.

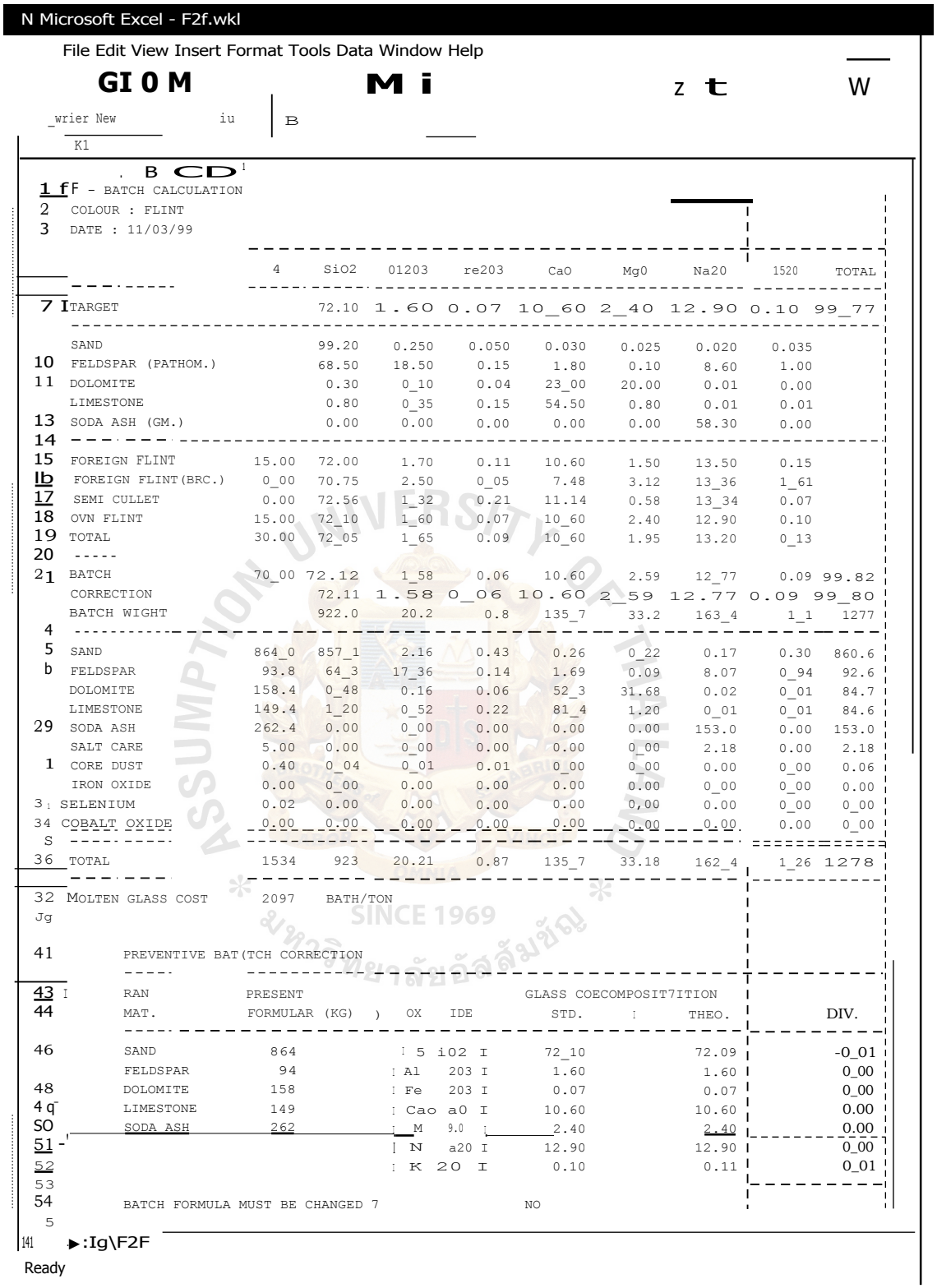
The proposed system is very attractive, undoubtedly. As in this kind of business, the key driver in material planning is the MRP system which is very important; thus the company should turn to the proposed system.

After this proposed system is applied, this will help in enhancing accuracy of information, improving efficiency of operation, and also reducing time in searching

required data. This will be suitable for the future growth of the business. It is to be expected that this software will play an important role in the future as well, whether or not as part of company.

APPENDIX A

EXISTING SYSTEM REPORT LAYOUT



N Microsoft Excel - F2f.wkl

File Edit View Insert Format Tools Data Window Help

1 fF - BATCH CALCULATION

2 COLOUR : FLINT

3 DATE : 11/03/99

	4	SiO2	01203	re203	CaO	Mg0	Na20	1520	TOTAL
7 I TARGET		72.10	1.60	0.07	10_60	2_40	12.90	0.10	99_77
SAND		99.20	0.250	0.050	0.030	0.025	0.020	0.035	
10 FELDSPAR (PATHOM.)		68.50	18.50	0.15	1.80	0.10	8.60	1.00	
11 DOLOMITE		0.30	0_10	0.04	23_00	20.00	0.01	0.00	
LIMESTONE		0.80	0_35	0.15	54.50	0.80	0.01	0.01	
13 SODA ASH (GM.)		0.00	0.00	0.00	0.00	0.00	58.30	0.00	
14									
15 FOREIGN FLINT	15.00	72.00	1.70	0.11	10.60	1.50	13.50	0.15	
lb FOREIGN FLINT(BRC.)	0_00	70.75	2.50	0_05	7.48	3.12	13_36	1_61	
17 SEMI CULLET	0.00	72.56	1_32	0.21	11.14	0.58	13_34	0.07	
18 OVN FLINT	15.00	72_10	1_60	0.07	10_60	2.40	12.90	0.10	
19 TOTAL	30.00	72_05	1_65	0.09	10_60	1.95	13.20	0_13	
20									
21 BATCH	70_00	72.12	1_58	0.06	10.60	2.59	12_77	0.09	99.82
CORRECTION		72.11	1.58	0_06	10.60	2_59	12.77	0.09	99_80
BATCH WIGHT		922.0	20.2	0.8	135_7	33.2	163_4	1_1	1277
4									
5 SAND	864_0	857_1	2.16	0.43	0.26	0_22	0.17	0.30	860.6
b FELDSPAR	93.8	64_3	17_36	0.14	1.69	0.09	8.07	0_94	92.6
DOLOMITE	158.4	0_48	0.16	0.06	52_3	31.68	0.02	0_01	84.7
LIMESTONE	149.4	1_20	0_52	0.22	81_4	1.20	0_01	0_01	84.6
29 SODA ASH	262.4	0.00	0_00	0.00	0.00	0.00	153.0	0.00	153.0
SALT CARE	5.00	0.00	0_00	0.00	0.00	0_00	2.18	0.00	2.18
1 CORE DUST	0.40	0_04	0_01	0.01	0_00	0_00	0.00	0_00	0.06
IRON OXIDE	0.00	0_00	0.00	0.00	0.00	0.00	0_00	0_00	0.00
3 SELENIUM	0.02	0.00	0.00	0.00	0.00	0,00	0.00	0_00	0_00
34 COBALT OXIDE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0_00
S									
36 TOTAL	1534	923	20.21	0.87	135_7	33.18	162_4	1_26	1278

32 MOLTEN GLASS COST 2097 BATH/TON

Jg

41 PREVENTIVE BAT(TCH CORRECTION

	RAN MAT.	PRESENT FORMULAR (KG)	OX IDE	GLASS COECOMPOSIT7ITION STD.	THEO.	DIV.
43 I						
44						
46	SAND	864	5 i02 I	72_10	72.09	-0_01
	FELDSPAR	94	Al 203 I	1.60	1.60	0_00
48	DOLOMITE	158	Fe 203 I	0.07	0.07	0_00
4 q	LIMESTONE	149	Cao a0 I	10.60	10.60	0.00
SO	SODA ASH	262	M 9.0	2.40	2.40	0.00
51			N a20 I	12.90	12.90	0_00
52			K 20 I	0.10	0.11	0_01
53						
54	BATCH FORMULA MUST BE CHANGED 7		NO			
5						

141 ▶:Ig\F2F

Ready

Figure A.1. Current Raw Material Monthly Report Layout in MS-Excel Format.

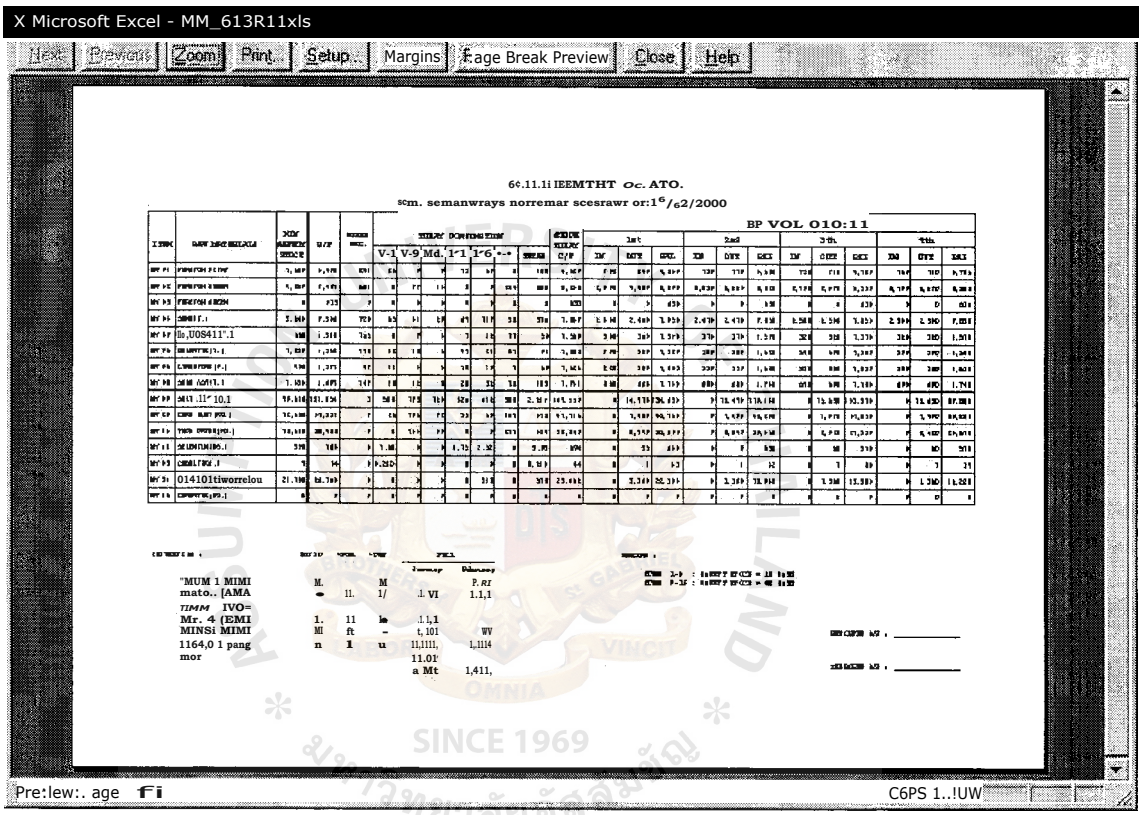
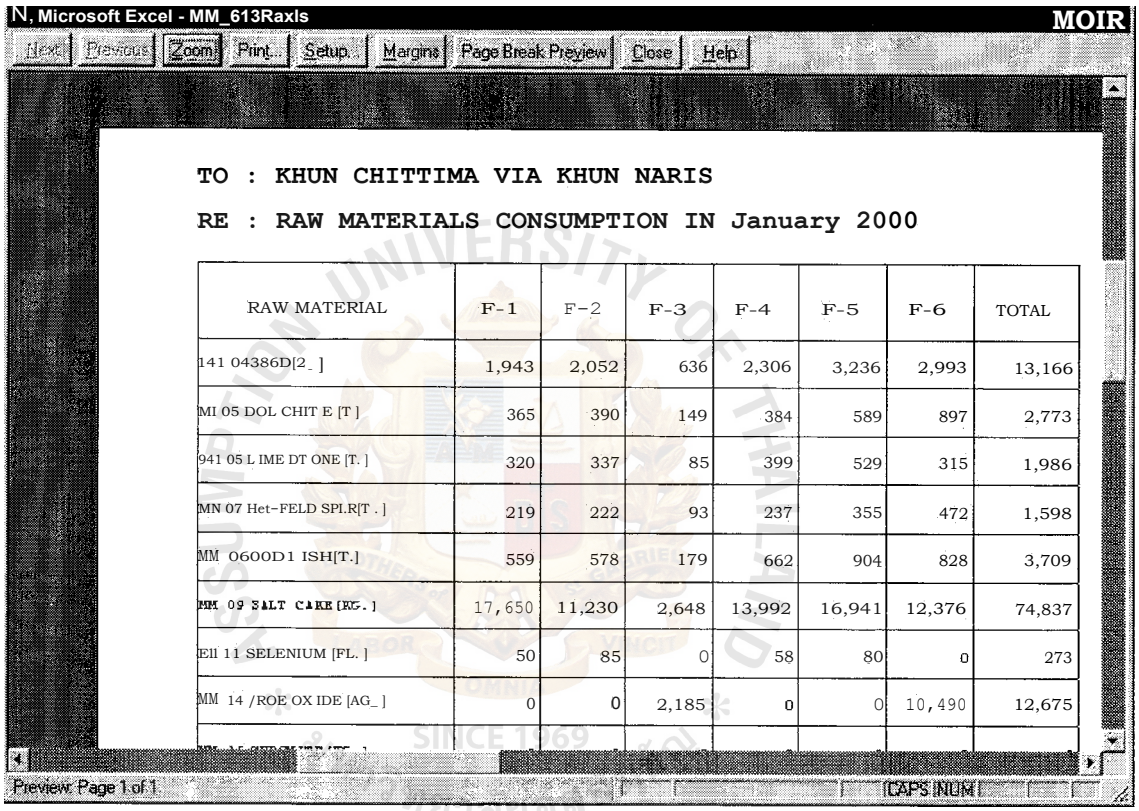


