READY-MIXED CONCRETE DELIVERY SYSTEM DEVELOPMENT

by

Mrs. Ma Socorro L. Calingo

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	Ready-Mixed Concrete Delivery System Development
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Academic Year	November 2002

The Graduate School of Assumption University has approved this fmal 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

ACO Company is a producer of ready-mixed concrete and it is one of the leading concrete mix suppliers serving various construction companies in the area. The company is located in Pampanga province, northern part of the country. It intends to expand its ready mixed concrete business in the near future in order to cope with the increasing rate of local construction activities within the area.

ACO is currently using the application in which filling and recording works were done manually, and later on realized that there was a need to develop the system because of the problems that arise during the performance of their task with the use of the existing system.

Generating timely reports for the manager is a difficult task for the employees due to the manual system method. The company is encountering some erroneous and inaccurate data recording, inability to work faster, work accurately and processing of data activities such as misfiling, valuable information misplaced and lost, some more factors. The employees also are losing the opportunity to be able to adopt or apply and to have knowledge with the modern technology due to the unavailability of the computerized system in the company.

Accurate and timely information is very important in an organization and which will also guide as a support for decision making of the management. Changing an old system to a new system is recommended to develop and implement an Information System particularly in the Delivery System of the Ready-Mixed Concrete company in order to support management's decision making and to help solve the above stated problems that the company is currently encountering and experiencing.

ACKNOWLEDGEMENTS

Several persons had made this Project possible, and I would like to acknowledge their efforts and express gratitude for their contributions.

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I. INTRODUCTION

1.1 Overview of the Project

ACO (Amando Coronel Ordonez) Company is a supplier of ready-mixed concrete in the Philippines, which batching plant is located in a small town in Pampanga province, northern part of the country. It is one of the leading ready-mixed concrete producers serving the town and 4 nearby towns within the province, supplying concrete to many projects with special requirements and technical specifications of local construction activities particularly on government funded projects like roads and highways, bridges and buildings construction/maintenance and many more, including private-owned projects.

The company's goal is to reduce cost on its production, whereby, reducing price but to keep increased customer service and quality, and to introduce various new products to the ready-mixed industry. Its intention is to continue growing its business and driving the best practices in business process. The company intends to leverage new technology to drive increased operational efficiency, cost savings and higher profits.

ACO Company became the company of choice of many contractors in the area, thus, demands' rate continue to grow annually, due to its lower price high quality scheme and the continuous improvement of the product. With this regards, the company aims to develop the Delivery System of the company so as to meet the demands and to cope with the increasing forecasted growth in the local construction activities within the area and to expand its business in the near future.

1.2 Objectives of the Project

The ready-mixed concrete industry is very competitive, highly fragmented and relies on paper and manpower-intensive management methods. Order fulfillment and logistics costs are high, especially because ready-mixed concrete is a perishable product. Concrete mix should be discharged from the mixer or agitator within 1 1/2 hours after the water is added to the batch. Concrete is batched and then hauled to the site in mixer trucks, partially mixed at the plant with mixing completed in a truck mixer while the truck mixer is in motion.

The current process of the system consists of dozens of discrete independent transactions with suppliers, involving phone calls and the generation of many paper documents. The process is difficult to manage and track accurately, therefore utilization of resources is poor, timing of orders and demand is uncertain. Fleet management is difficult. Delays and the possibility of errors are inherent throughout the process. The typical strategy for dealing with these problems has been to build **in** contingencies in terms of time, numbers of trucks and personnel.

The objective of the project is to analyze and develop an automated delivery system replacing the current system on which a manual system was being applied. This system will improve the following activities:

(1) Filing and recording system

(2) Reporting system in generating various reports to support management decision making at all levels of management.

(3) Streamline work responsibility through staff accountability and responsibility.

(4) Ability to cope with the increasing demands due to the increasing growth rate

in the local construction industry activities in the area.

1.3 Scope

The Scope of the Project is to analyze the current manual delivery system, and to develop a new delivery system:

a. To make fleet management easy and fast so as to avoid errors throughout the process.

b. To improve the reporting system of the company's delivery system..

c. To improve the timing on orders, demands and production.

d. To make the delivery tracking system of the company accurate and easy to manage.

e. To enable to cope with the increasing demand growth rate in the local construction activities so as to increase profit of the company, thus continuously keeping its high quality on its product and customer service.

II. THE EXISTING SYSTEM

In analyzing a new system, one must be acquainted with the current system first in order to be fully aware which problems are needed to be prioritized in developing the system. The existing Delivery system of ACO Company is using the manual system, however, there was a need to a convert to computerized system to improve and develop the process in relation with the delivery system of the company's ready-mixed concrete production business. With the development of the system, performance of the functions under the ACO Ready-Mixed Concrete Company will become more effective and efficient.

2.1 Background of the Organization

ACO Company was established in 1986. The company's principal activities were quarrying; mixing and selling of rock, stone and lime products; excavating sand and gravel and other earthworks activities; and constructing roads and highways.

During the year 1991, the company had established another type of business which was Ready-Mixed Concrete production and it was the first ready-mixed concrete company to operate in the area.

The company has a total of 26 mixer trucks, equipped with mobile communications to keep track of each truck's location and status during delivery. The ready-mixed company is capable of supplying massive quantities of concrete around the clock promptly and capable of producing over 200 cubic meters of concrete per hour. Each mixer truck has a capacity of a maximum of 6.5 cubic meters of ready-mixed concrete per load.

ACO Company's current system consists of five departments.

(1) Accounting Department - in charge of the accounts receivables/payables

and other accounting activities of the company.

(2) Finance Department - in charge of the company's assets, financial statement, plans and schedule of expenses according to budget.

(3) Personnel Department - in charge of the human resources of the company, checks performance and behavior of every employee and worker, and support the needs of all employees and workers.

(4) Site Office Supervisor - instructs the chief operator and overall in charge of the site operations which relates to delivery including pre-inspection of construction sites, planning and scheduling of deliveries, etc.

(a) Chief Operator - overall supervision of drivers and operators including solving problems occurred during delivery and reporting accidents to the supervisor.

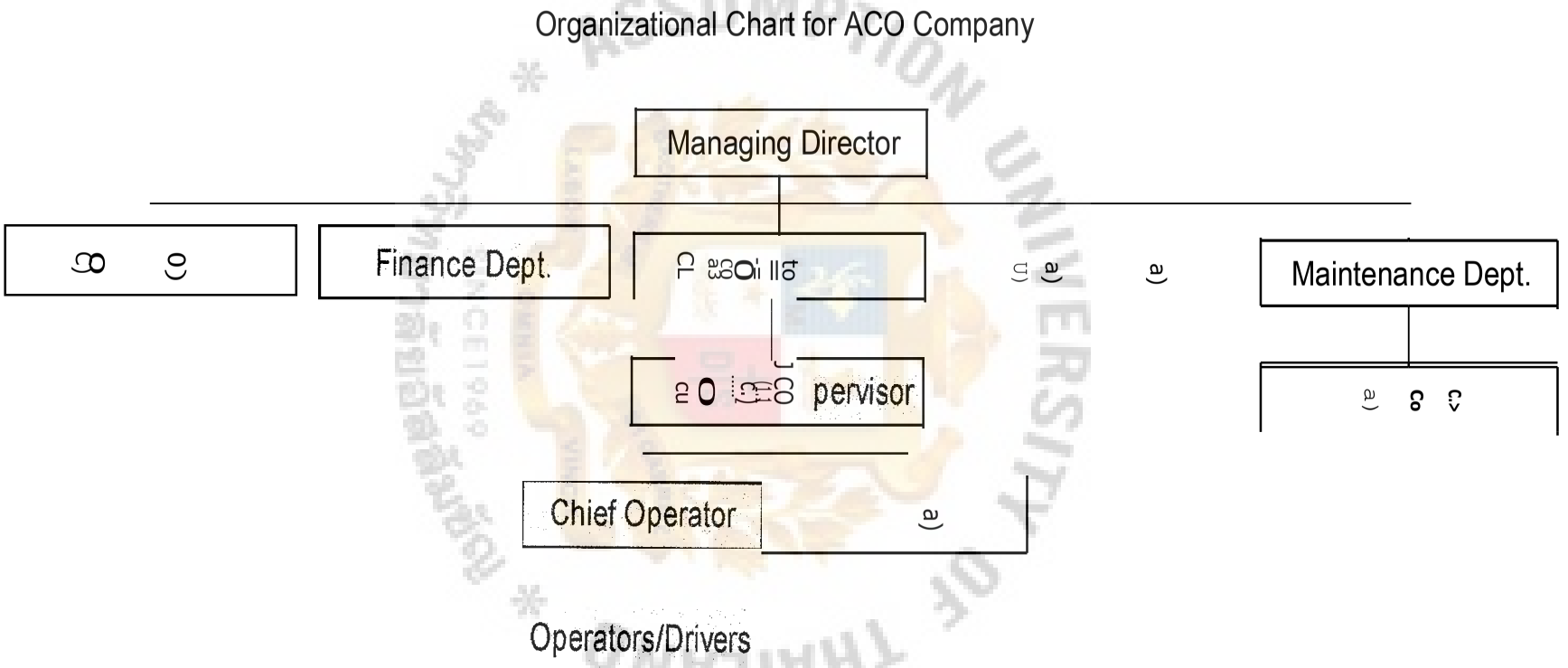
(b) Site Office Clerks - assist the site office supervisor in all paper works.

(5) Inspection Department - check and inspect the equipments and trucks, mixers working conditions and generate updated inspection reports to the managing director.

(6) Maintenance Department - maintain all equipments, trucks, mixers, prepare an estimate for the proposed repair works, generate reports to the managing director and instruct and monitor the works of mechanics.

(a) Mechanics - in charge of all repairs and maintenance of equipments, trucks, transit mixers/lorries.

CURRENT ORGANIZATIONAL CHART OF ACO COMPANY



C urent Organizational Chart of ACO Company.

2.2 Existing Work Flow of the System

The existing work flow of the delivery system of ACO Company is performed through the following activities:

(1) The ready-mixed concrete production plant issues three (3) copies of delivery receipt to each drivers on each contractor or customer on every delivery.

(2) The driver delivers concrete to the construction site and have the delivery receipt signed by the contractor's construction foreman upon delivery.

(3) After receipt, the construction site foreman returns two (2) copies of delivery receipt back to the driver including the record form (white form) and keep one (1) copy for them.

(4) The driver will give one (1) copy to the production plant.

