A STUDY

OF

MINICOMPUTER SYSTEMS FOR CONTRACTORS

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ABSTRACT

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The following topics are examined in this report:

1. The current status quo of computer usage by contractors.
2. Problems faced by contractors for which the use of computers may provide, at least, a partial solution.
3. Three comprehensive hardware and software systems available for the management accounting functions.
4. Major implications of computer usage for the firm.
5. The essential elements of a framework for the assessment of computer system alternatives for the firm.

The information presented in this report was gathered by means of a literature survey and interviewing of both computer companies and contractors.

The major findings of this report are as follows:

(1) Significant benefits have accrued to those contractors who have computerized one or more functions. (2) Several comprehensive computer systems are available for contractors. Their use implies a rigorous approach to data collection and processing by the firm. (3) There are significant implications for the firm adopting computer systems relating to human, organizational, functional and technical aspects. (4) Contractors are in need of literature directed at their specific concerns with respect to computer usage. Little useful information is currently available in this regard. Recommendations for developing this information are suggested in this report.

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CHAPTER 1

1.1 INTRODUCTION

The use of computers by contractors did not catch on in the 1960's and early 70's despite the advances in computer technology which made them more adaptable to contractor needs. One can cite several reasons for this, as follows:

1. In general, contractors have not exposed themselves to developments in the computer field. They lack expertise on their staff to properly assess the functions and the benefits to be derived from such use.

2. Contractors tend to claim that they cannot afford the costs associated with computer use (hardware, software, personnel) and that the benefits derived from such use will not offset the costs involved. Consequently they believe that computers will just increase overhead costs.

3. Contractors express lack of confidence and trust in the computer's calculations and output reports.

4. Some contractors believe that use of computers will result in a loss of their control over the firm. Inherent in this belief is the thought that their organizational structure and mode of operation will increase in complexity.

Little information is currently available on the extent of computer usage in the construction industry. Results from a survey conducted in 1972 by Revay (21) give some indication of usage. Of 3000 firms contacted,

394 usable responses were received. Results obtained are reproduced in Table 1.1.

Since 1972, developments in both hardware and software, particularly in terms of applications for contractors, have probably increased the rate of usage. Some of these developments form the focus of this report.

The number of firms in the construction industry which could potentially benefit from the use of computers is quite large. If attention is limited to contractors whose annual volume is in excess of $2 million, the number of firms in the building sector alone is 762 (Table 1.2).

Over the last two decades the computer field has evolved very rapidly as shown in Tables 1.3 and 1.4. Of considerable importance to contractors has been the development of small business computers. During this period, the cost per unit of computing power has decreased substantially. This downward trend of cost can be viewed as the leftward movement of the breakeven point between manual processing and computer processing, Figure 1.1.

Of importance to this study are the developments with respect to mini and small computers because of the control they allow the contractor over his data processing and because of their relatively low cost.

For purposes of this report, no distinction is made between mini computers and small computers. The following description is based on reference [1].

A minicomputer may be characterized as a low-cost, physically small, general-purpose digital computer. Its memory structure ranges from 8 to 16 bits and has a minimum primary word memory of 4096 (4K). The

basic configurations of a minicomputer system consists of a central processing unit (CPU), a number of input/output devices and possibly some secondary disk or cassette storage. Figure 1.2 depicts a typical minicomputer configuration. The CPU includes:

(i) A core storage memory with an operating speed between 0.5 and 1 microsecond per cycle.

(ii) A set of registers generally designed to hold one word of data.

(iii) An arithmetic unit for performing arithmetic and logic operations.

(iv) One or more data bases for facilitating data transfer to the various CPU components.

When selecting a minicomputer, the user must assess his needs in terms of the following hardware choices [1].

(i) *Dual processor, single access.* One processor handles communications, freeing the other processor to act as the monitor control and to handle compilations and program executions. That is, it is generally a "one language" processor system.

(ii) *Dual processor, dual access.* One processor handles communications and monitor control; the other processor handles execution and compilations. Advantage of this arrangement module:

(a) Multi-language capability

(b) Ability to handle many simultaneous users

(c) Ability to handle many programs effectively

Four advantages offered by a minicomputer are [1]:

(i) *Flexibility* It permits the execution of a large range of data processing functions, provided appropriate software is available.

(ii) *Adaptability* The minicomputer is easily upgraded into a powerful system because many compatible peripheral and memory extension devices are available.

(iii) *Low cost and ease of use* Relatively low cost is a major attraction, and ease of use makes an in-house time-shared system ideal for a company that has multiple users. Because of these features, it is readily accessible to each user and offers many programming languages to suit the particular user. Additional advantages include:

(a) Increased use at a relatively fixed cost

(b) Low-cost access with protection of key, sensitive data

(c) Availability of common programs to all in-house users

(iv) It excels in applications calling for special software and communication capabilities.

Four disadvantages facing users of minicomputers systems are [1]:

(i) Core size is more limited than in larger systems.

(ii) Execution times are slower than in larger systems.

(iii) On an industry-wide basis, minicomputers manufacturers have not established themselves as known and responsible companies as have the large computer makers.

(iv) The minicomputer's cost may well be less than the cost of its peripheral devices, which means that the total cost of the system is likely to be much higher than the basic computer.

The developments in computer technology discussed imply that another look is due with respect to the use of computers by contractors. This report therefore attempts to set forth the current situation in terms of motivation to use the computers, experience to date of those who are already using the computers, availability of hardware and software, implications of using computers for the firm and guidelines for selection. It is not the intent of this report to either advocate the use of computers or recommend against their use.

1.2 OBJECTIVES OF THE REPORT

The specific objectives of this report may be described as follows:

1. To identify problems in the construction industry for which improved management information systems and data processing techniques may provide at least partial solutions (Chapter 1).

2. To determine what the introduction and use of mini-computers has meant for construction firms, by means of literature survey and through limited interviews with construction companies using a mini-computer (Chapter 1). (See Appendix 1 for questionnaire format)

3. To describe three major hardware and software systems available for use by contractors (Chapter 2).

4. To identify the implication of computer systems for the firm in terms of human factors, organization factors, functions to be performed and technical aspects.

5. To provide a possible framework for the assessment of a computer system in terms of its compatibility with a firm's requirements (Chapter 3).

In Chapter 4 of the report, the major findings of the report are summarized. Recommendations regarding further studies in this area are also presented.

1.3 POSSIBLE MOTIVATIONS TO USE COMPUTERS

Through a search of the trade literature eg. Heavy Construction News, Engineering News Record, Construction Methods & Engineering Management and limited interviewing, an attempt was made to document the experiences of contractors who have opted to use minicomputers and the reasons for doing so.

The companies whose experiences came into view included subcontractors, specialty contractors and general contracting firms. Their annual volume of business ranged between $5 to $20 million dollars. One of these companies has its operations spread over four western provinces and the Northwest Territories. Peak employment in the past has reached three thousand people [15]. A specialty contractor had an annual volume of $5 M which was generated through execution of two thousand contracts per year. This firm has ten operational cost divisions [13].

The main reasons, cited in the literature and interviews conducted, for implementing a computer system centered upon the need for accurate and timely reports. The majority of firms were concerned about the lack of accuracy in their job cost reports and the time it took to prepare them manually. They were normally late and were often suspected of containing errors. For the labor intensive companies the problem of timely preparation of payroll was a major concern. This problem was compounded because jobs were spread over several provinces, various labour types were involved, various wage scales were involved and each province tended to have different tax regulations and deduction requirements.

These contractors started to think of using computers when expansion of their business meant that manual processing even with additional staff could not handle the complexity of record keeping, data processing and report generation. Accompanying this thought process was the realization that late and erroneous reports affected proper decision making and thus inhibited the firm from achieving its objectives.

For the companies examined, the start of the use of computers ranged from as early as 1969 to as late as 1976. These companies are using several of the standard computer systems available (tailored sometimes to their needs) such as IBM System 3, System 32, NCR 399, 499 and Basic Model 400 or 350 of MAI. In general, the companies started with one or two computer applications and then with the growth of the company added more applications to carry out almost all the accounting functions such as payroll, accounts payable, job costing, general ledger and financial reporting.

Almost all the firms reviewed expressed numerous benefits from use of the computer. Major benefits cited include:

1. Reduction in staff.
2. Clerical errors reduced.
3. Accurate and timely reporting achieved.
4. Ability to control operations more closely.
5. Better understanding of operations and the ability to determine accurately where problems lie.
6. Reduced time in payroll processing.
7. Ability to compare actual performances with estimated performance in order to assess project completeness, overhead and

profits.

8. Tighter control over pricing.

9. Savings were achieved through better inventory management.

None of the firms examined had tried to quantify the benefits achieved but stated that the benefits obtained in different areas such as accounts payable, staff reductions and job costing have paid for the cost of computerization over a period of time. One user of IBM System/3 stated "We saved enough on payroll alone to more than pay for the System/3 installation [14].

Adoption of computer processing, however, is not without its problems. Additional data gathering in the field may be required. Changes in communication modes within the firm - e.g. oral to written will be required. More precise definitions of functions and roles are necessary. These and other implications for computer use are described in Chapter 3.

Extent of computer usage by the Industry

1) 27% of all respondents use computer for payroll.
26% of all respondents use computer for cost accounting.
28% of all respondents use computer for general accounting.
4% of all respondents use computer for cashflow forecasting.
9% of all respondents use computer for scheduling.
7% of all respondents use computer for estimating.

2) 57% of those using computer for general accounting have in-house computer installation.

Nevertheless, the majority of computer users rely on the services of EDP centers.

3) The breakdown of the computer users follow the yearly volume in a straight line.

Yearly volume:	Less than $3 M	$8-10 M	Above $10 M
Payroll	14%	28%	71%
Cost accounting	12%	34%	54%
General accounting	16%	34%	56%
Cashflow forecasting	2%	5%	8%
Scheduling	-	5%	40%
Estimating	4%	9%	16%

4) The following is the breakdown of those respondents who would not use computers under any circumstances:

Less than $3 M yearly volume	60%
$3 - 10 M yearly volume	20%
Above $10 M yearly volume	25%

TABLE 1.1

USAGE OF COMPUTERS AND COMPUTER SERVICE
BY CANADIAN CONTRACTORS [2]

Classification of Residential and Non-residential
General Building Contractors by Annual Volume

Category	Classification	Total Number	Range of Annual Volume		
			$10,000 to 1,999,999	$2,000,000 to 9,999,999	$10,000,000 and over
Residential general building consturction industry	by size	8070	7757	264	49
Non-residential general building construction industry		1567	1118	374	75
Residentail general building construction industry	by percentage	100	96.1	3.2	0.7
Non-residential general building construction industry		100	71.3	23.9	4.8

TABLE 1.2

Source: Statistics Canada Publications 64-207 and 208, 1978.

TABLE 1.3

Characteristics of the Computer Generation

Characteristic	Computer Generation			
	First 1946-1960	Second 1960-1964	Third 1964-????	Fourth (?) 19??-
Major circuit component	Vacuum tubes	Transistors	Microcircuits	Minaturized microcircuits
Speed	Milliseconds	Microseconds	Nanoseconds	Picoseconds
Major storage components:				
CPU	Drums Special devices	Core	Core	Core Microcircuits
Online secondary	Very little	Tape	Disk Drums	Core Drums Disk
Offline	Punched cards	Tape	Tape & disk	Disk & tape
Major input	Punched cards	Punched cards	Incremental recorders (tape,disk) Cards	Incremental recorders Terminals
Major output	Punched cards	Line printers	Line printers	Line printers CRT Microfilm
Operating control	Manual	Queue monitor (software)	Executive (software)	Executive (software & hardware)
Major programming languages	Machine	Symbolic assemblies and compilers	Symbolic compilers	Improved compilers
Modularity	None	Limited	Extensive	Very extensive
Simultaneity	None	Limited	Extensive	Very extensive
Multiprogramming	None	Limited	Extensive	Routine mode
Timesharing	None	Almost none	Available	Routine mode

Source: Computers and Infomration Systesm in Business, George J. Brabb, Houghton Mifftin Co., 1976.

Generation	Model	Monthly rental	Hardware characteristics	Organization	Cycle time microseconds (1)	Storage access (2)
First (1950s)	IBM 650	$3200†	Vacuum tubes. Memory = 3000 bits (600 digits), 1–4 K‡ of drum memory	5 bits/digit, 10 digits/word	100	1 word (10 digits)
Second (1961)	IBM 1410	$4000	Transistorized CPU data channel, memory = 10 K words	6 bits/digit, 1 digit/word	4 5	1 word (1 digit)
Third (1965)	IBM 360/40	$5300	Monolithic circuits more CPU features communications emphasis, memory = 65 K bytes	4 bits/digit, 2 digits/byte, 4 bytes/word	2 5	2 bytes (4 digits)
Third-and-a-half (1971)	IBM 370/135	$6400	Semiconductor primary memory, virtual memory, communications emphasis, memory = 98 K bytes	4 bits/digit, 2 digits/byte, 4 bytes/word	0.77	2 bytes (4 digits)

(*Continued*)

Generation	Access time per digit (2) − (1) microseconds (3)	Binary add time, microseconds (4)	Binary add size (5)	Add time per 2 digits (4) ÷ (5) microseconds (6)	2-digit adds per hour [1 − (6)] (3600) millions (7)	Rental hour (monthly rental − 176 hours) (8)	Cost per million 2-digit adds (8) − (7) (9)*
First (1950s)	10	700	1 word (10 digits)	70	51 4	$18 18	35 00¢
Second (1961)	4 5	88	10 words (10 digits)	8 8	409	$22 73	5 56¢
Third (1965)	0 63	12	4 bytes (8 digits)	1 5	2400	$30 11	1 25¢
Third-and-a-half (1971)	0 19	4 2	4 bytes (8 digits)	0 53	6792	$36 36	0 54¢

*These figures are for comparison among machines because of the limited configurations the absolute costs are not meaningful

†Costs are for rental of CPU and main memory no peripherals are included No adjustment has been made for inflation

‡K = 1024

TABLE 1.4
COMPUTER GENERATION

Source: Information Systems Concepts for Management by Henry C. Lucas Jr. McGraw Hill Book Co. 1978.