Figure A.2. Current Raw Material Movement Report Layout in MS-Excel Format.



RAW MATERIAL	F-1	F-2	F-3	F-4	F-5	F-6	TOTAL
141 04386D[2_]	1,943	2,052	636	2,306	3,236	2,993	13,166
MI 05 DOL CHIT E [T]	365	390	149	384	589	897	2,773
941 05 L IME DT ONE [T.]	320	337	85	399	529	315	1,986
MN 07 Het-FELD SPI.R[T .]	219	222	93	237	355	472	1,598
MM 0600D1 ISH[T.]	559	578	179	662	904	828	3,709
MM 09 SALT CAKE[RG.]	17,650	11,230	2,648	13,992	16,941	12,376	74,837
Ell 11 SELENIUM [FL.]	50	85	0	58	80	0	273
MM 14 /ROE OX IDE [AG_]	0	0	2,185	0	0	10,490	12,675

Figure A.3. Current Raw Material Consumption Report Layout in Ms-Excel Format.

APPENDIX B

PROPOSED SYSTEM'S SCREENS LAYOUT

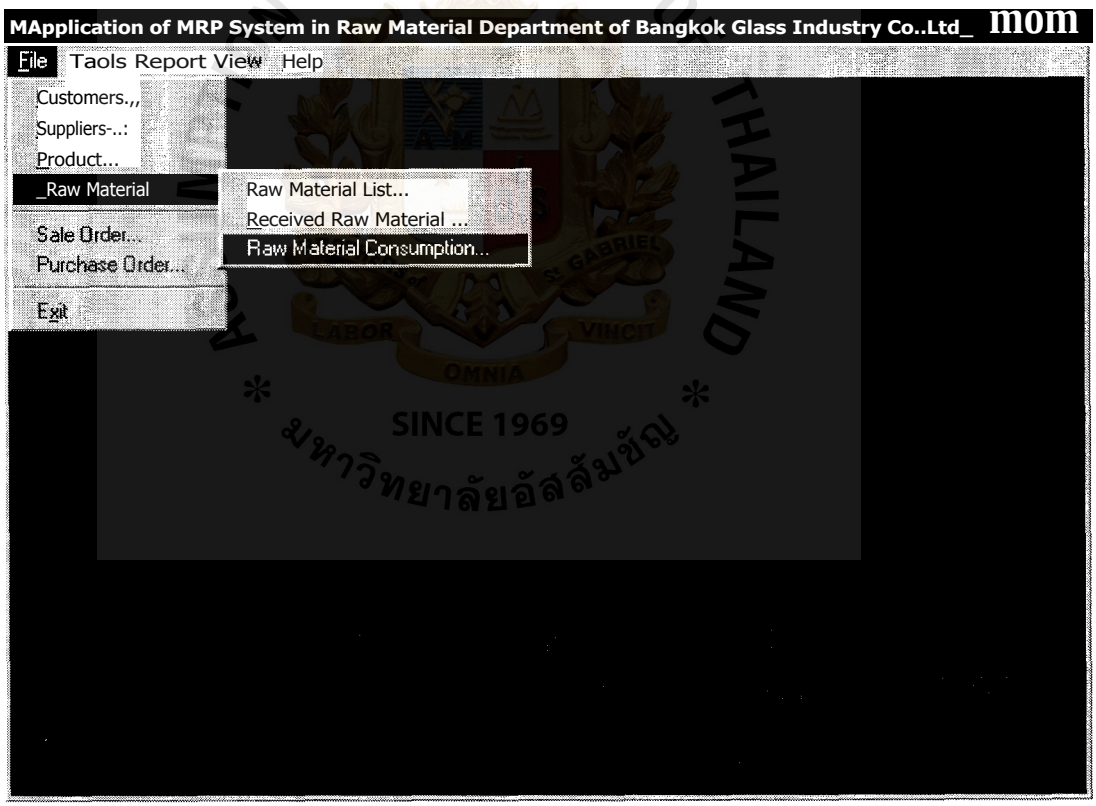


Figure B.1. File Menu on Main Screen of Glass Container's MRP System.

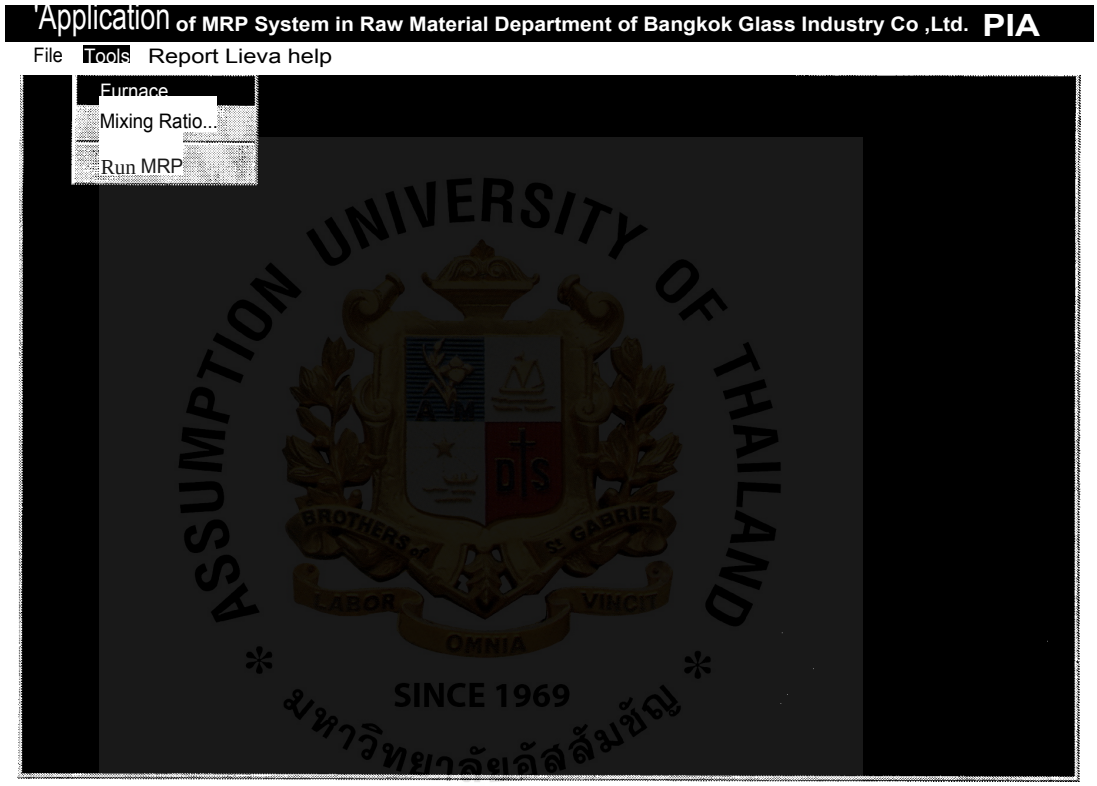


Figure B.2. Tools Menu on Main Screen of Glass Container's MRP System.

Figure B.3. Report Menu on Main Screen of Glass Container's MRP System.

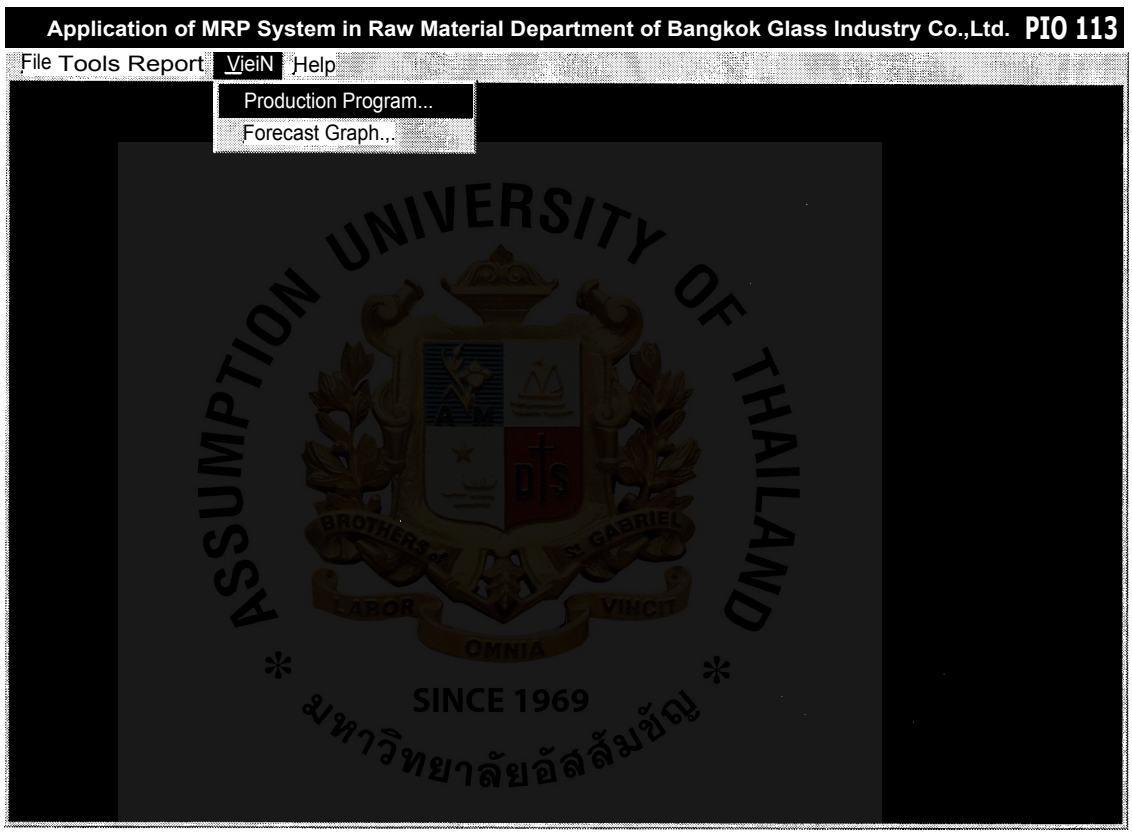


Figure B.4. View Menu on Main Screen of Glass Container's MRP System.