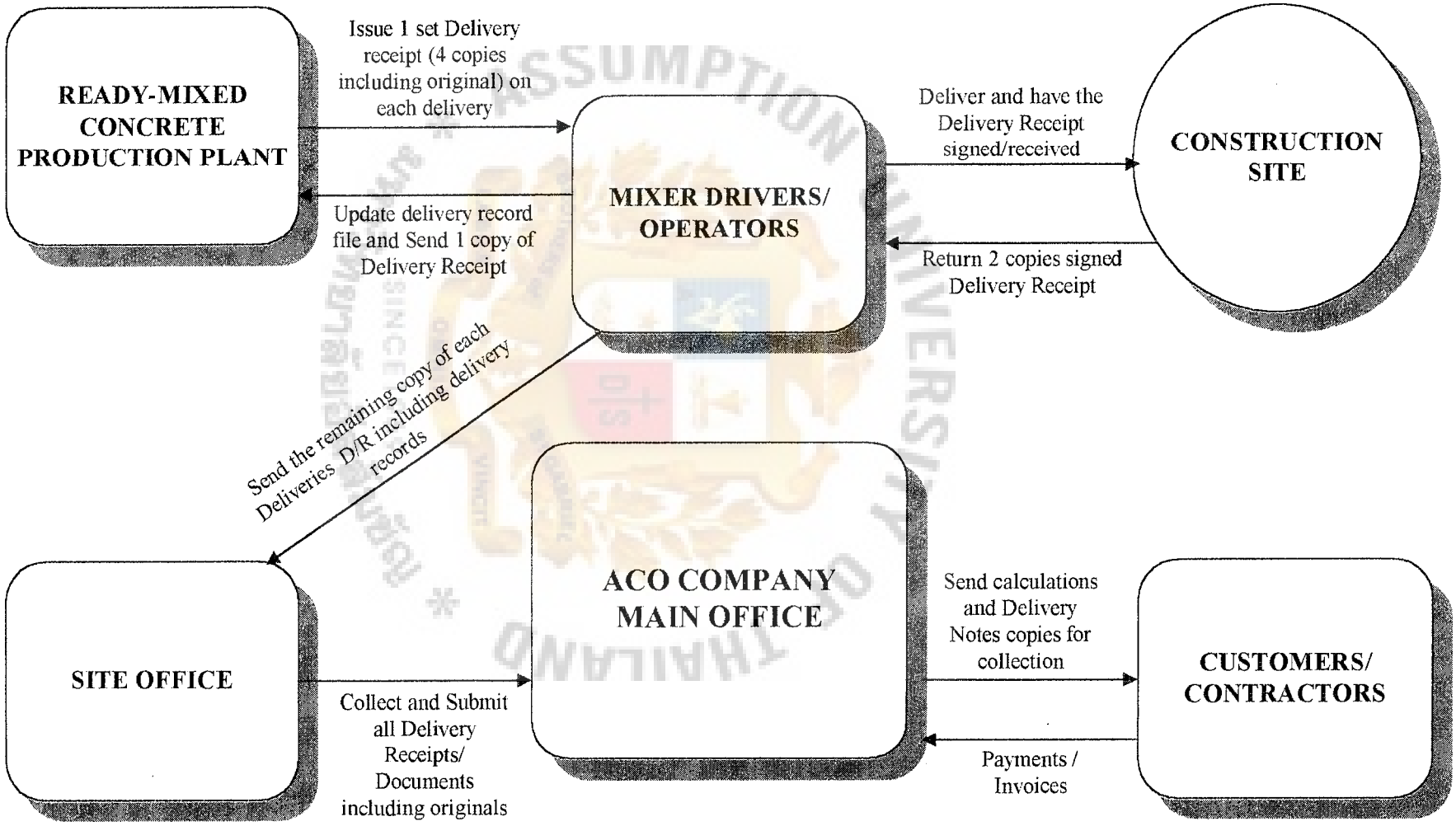
(5) The driver will then send the remaining signed delivery receipt copy to the site office clerk including the delivery record.

(6) The site office clerk then submits all gathered delivery documents to the main office daily.

(7) The main office will calculate all delivery receipts and send the calculations with details to the customers for collection purposes, with the payment terms agreed upon between them, either monthly, semi-monthly or every certain amount or volume/quantity limits.

(8) Customers generate payments based on the terms and conditions between them and the company.

CURRENT WORK FLOW OF ACO COMPANY



Current Work Flow

2.3 Existing System Data Flow Diagram

ACO Company current system is composed of the following subsystems:

(1) Operator / Driver

Gather signed receipts for the calculations of customers payment and salaries and wages of the operators/drivers. Collection of oil coupons to verify and record monthly oil consumption of the company.

(2) Supplier

Involves the orders placed and made, payments and others in relation with the goods ordered from the supplier for the company use including receipts and other documents.

(3) Oil / Lubricants

Collecting all oil invoices from the oil stations and check accuracy before making payment.

(4) Inventory

See to it that there is enough required materials in the stock, no inventory shortages and no inventory excess. Control Inventory and provide updated inventory report to the management. Check delivered goods or items if it conforms to the quality and specifications required by the company and check if the quantity of materials delivered conform to the quantity stated in the suppliers' delivery receipt.

(5) Customers / Contractors

Making comparison from the delivery reports to actual concrete

mix delivered on site to check any discrepancies between the actual delivered concrete mix and computed total delivery charges for each customer or contractor as a basis for collection of payments from the company, and as a proof of payment or upon receipt of payment, in return will be issued receipts and invoices by the company.

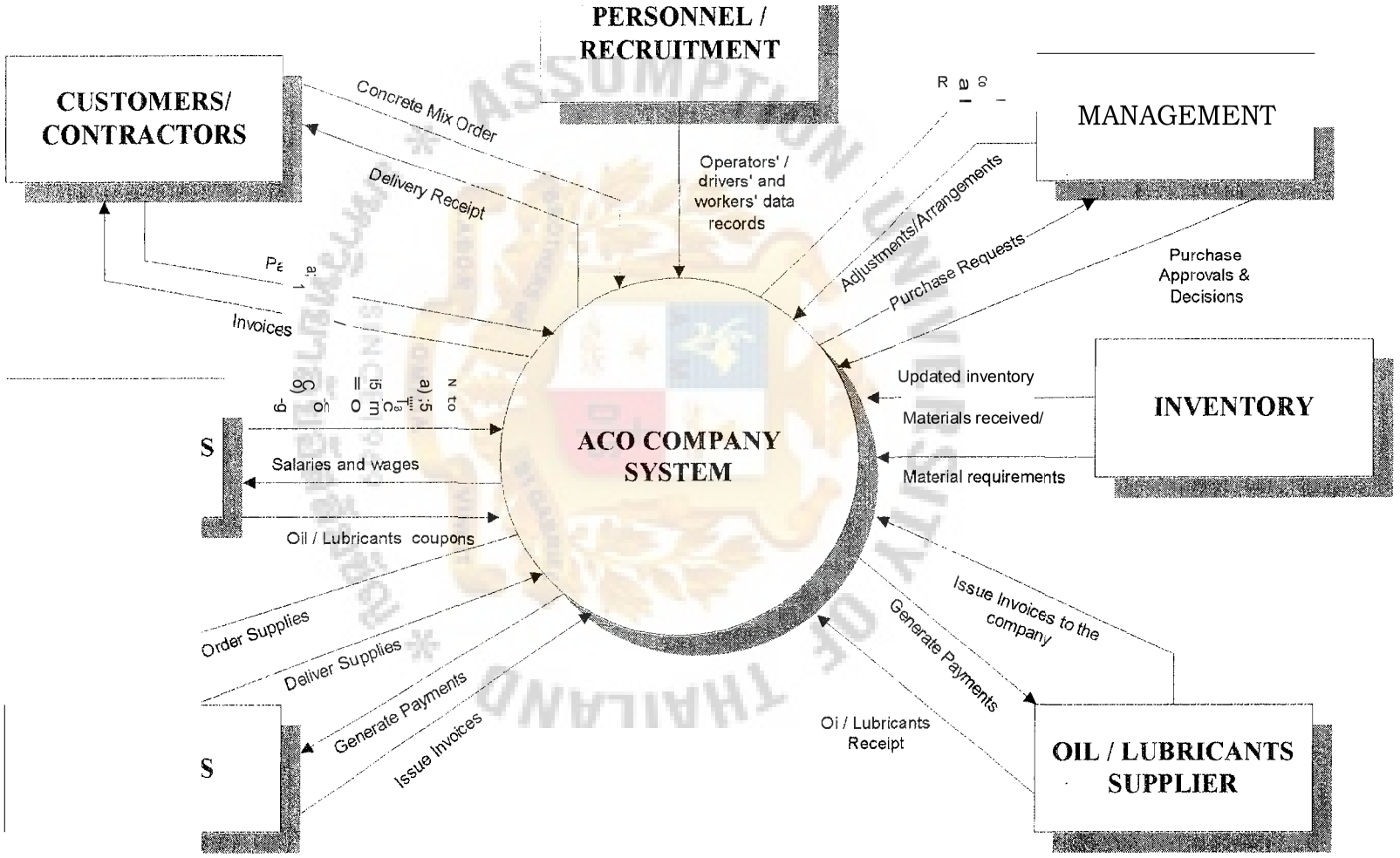
(6) Personnel / Recruitment

Responsible for recruiting new operators and workers, processing new operators' and workers' data, maintaining and updating personnel data and information, support the needs of the personnel in the organization.

(7) Management

Decision making based on submitted generated various reports, controlling the expenses and budget and other activities of the company. Analyze and solve the company's problems.

CURRENT FWD CONTEXT DIAGRAM OF ACO COMPANY



Current System Context Diagram

2.4 Current Information System

ACO Company was established in 1986. The company had been operating for 16 years and during the early years, the prime activities of the company were quarrying, mixing and selling of boulders, aggregates and lime products, sand and gravel excavation and other earthworks activities including roads and highways construction and improvements. After 5 years of its operation, the company had set up a ready-mixed concrete production business, and currently had been in the operation for more than 10 years.

The ready-mixed concrete business has 26 mixer trucks and 1 batch plant, the company's main office is located 4 kilometers away from the production plant or batching plant site. Each truckload has a capacity volume of 6.5 cubic meters and the proportion of concrete mix of the company was by weight method.

For each truckload of ready-mixed concrete delivered on the construction site, two (2) received (signed) copies of delivery receipt has to be returned to the mixer operator to be submitted to the site clerk each time. The site clerk will then gather all daily delivery receipts and other documents and forward them to the main office. The main office personnel will keep all this information for records purposes, and input the data in the computer the following day to update the calculation of delivery fees for the drivers and at the same time to calculate the amount to be charged to the customer in a particular month.

The current information system in the main office of ACO Company used five (5) units of standalone computers in its operation. These computers have no terminals and they were not linked and connected with each other, no sharing of data and printers within the office. Whenever one machine has no available application or program that

one employee needs, he will have to wait for the other computer to be free before he can be able to do his job or rather he will have to switch or use the other personnel's computer machine.

The following were the units used by the company.

(a) Computers

(1)	1 unit	for Secretary
(2)	1 unit	for Clerk
(3)	1 unit	for Sales
(4)	2 units	for Accounting

(b) Printers

(1)	1 unit	for Secretary
(2)	1 unit	for Clerk and Sales
(3)	1 unit	for Accounting

In recording data and calculating fees, charges and payments, Microsoft Office spreadsheet program was being applied. This program was used to record the following activities:

(a) Summary of oil expenses

(b) Spare parts used for mixer trucks, and other equipments

(c) Daily delivery receipt records updating

(d) Updated data and information

(e) Generate report to the Manager

The company's existing system do not have a database system in keeping the records and data regarding delivery activities and other activities in the operation. There was a plan for setting up additional computer machine units within the office due to the required additional workers and staff. However, continuous use of the standalone system was still to be applied and there is still no plan of deciding to change the system because they thought they will not be needing an upgrading of the system, in as much as the company has only one (1) main office and one (1) site office/production plant office and considering these offices were very close to each other in a distance of 4 kilometers.

2.5 Problem Definition

The problems that exist in ACO Company in relation with using the existing system consist of the following:

(1) Current Filing and Recording System Inefficiency

(2) Management Reporting System Inefficiency or Inaccuracy

(3) Poor Performance

Current Filing and Recording System Inefficiency

(a) Slow information retrieval due to the use of manual system.

(b) Misplaced or lost files/records means lost of information.

(c) Wage and payments calculations requires much time.

(d) Computers were not used for feeding or searching information because no shared data between the staff in the company, thus, searching files and information as well as processing was done manually so the tendency was to have heavy workload and inability to use available resources, and each transaction takes a lot of time before it can be finished or accomplished.

Management Reporting System Inefficiency and Inaccuracy

(a) Management Reporting System Inefficiency and Inaccuracy

(b) No available updated information or basis for the manager necessary for decision making in the company.

(c) Inability for the manager to control expenses or to control budget because of lack of necessary information.

(d) Inability for the manager to make efficient problems solving due to insufficient information.

(e) No flexibility and free flow of information in the firm.

Poor Performance

(a) Repeated mistakes and errors because of the use of manual system.

(b) The activities in the firm are carried out slow because of the current system.

(c) No shared data and information between the staff so retrieval of information takes much time and effort.

(d) Heavy workload and time consuming functions.

(e) Inability to have the opportunity of every one in the firm to improve knowledge regarding the modern technology.