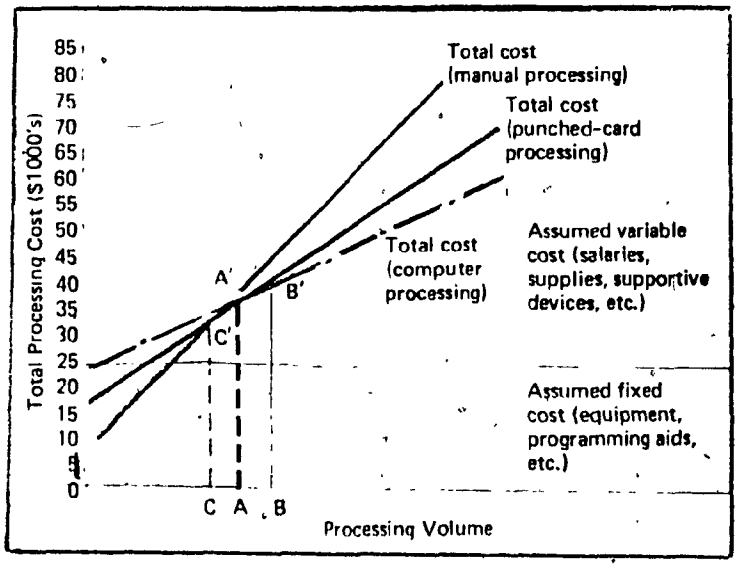


FIGURE 1.1
Break even chart showing Cost effectiveness methods - A hypothetical Example [1]

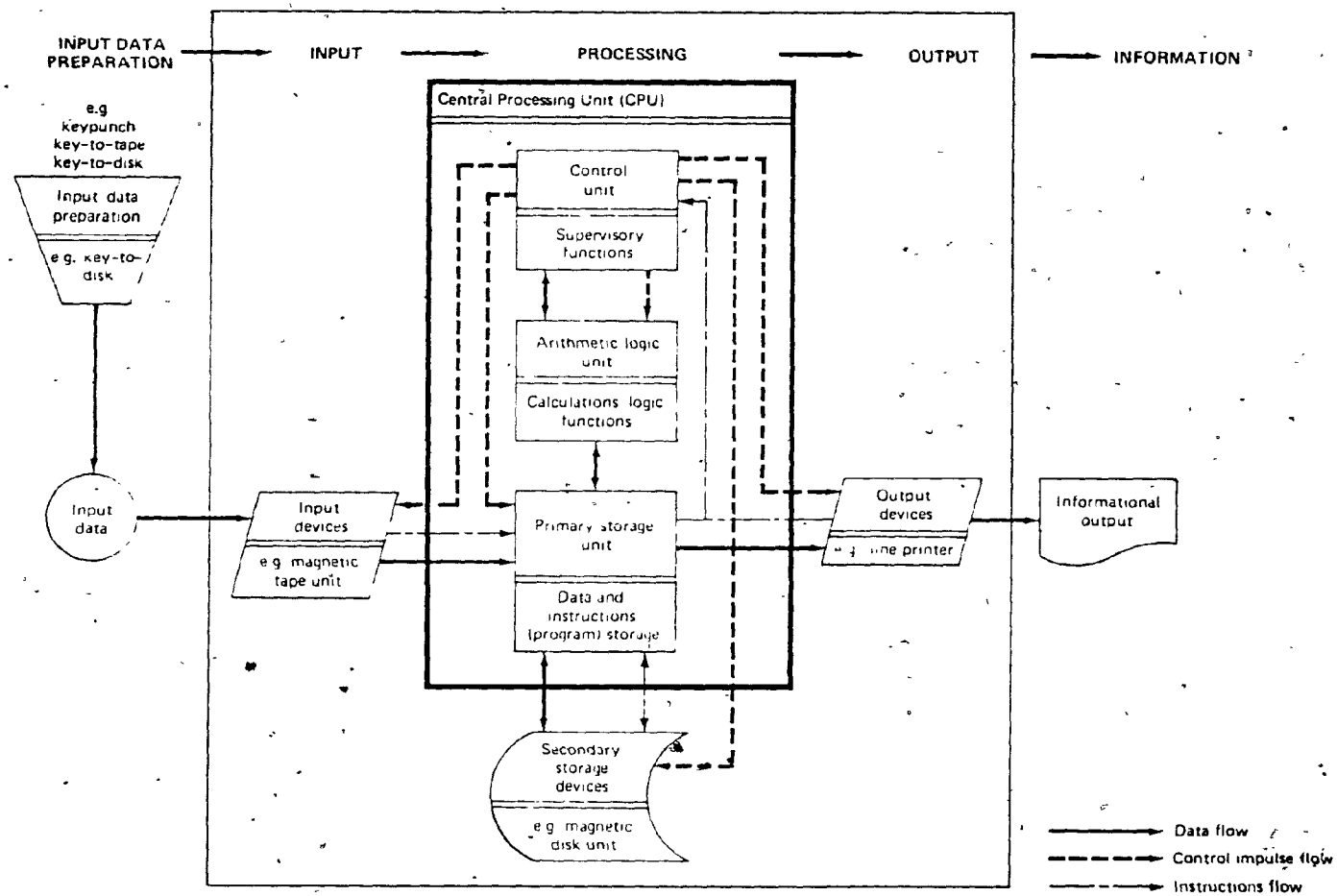


FIGURE 1.2

Major functional elements and units of a computer system [1]

CHAPTER 2

2.1 INTRODUCTION

In 1977, some 73 electronic data processing firms in Canada had revenues in excess of $1 million (see Table 2.1). These revenues consisted of the sale of both hardware products and data processing services and relate to the sale, lease and/or use of minicomputers to the largest machines available. With respect to minicomputers and small computers alone, a recent survey indicated that approximately 29 manufacturers were providing machines that could be adaptable for use in the construction industry (see Table 2.2). Recent surveys of software [3] and Appendix II developed for construction and related firms demonstrate that many software packages are available in the areas of pre-bidding, construction, office administration and equipment management [21]. Applications in pre-bidding include contract documents, specifications, materials and supplies listings, equipment scheduling, bid-drawing take-offs, materials and labour cost estimates and subcontractor bid evaluations. For the construction phase, applications include budgeting, CPM/PERT schedules and charts, manpower schedules, progress payment requisitions, change orders, materials inventory, manpower and machinery allocations, operation and phase scheduling, record keeping and progress reports. For office administration, applications include general accounting, payroll, record keeping, progress payments, financial statements, progressive cost analysis, cash flow control (cumulative labour/materials and time/material costs, costs and profitability reports, expense/budget monitoring, actual vs. estimated cost assessment, project

status), materials and supplies purchasing, delivery scheduling, inventory control. For equipment management, applications include equipment scheduling, replacements allocations, service/repair scheduling, order and inventory of replacement parts and small tools and hardware distribution. It should be noted that much of the software described in Appendix II is for large machines as opposed to minicomputers and small business machines.

The main objective of this chapter is to describe, in some detail, these software systems specifically designed for contractors for use on small computers. Supporting hardware for these systems is also briefly discussed. The systems selected are IBM's CMAS - Construction Management Accounting System - designed for use on their System 32 and 34 machines, NCR's Construction Management System for their system 499, 8150 and 8250 machines, and Burroughs MAC system - Management Accounting for Contractor for use on their B80-21/121 and B80-64/164 systems. Information presented herein has been obtained from publications of these firms [2, 15, 16, 18, 19] and by way of extensive discussion with their representatives. Emphasis has been placed on the data required for the systems and the information generated.

2.2 IBM - CONSTRUCTION MANAGEMENT ACCOUNTING SYSTEMS (CMAS) IBM SYSTEM/32

2.2.1 Overview and Major Features

CMAS is a modular system consisting of four modules which are:

Payroll

Accounts Payable

Job Costing

General Ledger

These modules are designed to function both independently and as an integrated package. All the modules can be tailored to meet specific needs of a contractor. This is done through a special procedure called "system tailoring procedure". (STP)

Each application module has its own set of system initialization questions which are used to input to the STP. Before the contractor implements any one of the CMAS applications, he has to answer the system initialization questions, perform STP, and build his unique system for each application he intends to use. Different parameters and options handled by STP are given under the description of each application in section 2.2.2.

The advantage of S.T.P. is mainly that it provides the contractor with a method to change the system to reflect changes in his business as they occur.

When a module is independently installed the functions performed by the

module are completed within that module. When the modules are used in an integrated application information produced by one module that is required in another module is automatically transferred to that module. Figure 2.1 depicts how the modules function and interact with each other and how different reports are produced through system processing. A detailed description of each module and the details of various input and output reports are given in the following section. Where possible reference to the step numbers in figure 2.1 have been made in this description.

2.2.2 CMAS System Description

I. PAYROLL MODULE

The payroll module uses information from payroll time sheets to calculate the payroll, provide year-end reports, and if required union reports. A field reporting capability can be used in projecting labour costs and profits of the job. An additional feature of this module provides for the automatic reconciliation of the payroll bank account. Figure 2.2 depicts the information input to this module and the output report generated as a function of the level of input. The payroll module is designed to integrate with other CMAS modules. It, however, operates independently if desired by the contractor. Through the use of System Tailoring System procedure (Step 2) the contractor implements certain options depending on his specific business requirements. These are selected while building the System Tailoring file. Once the file is built up, system processing automatically follows the instructions of the Tailoring file. Some of the major tailoring options offered are

as follows:

1. Use of Security Code to secure payroll information;

2. payroll distribution by General ledger account number;

3. Saving of General ledger entries for later posting;

4. maximum check amount payroll module is required not to exceed;

5. Minimum check amount payroll module is allowed to write. (If any check is below this amount, no check will be issued).

6. Maximum number of regular hours per day/week a person should work;

7. Minimum number of regular hours per day/week a person should work;

8. Labour cost distribution (costing reports) required or not?

9. Ability to override the employee's normally assigned job/class Employee type on payroll account

10. Ability to enter employee transactions with union distribution

11. Keeping records separately by each company if the contractor has more than one.

As the business changes the payroll module can be modified through the system tailoring file. Examples of parameters which can change are:

1. Single Company to multiple Company

2. Tax Criteria

3. Addition of various management reports

4. Level of details in cost distributions

5. Addition of security access codes

6. Addition of automatic General ledger updating

Time sheet data required by the payroll module is entered in two stages. First the following information is input once per group of entries.

- Day number
- Week number
- Union number
- City number
- Province number
- General ledger account to be charged
- Employee type (apprentice, journeyman, etc.)
- Company number, job number, pay item, cost code, cost type, job class.
- Company number, equipment number (if charging equipment), cost type.

Once this information is input, then manhour information is entered as follows:

- Man number
- Regular hours worked
- Overtime hours worked

This process is repeated for each group of entries.

PAYROLL REPORTS

Once time sheet information is entered into the system (Step 1) and verified for correctness, the payroll is calculated, checks are printed, and payroll reports prepared. Eleven different steps are automatically performed.

(i) *Payroll Edit-register* The time sheet data is printed on the edit register and errors noted. This is to verify that the data is consistent with the data already stored in the system.

(ii) *Current hours proof* It provides a listing of all payroll information to be checked and reconciled prior to calculation of the payroll.

(iii) *Gross Earning Register* This indicates the gross earnings for each employee who worked during the pay period.

(iv) *Payroll register* is printed showing payroll data for the period.

(v) *Payroll checks* with all pertinent earning information are automatically printed. As each check is printed, the system adds check reconciliation information to an outstanding re-conciliation file. This information includes company number, check number, employee number, check amount and check date. This greatly simplifies bank reconciliation.

(vi) *YTD Earning register* This register lists year-to-date (YTD)

earnings for all employees. It is used for federal and Quebec tax, UIC, CPP/QPP and Quebec medical reporting.

(vii) *Employee deduction register* This register lists all miscellaneous deductions for each employee for the payroll period.

(viii) *Employer contribution register* lists all contributions made by the employer on behalf of the employee. Taxable and non-taxable contributions are itemized.

(ix) *Labor cost register* This highlights the hours and dollars charged to the job for the distribution specified by the contractor.

(x) *Payroll distribution journal* It is printed showing the distribution by general ledger account number. The payroll journal can be used as the book of original entry for general ledger accounting. The automatic preparation of the payroll distribution journal can save time and dollars in accounting, auditing and posting. If the contractor has the General ledger module installed, CMAS updates the proper General ledger accounts at this time.

(xi) *Job/Employee Report* This report lists all employees and their pay for each job worked during the pay period. This report can be used to substantiate billing to contractors and to identify and control problem areas. This report will print all active jobs.

Figure 2.3 depicts four of the major reports prepared in the payroll processing phase.

FEDERAL AND PROVINCIAL REPORTS (Step 6)

The provincial and federal updating aspect of the payroll module calculates and prepares the T4's and TP4's required by Federal and Provincial Governments on continuous pre-printed forms.

UNION REPORTING (Steps 4, 7)

Standard union deductions are used by the system processing to prepare two standard union deduction reports and local union reports. These are:

(i) *Union Calculation Register* It lists both employee paid union deductions and employer paid fringe benefits. These deductions may be taxable or non-taxable.

(ii) *Weekly Union Listing* This provides all the information used to produce union reports. It can be printed and reviewed prior to printing the actual union reports. This listing can also be prepared monthly.

(iii) *Local Union Reports* Two local union reports are provided. One report lists all deductions by each employee; the other lists all deductions for each union by deduction type.

OPTIONAL REPORTING

The payroll module provides a number of optional reports as needed, as an automatic by product of payroll processing. The main feature is the field report worksheet which enables a contractor to include field progress (as measured by the field superintendents) in management reports.

Following are the reports generated:

(i) *C.I.C. Report* This report itemizes the vacation pay due each employee in Quebec, and summarizes the amount due the commission.

(ii) *Equipment Labour Charges* This report lists maintenance hours on equipment by pay period.

(iii) *Field Report Worksheet* It is a turn around document used by field personnel to report quantities put-in-place or percentage complete during the pay period.

(iv) *Check Reconciliation Register* This report provides the current status of all checks, both outstanding and reconciled during the pay period. This is an accounting document and assists the operator in reconciling checks and also provides hard copy to determine if all entries are correct.

MANAGEMENT REPORTING (Steps 5, 9, 10)

If management is prepared to collect information regarding job progress in terms of quantities placed and/or percent complete, then the CMAS system can generate reports useful for the job control functions by processing this data along with the labour cost data previously described. The additional field information required is shown in Figure 2 and corresponds to step 9 in Figure 2.1. The reports generated by use of this information are shown in Figure 2.4. They include:

(i) *Labour Cost Report* highlights the hours and dollars charged to the job in the cost breakdown already selected. The detail of distribution, breakdown and reporting is dependent upon options selected during system tailoring procedure.

(ii) *Labor Cost Report By Period* prints the hours and dollars distributed to each job. This report has the same options (job totals, averages only, priority cost codes or specific jobs) as labor cost reports. Many contractors desire a comparison of labor hours and dollars per cost code between different periods.