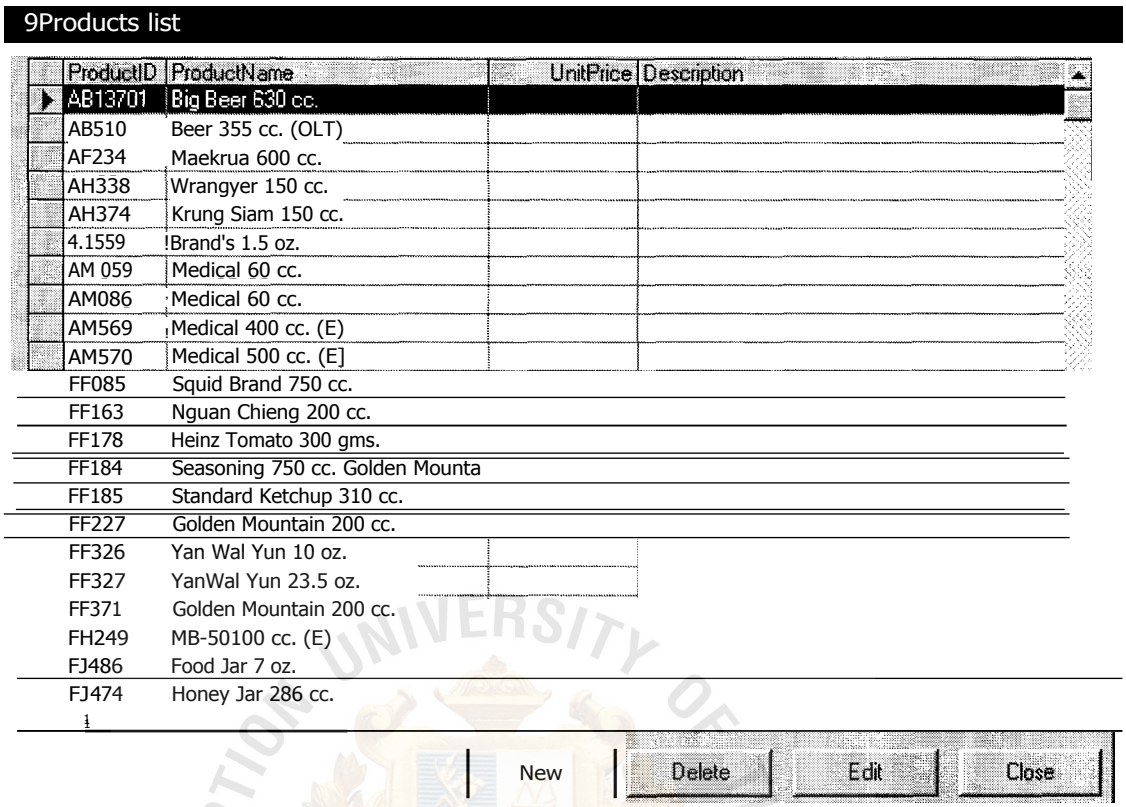


Figure B.S. Display Screen Layout of Glass Container's List.

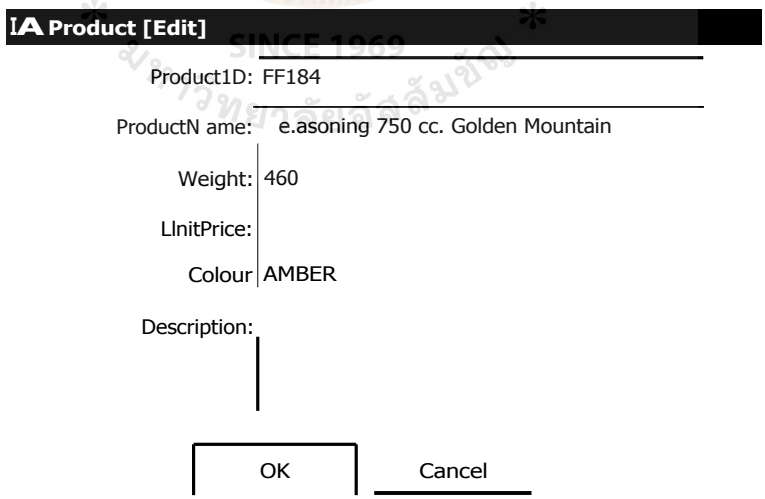
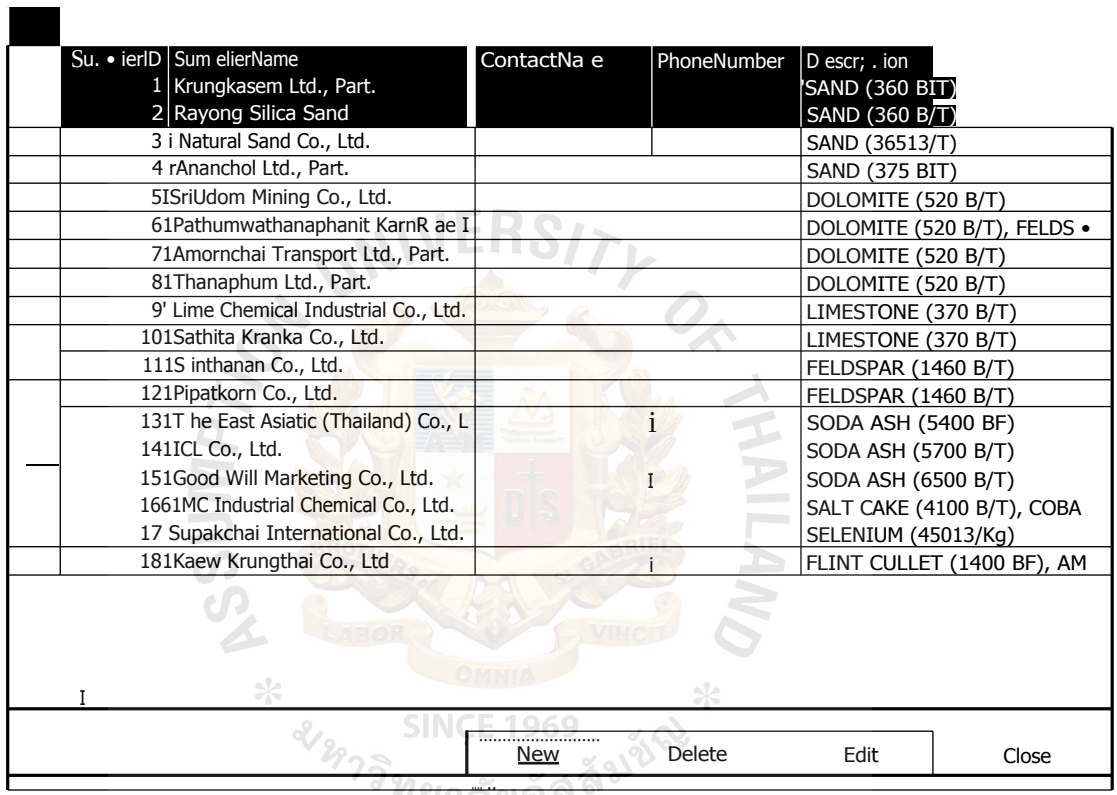


Figure B.6. Display Screen Layout of Editing Glass Container's List.



Su. • ierID	Sum elierName	ContactNa e	PhoneNumber	D escr; . ion
1	Krungkasem Ltd., Part.			'SAND (360 BIT)
2	Rayong Silica Sand			SAND (360 B/T)
3	i Natural Sand Co., Ltd.			SAND (36513/T)
4	rAnanchol Ltd., Part.			SAND (375 BIT)
5	ISriUdom Mining Co., Ltd.			DOLOMITE (520 B/T)
61	Pathumwathanaphanit KarnR ae I			DOLOMITE (520 B/T), FELDS •
71	Amornchai Transport Ltd., Part.			DOLOMITE (520 B/T)
81	Thanaphum Ltd., Part.			DOLOMITE (520 B/T)
9'	Lime Chemical Industrial Co., Ltd.			LIMESTONE (370 B/T)
101	Sathita Kranka Co., Ltd.			LIMESTONE (370 B/T)
111	S inthanan Co., Ltd.			FELDSPAR (1460 B/T)
121	Pipatkorn Co., Ltd.			FELDSPAR (1460 B/T)
131	T he East Asiatic (Thailand) Co., L		i	SODA ASH (5400 BF)
141	ICL Co., Ltd.			SODA ASH (5700 B/T)
151	Good Will Marketing Co., Ltd.		I	SODA ASH (6500 B/T)
1661	MC Industrial Chemical Co., Ltd.			SALT CAKE (4100 B/T), COBA
17	Supakchai International Co., Ltd.			SELENIUM (45013/Kg)
181	Kaew Krungthai Co., Ltd		i	FLINT CULLET (1400 BF), AM

Figure B.7. Display Screen Layout of Supplier's List.

Figure B.8. Display Screen Layout of Editing Suppliers.

St. G

Customers list

CustornerID	CustomerName	PhoneN umber	FaxNumber	Descri tion
2	Boonrod Asia Beverage Co., Ltd.			
3	Sermsook Public, Co., Ltd.	975-3333		
4	Pichai Fish Sauce Co., Ltd.	(038) 397537	(038) 397530	
5	T ra Mae Krua Co., Ltd.	(662) 312-7224 - 33	(662) 312-76181	
6	Jew **Huad** Co., Ltd.	(038) 381114, 387367	(038) 387382	
7	Universal Food Public Company Limited	237-8010		
8	NCI I ntermart Co., Ltd.	819-1920		
9	Taki Saying Sangorsuk Co., Ltd.			
10	B oorawd Brewery Co., Ltd.			
11	Chuewhuad Co., Ltd.	(038) 381114, 381361	(038) 381382	
12	i Thai Pure Drink Co., Ltd.	955-0888		

Close

Figure B.9. Display Screen Layout of Customer's List.