2.6 Alternatives

The possible solutions or alternatives to be considered in dealing with the problems of ACO Company were the following :

(1) Hiring additional staff and workers, buying more computer machine units and printers but manual system will be used continuously. This is easy to implement in as much there are a lot of available workers in the vicinity that need jobs.

(2) Design, program and install a computerized system for the company. This will provide support for future business expansion, helps to increase productivity and helps to reduce cost in the company.

2.7 Recommended Alternative

The alternative is to design and install a computerized system for ACO Company. Setting up a LAN system and develop customized software, specifically tailored to the needs of ACO Company to develop an in-house computer system to handle all tasks with regards to collecting, filing, recording, retrieving and reporting. In addition to that, there may have been some other features to be applied with the use of computer system such as generating graph which will a guide and basis in decision making and solving the company's problems.

The system will collect all data such as delivery data, inventory data, oil data and send those data in the main office at the end of each day via modem. The main office responsibility then is to verify the input data, assuring the accuracy of data by double checking before calculating and finalize translated data forms such as wage report,

delivery report and other reports concerning the company's business.

In this alternative, the existing problems within the company will be solved. Production Plant can now perform the uploading and downloading of data from the server in the main office via the modem. Office activities functions can now be streamlined with the use of processing software which are available in every computers. At the present time, there are two messengers in the company doing delivery of messages and records of delivery transactions back and forth from production plant to main office daily. And with this alternative, one of these two messengers can now be eliminated.

With the setting up of a LAN, Dial-Up Sytem, WAN, VPN, the company will have a computerized filing and recording system which will be the aid to ensure fast retrieval of information. The staff will no longer be needed to search manually. The problem of misfiling will also be eliminated since all the files are stored in the server and the staff can now easily retrieve the data from the server and use software developed for processing the retrieved data to generate reports that will be submitted to the Manager.

With these developments, the productivity of the staff increases dramatically. Various types of reports can be easily generated from the computerized file using the developed software. The software development support many activities such as calculation of wages of the drivers, accounts payables, calculation of monthly oil expenses, other accounting activities and other functions in the company as well.

III. THE PROPOSED SYSTEM

The project aims to develop the company's information system to support the management in interfacing and interacting with internal and external entities such as suppliers, contractors/subcontractors, engineers and support for decision making. It intends to develop further additional knowledge pertaining delivery procedures and related activities.

3.1 Proposed Organizational Chart

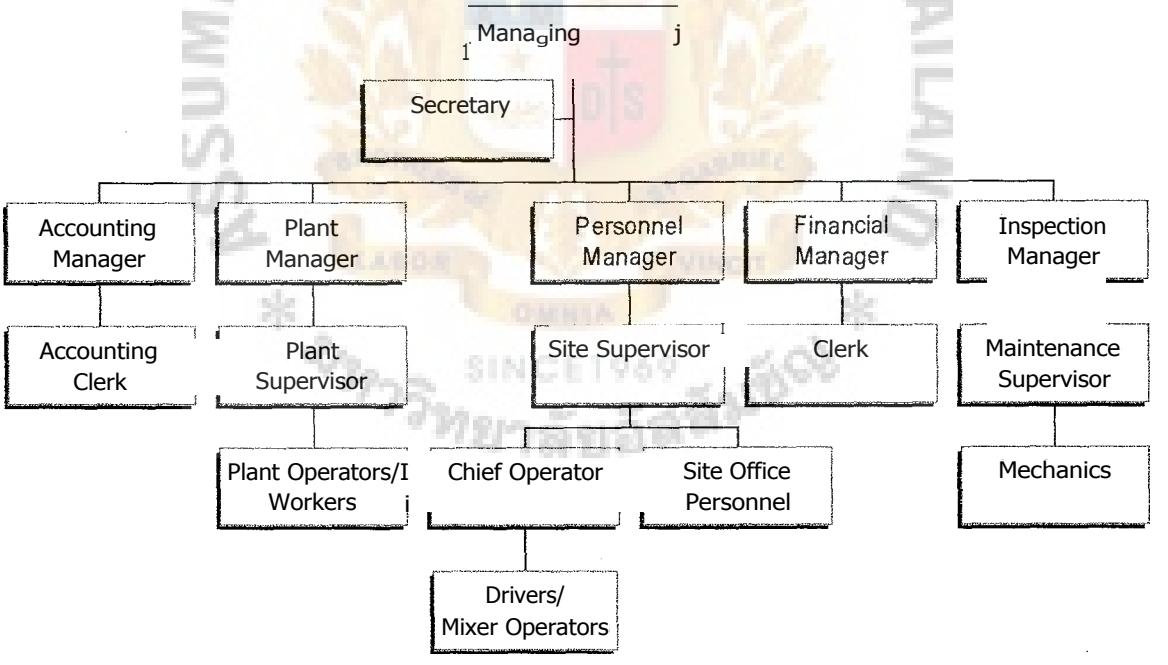


Figure 3.1. New Organizational Chart for ACO Company.

ACO Company's proposed system's functions will be organized as shown in Figure 11. In the new chart, the secretary will be reporting directly to the Managing Director. There is going to be one manager on each department, Accounting Department. Production Plant, Personnel Department, Finance Department and Inspection Department.

Plant Department Manager was added to do the managing and controlling the plant's operation. Inspection and Maintenance functions were integrated. Maintenance Department will now be controlled by Inspection Manager. These five (5) managers of each departments will be under the control of the Managing Director. Shown below are the ffinctions to be performed by each Manager in the proposed system.

Secretary

Secretary will assist and act as a liaison to the Managing Director. She will do the coordination with other managers on each department upon the directive of the Managing Director. She will also generate reports and graphical reports to the Managing Director pertaining the performances of drivers, accounting, deliveries, inventories and equipments, trucks/lorries.

Accounting Manager

Accounting Manager will be responsible for all accounting activities of the company such as accounts receivables/payables, payroll, and production cost/expenses including updating delivery files and records input in the computer system. The function is also responsible in generating accounting reports for the Managing Director.

Finance Manager

Finance Manager will be in charge of the financial department such as keeping records in the computer system of the following transactions, i.e. purchases, inventory,

accounts payables of the company and other activities which may be included in the finance functions such as recording the number of accidents of drivers/operators for payment cut and probation purposes. Generate updated financial reports for the Managing Director.

Personnel Manager

Personnel Manager will be responsible for the operation of the personnel department. The functions in the personnel department consist of keeping and updating employees and drivers/operators' personal data and information and recording drivers/operators' accidents in the Database which will be a basis for probation. promotion, providing benefits and rewards to personnel.

No information pertaining to personal data of all the personnel will be shared in the other department of the organization. These information will be confidential and will only be kept in the Personnel Department, thus, viewing, modification and erasing will be done only by an authorized person within the department.

Plant Manager

Plant Manager will take charge of overall production plant operation. He will act as a liaison between Managing Director and the Plant Supervisor on the latter's performance. He will be responsible for training the production plant supervisor and personnel with the computer system application. His responsibility includes keeping delivery transaction documents and assuring accuracy of the records with regards to the daily delivery transaction of the concrete mix plant, and updating records and files into the database.

Site Supervisor

Site Supervisor will take charge of the site operation. He will be coordinating with the Plant Manager and the Chief Operators/Drivers pertaining daily deliveries of concrete mix to the construction site, including the pre-inspection of construction site location, planning and scheduling of deliveries. He will be responsible for keeping and maintaining delivery transaction records and documents to be submitted to the main office, input daily data in the database regarding delivery order and order quantities, customers/contractors details, construction site location, equipments, mixers, operators/drivers and other activities related to delivery function. After generating all these files and data, these data will be transferred to the main office via modem.. In this connection, this data in the database will be the basis of information for the Managing Director and Accounting Department. He will be reporting directly to the Personnel Department regarding the performance, behavior and whereabouts of the drivers/operators.

Chief Operator

Chief Operator will be responsible for managing and instructing drivers/operators activities as well as solving problems occurred during the delivery and reporting accidents to the supervisor. He will be coordinating with both drivers and site supervisor.

Inspection Manager

The inspection Manager will take charge of the inspection of all the equipments and mixer trucks available on site and will be coordinating with the Managing Director, Site Supervisor and the Maintenance Division personnel. In addition,he will be responsible for recording and updating inventory/inventory usage, oil consumption data in the database which will be used by the Accounting Department, and generate

inspection reports.

Maintenance Supervisor

Maintenance Supervisor will take charge of the Maintenance Division, will be responsible for the maintenance / repair of all equipments, transit mixers and trucks.

Prepare estimates for the proposed repair works, generate reports and other documents necessary and instruct/monitor mechanics works.

3,2 Proposed System Work Flow

The existing work flow of the delivery system of ACO Company is performed through the following activities:

(1) On each delivery, the ready-mixed concrete production plant issues three (3) copies of delivery receipt to each drivers on each contractors or customers.

(2) The driver delivers concrete to the construction site and have the delivery receipt signed by the contractor's construction foreman upon delivery.

(3) After receipt, the construction site foreman returns two (2) copies of delivery receipt back to the driver and keep one (1) copy for him.

(4) The driver will give one (1) copy to the production plant and submit the other one (1) remaining copy to the site supervisor together with the record of deliveries.

(5) The site supervisor, upon collection of delivery receipts/records to the operators, will have to instruct the site office clerk to input the data in the computer system and transfer the information in the main office via modem at the end of each day and then forward delivery receipts/records to the main office. (In the existing system, site office's function was just to collect and gather all delivery receipts and records, and forward all these delivery

transaction documents to the main office afterwards. Whereas, in the new system, there is no need to keep these documents in the site office, instead, will just have to keep all the records and files in the computer system. thus. reducing workload for both the site office and accounting department personnel).

(6) The main office will use these data and information in the computer system as the basis for all the department functions, particularly accounting activities function.