(iii) *Labor Cost Report; % Reported* This labor cost analysis report projects hours and cost based on work performed to date in terms of percent complete. The report projects the job status at the end of the job to determine whether cost will be over or under estimated cost. The following calculations are used in the labor cost by % reported (see Figure 2.4),

should-be hours = (reported percentage completed) x (estimated hours)

$$\text{(Projected hours)} = \text{(estimated hours)} + \frac{\text{(To date hours)} - \text{(should be hours)}}{\text{(Percentage reported)}}$$

The should be dollars calculations use the same calculations substituting dollars for hours.

(iv) *Labor Cost Report; Qty % Reported* If reporting by quantities (units) in place is desired, this labor cost analysis report can be prepared. It utilizes quantities put-in-place or percent

complete (as reported on field worksheet) to calculate projected cost.

If the percentage completed is provided from the field, that figure is used. Otherwise percentage complete is calculated as follows:

$$\text{Percent complete} = \frac{\text{Actual qty put in place}}{\text{(estimated quantity)}}$$

Also:

Should-be-dollars = (Percentage complete) x (estimated dollars)

$$\text{Projected cost} = \text{(estimated dollars)} + \frac{\text{(Actual dollars to date)} - \text{(should be dollars)}}{\text{percentage expended}}$$

In addition to projecting the costs, this report also projects hours to completion. Note that this measure of percent complete may not be representative of actual progress in the field.

(v) *Labor Productivity Report* This report utilizes data from the field report worksheet to calculate unit cost-to-date. The labor productivity report also calculates and prints the projected over or under figures per cost code.

The following calculations are used in this report:

- Estimated Unit Cost = $\frac{\text{estimated dollars}}{\text{estimated quantity}}$

[over (or under) to date] = [(estimated unit Cost) - (Actual unit cost)] x Actual qty to-date

$$\text{(To-date unit cost)} = \frac{\text{(actual cost-to-date)}}{\text{(Quantity to-date)}}$$

(Net change unit Cost) = (Unit cost this week) - (Unit cost to date)

If the result is positive. the plus sign prints indicating that the unit cost this week is rising in relation to the to-date unit cost. If the result is negative, a minus sign prints, indicating that the unit cost is trending downward in relation to the to-date unit cost.

[Projected over (or under)] = [(estimated unit cost) - (Actual unit-cost-to-date] x (estimated qty)

If actual quantity exceeds estimated quantity, then over (or under) to date and projected over (or under) = (Cost) - (Total actual cost).

II. ACCOUNTS PAYABLE

General Description

The "Accounts payable module" integrates with other CMAS modules to provide a tailored package in accordance with a contractor's needs. Figure 2.5 shows the input reports required for use of this module and the output reports generated.

The system tailoring procedure enables the contractor to select certain accounts payable functions based on his specific business requirements. Following are accounts payable criteria which the contractor himself can

tailor to his needs:

1. Level of detail in cost distribution (pay item, cost code, cost type, equipment)
2. multi or single company
3. Maximum check limits
4. General ledger account number
5. Addition of security code
6. Addition of automatic General ledger module updatung

Once the vendor invoices, prepaid checks and credit memo sheets have been received and approved, they are entered. From this point on CMAS posts the information to the proper records and handles the remaining payables functions automatically. CMAS writes the checks and updates the proper records. Additionally the system provides input to the General ledger (if installed) through the purchase journal and through the cash disbursement journal. If the job costing module is installed, the A/P module automatically provides input through the purchase journal.

INVOICE PROCESSING CYCLE (Step 13)

(i) *Accounts Payable Edit Register* After all information is entered, the accounts payable application passes the data through extensive editing. An A/P edit register (figure 2.6) is printed which lists all entered information so that visual verification can be made. The advantage of this editing is that errors are

minimized throughout the system.

(ii) *Purchase Journal Proof* After corrections are entered and edited, the module produces the purchase journal proof listing which is used to proof the invoices and their respective totals prior to the actual processing of open payables and updating of job costing.

(iii) *Purchase Journal* It is the permanent account document detailing all invoices being used to update job cost records, general ledger records and to update the open payables file by adding new invoices to that file.

(iv) *Open Payables Posting Register* The system combines existing open payables data and new payables to produce an up-to-date open payables posting register. The posting register identifies each invoice entered during each batch, showing dollar amounts and indicating whether it was a prepaid check.

PAYMENT PROCESSING CYCLE (Step 13)

(i) *Payment Selection* The operator can select invoices for payments in a variety of ways which are:

a. by due dates
b. by specific job
c. by specific vendor
d. by specific invoice

(ii) *Cash Requirement Report* After invoices to be paid are selected, the system produces a cash requirement report which identifies each invoice to be paid and the total cash required.

(iii) *Cash Disbursment Journal* The next step is the production of cash disbursment journal (figure 2.6) which details all disbursments for invoices to be paid. At this time the system also updates the General ledger application (if installed).

(iv) *Accounts Payable Checks* Accounts payable checks are automatically printed based on the selection method already chosen.

SUBCONTRACT REPORTING (Step 16, 17)

When subcontractors are involved in projects, the module is capable of producing accounting for sub contracts, through the data entered by sub-contractor invoices.

(i) *Sub-Contract Status Posting* First a subcontract status posting register is produced which shows the total gross amount, retention amount, and retained taxes of all invoices to be posted to exising sub-contracts.

(ii) *Sub-Contract Status Report By Vendor* This report lists all subcontracts in vendor sequence, showing the current status of each subcontract. Information shown includes the subcontract amount, amount billed, how much has been paid and retained to date and the current balance.

(iii) *Sub-Contract Status Report By Job* This report contains the same information as in the report by vendor; however, it is listed by specific job (figure 2.6).

(iv) *Sub-Contract Payment Listing* After the cash disbrusment journal

is printed (in payment processing cycle), the subcontract payment listing is printed. This register identifies all subcontract payments to verify payments made to subcontractors.

MANAGEMENT REPORTING CYCLE (Step 17)

Management reports are available upon demand. These reports aid management in determining the status of sub-contracts, accounts payables, and vendors. No special sequence is required to be followed in generating the reports.

(i) *Open payable listing by due date* It contains the current status of all outstanding open payables. The report provides the list showing all invoices currently due. It also gives totals of those invoices thirty days past due.

(ii) *Open Payable Listing By Vendor* This report lists all open payables grouped by vendors.

(iii) *Vendor Analysis Report* This report lists by vendor the amount of business transacted with the vendor for the year. In addition it also shows discounts that were taken, and those not taken to-date.

(iv) *Accounts Payable Trial Balance By Vendor* This lists all invoices and existing sub contracts associated with each vendor. This gives an accurate picture of a contractor's short term liabilities (invoices) and long term liabilities (retention and retained taxes).

(v) *Accounts Payable Trial Balance By Job* This report lists the

same information as that contained in the trial balance in vendor sequence; however, it shows liabilities by specific jobs.

CHEQUE RECONCILIATION CYCLE

As accounts payable cheques are printed (in payment processing cycle), the system automatically adds records to the cheque reconciliation file, which is used to reconcile cheques with the bank statement.

Next, the CHEQUE RECONCILIATION REGISTER, the permanent document listing all cheques reconciled by the operator, is printed. In addition, the register also lists all outstanding and voided cheques.

III. JOB COSTING MODULE

General Description

Figure 2.7 shows the input data required and output report generated by the Job Costing Module. The flow of calculations in this module to determine overall profitability is depicted in figure 2.8 .

The job costing module can function independently or be integrated with other modules. The payroll and accounts payable modules automatically provide the labor, material, and subcontract expenses for the job costs reports, if originally input through these modules.

Before J.C. module is made operational, the contractor has to perform the system tailoring procedure. Using job cost system tailoring initialization questionnaire, he specifies parameters for his company. These parameters can be changed at any time when adding features or functions

within the requirements file to reflect changes in his company. These parameters are:

1. Security Code
2. Pay item (sub-job) distribution capabilities
3. Cost code distribution capabilities
4. Cost type distribution capabilities
5. Choice of standard cost types
6. Selection of labor, material, sub contract, and equipment cost type codes
7. Records keeping capabilities for multi-company - organization

Inputs to the J.C. module consists of any transactions which the contractor wishes to charge to a particular job. Examples of those transactions are:

1. Materials
2. Billing/Income
3. Equipment
4. General Expenses
5. Materials for Inventory
6. Subcontractors

If the payroll and accounts payable modules are installed, the need to enter transactions distributing labor costs to jobs and vouchers distributing subcontract and material costs, does not arise.

Prior to entering the transactions, manual totals are done of the number of transactions and the amounts of transactions.

Depending on the contractor's preferences as indicated in the system tailoring procedure, the system prompts the operator to enter the appropriate data from this list:

1. Company Number
2. Job Number
3. Pay Item
4. Cost Code
5. Cost Type
6. Transaction Source
7. General Ledger Debit Number
8. General Ledger Credit Number
9. Dollar Amount

Through system processing four major cycles are carried, as a result of which different reports are generated as described below:

VOUCHER PROCESSING CYCLE (Step 20)

(i) *Job Cost Edit Register* After all job cost transactions are entered, the data is extensively edited. Errors are flagged on the edit register which lists all transactions. Errors are then corrected by the operator.

(ii) *Job Cost Proof* After corrections are made, the job cost proof listing prints all transactions since the preceeding job cost journal was printed. If fixed reporting is also implemented, the operator is required to enter quantities put in place and percentage completed to date.

(iii) *Job Cost Journal* The job cost journal is now printed on which all job cost transactions are journalized. If the General ledger module is not installed, the job cost journal is used for manually posting journal entries into the general ledger books.

COST ANALYSIS (Step 24)

(i) *Field Report Worksheet* (Step 23) This is utilized as the turn-around document from the field to obtain quantities put in place and percentages of various activities completed.

(ii) *Job Cost Analysis by Job* The job cost analysis by job provides the contractor with the status of all jobs by major cost types. On the report is a breakdown of the cost types at a specific period in time (Figure 2.9). This allows management to monitor the progress of all jobs to determine if any cost types are getting out of hand. Cost types included on the report are direct labor, material, subcontract, equipment and general expenses.

(iii) *Job Productivity Report* If the quantitites have been reported, the system prints a job productivity report (figure 2.9). This report shows estimated unit cost, and to-date costs. Printed on the report is the calculated to-date and projected profit or losses on each work item.

(iv) *Job Cost Analysis By Quantity/Percentage* This report uses

quantities to-date, percentage completed, estimated cost, and to-date costs to calculate project cost at job end. Projected total cost can be compared to estimated cost to spot unfavorable trends (figure 2.9).

COST ACCOUNTING CYCLE (Step 25)

(i) *Job Cost To Date Report* It provides a breakdown of the costs of different work items on each job (figure 2.9). The costs are accounted for by period. Percentage expended is the ratio of actual cost to date to estimated cost. Remaining cost is the difference between estimated cost and cost to date. This advises the contractor of budgeted dollars remaining by cost breakdown.

(ii) *Job Cost Status Report* This report represents an accounting of estimated cost and estimated billings. It also contains the difference between costs and billings. When income is also shown on the report, the contractor can easily compare costs with income.

CASH FLOW CYCLE (Step 26)

(i) *Job Cash Flow Report* Important profitability information by cost code is printed on the job cash flow report (figure 2.9). Progress from the field as reported on the field report worksheet and cost data reported into the job costing module are utilized to project profitability. With this report, the contractor determines which work items are meeting profit projections

and which are not.

(ii) *Summarized Cash Flow Analysis* This provides a breakdown of cost and billings by each individual job and projected profit or loss for each (figure 2.9). The totals of this report provide a summary of all projects in the company.

IV. GENERAL LEDGER MODULE

General Description

Figure 2.10 shows the input data required for the general ledger module and the output reports that it generates. Although this module can function independently, it is normally integrated with other modules.

Using a pre-designed referencing system, CMAS posts the appropriate general ledger account when postings are entered by the operator to the various CMAS journals.

The CMAS General ledger uses standard double entry accounting procedures. It prepares financial statements (monthly/quarterly/annual income statements and balance sheets) as a by product of the general ledger accounting function.

The System Tailoring Procedure allows the contractor to have one or more companies. He has a choice to use his own chart of accounts or the CMAS standard ledger accounts. Also a choice is offered to use his own financial statement formats or, the suggested CMAS general ledger formats.

Normally, the general journal is used to enter miscellaneous transactions

not affecting other modules. In a fully integrated system, these modules (payroll, accounts payable, job costing) post automatically to the general ledger. If the systems are not integrated, the contractor uses the general journal input to enter the transactions from these modules.

The system processing undergoes three major cycles consisting of various output reports and files. These are described as follows:

G/L VOUCHER PROCESSING CYCLE (Step 29)

(i) *General Ledger Proof* After general journal items are entered, the general ledger proof listing is printed. This lists all transactions entered since the preceeding general journal. This report is used as a check that all transactions were properly entered.

(ii) *General Journal* After the general ledger proof has been verified for correctness a general journal is printed. This lists all general journal transactions of the particular input run. As a check totals on the general journal should balance to the totals of all batches entered since the most recent general journal.

MONTHLY PROCESSING CYCLE (Step 31)

After the general journal is printed, the contractor can begin the monthly cycle in order to produce the following reports.

(i) *Financial Statement Worksheet* This lists the total debit and

credit balances of each general ledger account (figure 2.11). The income or loss for the month is reflected on this document for subsequent entry.

(ii) *G/L Monthly Audit Listing* This listing can be printed to provide a listing of all transactions for the month or of journal totals only.

(iii) *Selective Monthly G/L Audit Listing* If the audit listing is prepared by totals only, and there is a need to examine a questionable journal, a selective general ledger audit listing is printed.

(iv) *Monthly G/L Trial Balance* The G/L trial balance is retained for the year-end audit. Listed on the trial balance are all transactions for the month in the general ledger account sequence. Total debits should equal total credits on this trial balance.

(v) *General Ledger Listing* This report provides a one line summary of each journal ledger account and prints current and year-to-date balances.

(vi) *Monthly Statement of Income* The monthly statment of income shows the income, expenses, and net income or net loss (figure 2.12).

(vii) *Monthly Balance Sheet* The balance sheet lists all assets, liabilities and capital as of a specific date (figure 2.11).

ANNUAL PROCESSING CYCLE (Step 33)

(i) *G/L Year-To-Date Audit Listing* This listing is printed by

general ledger account number and is the first step in the year-end closing. Listed on the report are monthly debit and credit amounts for the twelve previous months. This listing verifies that the data is in balance.