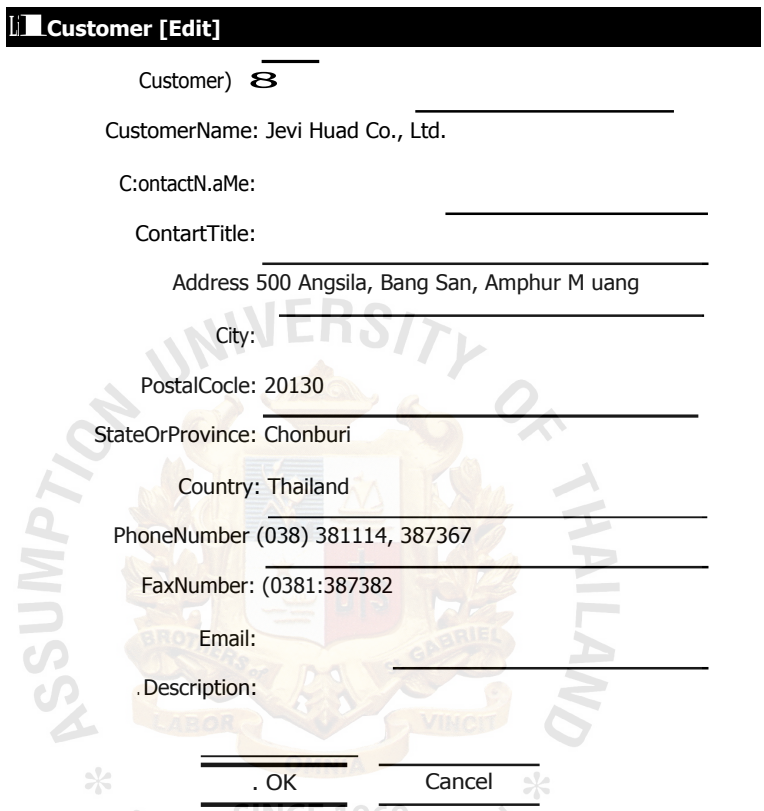


Figure B.10. Display Screen Layout of Editing Customer's Record.

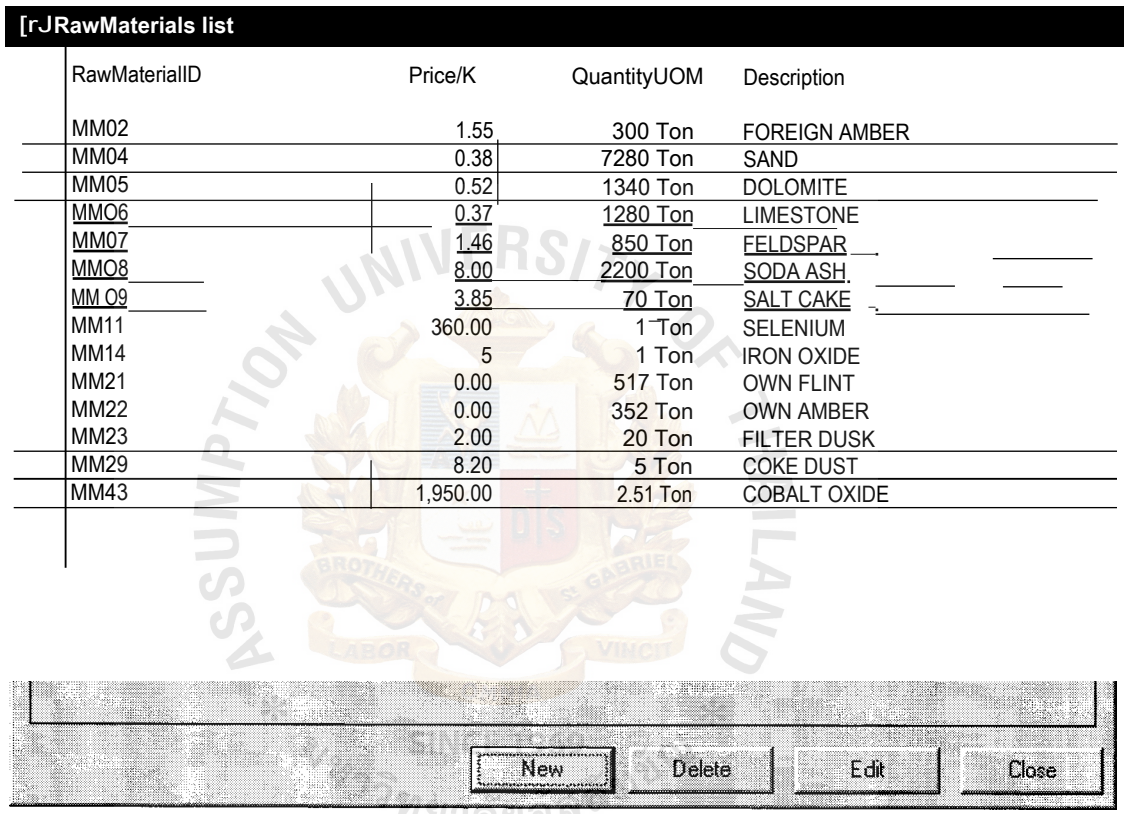


Figure B.11. Display Screen Layout of Raw Material's List.

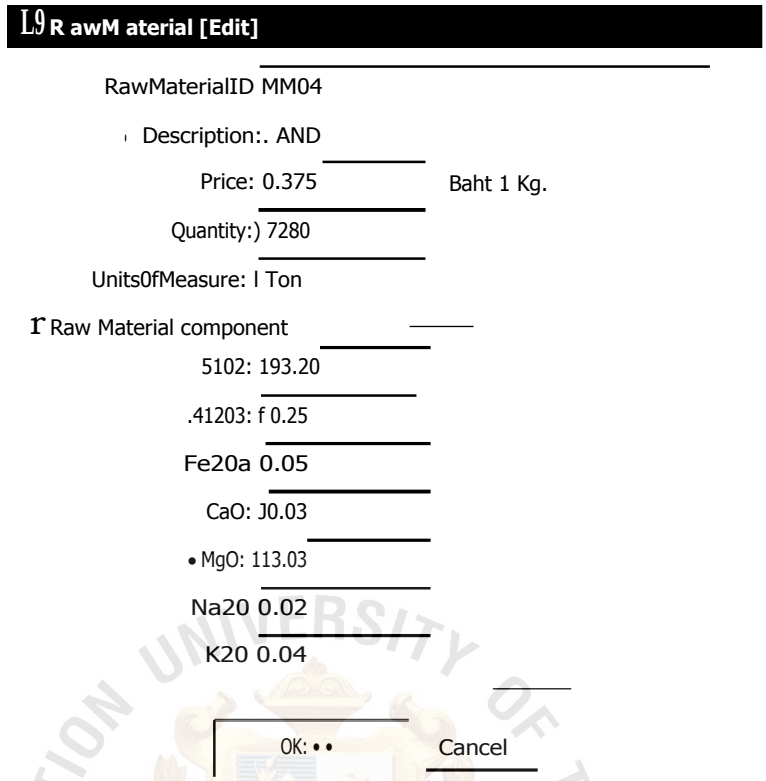


Figure B.12. Display Screen Layout of Editing Raw Material's Record.

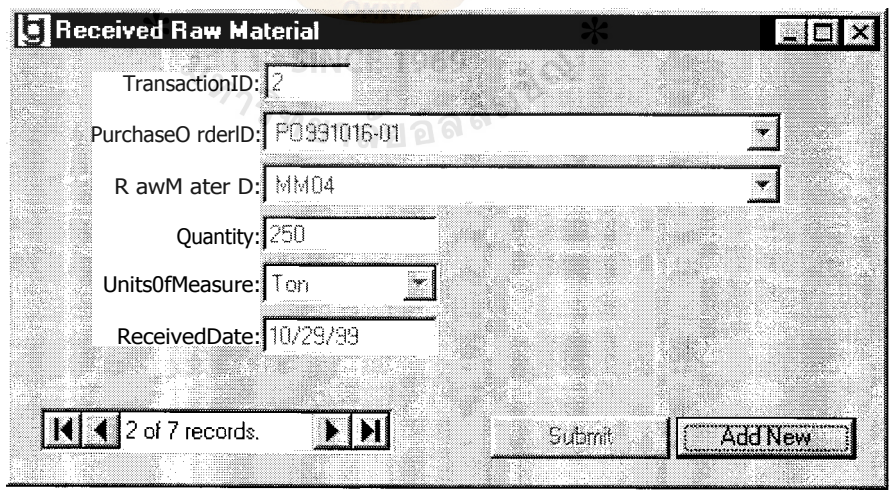


Figure B.13. Display Screen Layout of Received Raw Material.

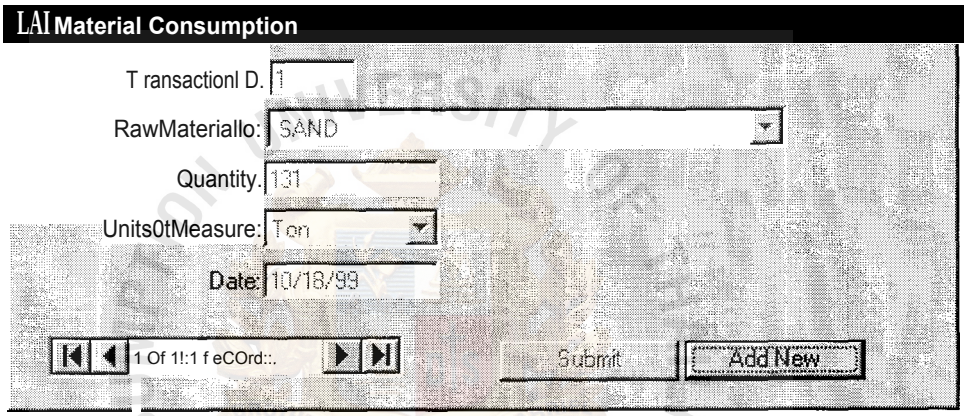


Figure B.14. Display Screen Layout of Material Consumption.

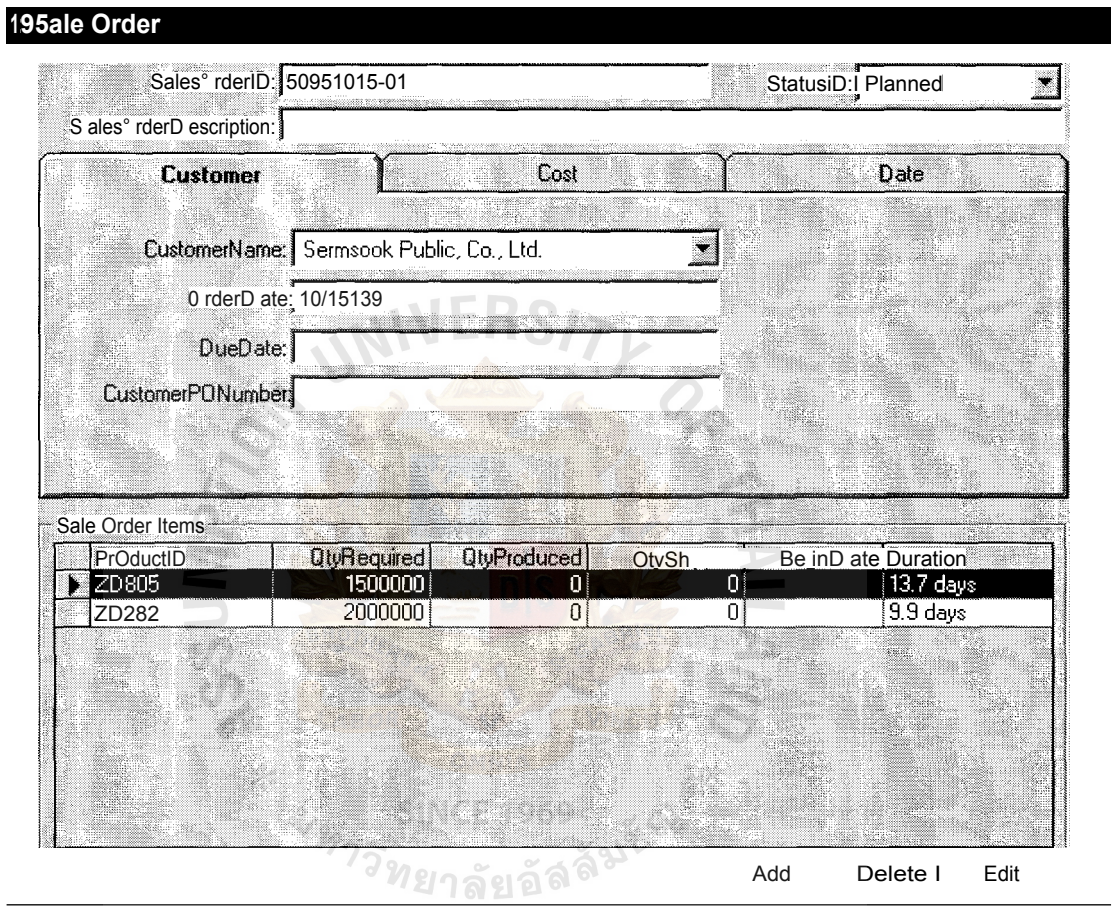


Figure B.15. Display Screen Layout of Sales Order.