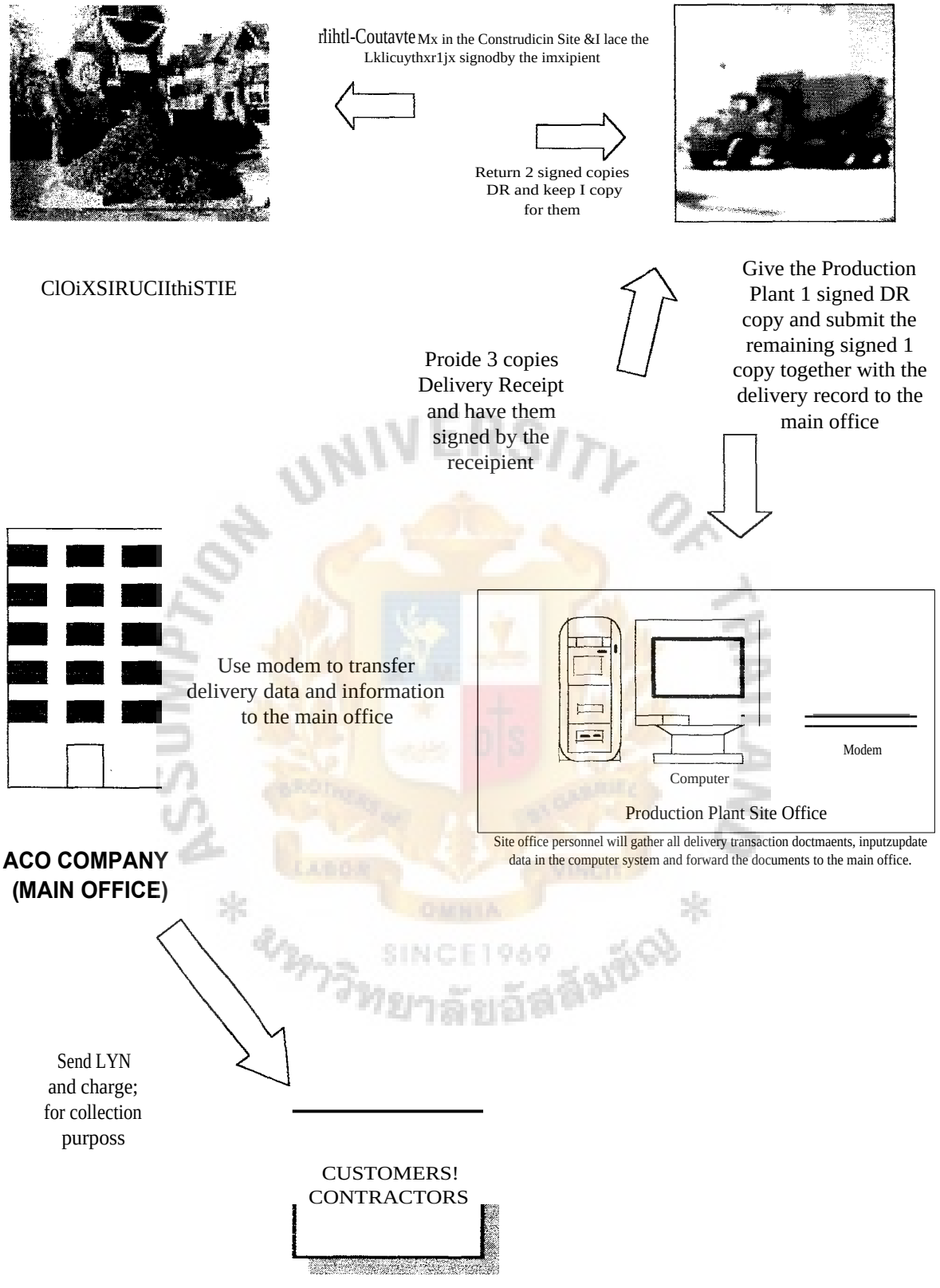


Figure 3.2. Proposed System Work Flow

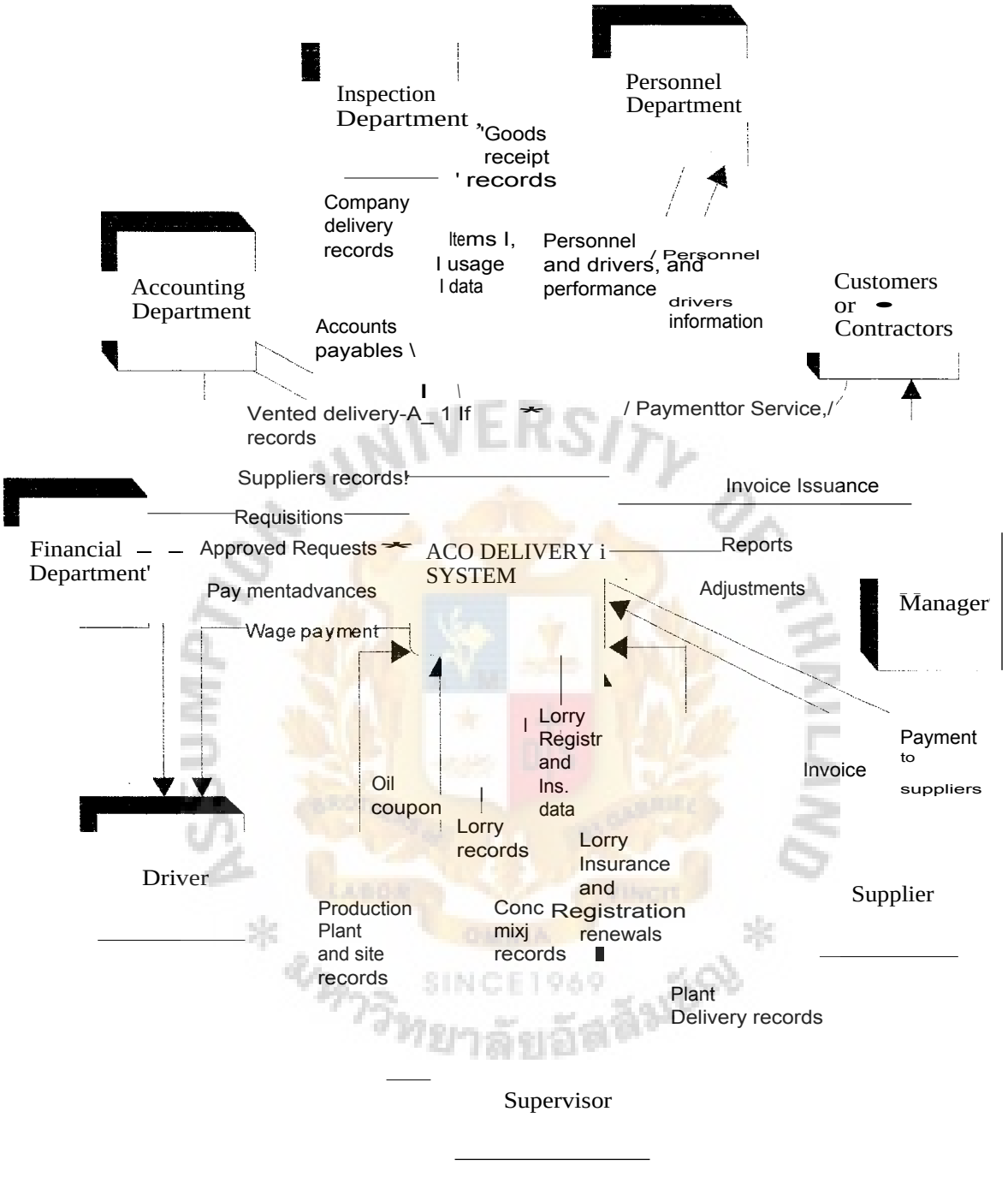


Figure 3.3. Proposed System Work Flow Diagram

3.3 Network Design

Two plans were recommended for developing the new system for ACO Company. The first recommendation is to set up a LAN to replace the current system to solve several problems. Then, secondly, the dial-up modem system for transferring file or data from the plant to main office.

LAN System Plan

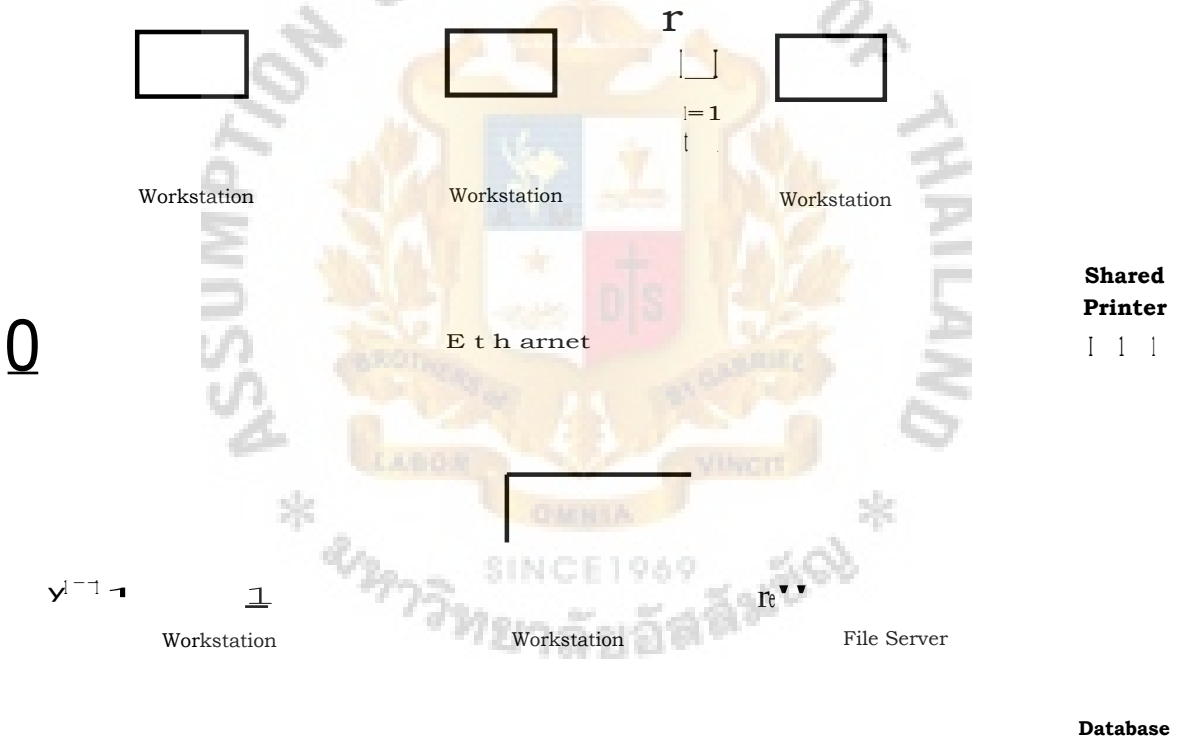


Figure 3.4. Network in the Proposed System

Dial-Up Modem System Plan

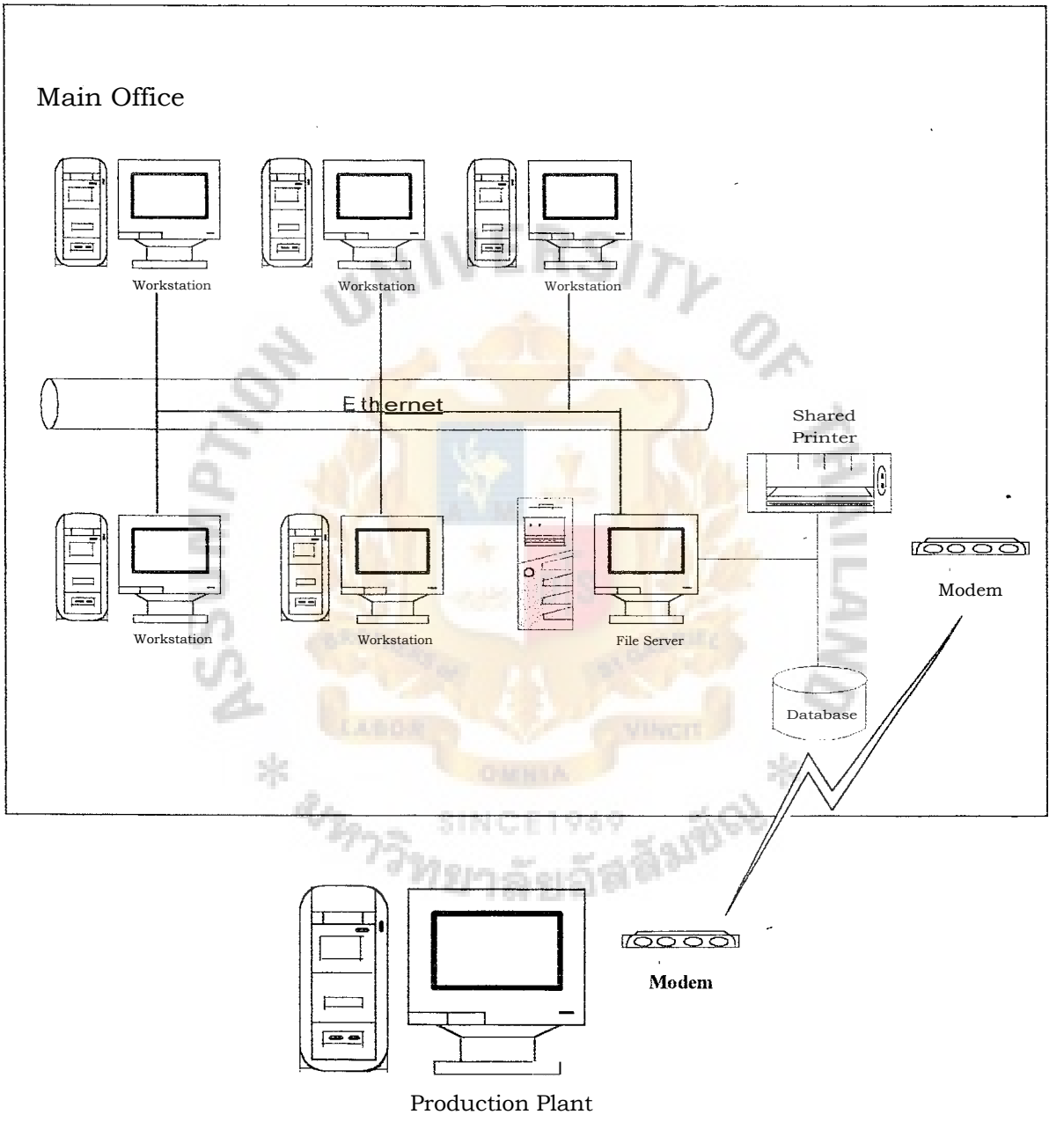


Figure 3.5. Dial-up Modem System

3.4 User Requirements

The users' requirements of the system are as follows:

Manager Requirement

(1) Oil consumption report to identify whether the usage of oil is justified and make comparison with other drivers/operators' oil usage and consumption.