(ii) *Annual Statement of Income* An annual statement of income is printed showing the income, expenses, and net profit or loss for the fiscal year (figure 2.12).

(iii) *Annual Balance Sheet* The annual balance sheet shows the assets, the liabilities, and the capital as of the last day of the fiscal year (figure 2.12).

2.2.3 Hardware Configuration Required for CMAS

The CMAS system has been developed for use on two IBM computer configurations, System/32 and System/34. The main feature of these systems are presented in Table 2.3.

The cost of hardware is very dependent upon the type and number of peripherals used. The base System/32 hardware cost is $38000 and that of System 34 is $41600. The company policy is lease oriented. System/32 is leased at $900 per month while system/34 is leased at $1300 per month.

2.2.4 Assessment of Contractor Needs and Implementation of the System

A brief discussion was held with IBM personnel to determine the manner in which they assess the needs of the contractor. The overall flow of activities involved in this process including system implementation is shown in figure 2.13 . IBM's literature suggests that this process requires approximately 5 months. On initial contact with the contractor,

the company determines the client's need and problem areas. This is done by a detailed study of their existing system. A questionnaire is used to ascertain details regarding the company size, type, organization, information flow, and volume of information handled. This questionnaire was not made available to the writer as it was deemed confidential by IBM.

The results of the survey are then studied by IBM's system engineers, so that the CMAS system may be fitted to the contractor's needs by way of the system tailoring procedure described previously.

Once the system is designed, approved, installed and implemented the software is constantly revised as per the growing needs of the contractor. The system is advertised as requiring no special computer knowledge of the customer and no special EDP staff is necessary to run the system. IBM offers a training programme for company staff as part of the installation contract.

2.3 NCR - CONSTRUCTION MANAGEMENT SYSTEM (SYSTEM 499/8150/8250)

2.3.1 General Overview

The NCR Construction Management System is designed to meet the accounting and reporting requirements of the construction industry. This system is similar in nature to the IBM CMAS system and consists of the following applications:

Payroll

Accounts Payable

Job Cost

General Ledger

Two additional modules are available, one dealing with accounts receivable, the other with material and equipment.

The software was basically developed for use on NCR's line of minicomputer and small business computers such as NCR 399 and NCR 499 and system 8150 and 8250. The system flow and description presented herein is based on the system 8250 manual (19).

2.3.2 System Description

Introduction

Fig. 2.14 shows the general relationship of all the applications and their interactions. The flow chart depicts how the input is fed into the various modules, processed through system processing and then incorporated into the master files.

An optional feature is the Accounts Receivable module which gets its input through "input authorization data" and General journal. The output reports are invoices, statements and data on overdue accounts (called an Ageing report).

PAYROLL APPLICATION

Input to the system is through payroll time tickets. Header information such as employee name, number, trade, period, social security number and job number last worked are printed by the system automatically in sequence of the last job worked. The foreman, on the job site, completes the time sheet by recording hours worked and cost codes for labour distribution.

Using this information the system then provides the following reports:

(i) *Gross Payroll Distribution* After all transactions have been entered from the time tickets the system prints this report in employee number sequence (figure 2.15). This report shows earnings and pay-period totals for each employee. This data is used to check hours and earnings prior to calculating and printing the final payroll.

(ii) *Payroll Check* After the hours and earnings on the gross payable distribution report have been verified, the system prints payroll checks and earning statements.

(iii) *Payroll Earning Register* This register serves as a permanent record of all checks written.

(iv) *Certified Payroll Report* This report is prepared for all American government related jobs.

(v) *Monthly Manpower Utilization Report* The report is printed on demand. It lists the number of employees by trade and ethnic background in job-number sequence (for American use).

(vi) *Union Fringe Benefit Report* Printed each month, this union report provides both deductions and fringe benefits as required by the unions.

(vii) *Employee City/State and Local Earning Register* Earnings and taxes are printed for each city/province and locality in which the employee has worked.

ACCOUNTS PAYABLE

The distribution journal is the original record of entry for all accounts payable transactions. Created at the time of input, this journal establishes the accounts payable liability, lists all invoices and shows expense distribution (figure 2.15).

Based on the information shown in the distribution journal, the accounts payable module produces the following reports:

(i) *Aged Trial Balance* Printed monthly, lists all unpaid invoices in vendor-number sequence. Invoices are aged by due date into four payment periods (figure 2.15).

(ii) *Cash Requirements Analysis* Available monthly, this report

lists all unpaid invoices in job number sequence and shows total cash requirements for each job.

(iii) *Check Register* The check register is a record of all cash disbursements. It provides separate totals for checks written to regular vendors and sub contractors.

(iv) *Check and Remittance Advice* These are printed on request. Invoices may be paid at due date or held until released by management.

(v) *Subcontractor's Report* This report is printed in job number sequence and lists all unpaid invoices for each job. The report provides current subcontractor liability and current retainage.

(vi) *Sub-Contractors Status* This report provides an overview of subcontractors status on each job (figure 2.15). It helps to evaluate subcontractor status, provides control of payments and permits comparison of balance to performance.

JOB COST

All payroll, accounts payable and journal entry distributions are reported to this system according to the type of distribution entered initially by the operator. With the type of distribution, the user will be able to distribute amounts and units to a job cost number or to an equipment cost number. The system provides the user with several reports.

(i) *Job Cost Analysis - Summary* This report provides a starting point for job cost analysis. The report shows total cost, estimated percentage completed and the dollar amount over/under the budgeted figures, (figure 2.16). This enables the user to compare actual cost with budget, and assess overall profitability for each job.

(ii) *Job Cost Analysis - Detail/Type* This report provides six types of cost for each cost code within a job: Labor, material, subcontractor, equipment, overhead and other (figure 2.16). This enables the user to identify activities that may require corrective action. It also provides a source of information for future estimates.

(iii) *Unit and Job Labor Cost Report* The unit and job labor cost report reflects the labor cost of each unit and serves as a tool to help control profitability (figure 2.16). The report projects profitability in terms of gain and loss figures.

(iv) *Cash Flow Analysis* This report compares actual costs to billings and projects the final job profitability (figure 2.16). This enables the user to predict cash flow, to know profitability by job, and compare costs versus billing.

GENERAL LEDGER

With the general ledger application, the preparation of the general ledger trial balance, income statement and balance sheet is combined.

The updating of the general ledger accounts is performed automatically. Daily updating or periodic dating during the month is also allowed.

In order to provide reference document for auditing the general ledger system, G/L up-date Journal is printed which lists all general ledger transactions for the current period sorted into account-number order.

The system then produces the following reports:

(i) *General Ledger Trial Balance* The trial balance provides a listing of account names and the closing balances for the reporting period.

(ii) *General Ledger Balance Sheet* It is the statement of financial condition at a given date (figure 2.17). Assets and liabilities are listed with current balances. This monthly report provides an overall financial picture.

(iii) *Incomes Statement* The monthly income statement reflects costs and income for the current and year-to-date periods (figure 2.17). It is used to determine the company's profitability and to spot financial trends as they develop.

(iv) *Comparative Balance Sheet* Available monthly, this statement of financial condition compares balances this year with the same period for the prior year (figure 2.17).

(v) *Comparative Income Statement* This monthly report provides a comparison of current figures with those of the previous year (figure 2.17).

2.3.3 Hardware Configuration and Cost

Attention is focused on those NCR hardware systems to which the construction Management systems can be adopted. They include NCR 399, 499, 8150 and 8250. Development of the 8000 series of machines has resulted in termination of production of the 399 and 499 systems as the new systems are more cost effective. Table 2.4 contains information describing the main features of the foregoing hardware systems.

The cost of the software is $1000 per module. There is an installation charge of $30/ per hour per module. An NCR representative estimated that the installation time per module on the NCR499 system is 10 hours, while for the 8150 and 8250 systems it is estimated at 20 hours.

2.3.4 Assessment of Contractors Needs and Implementation of System

Detailed discussion with an NCR representative was held in order to determine their method of assessing the needs of the contractors. The NCR needs assessment method was described as follows. An initial assessment of the contractor's requirements is made by interview and questionnaire. Analysis of result obtained from this process leads to a more detailed analysis of the firm's needs by way of interview. Results from this second pahse of analysis are used to tailor the system to the identified needs of the contractor. NCR then holds a practical demonstration for their client. If he finds it suitable, installation is approved. Otherwise the system is further revised to more closely match their requirements.

Limited information was made available regarding the content of the

questionnaire employed by NCR. The representaive contacted indicated that the following information was sought from the contractor with reference to the module applications.

PAYROLL

1. Number of employees - minimum and maximum
2. Class, salary type, kind of hours and related rates
3. Number of T4's, TP4's needed at the end of the year
4. Number of deductions, number of unions

ACCOUNTS PAYABLE

1. Number of suppliers active at one time
2. Number of invoices per month
3. Number of distribution
4. Number of disbursment cheques
5. Frequency of payment
6. Discounts taken or not

JOB COST

1. Number of Jobs active at one time
2. Number of jobs handled in one year
3. Equipment details
4. Phases and sub-phases of jobs
5. Number of sub-contractors

GENERAL LEDGER

1. Number of companies within organization

2. Number of accounts within each company

3. Type of statements required - company wise or consolidated

4. Need of comparative statements

2.4 BURROUGHS MAC (TIMERLINE SYSTEMS)

2.4.1 System Description

MAC - Management Accounting for Contractors - is designed specifically to meet informational needs of the contractors. It consists of four major modules which are:

1. Payroll system
2. Accounts Payable
3. Job Costing
4. General Ledger

Figure 2.18 shows the interrelationship of these modules. Several optional modules are also available. They include:

Inventory

Depreciation Schedule

Equipment Costing

Accounts Receivable

No comprehensive manual on the Burrough MAC system was obtained for this study despite repeated attempts to acquire one. The description presented herein is based on the limited information made available.

PAYROLL SYSTEM

Input data keyed into the system is furnished through time sheets. After the editing and corrections are done, the system produces the following reports:

i Cheques

ii Tax calculations and reports

iii standard deductions

iv payroll register

v year-to-date payroll ledger

vi payroll journal (figure 2.19)

vii Labor distribution report (figure 2.19)

viii Certification report (for government jobs)

ix Monthly union reports

ACCOUNTS PAYABLE

Invoices and bills form the main source of input data. When each bill is originally posted, a proposed payment date is established. Bills are automatically relieved and paid as checkwriting dates reach the proposed payment date. Through the use of payment dates, cash requirement forecasting can be done as exactly as needed and into the future as far as desired. The system permits changes to be made to payment dates for early or deferred payments.

The system generates the following reports once the input data from invoices is entered and edited for correction:

i Purchase journal (figure 2.20)

ii Accounts Payable Register

iii Vendor and Sub Contractor Checks

iv Disbursement Register

v Check Reconciliation Register

vi Accounts Payable Analysis

a. Cash requirements projections (figure 2.20)

b. Job summary report

c. Outstanding invoice and worksheet

JOB COST

The primary components of the job cost module include journalizing, automatic sorting, job cost master update and flexible job cost report generators.

The job cost application is designed to be used as an independent system and also to function with other applications modules such as Accounts payable, payroll and General ledger. The output files from these modules supply input directly to this system when all the modules have been installed.

The system produces reports giving overall job information as well as information pertaining to diffferent phases of the job (figure 2.21). Reports concerning summary data on change orders, equipment, labor, materials, general expenses and income are also generated.

A list of reports furnished by the system is as follows:

i Job Cost Report by Group (figure 2.22)

ii Job Cost Journal

iii Job Summary Report (figure 2.22)

iv Budget Analysis Report

GENERAL LEDGER

The general ledger module system functions by retrieving data from the

other MAC systems - job costing, payroll and accounts payable - and assembling it for generation of financial statements.

While generating the necessary financial reports like balance sheets and income statements the system produces routine journals, ledgers, subsidiary schedules and consolidated reports.

Some of the reports generated by the system are:

i Statement of Income and Expenses (figure 2.23)

ii Balance Sheet

iii Comparative balance sheet

iv Budget Comparison

v Statement of changes in financial position

vi Budget Analysis report

vii Profit and loss statements

2.4.2 Hardware Configuration and Cost

The most common hardware configuration used for the application program are B80-21/21 and B80-64/164, the description of each of the systems is given in the table 2.5. A detailed description of different features of the applications which are common to both the models is also given. Cost figures for the system could not be obtained.

2.4.3 Assessment of Contractors Needs and Implementation of the System

An approach similar to that employed by IBM and NCR is used by Burroughs

in identifying the client's needs and tailoring the system to these needs. Figure 2.25 depicts the process followed by Burroughs. With the help of a marketing representative, a survey is conducted by way of questionnaire to assess the volume of data processed by the firm in each of the main functional areas. A sample questionnaire is shown in Appendix III for the first part of the survey. Questions asked for the second part of the survey were deemed to be confidential and thus were not provided.