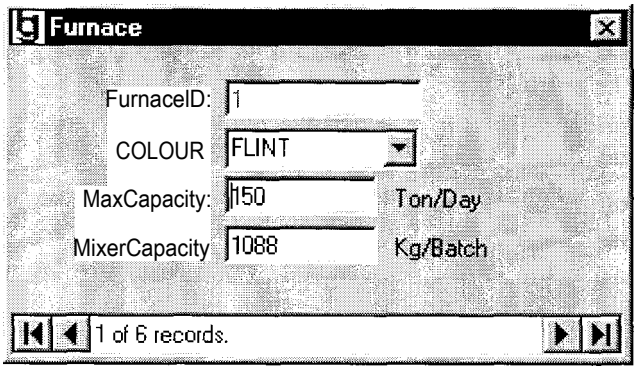


Figure B.16. Display Screen Layout of Furnace.

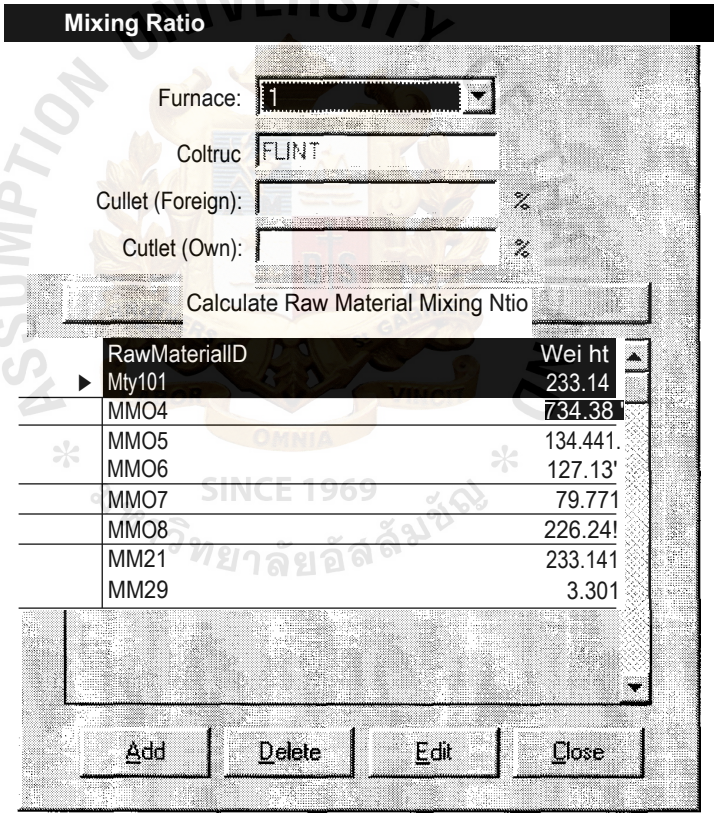


Figure B.17. Display Screen Layout of Mixing Ratio.

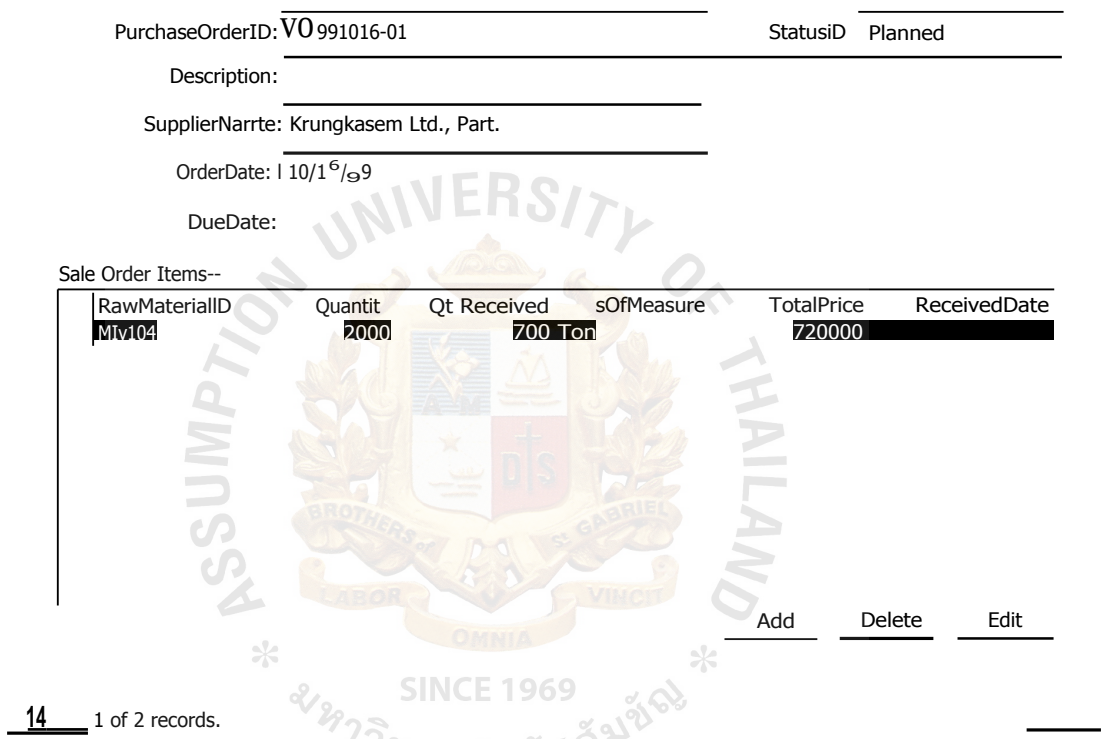


Figure B.18. Display Screen Layout of Purchase Order.

APPENDIX C

PROPOSED SYSTEM'S REPORT LAYOUT

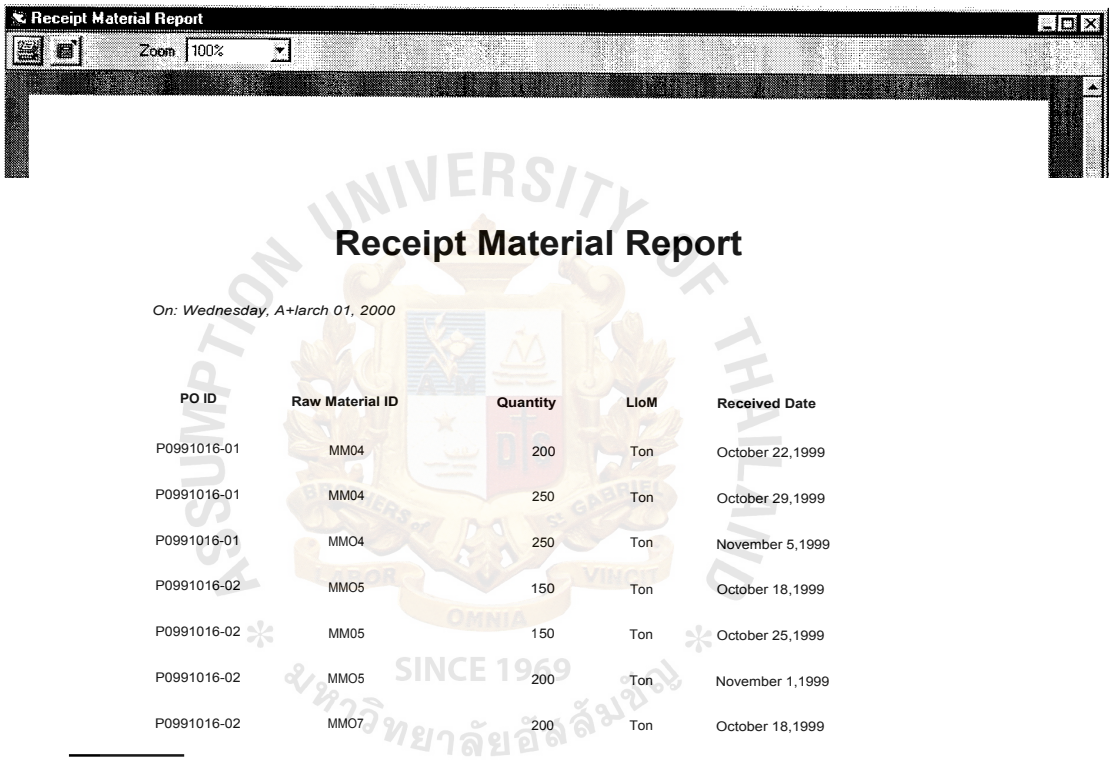


Figure C.1. Report Layout of Receipt Material Report.

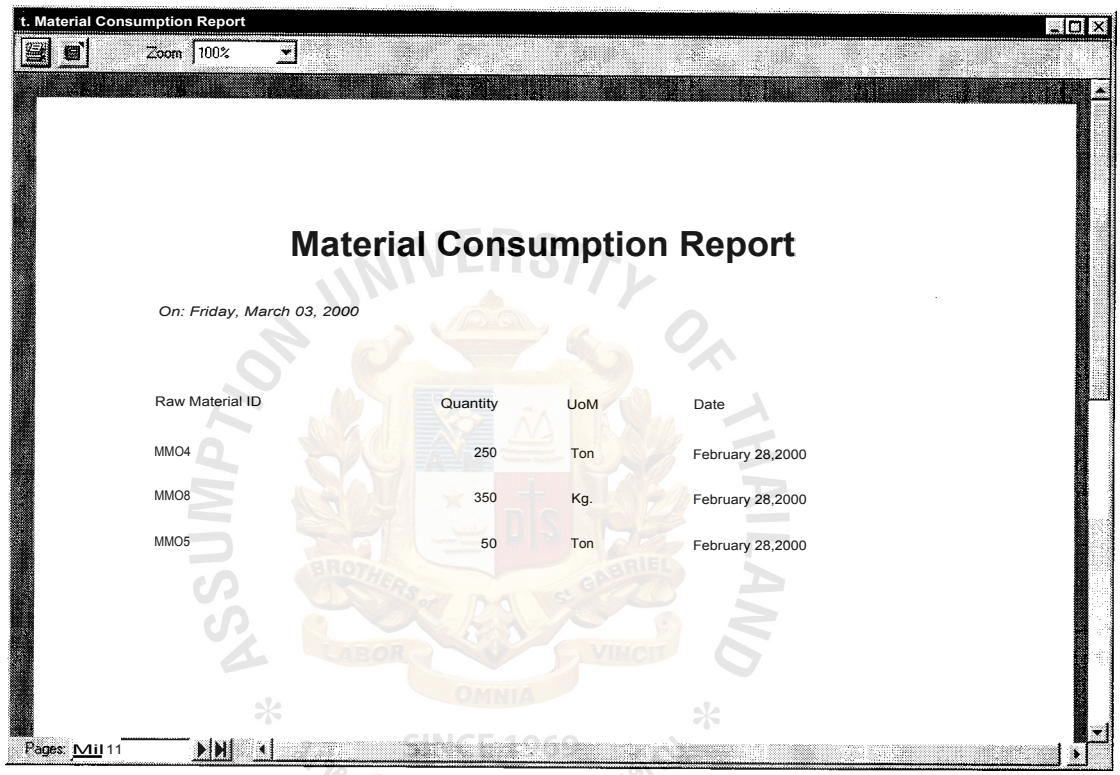


Figure C.2. Report Layout of Material Consumption Report.