(2) Updated inventory report to estimate similarity of outgoing and incoming materials and the correct usage of materials conforming with the quantity produced.

(3) Accident report in order for the manager to control the performance of d drivers/operators.

(4) Ready-mixed concrete monthly and yearly delivery report for the manager so as to make a comparative view and have decisions making support to improve the company's performance.

Accountant Requirement

(1) A requirement of a system which can make recording of transactions easier, more accurate and faster.

(2) A system which has an automatic delivery rate searching function of ready-mixed concrete deliveries. In the current system, searching delivery rate was done by paper index and it was so uncomfortable and takes a lot of time.

(3) A system which generates computerized monthly delivery report.

(4) A system which can reduce workload in the company at this point of time.

Inspector Requirement

(1) A system that will be used for recording inventory data including inventory usage.

(2) A system that will have an updated inventory stock details to identify if there is a need to order on which kind of materials is already required, to be able to prepare a purchase requirement to the head office.

(3) A system that will support in obtaining inspection reports for the manager.

Production Plant Site Office Requirement

(1) A system to be used in recording delivery notes of every ready-mixed concrete delivery transaction.

(2) A system to be used in recording oil consumption of the drivers.

(3) A system to be used in generating delivery reports, oil reports, and other reports to be submitted to the main office.

3.5 New System Data Flow Diagram

In the proposed system, the data flow diagram was divided into nine subsystems :

(1) Ready-Mixed Concrete Subsystem

Compute the semi-monthly delivery charges for each customer and upon receipt of each payment will issue receipt to the appropriate customers.

(2) Personnel Subsystem

Responsible for recruiting new drivers/operators in the company and processing new drivers/operators personal data and information. This subsystem is authorized to check every driver's performance including giving probation or firing driver due to his bad behavior.

(3) Management Subsystem

Involves in generating various reports for the management and responsible for making adjustments necessary decided by the

management.

(4) Supplier Subsystem

Involves in gathering the invoices from the suppliers for oil and spare parts and calculate the payments needed to pay to the supplier for the goods ordered.

(5) Inspection Subsystem

Responsible for checking the delivered goods whether it conforms with the quality and standards as required by the company and checking the accurate comparison between the delivered goods and the quantity indicated in the delivery receipt.

(6) Supervisor Subsystem

Involves in gathering the delivery notes and delivery records of the drivers / operators and collecting used oil coupons from drivers to update oil consumption. This subsystem sends all daily delivery records, oil records and other plant's records to the main office via modem. It also involves recording lorry/truck records which includes records of expiration of licenses, registration and insurances for renewal purpose, customers/contractors" details records, construction site location records, production plant records, and drivers' accident records.

(7) Driver Subsystem

Concerning salaries, wages, payment advances and benefits of each driver.

(8) Financial Subsystem

Authorized to decision making of all payments in the company such as drivers' payment advances, payments to suppliers and making payments to oil/lubricants stations.

(9) Accounting Subsystem

Checking and sorting of all delivery records. Responsible for accounting records of all accounts payables/receivables of the company and suppliers' records as well.

Proposed System Data Flow Diagram — Context Diagram

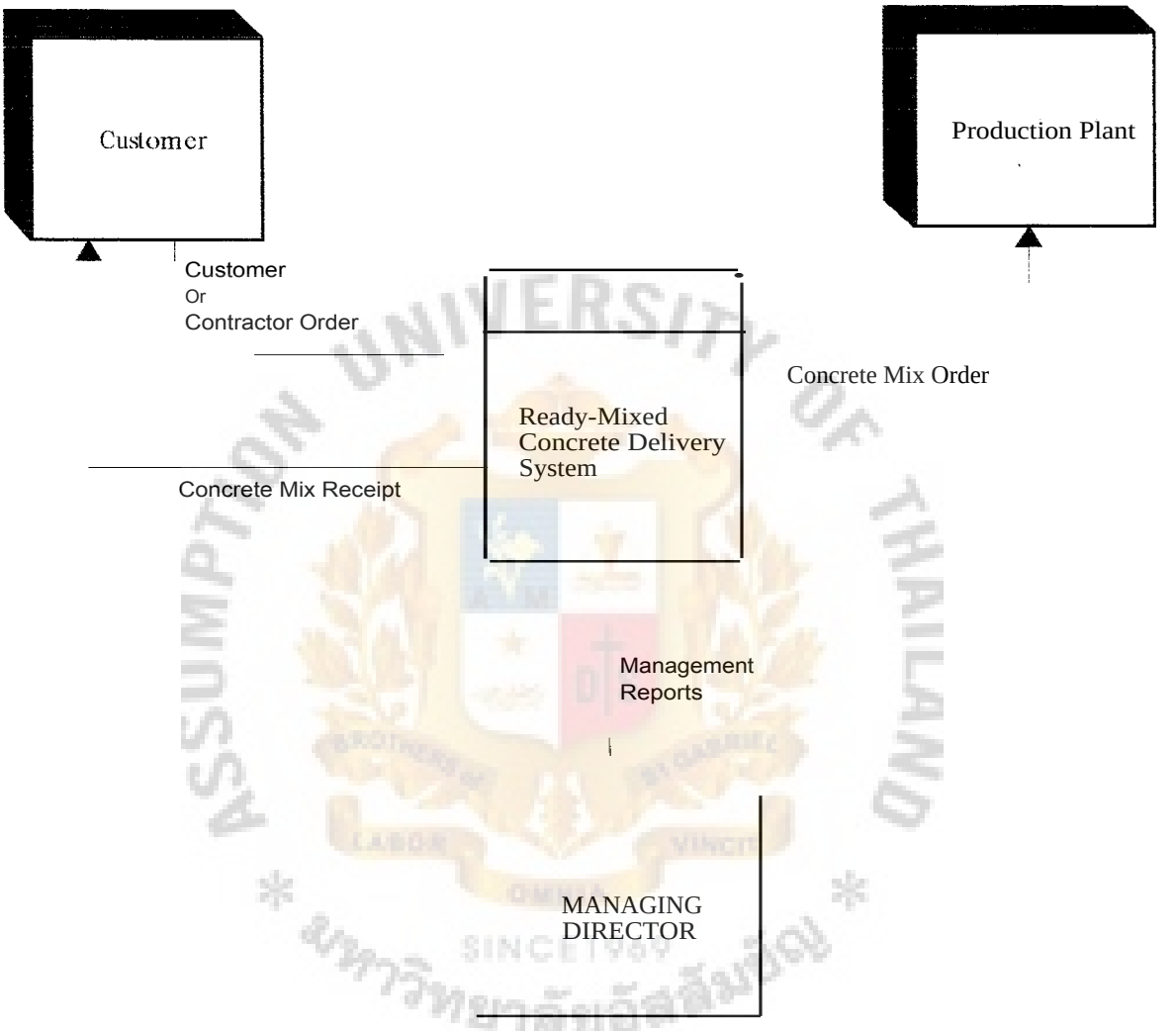


Figure 3.6. Proposed System DEl) Context Diagram.