		1977			1976				
Rank	Company Name	EDP Revenue ($ M)	EDP Revenue % of Total	Total Revenue	EDP Revenue	Total Revenue	Fiscal Year Ending	Incor-poration Date	Code
1	IBM Canada Ltd	$ 805 2	81.4%	$ 989 2	$ 681 4	$ 837 4	Dec. 31, 1977	1917	(Q)E
2	NCR Canada Limited	$ 109.4	76%	$ 144 0	$ 137 2	$ 180 5	Nov. 30, 1977	1915	(Q)E
3	Control Data Canada, Ltd.	$ 101 0	100%	$ 101.0	$ 93 0	$ 93 0	Nov 30, 1977	1962	Q
4	Digital Equipment of Canada Limited	$ 84 6	100%	$ 84 6	$ 54 1	$ 54 1	June 30, 1977	1963	Q
5	Sperry Univac Computer Systems, Division of Sperry Rand Canada Ltd	$ 66 0	35%	$ 188 0	$ 60 0	$ 180.0	March 31, 1977	1956	(Q)L
6	Burroughs Business Machines, Ltd	$ 59 0	80%	$ 74 0	$ 46 0	$ 58 3	Dec. 31, 1977	1917	E.R C.
7	Honeywell Information Systems	$ 57 0	100%	$ 57 0	$ 45 0	$ 45 0	Dec. 31, 1977	1958	(A.R) E
8	Canada Systems Group	$ 26 4	100%	$ 26 4	$ 23 79	$ 23.79	Dec. 31, 1977	1971	Q
9	Hewlett-Packard (Canada) Ltd.	$ 23.1	42%	$ 54 9	$ 18 01	$ 42 9	Oct. 31, 1977	1961	(A R.) E
10	Amdahl Limited	$ 22 0	100%	$ 22 0	$ 22 0	$ 22.0	Dec 31, 1977	1977	(Q.)E
11	Systems Dimensions Limited	$ 21.0	100%	$ 21 0	$ 18 0	$ 18.0	June 30, 1978	1968	Q
12	MAI Canada, Ltd.	$ 20 9	100%	$ 20 9	$ 16 00	$ 16 00	Sept 30, 1977	1965	Q
13	Datacrown Limited	$ 20 0	100%	$ 20 0	$ 15 8	$ 15 8	Dec. 31, 1977	1971	Q
14	Canadian General Electric Co. Ltd	$ 19.2	1.8%	$1,079 7	$ 15 5	$ 861.1	Dec. 31, 1977	1892	E.R C.
15	Multiple Access Computer Group	$ 18 84	100%	$ 18.84	$ 15 68	$ 15.68	March 31, 1977	1967	Q
16	Consolidated Computer Inc.	$ 18 81	100%	$ 18.81	$ 25 3	$ 25 3	Dec. 31, 1977	1968	A/R
17	Computel Systems Ltd.	$ 15.9	100%	$ 15.9	$ 11 7	$ 11 7	Dec 31, 1977	1967	A/R
18	I P. Sharp Associates Limited	$ 14 7	100%	$ 14.7	$ 10 15	$ 10 15	Dec. 31, 1977	1964	Q
19	Philips Electronics Limited	$ 14.1	10%	$ 141 14	$ 13 8	$ 138 0.	Dec. 31, 1977	1941	E
20	TRW Data Systems	$ 13 2	100%	$ 13 2	$ 9.8	$ 9.8	Dec 31, 1977	1971	Q
21	Memorex Canada Limited	$ 12 24	90%	$ 13 6	$ 8.82	$ 9 8	Dec. 31, 1977	1978	Q
22	IST – Industrial Life-Technical Services, Inc.	$ 12 2	100%	$ 12 2	$ 5 1	$ 5 1	Dec. 31, 1977	1974	Q
23	Data 100 (Canada) Limited	$ 12 0	100%	$ 12.0	N/A	N/A	Dec. 31, 1977	1968	Q
24	Data General (Canada) Ltd.	$ 10 5	100%	$ 10 5	$ 7 4	$ 7.4	Sept. 25, 1977	1970	E.R C.
25	Systemhouse Ltd	$ 10 0	100%	$ 10 0	$ 6 79	$ 6.79	Aug 31, 1977	1974	Q
26	Computer Sciences Canada, Ltd	$ 9.0	100%	$ 9 0	$ 7.5	$ 7 5	March 31, 1978	1966	Q
27	Saskcomp	$ 7.2	100%	$ 7.2	$ 5 6	$ 5.6	Dec. 31, 1977	1973	Q
28	ICL Computers Canada Ltd	$ 6.5	100%	$ 6 5	$ 5 0	$ 5.0	Sept. 30, 1977	1968	E
29	Manitoba Data Services	$ 6.2	100%	$ 6.2	N/A	N/A	March 31, 1977	1976	Q
30	Tulsa Computer Products Ltd.	$ 6 0	100%	$ 6.0	$ 5 0	$ 5 0	March 31, 1978	1973	Q
31	Geac Canada Limited	$ 5.5	100%	$ 5.5	$ 2.7	$ 2.7	April 30, 1977	1971	Q
31	Greyhound Computer of Canada	$ 5 5	100%	$ 5 5	$ 4 8	$ 4.8	Dec. 31, 1977	1968	Q
32	Aquila BST (1974) Ltée/Ltd	$ 5.42	100%	$ 5.42	$ 8 64	$ 8.64	August 31, 1977	1964	C.C.A
33	Comshare Limited	$ 5.4	100%	$ 5 4	$ 3.9	$ 3 9	Dec. 31, 1977	1968	Q
34	SDI Associates Ltd.	$ 5 1	100%	$ 5.1	$ 4.94	$ 4.94	Dec. 31, 1977	1966	Q
35	Dataline Systems Limited	$ 4 9	100%	$ 4.9	$ 4 27	$ 4.27	Dec 31, 1977	1968	Q
36	Boothe Computer, Ltd	$ 4 8	100%	$ 4 8	$ 4 79	$ 4.79	Dec 31, 1977	1968	Q
37	Alphatext Limited	$ 4.7	100%	$ 4 7	$ 4.0	$ 4 0	Dec 31, 1977	1969	C.C.A.
38	Digitech Ltd.	$ 4.4	100%	$ 4.4	$ 4 04	$ 4.04	June 30, 1977	1973	Q
39	California Computer Products of Canada Ltd.	$ 4.2	100%	$ 4.2	N/A	N/A	June 30, 1977	1977	Q
39	Perkin-Elmer Data Systems of Canada Ltd.	$ 4.2	100%	$ 4.2	$ 2.7	$ 2.7	June 30, 1977	1971	Q
40	Newfoundland & Labrador Computer Services	$ 4.1	100%	$ 4.1	$ 3.8	$ 3.8	March 31, 1978	1969	Q

TABLE 2.1 TOP 73 Canadian EDP Companies

Rank	Company Name	1977 EDP Revenue ($ M)	1977 EDP Revenue % of Total	1977 Total Revenue	1976 EDP Revenue	1976 Total Revenue	Fiscal Year Ending	Incorporation Date	Code
41	Tektronix Canada Limited	$ 3.74	22%	$ 17 0	$ 2 86	$ 13 0	May 31, 1977	1961	(Q)F
42	Comtech Group International Ltd	$ 3 73	100%	$ 3 73	$ 3 72	$ 3 72	June 30, 1977	1963	Q
43	National Datacentre Corp	$ .36	100%	$ 3 6	$ 3 4	$ 3.4	March 31, 1977	1950	C D.P.D
44	CMI Corporation	$ 3 52	100%	$ 3 52	$ 4 05	$ 4 05	Dec. 31, 1977	1969	Q
45	Computrex Centres Ltd	$ 3.5	100%	$ 3 5	$ 3.3	$ 3.3	March 31, 1977	1959	Q
45	Datatech Systems Limited	$ 3 5	100%	$ 3 5	N/A	N/A			C.D P.D
46	Gandalf Data Communications Ltd	$ 3 1	100%	$ 3 1	$ 2 4	$ 2 4	July 31, 1977	1971	Q
47	Cygnet Computer Group Ltd	$ 3 04	95%	$ 3 2	$ 2 09	$ 2.2	Dec. 31, 1977		Q
48	Systems Approach Limited	$ 3 0	100%	$ 3 0	$ 1 6	$ 1 6	Dec 31, 1977	1973	Q
48	Dearborn Computer Company	$ 3.0	100%	$ 3.0	$ 2.5	$ 2 5	Dec. 31, 1977	1967	Q
49	Quasar Systems Limited	$ 2 98	100%	$ 2.98	$ 2 12	$ 2 12	Aug. 31, 1977	1969	Q
50	Xerox of Canada Limited	$ 2 94	10%	$ 294 0	$ 2 51	$ 251 0	Dec 31, 1977	1953	(Q)E
51	Comten Inc.	$ 2 88	100%	$ 2 88	$ 31	$ .31	Dec. 31, 1977	In process	Q
52	Riley's Datashare International Ltd.	$ 2.80	100%	$ 2.80	$ 2.7	$ 2.7	May 31, 1977		E.R C.
53	Real Time Datapro Limited	$ 2.58	100%	$ 2 58	$ 2 13	$ 2 13	Feb. 28, 1978	1962	Q
54	Tyme Systems Limited	$ 2 5	100%	$ 2 5	$ 1 8	$ 1.8	April 30, 1978	1973	Q
55	Pertec Computer Corp (Canada) Ltd	$ 2 2	100%	$ 2 2	N/A	N/A	May 31, 1977	1973	E
56	National Data Company	$ 2 005	100%	$ 2 005	N/A	N/A	May 31, 1977	1970	Q
57	Automation Centre of Ottawa Ltd	$ 2 0	100%	$ 2 0	$ 1.0	$ 1 0	Dec 31, 1977	1964	Q
57	Teldata	$ 2 0	100%	$ 2 0	N/A	N/A	Dec 31, 1977	1972	Q
57	Dasco Data Products Ltd	$ 2.0	80%	$ 2.5	$ 1.5	$ 1.75	Sept 30, 1977	1963	Q
58	Polycom Systems Limited	$ 1 99	100%	$ 1 99	$ 1 47	$ 1 47	Sept 30, 1977	1968	Q
59	York-Ryerson Computing Centre	$ 1 96	99%	$ 1 97	$ 1.60	$ 1 62	Dec 31, 1977	1973	Q
60	SNC Computation Limited	$ 1 9	100%	$ 1 9	$ 2 0	$ 2 0	Dec 31, 1977	1962	Q
61	Integrant Minicomputers	$ 1 87	100%	$ 1 87	$ 1 05	$ 1 05	Oct. 31, 1977	1974	Q
62	D E. McMullen & Associates Ltd	$ 1 8	100%	$ 1 8	$ 1 0	$ 1 0	Nov 30, 1977	1966	Q
62	Norpak Limited.	$ 1 8	100%	$ 1 8	N/A	N/A			E
63	Nelma Electronics Limited	$ 1 71	90%	$ 1 9	$ 40	$ .48	June 30, 1977	1973	Q
64	SED Systems Limited	$ 1 705	31%	$ 5 536	$ 1 2	$ 4 3	June 30, 1977	1972	Q
65	Courier Terminals	$ 1 7	100%	$ 1 7	$ 1 2	$ 1 2	Dec. 31, 1977	1976	Q
66	Dial Data Services Ltd	$ 1 5	100%	$ 1 5	N/A	N/A		1971	C D P D
66	Volker-Craig Limited	$ 1 5	88%	$ 1 7	$ 8	$ 9	Aug 31, 1977	1973	Q
67	Associated Computer Services Ltd	$ 1 32	100%	$ 1 32	N/A	N/A		1969	C D P D
68	Cincom Systems of Canada	$ 1 3	100%	$ 1 3	$ 1 1	$ 1 1	Sept 30, 1977	1971	F R C.
68	Data Terminal Mart	$ 1 3	100%	$ 1 3	N/A	N/A	June 30, 1978	1977	Q
69	Computer Utility Management Ltd. (GUMI)	$ 1 22	100%	$ 1 22	$ 1 09	$ 1 09	Oct 31 1977	1968	Q
70	Comcheq Services Ltd	$ 1 19	100%	$ 1 19	N/A	N/A	May 31, 1977	1968	Q
71	Maritime Computers Limited	$ 1 1	100%	$ 1 1	$ 8	$ 8	May 31, 1977	1976	C.D P D
72	Calculus, Cie	$ 1 04	100%	$ 1 04	N/A	N/A	Dec 31, 1977	1967	C D P D
73	Wabash Tape (Canada) Ltd	$ 1.0	100%	$ 1 0	$ 5	$ .5	Dec 31, 1977	1972	Q
73	University Computing Co	$ 1 0	100%	$ 1.0	N/A	N/A	Dec. 31, 1977	1976	E
	Totals	**$1,770.9**		**$3,658.3**	**$1,485.7**	**$3,075.8**			

CODE: A/R – Annual Report, C C A – Dept of Consumer & Corporate Affairs, E – Estimate, E R C. – Evans Research Corp , Q – Questionnaire

[redacted] business computers & programmable calculators

Manufacturer	Internal Storage	Word Size (bits)	Software
Basic Four	32K-65K	8	B,O
Burroughs	4K-378K	8-64	A,B,C,F,RPG,O
Century Computer	32K-240K	8-16	B,O
Cincinnati Milacron	32K-96K	16	RPG,O
Compucorp	12K-16K	64	O
Computer Hardware	8K-256K	16	B,C,F,RPG,O
Data General	96K-256K	16	B,C,F,RPG,O
Datapoint	4K-48K	8	B,RPG,O
Digital Computer Controls	48K-1M	16	B,C,F,O
Digital Equipment	16K-4M	12-64	B,C,F,RPG,O
Digital Scientific	16K-25K	16+2	F,O
Fedder	24K-256K	8	B,O
Four-Phase	24K-96K	24	C,RPG,O
Hewlett-Packard:			
Calculator Products*	3K-32K	8	B,O
Data Systems**	4K-608K	16	A,B,F,O
General Systems	96K-512K	16	B,C,F,RPG,O
Honeywell	5K-256K	8	B,C,F,RPG,O
IBM	8L-256K	8-16	APL,B,C,F,RPGII,
Litton/Sweda	16K-40K	16	B,O
Logical Machine	32K-64K	16	O
Microdata	16K-1M	16	B,C,F,RPG,O
Monroe Calculator***	532 steps		
Mylee Digital Sciences	56K-152K	16	O
NCR	8K-128K	8-64	B,C,F,RPGII,O
Nixdorf	6K-24K	12	O
Olivetti	8K-48K	8+1	B,O
Prime Computer	8K-8M	16	C,F,RPG,O
Sperry Univac	32K-64K		RPG,O
Texas Instruments*	960 steps		
Wang Laboratories	4K-32K	8	B,O
Wintex	8K-64K	8	O

**Hand-held programmable, or pre-programmed calculators, or both*
***Desk-top programmable calculators*
****Hand-held and desk-top programmable calculators*

A: ALGOL—an algorithmic and procedure-oriented language used principally in programming scientific problems.
APL: A Programming Language—a mathematical problem-solving language, designed for use with remote terminals.
B: BASIC—a procedural-level computer language, that permits the use of simple English words, abbreviations, and familiar mathematical symbols to perform logical and arithmetic operations, best suited for use with an interactive terminal.
C: COBOL—a procedure-oriented language used in programming commercial and business problems.
F: FORTRAN—a family of procedure-oriented languages used mostly for scientific or algebraic applications.
RPG (RPG II): Report Program Generator (II)—a non-procedural language that generates programs from the programmer's specifications to produce business reports.
O: OTHERS—assemblers, accounting packages, data base management, and various proprietary programs.