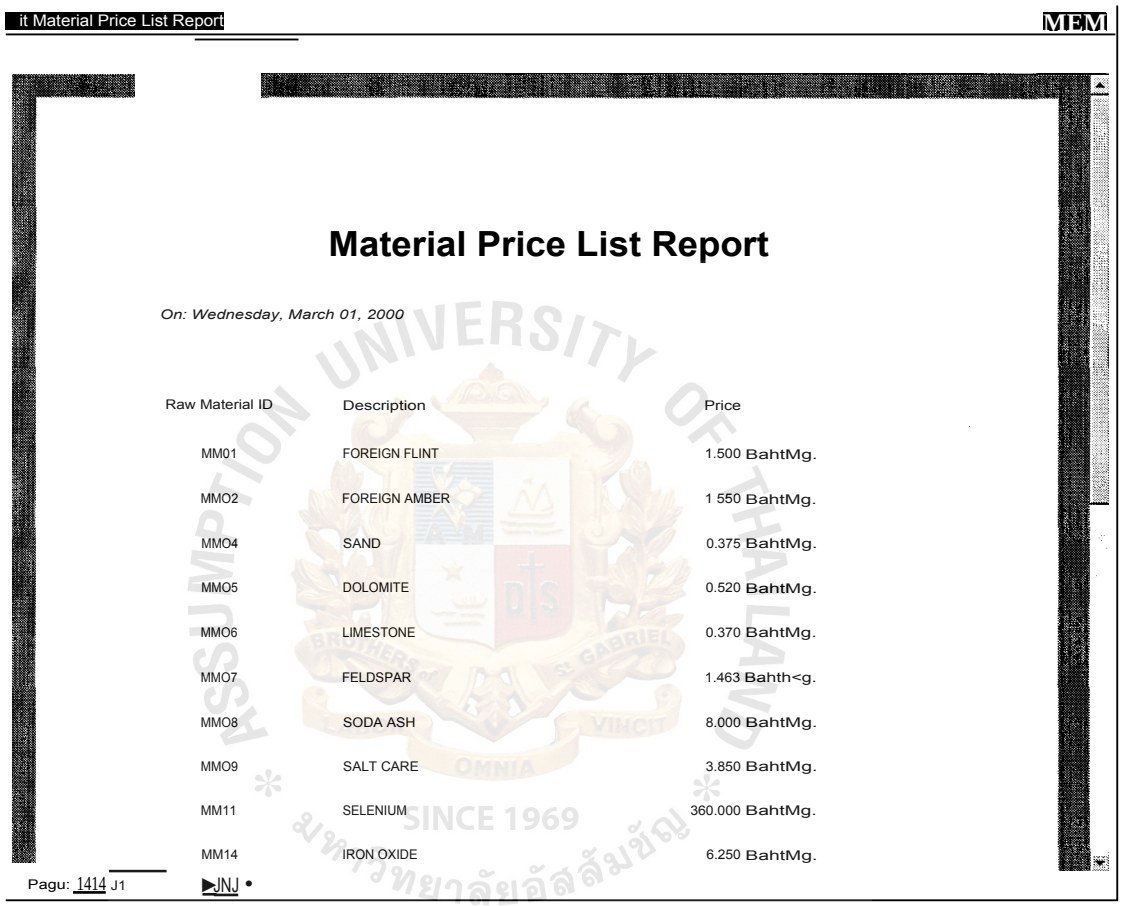
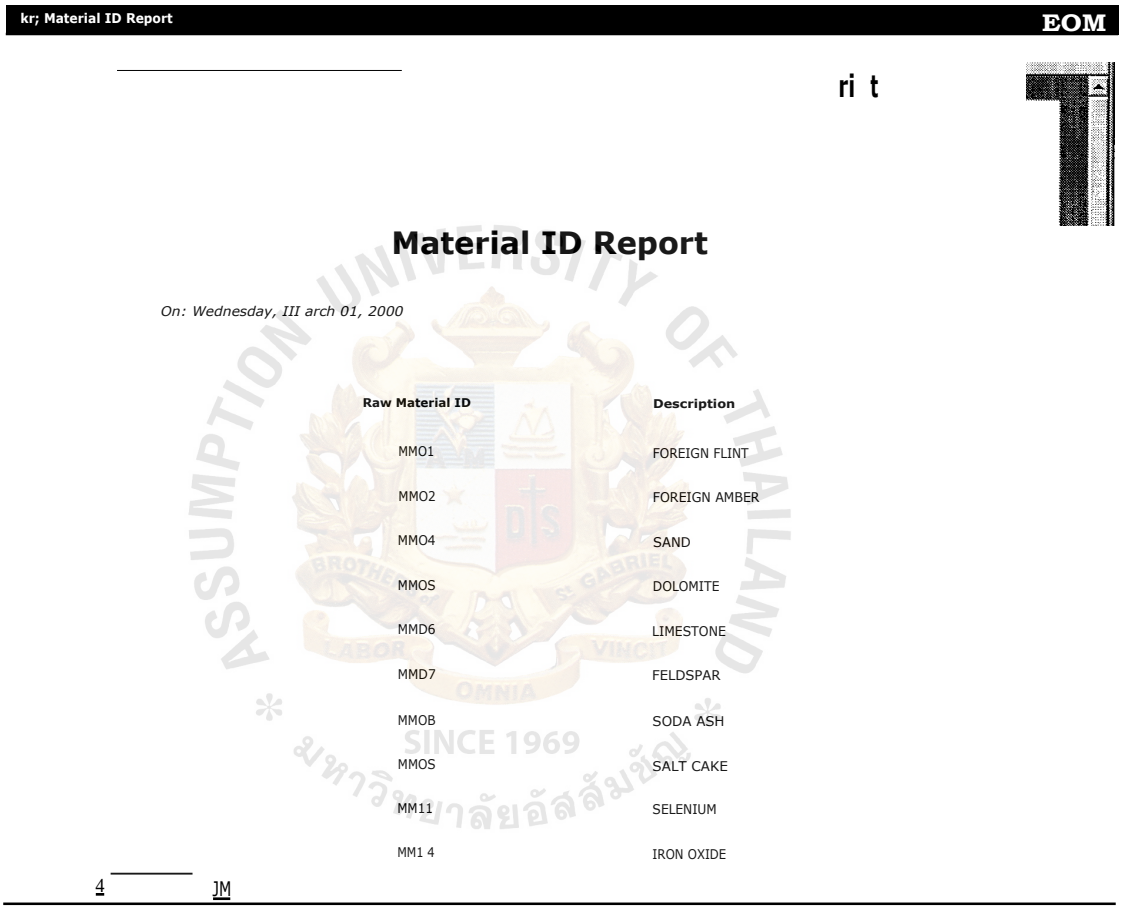


Figure C.3. Report Layout of Material Price List Report.



kr; Material ID Report EOM

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Material ID Report

On: Wednesday, III arch 01, 2000

Raw Material ID	Description
MMO1	FOREIGN FLINT
MMO2	FOREIGN AMBER
MMO4	SAND
MMOS	DOLOMITE
MMD6	LIMESTONE
MMD7	FELDSPAR
MMOB	SODA ASH
MMOS	SALT CAKE
MM11	SELENIUM
MM1 4	IRON OXIDE

4 JM

Figure C.4. Report Layout of Material ID Report.

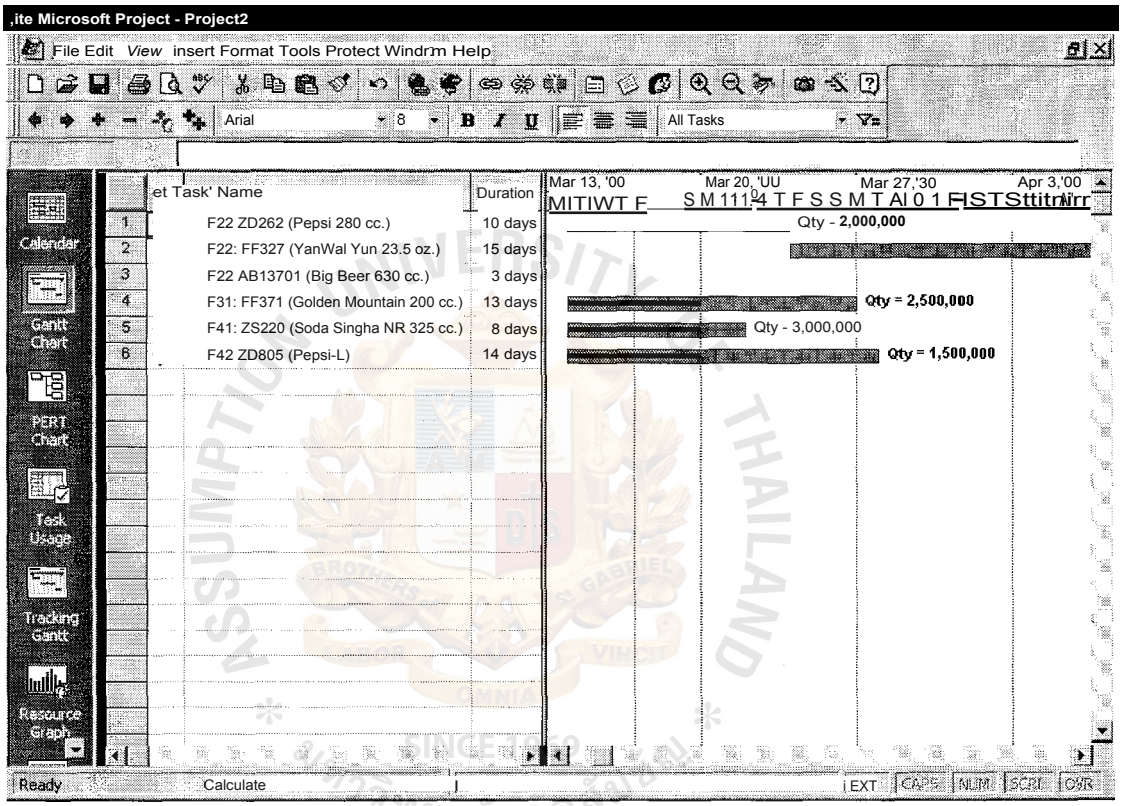


Figure C.5. Report Layout of Production Program Report.