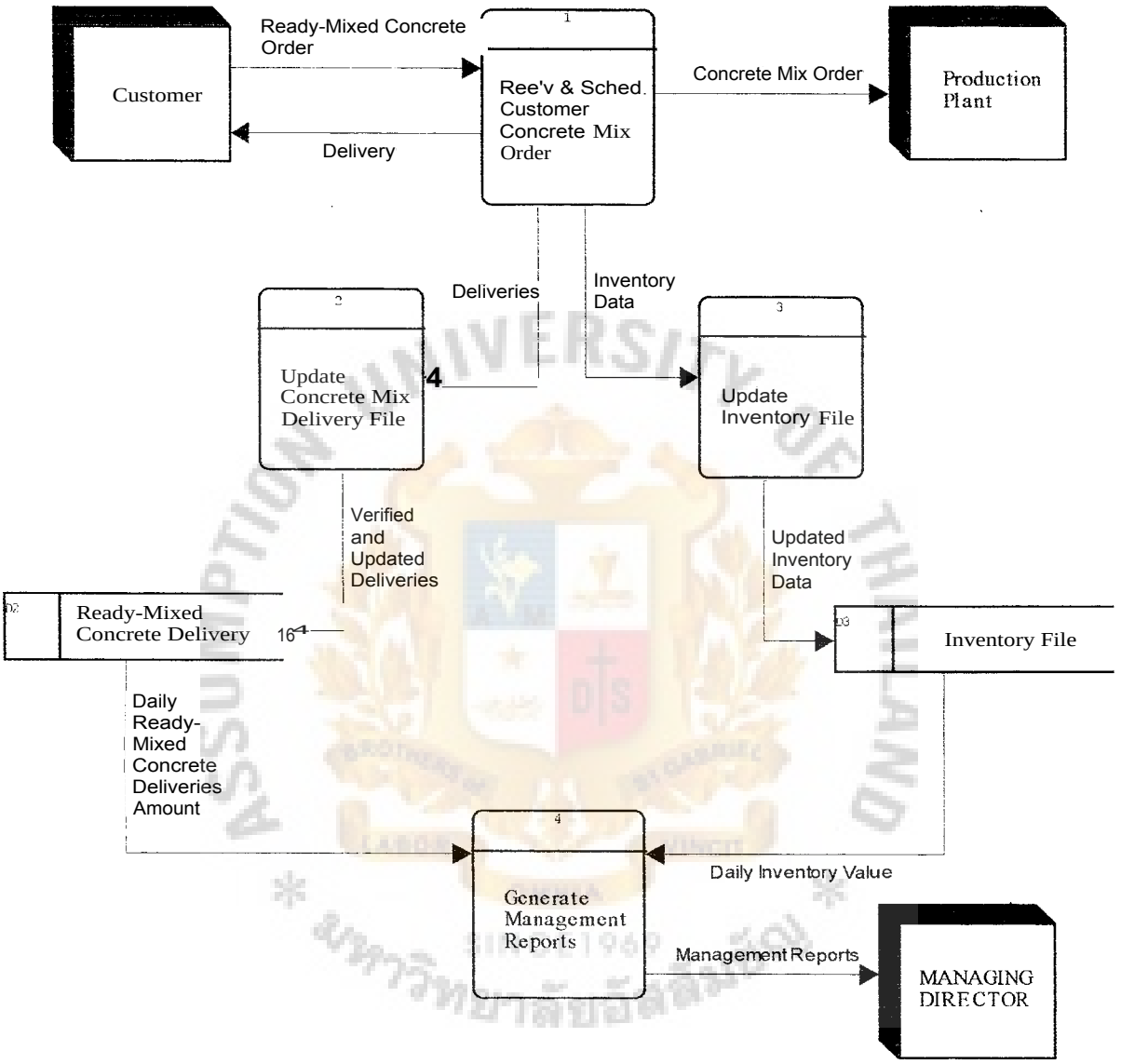


Figure 3.7. Proposed Data Flow Diagram Level 0

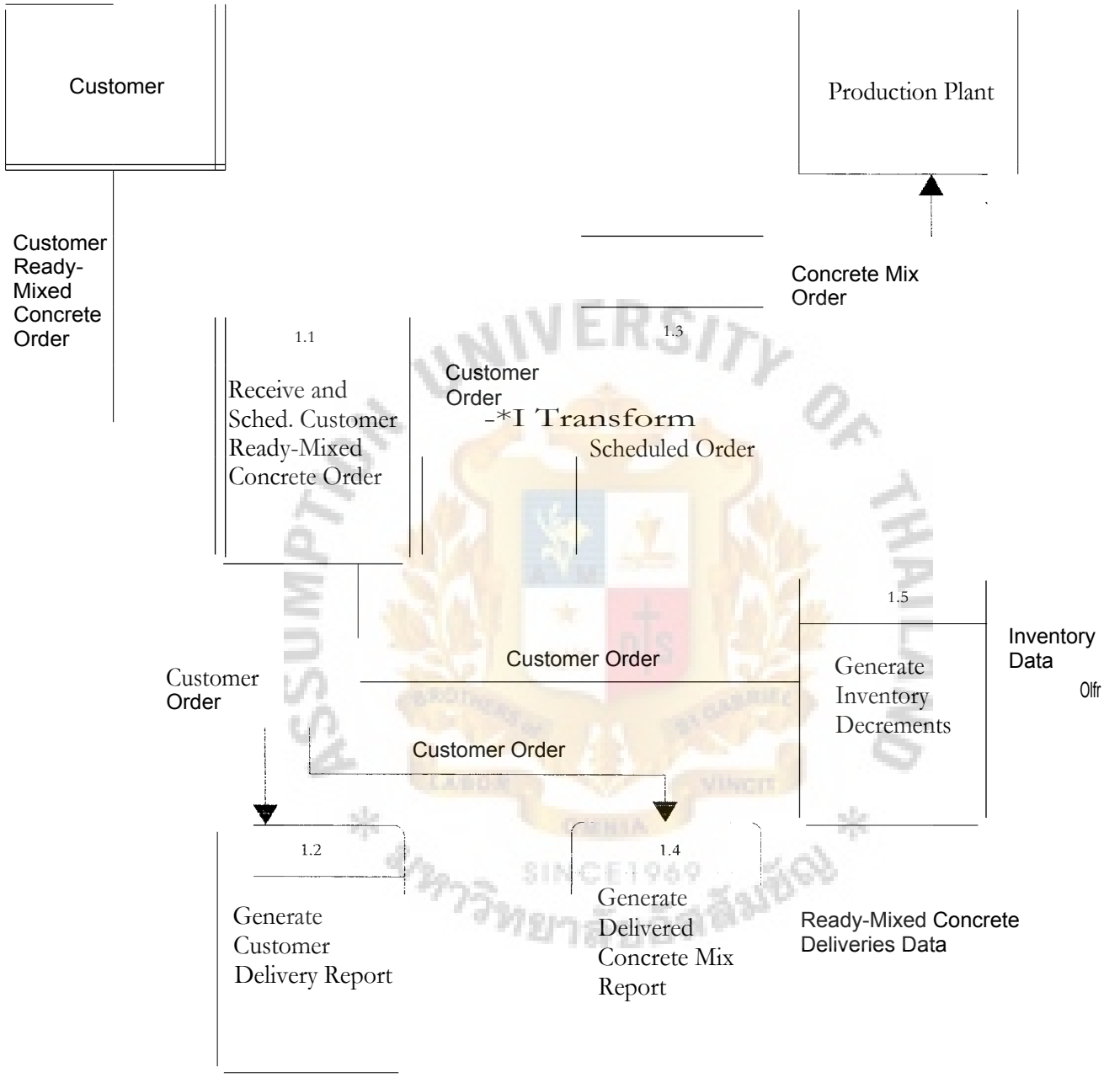


Figure 3.8. Proposed Data Flow Diagram Level 1.

3.6 Entity Relationship (E-R) Diagram

The Entity-Relationship of the ACO Computerized Delivery System consists of 13 entities which are in files:

(1) Accident file - contains operators' and lorries' accident record.

(2) Adv payment file - payment advances record made by lorry operators.

(3) A/P file - accounts payables

(4) Concrete Mix file - ready-mixed concrete record.

(5) Current Inventory file - updated inventory record.

(6) Delivery file - containing all delivery record of the company.

(7) Operator/Driver file - record containing all information pertaining operator/driver.

(8) Lorry file - lorry data including registration/license/insurance data.

(9) Oil file - oil consumption record.

(10) Plant file - production plant record file.

(11) Site file - production plant site office record.

(12) Supplier file - contains suppliers information.

(13) Inventory Usage file - details of usage of inventory.

Delivery Entity

(1) Production plant (Concrete Mix Entity) can send several delivery notes per days - *I to Many*

(2) One driver (Driver Entity) can delivery concrete mix several times per day - - 1 *to Many*

(3) One project (Project Entity) will require several deliveries of concrete mix to finish the work - - - 1 *to Many*

Driver Entity

(4) One driver will drive a specific lorry (Lorry Entity) - - - 1 *to 1*

(5) One driver will request for advance payments (Advpayment Entity) - - - 1 *to Many*

(6) One driver can meet accidents (Accident Entity) - - - 1 *to Many*

(7) One driver will use several types of spare parts (Inventory Usage) - - - 1 to Many

Lorry Entity

(1) Many lorries will be in the production plant site - - - *Many to I*

(2) One lorry will be filled oil (Oil Entity) several times in a month - - - *1 to Many*

Supplier Entity

(1) One supplier will provide the following whenever necessary:

Oil (Oil Entity) - - - *1 to Many*

Spare parts (Current_ Entity) - - - 1 *to Many*

(2) During payments due, the company will pay the suppliers according to accounts payable (A/P Entity) records - - - 1 *to Many*

Inventory Entity

(1) One specific inventory record (Current Inventory Entity) will relate to the usage of inventory (Inventory Usage Entity) record - - 1 *to*

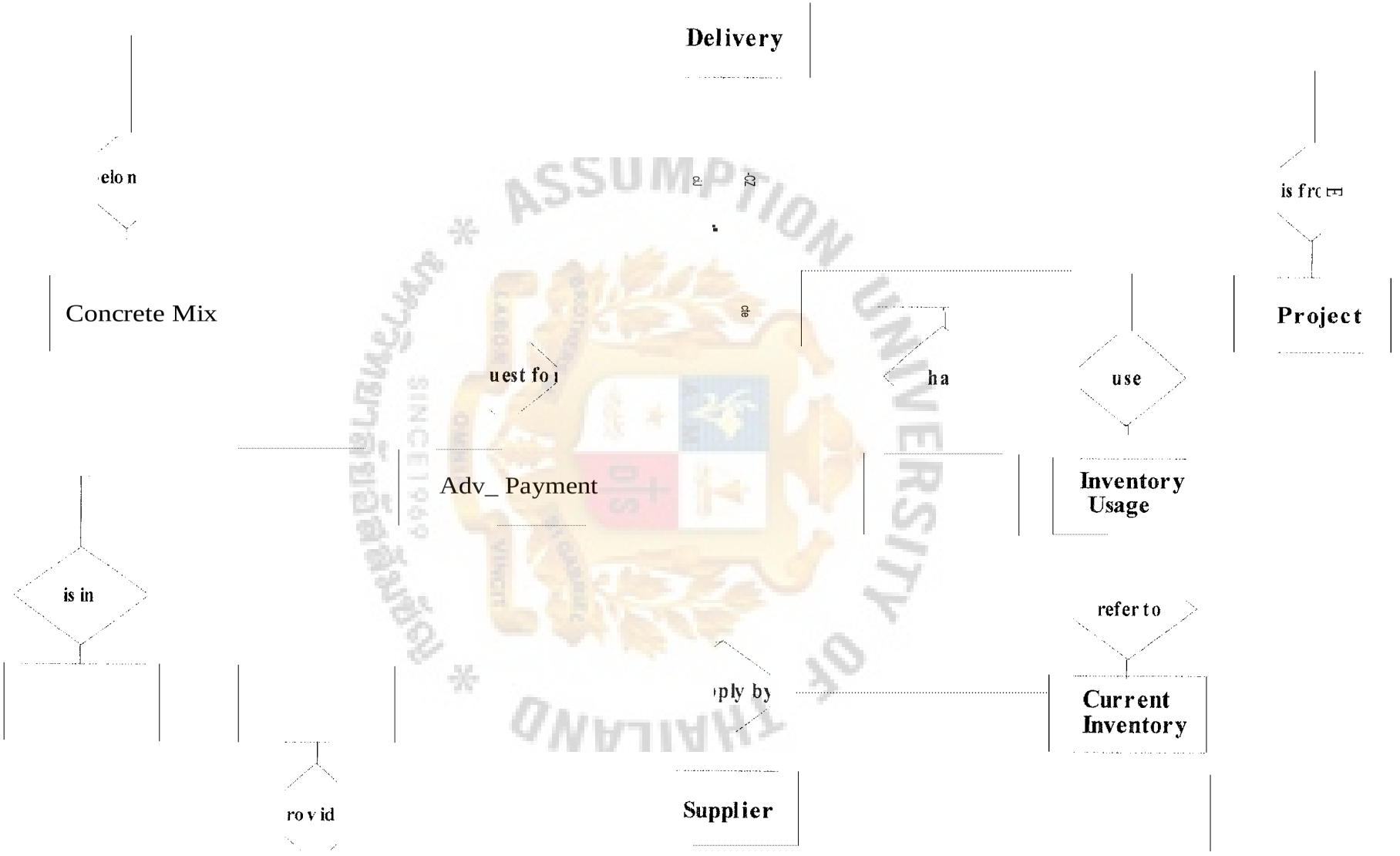


Figure 3.9. Proposed E- R

3.7 Output Design

(1) Screen Output and Input Reports

(a) Lorry/Mixer Truck Report

Lorry Oil Consumption Details and Record

Lorry Accident Record with High/Low Accident Rate

Lorry Registration and Licenses Details and Expiration

Lorry Insurance Details and Expiration

(b) Mixer Operator Details Report

Mixer Operator History details

Operator's Monthly Wage Payment, Payment Advances and Delivery Fee Rate details

Insurance Payment of Operator

Monthly and Annual Summary of Deliveries

Mixer Operator Accident Record, Probations

(c) Delivery Reports

Detailed Report Record by Production Plant / Site Office

Delivery Periodic Reports

Monthly and Annual Summary Delivery Reports

Monthly and Annual Report of Production Plant's Performance

Construction Site Location Report

(d) Inventory Reports

Current Inventory Details - current inventory report

Updated Inventory Report - updated materials and supplies stock

Inventory Usage Report - outgoing materials and supplies

(e) Account Payables Report

A/P Detailed Report - account payables for suppliers, loans

A/P Monthly Periodic Report

A/P Monthly Report

Monthly and Annual Summary Report

Near Due A/P Report - accounts payables near due schedule

2) Graph : Both Screen/Printer Output

(a) Ready-Mixed Concrete Delivery Graphs

Monthly and Annual Deliveries

Monthly and Annual Revenue earned

Summary Graph of Monthly and Annual Deliveries

Summary Graph of Monthly and Annual Revenue earned

(b) Inventory Graphs

Monthly Inventory Usage

Annual Inventory Usage

Summary Graph of Monthly Inventory Usage

Summary Graph of Annual Inventory Usage

(c) Oil Graphs

Monthly and Annual Oil Consumption

Summary Graph of Monthly and Annual Oil Consumptions

3) Query : Screen Output Only

(a) Delivery Queries

Mixer Operator details - query about operator's information

Lorry details - delivery trucks details and status

Project details - project information and site location.

Customer details - customer credit status, type and other information

Delivery details - schedule, quantity and specifications

OT details - justification of late deliveries or unstopped deliveries.

(b) Mixer Operator Queries

Mixer Operator history and details

Mixer Operator Identification / License No.

Probations - which may caused by misbehavior, frequent absences and tardiness, etc.