TABLE 2.2

Small Business Computers and Programmable Calculators [1]

MODEL	DESCRIPTION	MAIN MEMORY	STORAGE	PERIPHERAL/ SPECIAL FEATURES	SOFTWARE (Application Programs)	HARDWARE COST RANGE
IBM System/ 32	Basic System Consists of a Central processor with disk storage capacity, display screen, key board, print capability and multiple input/output media capability. - Diskette I/O, system 32 reads at the rate of 3,400 records (128 byte)/minute. - Keyboard is integrated operator console is a familiar typewriter arrangement - Display screen is a Cathode ray tube (CRT) device with a 64 character set and six lines of 40 characters each per screen.	16K capable of increasing to 32K	Direct access disk storage capacity. Following ranges are available 3.2, 5.0, 9.1 or 13.7 million bytes	Print Capability: - Line print capability available in 4 models. 50 lines/min. 100 lines/min. 155 lines/min. 285 lines/min. (48 character set) - Four point continuous form printing at 64 character set - Magnetic ink character reader (MICR) is provided as an optional feature - Attachment capability of either an IBM 5496 or 129 Data recorder allows preprocessing of punched cards. - The IBM 5321 Mag Card reader may be attached to allow reading from or writing to Mag Cards compatible with IBM Mag Card typewriters.	System/32 application programs are provided in two forms, either as general program or as industry application programs. A list of these programs currently available has 26 industry application programs one of which is CMAS.	The system leases for about $900 per month. Purchase price starts at $38000.
IBM system/ 34 (IBM 5390 system unit)	Single enclosure containing the processing unit, disk storage capacity, diskette input/output capabilities, and work station controller	32K can be increased to 48K, 64K, 96K or 128K	The base 5340 unit includes 8.6 million bytes of direct access disk storage housed inside. This can be increased to 13.2 or 27.1 million bytes	- IBM 5211 Printer Model 1. 1160 lines/min. Model 2. 2300 lines/min. (48 character set) - IBM 1255 MICR- optional feature to allow reading		The system typically leases for about $1300 per month. Base purchase price starts at $41600

TABLE 2.3

IBM - System/32 & System/34 Configuration

MODEL	DESCRIPTION (BASE SYSTEM)	MAIN MEMORY	STORAGE	PERIPHERALS/ SPECIAL FEATURES	SOFTWARE	COST RANGE	REMARKS
499	- Processor - Magnetic ledger - one continuous form feeders 2 casettes readers	16K to 32K	MAG/LED 1,546 num: character Casette 282 inch 150,000 character Alphanumeric Disc - 10M Bytes	- Line Printer 125 lines/min. 200 lines/min. 300 lines/min. - Card Reader - Disk Unit	Construction Acctg. Package Language, NEAT	$23,950 to $54,000	Base System Cost $23,950. With an addition of line printer cost goes up to $54000. (No longer in production)
8150	Processor Disc unit of 5M Bytes Printer cartage CRT 9".	48K expandable to 64.	Disc storage cartage casette Disquette	All printers communications can go up to 10 CRTS	Construction Accounting Package 7 Modules - Language COBOL	$30,000 to $55,000	
8250	Processor Disk units display terminal Printer Magnetic tape - handlers and flexible disk	48K expandable to 128K in 16K increments	Disks 80M bytes Fixed and removable storage	Matrix printers line printers up to 600 L.P.M. Casettes Magnetic tape channels Diskettes	Construction Accounting Package 7 Modules - Language COBOL	$44,000 to $150,000	

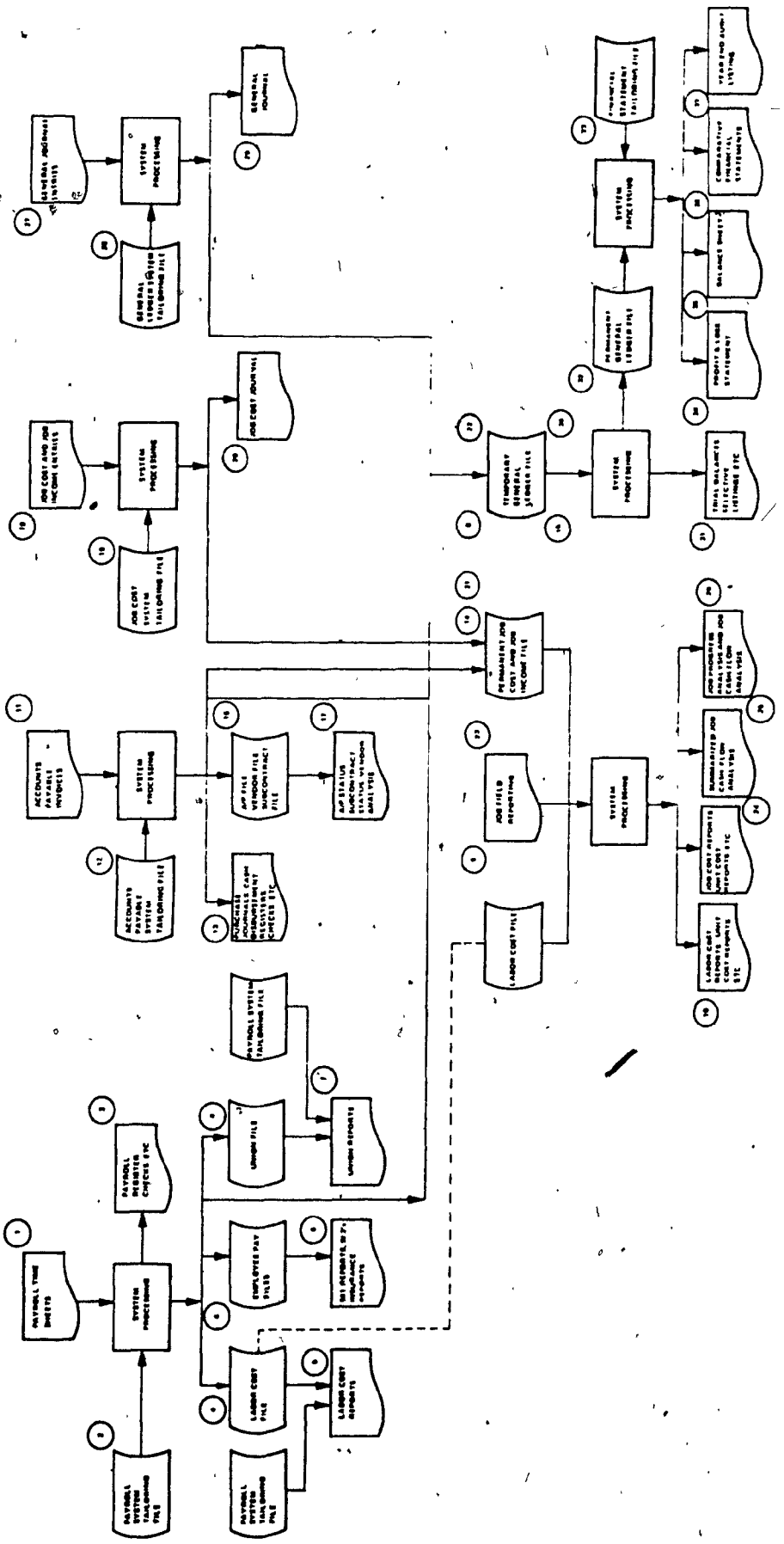
TABLE 2.4

NCR Configurations for Systems 499, 8150 and 8250

	SALIENT HARDWARE FEATURES	MEMORY	DISK STORAGE	OTHER FEATURES	PROGRAM APPLICATION
B80-21/121	- Main Processor - System Display - 60ch: /minute matrix printer - Super mini disk sub-system - cartridge subsystem - Fixed disk sub-system	60K to 124K in 16K increments	up to 4M bytes up to 18.4M bytes up to 18.8M bytes or 1M Bytes of super mini disk inbuilt.	- Mini disk drive of 243,000 bytes per single drive is optional - Line Printer (optional) - Combination system printer and built-in line printer. - Terminal system (optional)	CMS is an integrated software system designed to provide identical procedures and results for Burroughs interpretive computers. CMS includes: 1. Master Control Program Main activities include: a. Location of files. b. Data transfer c. Buffer Management d. Automatic label recognition e. Error monitoring f. Automatic retry or error detection 2. Data Control System It is an application development aid designed to provide the following data handling capabilities: a. Interactive data entry b. File creation c. File maintenance d. Inquiry 3. CMS Reporter Data to be reported may be selected based on: a. Record type b. Ranges of records c. Conditions d. Data calculated during each run. 4. High level languages and compilers a. Network Definition Language (NDL) Compiler simplifies the implementation of data communications networks. b. Message Processing Language II (MPL II) Compiler generates programs to process, edit, collect, verify, route and audit messages. c. On board COBOL compiles d. On board PPG compiles.
B80-64/164	- Main Processor - System Display - 180ch/minute - Super mini disk sub-system - cartidge disk subsystem - Fixed disk subsystem	60K to 124K in 16K increments	up to 6M bytes up to 27.6M bytes up to 37.6M bytes	- same as above	