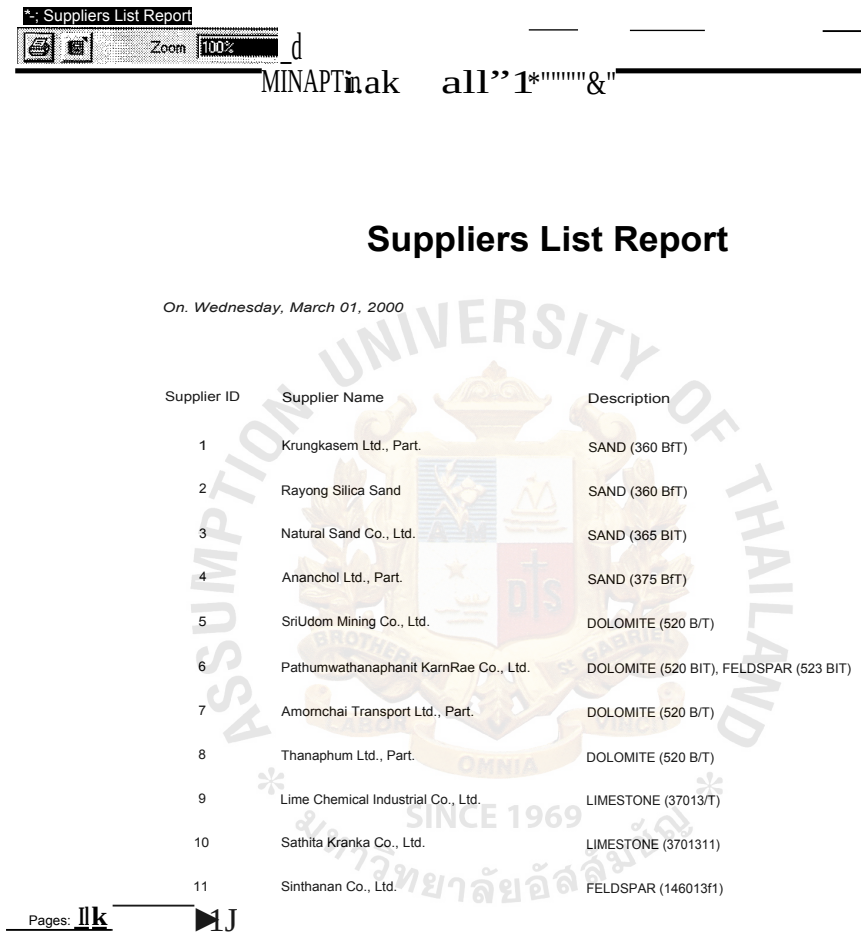


Figure C.6. Report Layout of Suppliers List Report.

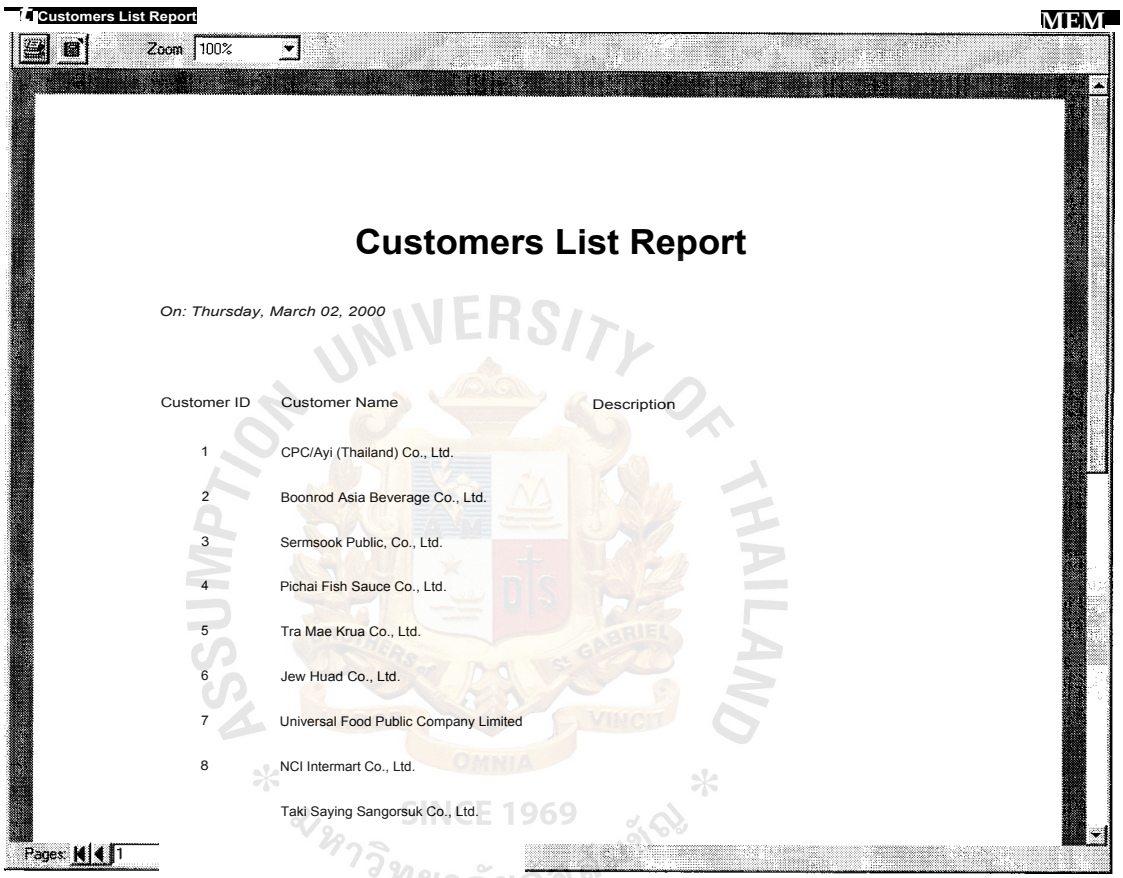


Figure C.7. Report Layout of Customer List Report.

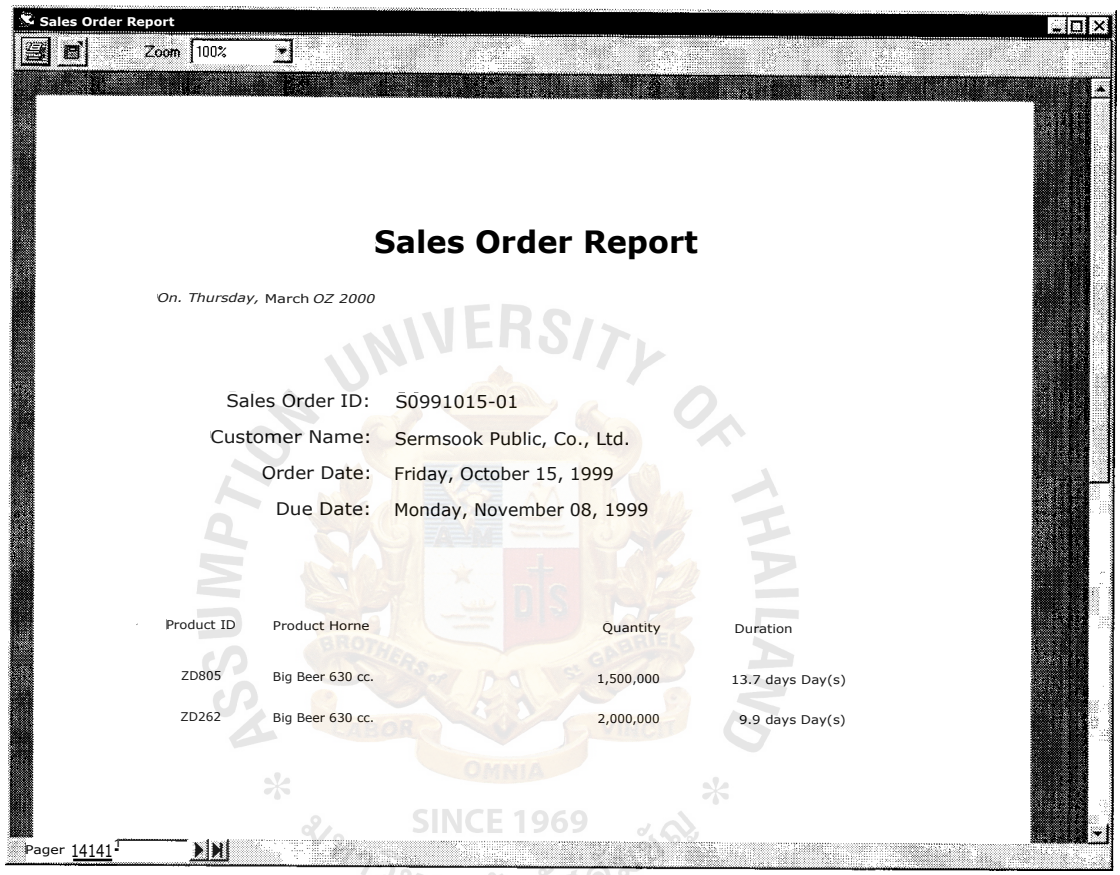


Figure C.8. Report Layout of Sales Order Report.

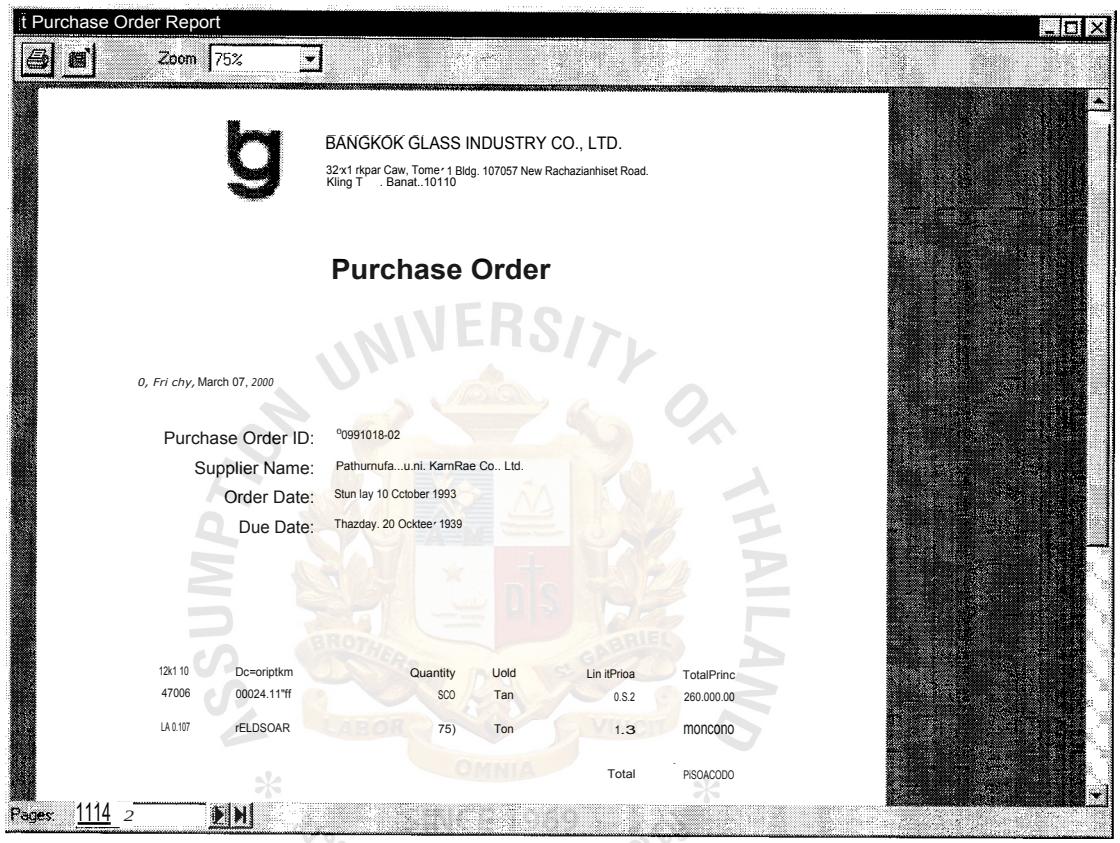


Figure C.9. Report Layout of Purchase Order Report.