Accident Record - operator;'s accident information

Payment Advances / Wage Record

(c) Inventory Query

Inventory details - inventory usage, updated inventory record, raw materials required

Supplier details - suppliers data and information

(d) Lorry Query

Mixer/Lorry details - contains all the information about mixer/lorry

Registration/License/Insurance - effectivity and expiration

Oil Consumption Records - oil consumption of lorry to indicate whether the lorry has high /low/average consumption.

(e) Account Payable Query

Supplier details

Order details - volume or quantity of order, description

Payment details - payment amount, schedule, terms, manner

Memo - charges, discounts, price increase

3.8 Input Design

The input screen should cover all the following :

(1) Delivery Record - delivery details

(2) Account Payables Record

Payment Record - payment details

(3) Mixer/Lorry Operator

Operator Record - operator infonnation and status

Accident Record

Payment Advances Record

(4) Lorry

Lorry/Mixer Record

Oil Consumption Record

(5) Inventory

Inventory Record

Purchase Inventory Record

Inventory Usage Record

(6) Production Plant

Production Plant Data Record

(7) Customer Record - customer history, credit status/limits, payment terms

(8) Site Record - site location details

(9) Supplier Record - order, product and other information.

The input screen will provide the following features:

(1) Calculate the possible new ID or number automatically.

(2) Outline the input for users

(3) Provide possible choices for the users

(4) Check for the validity of the input such as date, month or year

(5) Show error messages or information

(6) Guide the possible solution of the error

(7) Show some data automatically concerning the selected data such as contact number of the supplier.

(8) Easy to use

(9) Delete only unrelated records

(10) Change the required deleted records to historical records.

(11) Check the completeness and accuracy of the input data.

(12) Warn for important actions such as near payment due date.

(13) Provide date default of the current system date.

(14) Calculate input data for other related records such as purchasing and inventories.

(15) Provide "restore function" for data recovery.

(16) Provide "clear" function for the fast clearing of all data of the screen in recording.

(17) Supported by both mouse and keyboard method.

(18) Provide Help feature in the menu bar.

(19) Provide Confirmation for the action.

(20) Provide Security for each function of the input screen.

3.9 File Design

There are 15 normalized files in the system:

(1)	Accident	:	Records of drivers' accident
(2)	Advpayment	:	Records of payment advances of drivers
(3)	A/P	:	Records of account payables
(4)	Customers/Contractors	:	Records of construction company
(5)	Current inventory	:	Records of inventory
(6)	Delivery		Records of delivery transactions
(7)	Operator	:	Records of mixer/lorry operator
(8)	Lorry	:	Records of lorry/mixer truck
(9)	Oil	:	Records of lorries' oil consumption
(10)	Password		Records of password of each level
(11)	Production Plant	:	Records of plant
(12)	Security		Records of security control of modules
(13)	Site	:	Records of site
(14)	Supplier	:	Records of supplier
(15)	Inventory Usage	:	Records of used inventory

3.10 System Module

The ACO Company Delivery System Application Program will provide 13 modules:

(1) Delivery Module: Functions concerning delivery transaction records and delivery reports.

(2) Accounts Payable Module: Functions about accounts payable records, payment and accounts payable reports.

(3) Operator Module: Functions about mixer/lorry operator records, accident records, payment advances records and operator reports.

(4) Lorry Module: Functions about lorry records, oil consumption records and lorry reports.

(5) Inventory Module: Functions about inventory records, inventory usage records and inventory reports.

(6) Customer records: Functions about customer records.

(7) Production Plant Module: Functions about plant records.

(8) Site Module: Functions about site records.

(9) Supplier Module: Functions about site records.

(10) Report Module: Functions concerning the generation of all reports.

(11) Query Module: Functions concerning all queries.

(12) Graph Module: Functions concerning the generation of all graphs.

(13) Security Module: Functions regarding password and security control.

3.11 Security Module

There are 7 levels of password which can be modified by the manager:

(1) Manager

(2) Secretary

(3) Personnel Department

(4) Accounting Department

(5) Financial Department

(6) Inspection Department

(7) Supervisor

The security control of the system will be set up for each level for all modules in the system in such a way that each level will have a limited authorization in accessing to the system modules. Take for instance, the manager is able to access to all modules, but the secretary's access is only limited to query, report and graph module. In addition, password in each level can be changed by the manager for security control purpose. The system has provided a "default security control" for each level to set-up function easily.

3.12 Hardware and Software Requirements

Table 3.1. Hardware and Software Application Program Analysis.

Items	Option 1	Option 2
Operating System	MS Windows 2000 Professional	MS Windows XP Professional
Application Software Included	MS Office XP Professional with MS Word 2002 MS Excel 2002 MS Outlook 2002 MS PowerPoint 2002 MS Access 2002	MS Office XP Developer with all mentioned in Option 1 plus Microsoft FrontPage 2002 Sharepoint Team Services Developer Tools
System Minimum Requirements	*Memory* 64 MB RAM and 8 MB RAM per office application operating simultaneously.	*Memory* 128 MB RAM and 8 MB RAM per office application operating simultaneously.
	Hard Disk 245 MB of available hard disk space for application software and additional 115 MB space for operating system installation.	*Hard Disk* 450 MB of available hard disk space for application software and additional 115 MB space for operating system installation.
	Display Super VGA (800 x 600) or higher resolution monitor with 256 colors	*Display* Same as Option 1
Benefits	Cheaper than 1	Has more application program and more features with additional tool like VBA tool.
Server and Workstations	Windows 2000 Advanced Server Window XP Workstations	Novell Netware 6.0 with Windows XP Workstations
Method of Data	Client / Server	Same as Option 1
Output Devices and Implications	Network Laser Printer all-in-one for all departments	Same as Option 1
Input Devices	Keyboard and mouse	Same as Option 1
Storage Devices and Implications	MS SQL Server	HP TC2110 Server For growing business

IV. SYSTEM EVALUATION

4.1 Feasibility Analysis

Table 4.1. Hardware Software and Security Control Requirements Recommendation.

Operating System	MS-DOS version 6.22 3.5" Microsoft Windows XP Professional
Application	Microsoft Office XP Developer
Software Tools Needed	MS Word 2002 MS Excel 2002 MS Outlook 2002 MS PowerPoint 2002 MS Access 2002 MS Project 2002 MS VBA Tools Developer Tools Documentation
Microprocessor	Pentium 4
Memory	256 MB
Hard Disk	80 GB space available for the picture file of the program.
Disk drive	one 3.5¯ high-density drive
Video Adapter	Super VGA with 1024 x 768 resolution and 256 colors
Pointing Device	Microsoft Mouse or compatible
Scanner (optional)	HP 5100C or other brand
Colored Printer	HP LaserJet 1200n network printer

Table 4.2. LAN, Dial-Up System and Security Control Requirements Recommendation.

Requirements	Description
1. File Server	HP tc2110 Server - Pentium 4@ 2.4GHZ with 4001VIEZ front-side bus and 1.5 GB Memory
2. Network Operating Software	Novell Netware v.6.0 for 10 users
3. Network Adapter Card	Ethernet Card
4. Network Media	Coaxial Cable
5. UPS	Back-UPS Pro 1400 VA
6. Application Software	Windows XP Professional
7. Computer System	Pentium 4@ 2.4 MHZ with 512 MB DDR SDRAM 80 Ultra DMA GB Hard Disk with DVD writer Combo Drive and 48x CD ROM, 10/100 Base T Fast Ethernet; 56 ITU v. 90 modem
8. Modem	External Modem with 10.0 Mbps
9. Remote Control Software	Norton PC Anywhere
10. Virtual Private Network (VPN)	Snap Gear Soho+ ISDN

Table 4.3. Cost for Setting-Up Application Program.

Description	Cost
1. New Operating System (Windows XP Professional)	PHP 14,950.00
2. New Software (Microsoft Office XP Developer Software)	39,950.00
3. Development Cost	60,000.00
4. User Training Cost	
(5 days @ 3,000 php/day for 4 users, 2 hours per day	18,000.00
5. HP LaserJet 1200n network printers (2)	59,900.00
Total	PHP 177,850.00

Table 4.4. Cost for Setting-Up LAN, Dial-Up and Security Control System.

Description		Cost
1. New Hardware (HP tc2100 Server - Pentium 4-2.0GHZ with 400MHZ front-side bus 128 SDRAM and 1.5 GB Memory)	PHP	90,400.00
2. Network Operating System (Novell Netware v. 6.0 ibr 10 users)		92,000.00
3. 3Com 10/100 Ethernet NIC		3,000.00
4. 3Com Office Connect Dual 56K LAN Modem		18,950.00
5. 3Com Office Connect Switch 8		4,250.00
6. 3Com Office Connect Ethernet Hub 8C		6,250.00
7. Coaxial Cable with accesories		20,000.00
8. Back-UPS Pro 1400		38,773.00
9. New PC (HP Personal Computer 873n)		345,000.00
10. Norton PC Anywhere		7,950.00
11. Virtual Private Network (Snap Gear Soho+ VPN)		19,950.00
Total	PHP	646,523.00

Total Inplementation Cost THB 824,373.00

Total Monthly Maintenance Cost THB 2,000.00

Prices of computer products, printers, application system and software, servers, modem and peripherals as well the systems' requirements, system's compatibility and many more were taken from the current updated products' prices and information in the website; (i.e. microsoft.com, hp.com, 3com.com, no vell.com, snapgear.com)

4.1.2 Economic Analysis (Cost-Benefit Analysis)

The benefits from the new system are categorized into:

(1) Tangible Benefits

(2) Intangible Benefits

Table 4.5 Tangible Benefits of the New System.

Description		Cost
1. Messenger	PHP	8,000.00
2. Gasoline Expense (1 person @ 50 php/day x 26 days)		1,300.00
3. Reduced Overtime Cost (PHP2,036@6 days)		12,216.00
4. Elimination of 2 out of 5 Accg. Clerks @PHP15,00/mo.		30,000.00
5. Miscellaneous Expenses Cost Reduction (office supplies,paper)		2,000.00
Total Monthly Benefit	PHP	53,516.00
Reduction from Computerization Cost		
Sell of old Computer - 6 units @ 4,000 php/unit	PHP	24,000.00
Sell of old Printers - 2 units @ 2,000 php/unit		4,000.00
	PHP	28,000.00
Accountant PHP30,000/mo OT Rate = PHP 217/hr	PHP	217.00
Acctg. Clerks (2) PHP15,000/mo OT Rate = PHP 108/hr each		216.00
Finance Mgr. PHP30,000/mo OT Rate = PHP 217/hr		217.00
Fin. Clerks (2) PHP15,000/mo OT Rate = PHP 108/hr each		216.00
Personnel Mgr. PHP30,000/mo OT Rate = PHP 217/hr		217.00
Adm. Clerks (2) PHP15,000/mo OT Rate = PHP 108/hr each		216.00
Plant Mgr. PHP30,000/mo OT Rate = PHP 217/hr		217.00
Inspection Mgr. PHP28,000/mo OT Rate = PHP 202/hr		202.00
Site Supervisor F'HP20,000/mo OT Rate = PHP 144/hr		144.00
Site Clerks (2) Pf1P12,000/mo OT Rate = PHP 87/hr each		174.00
	PHP	2,036.00

Basis of Cost Reduction:

At present, the company has two messengers, one messenger's monthly salary excluding transportation or gasoline expenses ranges from php8,000 and the responsibility of each one of them is to distribute and send daily delivery transaction documents from the site office to the main office. With the implementation of the new system, one messenger will be enough to do the task that may be needed in the company.

Each month, usually six days a month, two days before the mid part of the month and 4 days before the end of the month, the staff are required to work overtime for about one to two hours per day to do reports, payroll, accounting activities and other activities needed to be finished at a certain time.

Furthermore, two out of five accounting clerks will be eliminated because of the reduced workload of accounting activities in the new system. The salary of accounting clerk is php15,000 per month.