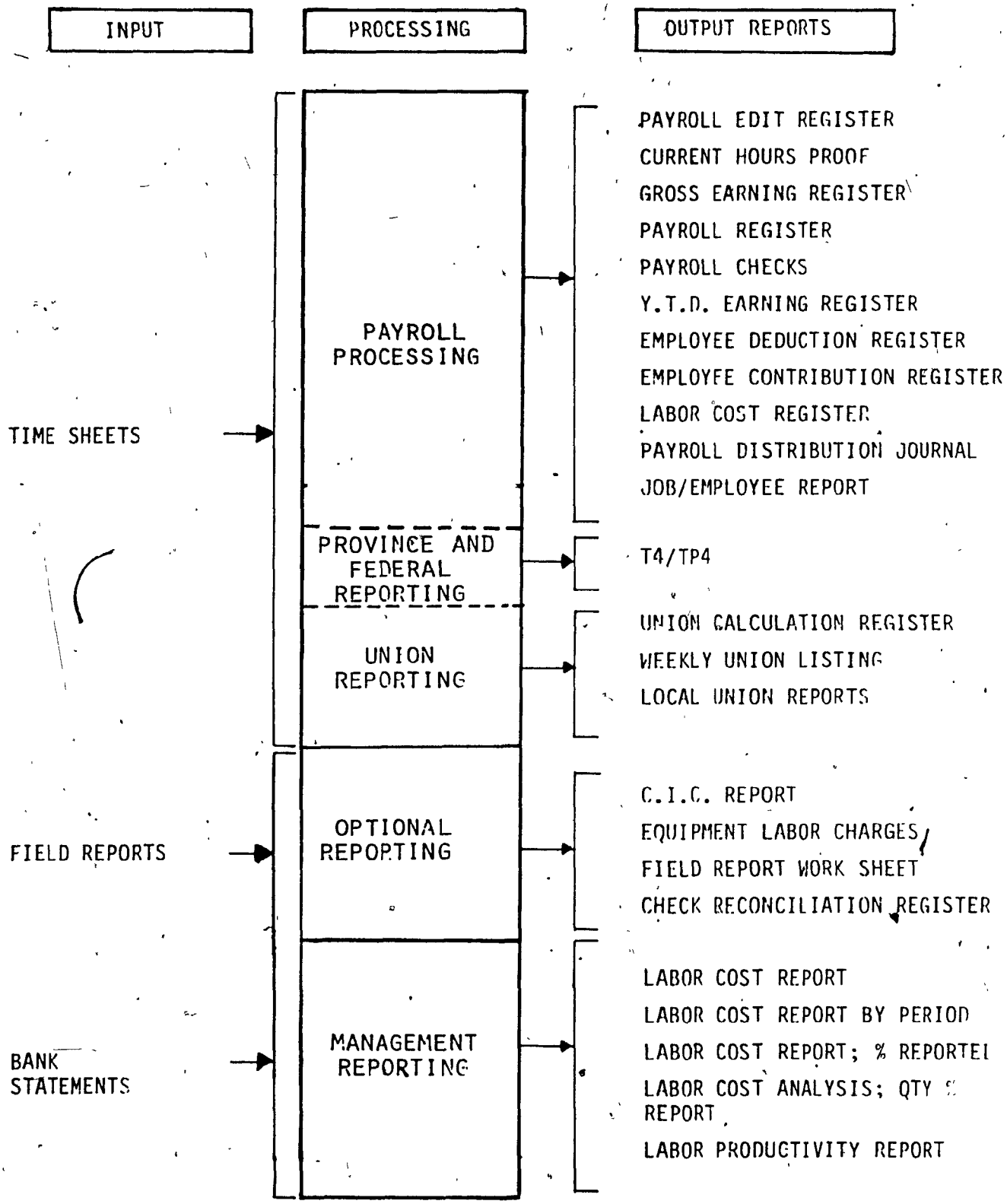
TABLE 2.5

Burroughs - Configurations for Systems B80-21/121 and B80-64/164



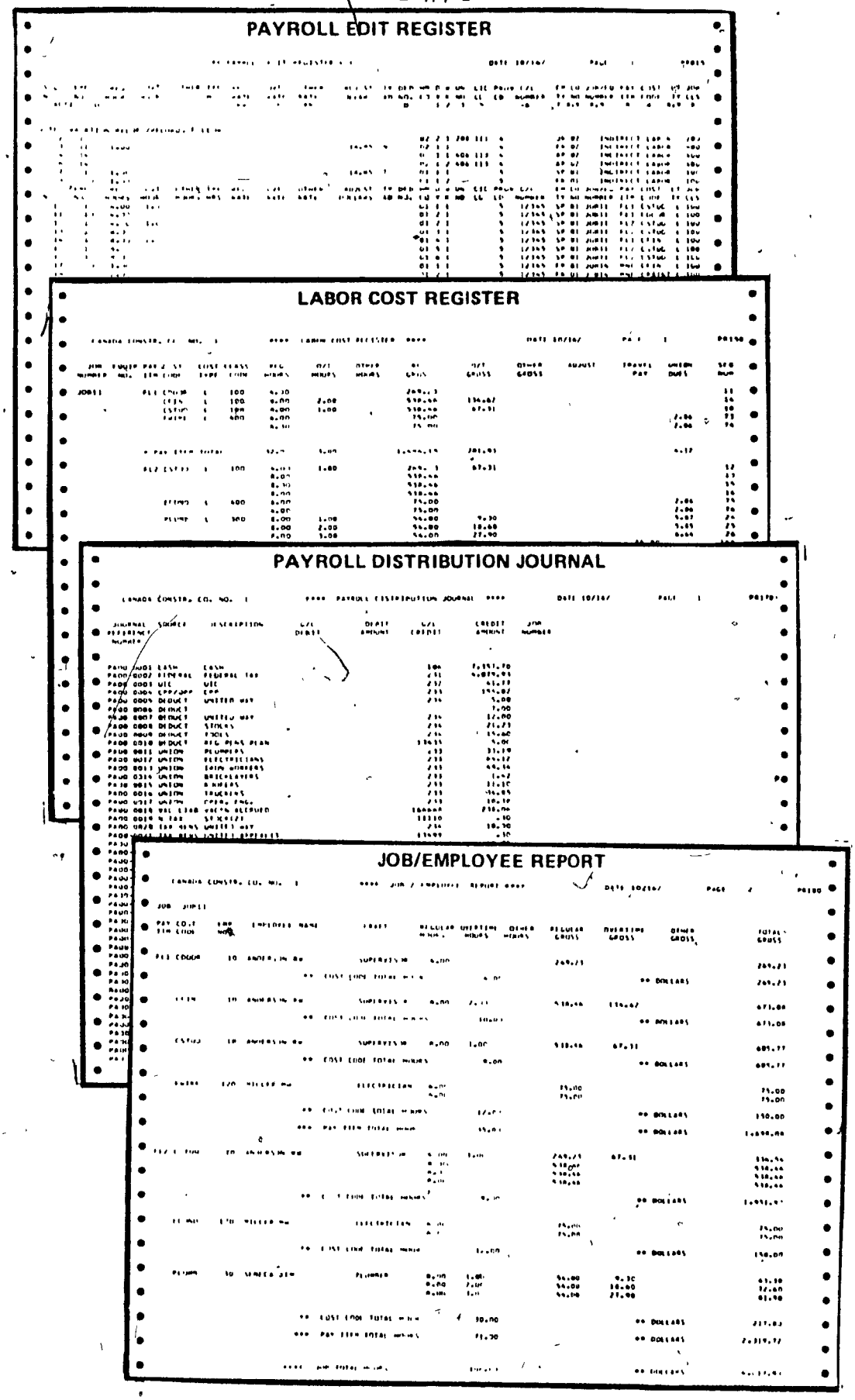
IBM - SYSTEM/32 - CMAS FLOW CHART

FIG. 2.1



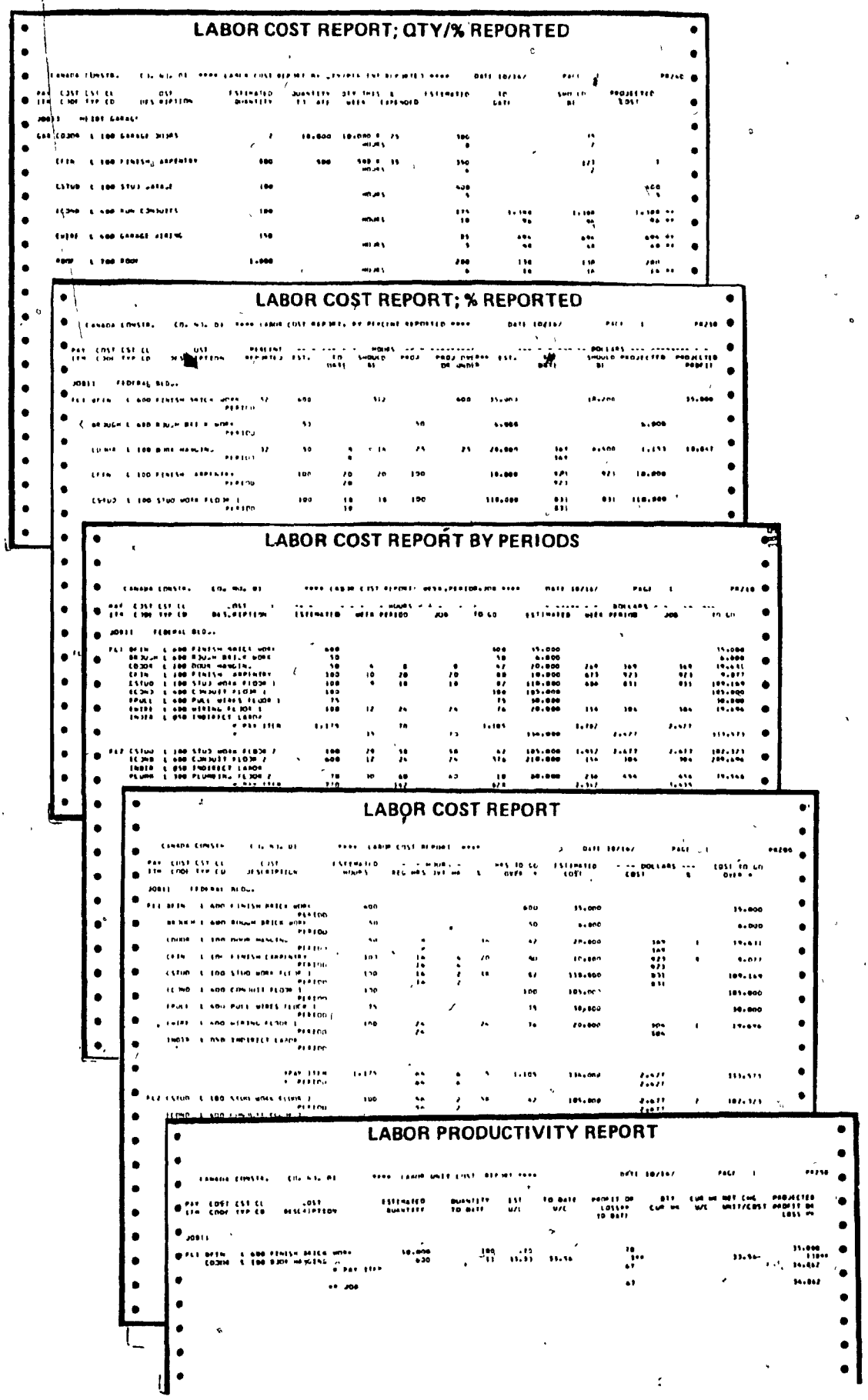
IBM - CMAS
PAYROLL MODULE SYSTEM FLOW

FIG. 2.2



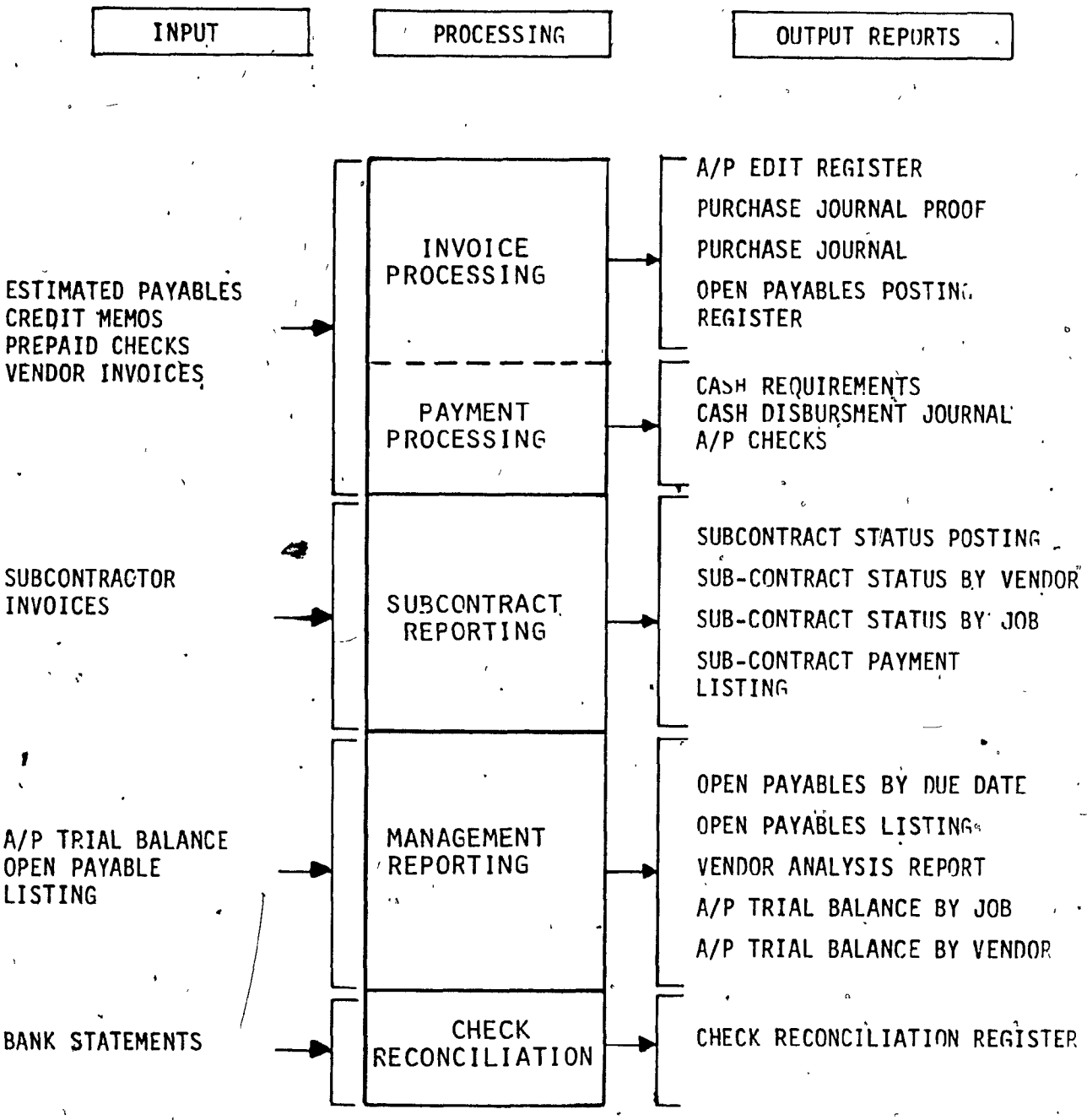
EXAMPLE REPORTS PAYROLL PROCESSING

FIG. 2.3



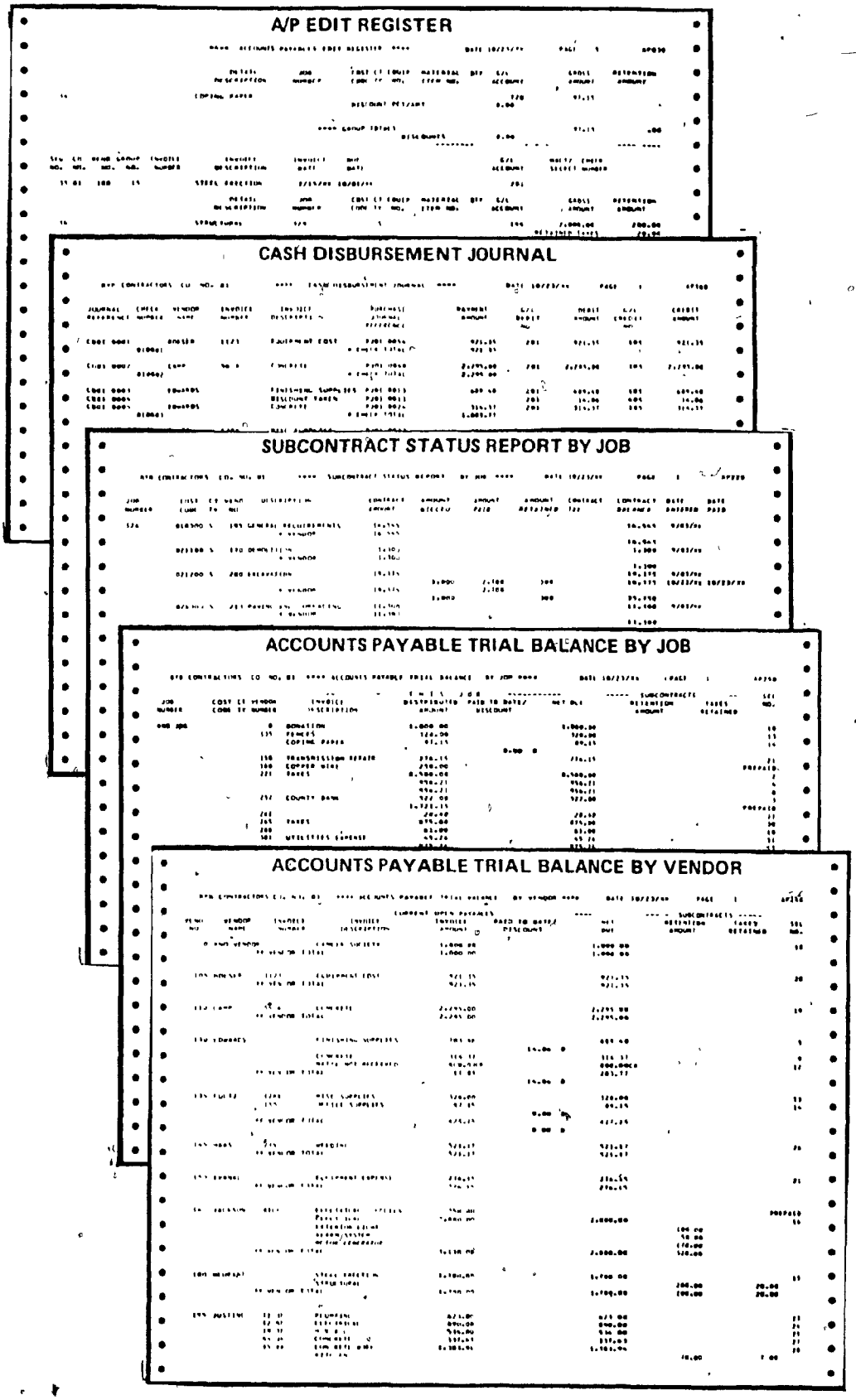