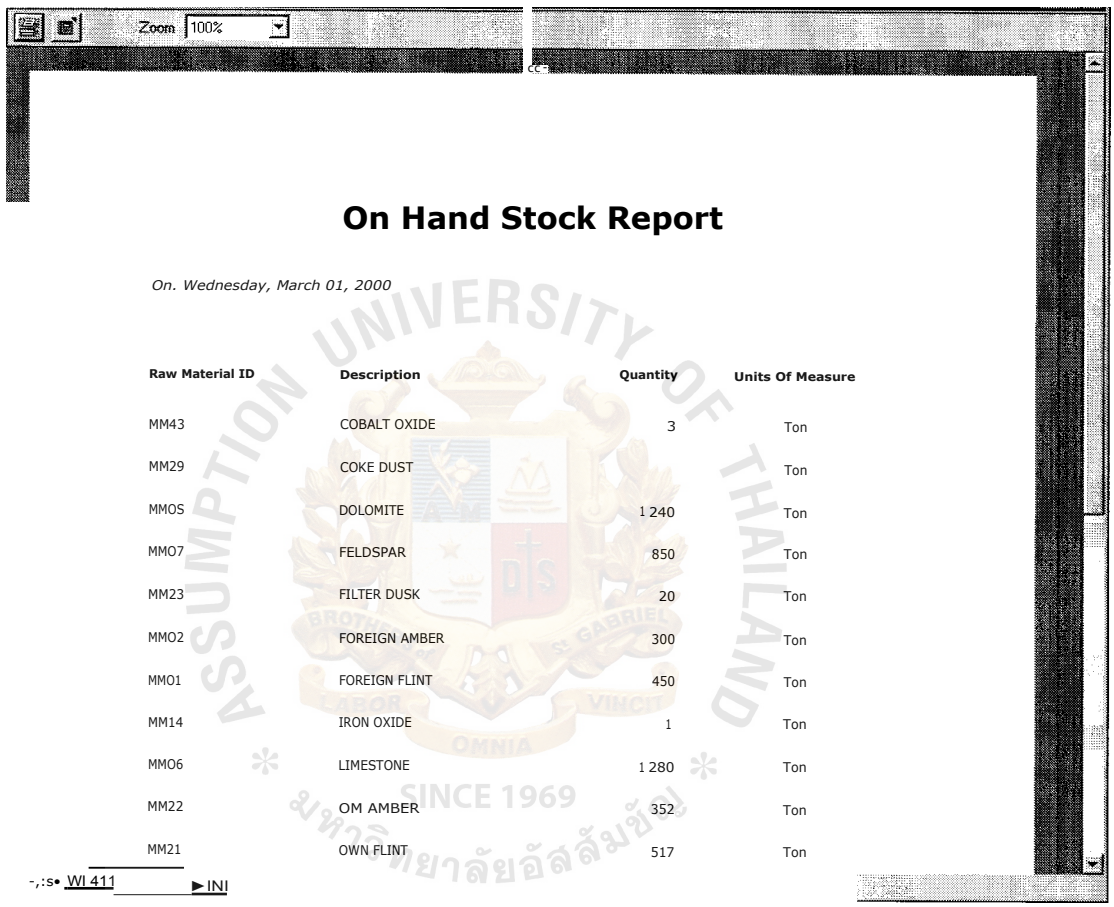
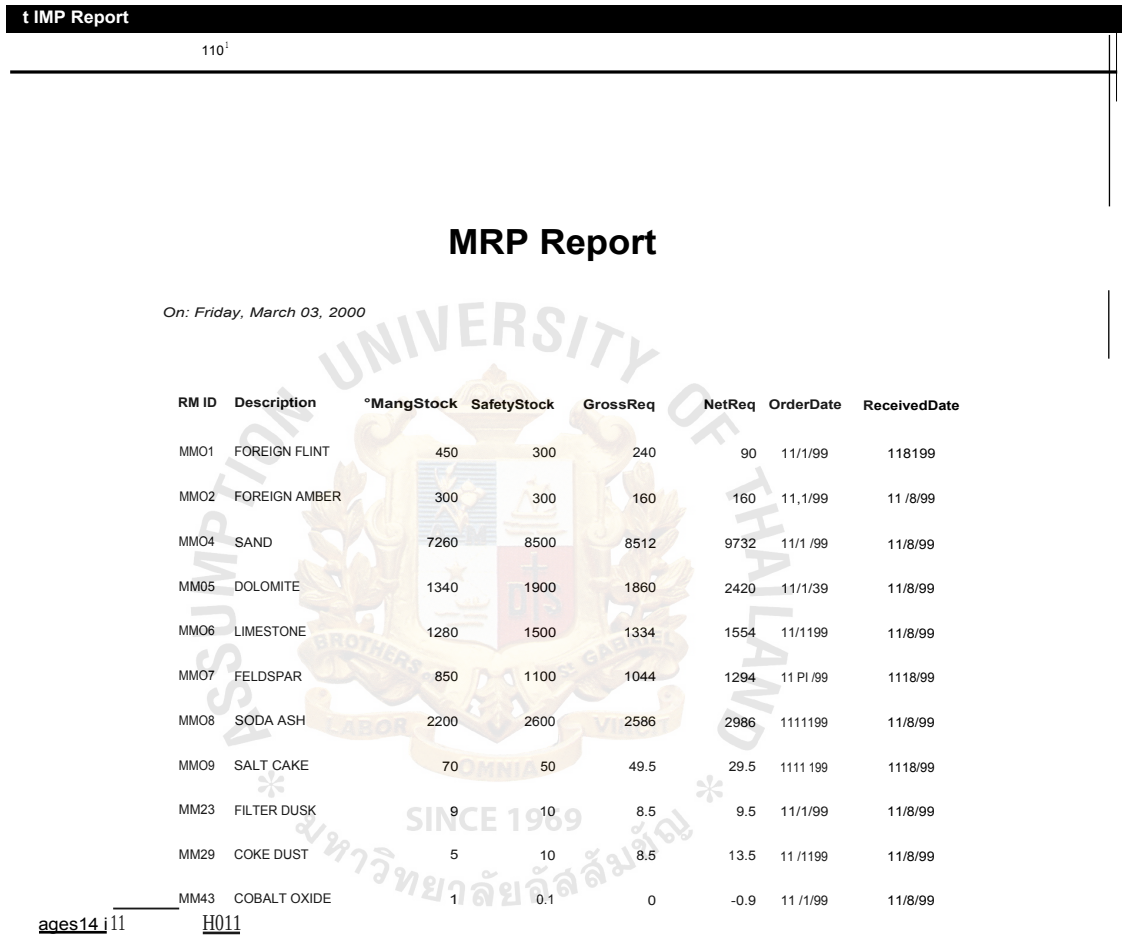


Figure C.10. Report Layout of On Hand Stock Report.



t IMP Report

110[1]

MRP Report

On: Friday, March 03, 2000

RM ID	Description	°MangStock	SafetyStock	GrossReq	NetReq	OrderDate	ReceivedDate
MMO1	FOREIGN FLINT	450	300	240	90	11/1/99	118199
MMO2	FOREIGN AMBER	300	300	160	160	11,1/99	11 /8/99
MMO4	SAND	7260	8500	8512	9732	11/1 /99	11/8/99
MM05	DOLOMITE	1340	1900	1860	2420	11/1/39	11/8/99
MMO6	LIMESTONE	1280	1500	1334	1554	11/1199	11/8/99
MMO7	FELDSPAR	850	1100	1044	1294	11 PI /99	1118/99
MMO8	SODA ASH	2200	2600	2586	2986	1111199	11/8/99
MMO9	SALT CAKE	70	50	49.5	29.5	1111 199	1118/99
MM23	FILTER DUSK	9	10	8.5	9.5	11/1/99	11/8/99
MM29	COKE DUST	5	10	8.5	13.5	11 /1199	11/8/99
MM43	COBALT OXIDE	1	0.1	0	-0.9	11 /1/99	11/8/99

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Figure C.11. Report Layout of Material Requirements Planning (MRP) Report.

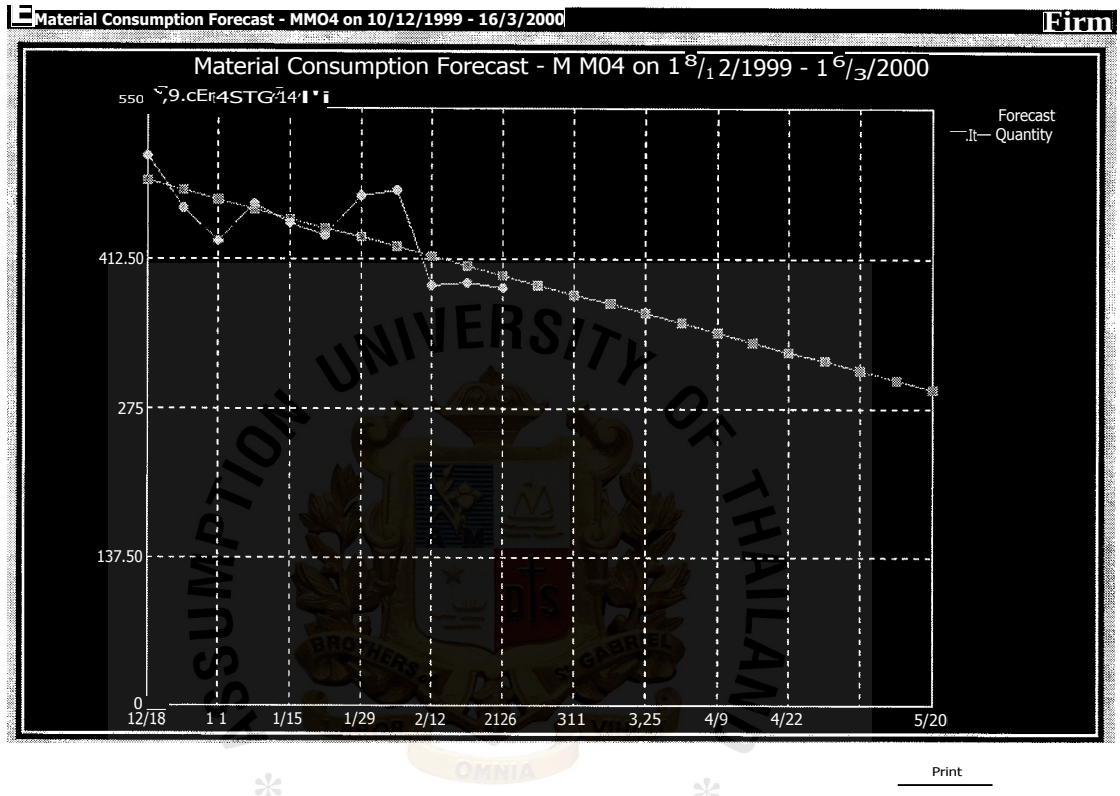

Figure C.12. Report Layout of Forecasting Raw Material Summary Report.

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3. Jessop, David and Alex Morrison. Storage and Supply of Materials, Sixth Edition. London: Pitman Publishing, 1994.

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