Apparently, since the company had decided to change all the computer machine units and printers to new units, the old units will be disposed according to the present running price of used or secondhand computer units and printers. The prices for used computer machine units set ranges from php4,000 and for used printers from php2,000. There will also be a cost reduction of miscellaneous expenses in the company resulted from reduced office supplies (paper, pen, etc.) consumption.

Intangible Benefits of the New System

(1) Each employee reaches higher productivity at a shorter time.

(2) Reduce workload.

(3) Higher employee satisfaction.

(4) Creating a better cooperation with customers and suppliers.

(5) Providing support for future business expansion, as when business expands, more computers can be added to the LAN.

(6) More effective and efficient way of filling with the use of a computerized filling system.

(7) Better security as only authorized personnel can able to access to the system.

(8) Reducing paper works with the use of electronic mail.

(9) Allowing the standalone to communicate with each other.

(10) Ability to operate the applications simultaneously.

(11) More economical because of resources sharing.

(12) Transferring of file can be done without the use of diskettes and can be done M a glance.

(13) Allowing the production plant site office to communicate with main office more efficiently and rapidly rather than the manual system and transferring of file can be done faster.

(14) Efficient and effective way of reporting system

(15) Provide support for management decision making.

4.1.3 Break-even Analysis

Table 4.6. Summary of Cost-Benefit Analysis (Payback Period).

Year	Cost	Cumulative Costs	Benefits	Cumulative Benefits
0	PHP824,373.00	PHP824,373.00	PHP 0.00	PHP 0.00
1	24,000.00	848,373.00	670,192.00	670,192.00
2	24,000.00	872,373.00	642,192.00	1,312,384.00
3	24,000.00	896,373.00	642,192.00	1,954,576.00

Break-even Analysis of ACO Computerization System

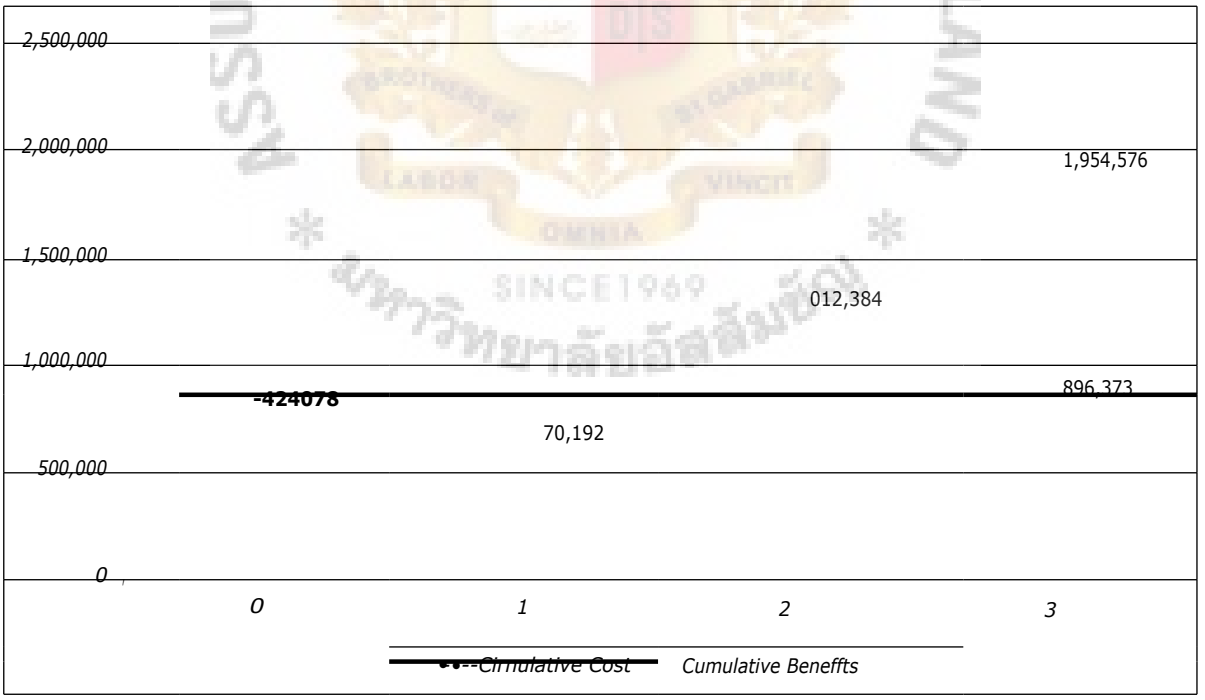


Figure 4.1. Break-even Analysis Graph of ACO Computerization System

$$(896{,}373 + 824{,}373)x = 1{,}954{,}576 \qquad x = 1.14$$

Break-even period of proposed system to current system is 1.14 year.

V. IMPLEMENTATION

5.1 Hardware Implementation

Hardware implementation plan consists of 2 steps:

(a) Implementation of a LAN system at head office and changing some configurations will be necessary until the system is completed and ready for operation.

(b) Implementation of the installation of dial-up modem in the production plant.

LAN System Implementation

(1) The first step is to install a new file server and a Pentium processor is recommended because of its better performance. The file server will have 1.5GB of RAM and 240GB Hard Disk. The server will be plugged with the UPS.

(2) The network interface card will be then installed into the empty slot of each computer in the company. A cable will be used to link these computers to the file server computer.

(3) Third step is to set the network operating system for LAN at file server. In this case, Novell Netware v.6.0 for 10 users will be used for the Network Operating System. The application will then be set up in the server, program and overall system will be tested to identify if ever there are some errors occurred in setting up the LAN system and will find the necessary solution to solve these problems.

(4) Appoint a LAN Manager to take care of the LAN system. Password and User ID will be provided for every user to be able to access or use the files in the

database and at the same time, printers will be set up to be shared in the LAN system.

(6) Provide training for the user in logging and using the application and print method in the LAN system.. to explain the overall performance of LAN, and use of E-mail and transferring files in the LAN system.

(7) Lastly, provide two weeks upon implementation, a thorough check of the whole system in order to solve any problems that may still occur and set a time schedule for LAN's maintenance, software and hardware of the new system.

Dial-Up Implementation

(1) Install a computer and a modem in the production plant office and a remote control software is to be set up to the hard disk of the computer and main office and plug the line with the modem.

(2) Testing the system by using the modem and remote control software through dial-up system to the main office. If the system operates properly, the users of the plant are needed to be trained so as to know and understand the use of the program and how to communicate with the main office regularly.

(3) Provide User ID and password for each user in the plant and train the users regarding login and transferring file to the main office. Setting up a time schedule in transferring files and specific time in using the programs or Electronic Mail is necessary.

(4) Check required daily time for the production plant and main office communication.

(5) Set up a maintenance schedule for the modem and the computer in the plant and main office.

5.2 Software Implementation

In the software implementation, first thing to do is to train all the concern people. The duration of the training course is about one week. Training will be two hours per day daily and most specifically the topic will be program operations and error handling (troubleshooting).

Upon the installation of the system, at the end of the week, information regarding the problems encountered by the users will be gathered, and will make necessary corrections regarding the matter. Trial of the system will be done until further problems in the system are eliminated.

If after the trial period, everything goes smoothly as planned, then the system will be fully and permanently installed. Feedbacks and comments from the users will be entertained in due time to be aware of any necessary modifications to be made with regards to the system.

VI. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This project is about development of a system, the analysis and design of a current company's manual system. In this topic, there are many things that are needed to be developed, the network system, hardware, software and security control. Understanding and choosing hardware and software, the capacity and capability of each as well as the compatibility is very much important. To be aware of the new programming languages (i.e.Microsoft Access) is necessary in order to be able to develop a software application. Security control, on the other hand, plays an important role in developing and maintaining the system.

The new system in the Delivery System of the company will be developed through the implementation of the LAN and Dial-Up Modem system. Hardware, software and security control products has been determined. The new system will run on Novell Netware 6.0 server with Microsoft XP workstations supported by HP servers. The application software to be used is Microsoft Office XP Developer because of its better performance and for its having more features and application programs which will be beneficial to all both Department Manager and subordinates. In the new system, the company will obtain many achievements upon the implementation of this development project.

6.2 Recommendations

In developing ACO Company's Delivery System, there are two options that were recommended in order to solve the existing problems of the company. First option was to a) hire additional staff, and each will responsible for filing, recording, indexing, storing, retrieving information from the file, and generating reports required by the manager; b) buying more computer machines and printers; thus, continue using the manual application. The new hired staff will be responsible with any lost or misplaced files and records. Hiring staff and workers on the part of the company can be easily implemented due to the availability of many staff and workers in the area. But reports and other information cannot be produced at once as the manager requires them, since preparation of necessary documents and information will take some time before reports can be produced and generated.

Second option was to design, install and implement a computerized system in the company by setting up a LAN and Dial-up Modem system, and developing customized software. In this way, the functions and activities in the company will be improved and accomplished easier, more accurate and faster. Timely and shared information will be provided within the company. Workloads and work time and the production cost as well, will be reduced.

The advantage of the second option is it provides support for business expansion and helps to increase the productivity of the company as the activity functions can be done and performed faster. As the business expands and grows, the company can connect more computers in the LAN system. LAN system supports resources sharing among users.

Another important thing is that the staff and employees in the company will be able to adopt an information system in their work and that will broaden their knowledge regarding the computerized system.

Whereas, the computerization program focused merely on the delivery process of the company, it is suggested that the company must adopt system development for the rest of the company's ready-mixed concrete business related process, and later on include the other businesses of the company like construction, earthworking, and quarrying business. It is likewise recommended that all these business processes be integrated altogether to able the owner or the managing director to define and analyze whatever problems that may arise, and to be able to keep track of all the company's activities, status, resources, profits, personnel and all information pertaining to all the company's business.

Upon the development of the whole system in the company, it is also recommended that extensive Computer Based Training must be arranged and provided for all end-users including Department Heads, regarding the operation, use, and the requirements of the system. Thus, continuous enhancement and system support must be adopted upon the implementation of the new system in order to be updated and to be fully aware of the modern technology.

APPENDIX A

DATA DICTIONARY

	Description	Inputs	Outputs
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Data Dictionary of Process

6. 5.

Process	Description	[illegible]	Description of Process	Outputs
1.Ready-Mixed Concrete Main Office Subsystem	Deal with Customers	[Payment for service	Send invoice and receive payment of each customers	Invoice for service
2.Personnel Subsystem 2.1 Recruit Drivers 2.2 Consider the probation of drivers	Deal with the personnel department Deal with recruiting new driver Deal with considering driver's probation	New driver records New driver records None	Receive driver's record from Personnel dept. & send memo for driver's status Memorandum of driver's status	Driver's status None Driver's status
3. Manage Subsystem 3.1 Generate reports 3.2 Make Adjustments	Deal with the manager Deal with generating report to manager Deal with making adjustment	Adjustment None Adjustments	Receive the adjustment from manager and send report to him. Send reports to the manager Receive the adjustments from manager	Reports Reports None
[4. Supplier Subsystem	Deal with suppliers	[illegible]	Receive invoice and make payments to suppliers	Payment to suppliers
Inspection Subsystem 5.1 Record usage of spare parts 5.2 Record received spare parts	Deal with Inspection Department Deal with spare part usage recording Deal with received spare parts recording	Items usage data Goods received notes Items usage data Goods received notes	Receive data of items usage and received notes. Receive data of usage items and goods received from Inspection Dept.	[illegible] [illegible] [illegible]
Supervisor Subsystem	Deal with supervisor	Lorry records Cement records Plant records Site records Accident records Plant D/N Oil Consumption Lorry.Ins./Reg. Renewal	Receive records of lorry, customers. plant, site. accident, D/N, oil coupon, lorry renewal data from supervisor. Send the lorry insurance and registration/license details to the supervisor of the plant.	Lorry Insurance/Regist-ration License Expiration data

Data Dictionary of Process

Process	Description	Inputs	Description of Process	Outputs
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Workflow	Description	Source	Destination
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Data Dictionary of Process

Workflow	Description	Source	Destination
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

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