EXAMPLE REPORTS MANAGEMENT REPORTING

FIG. 2.4



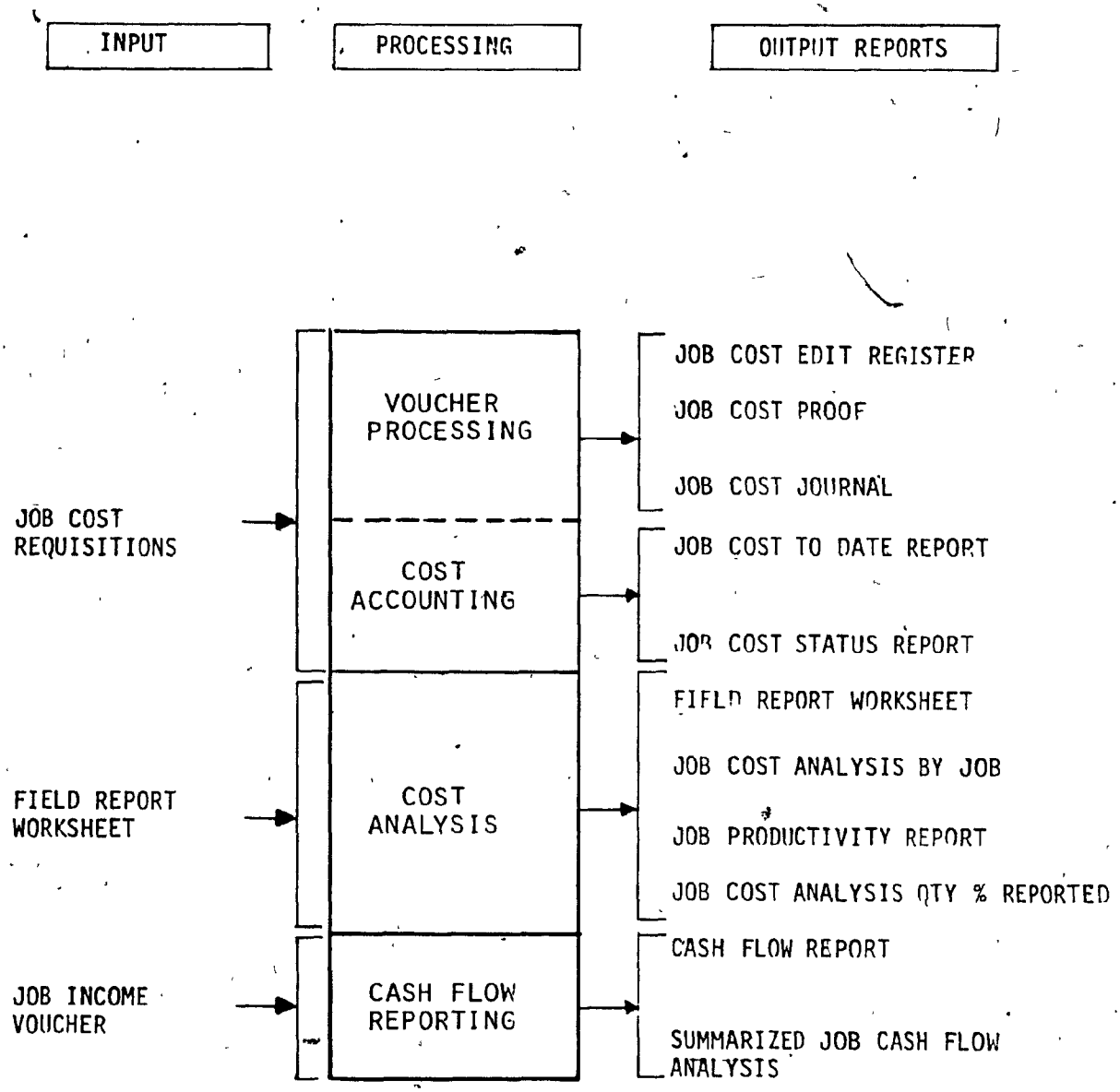
IBM - CMAS
ACCOUNTS PAYABLE MODULE SYSTEM FLOW

FIG. 2.5



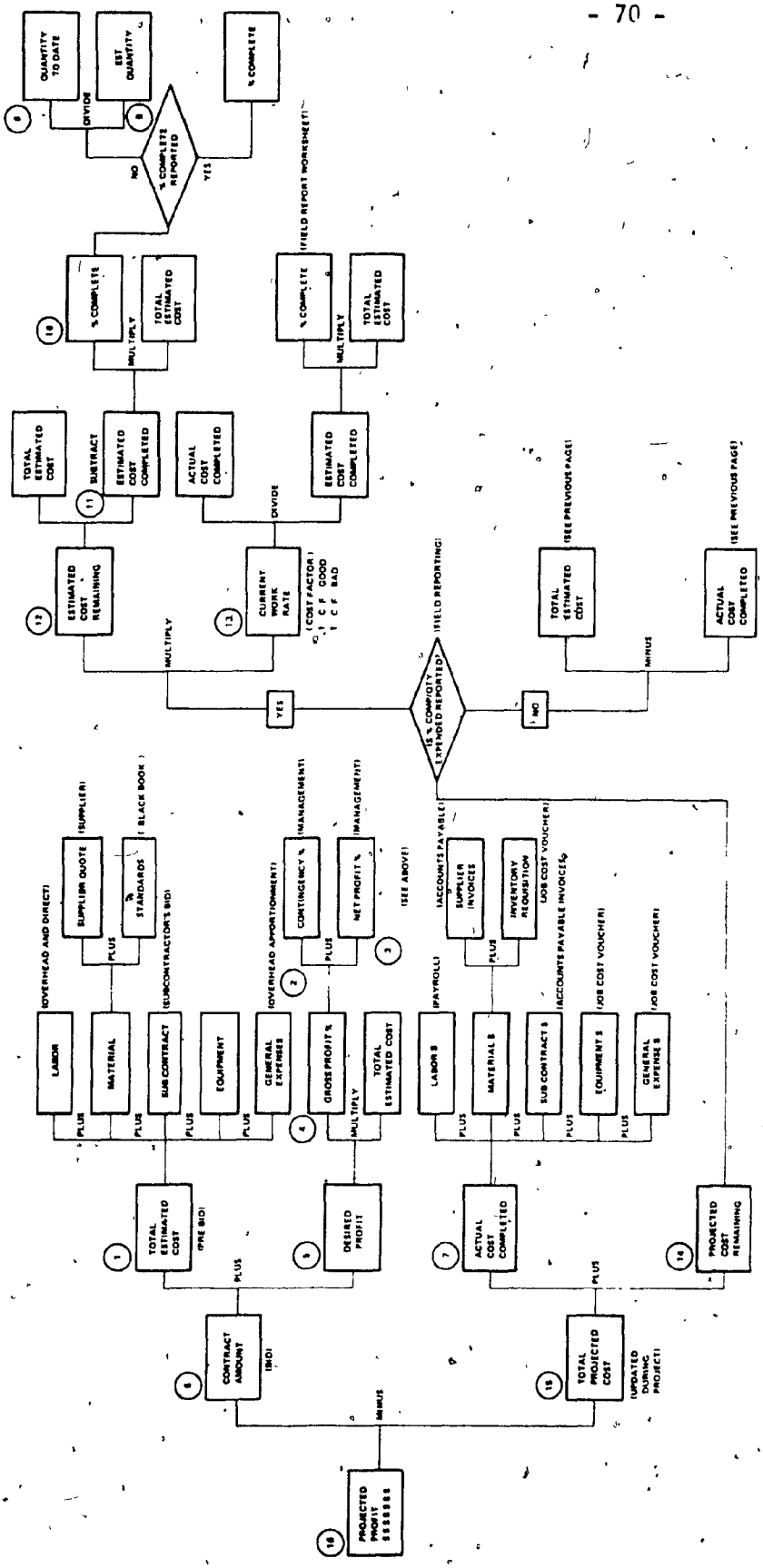
EXAMPLE REPORTS - ACCOUNTS PAYABLE MODULE

FIG. 2.6



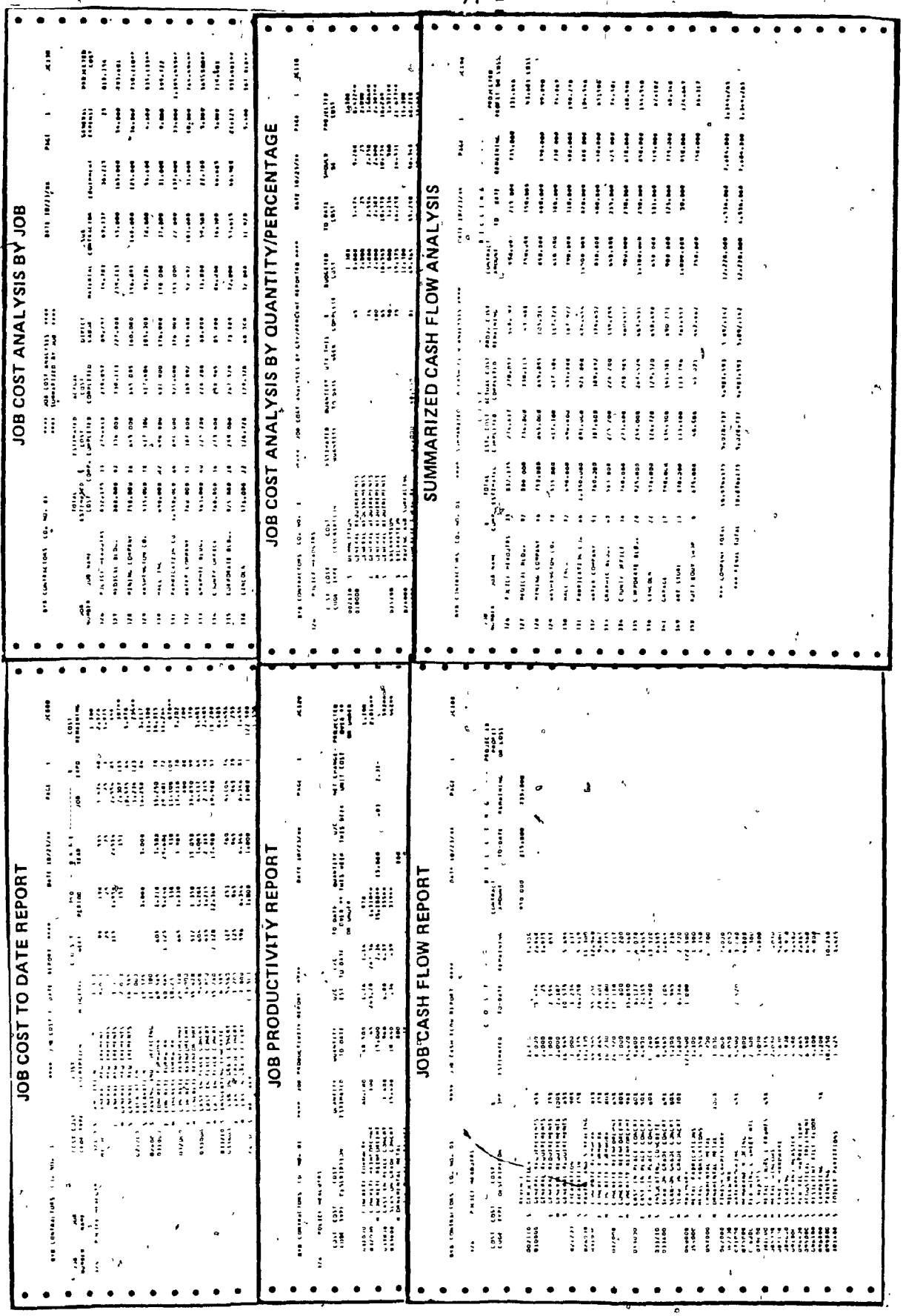
IBM - CMAS
JOB COSTING MODULE SYSTEM FLOW

FIG. 2.7



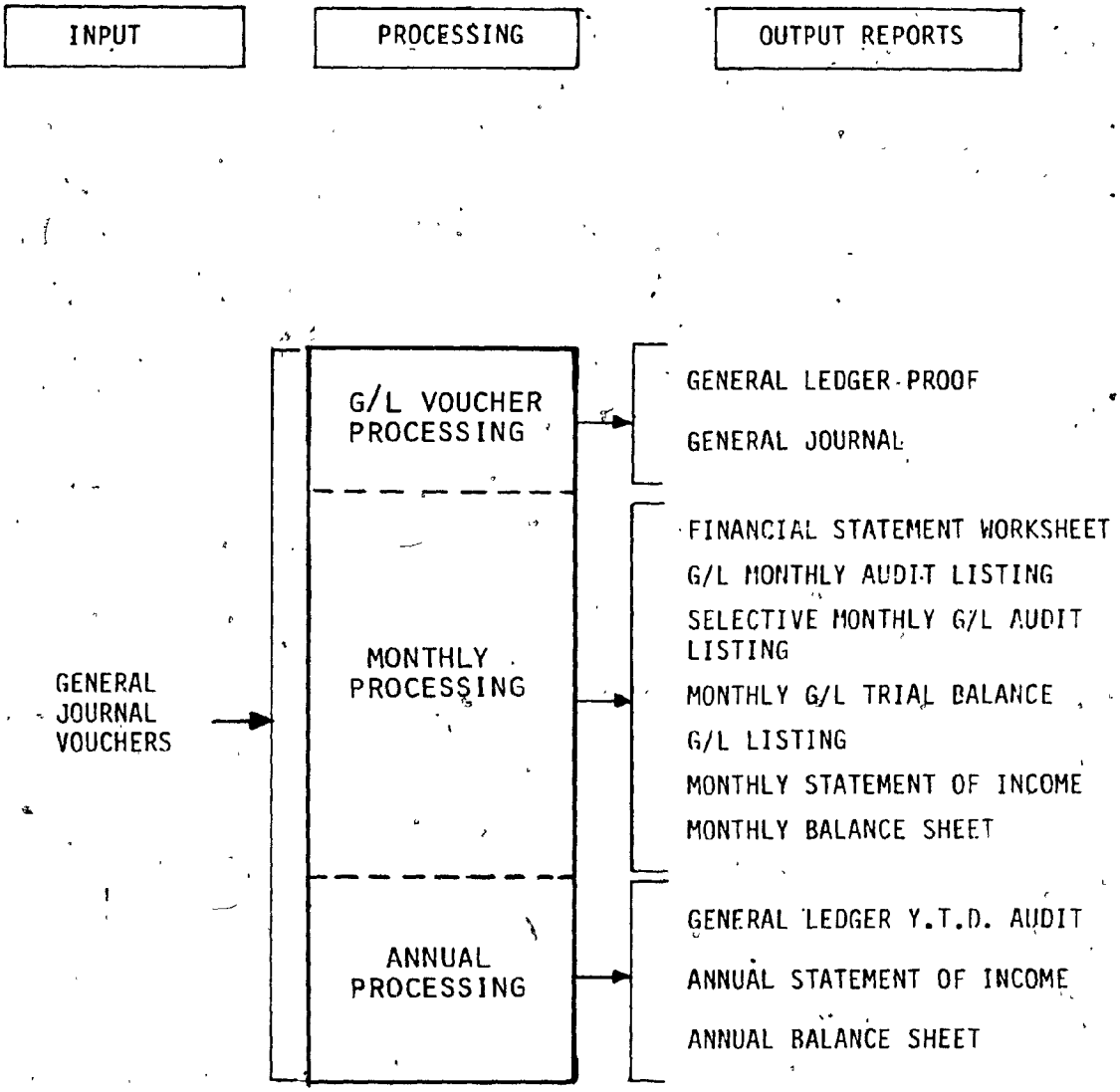
CMAS - JOB COST MODULE - FLOW OF CALCULATIONS

FIG. 2.8



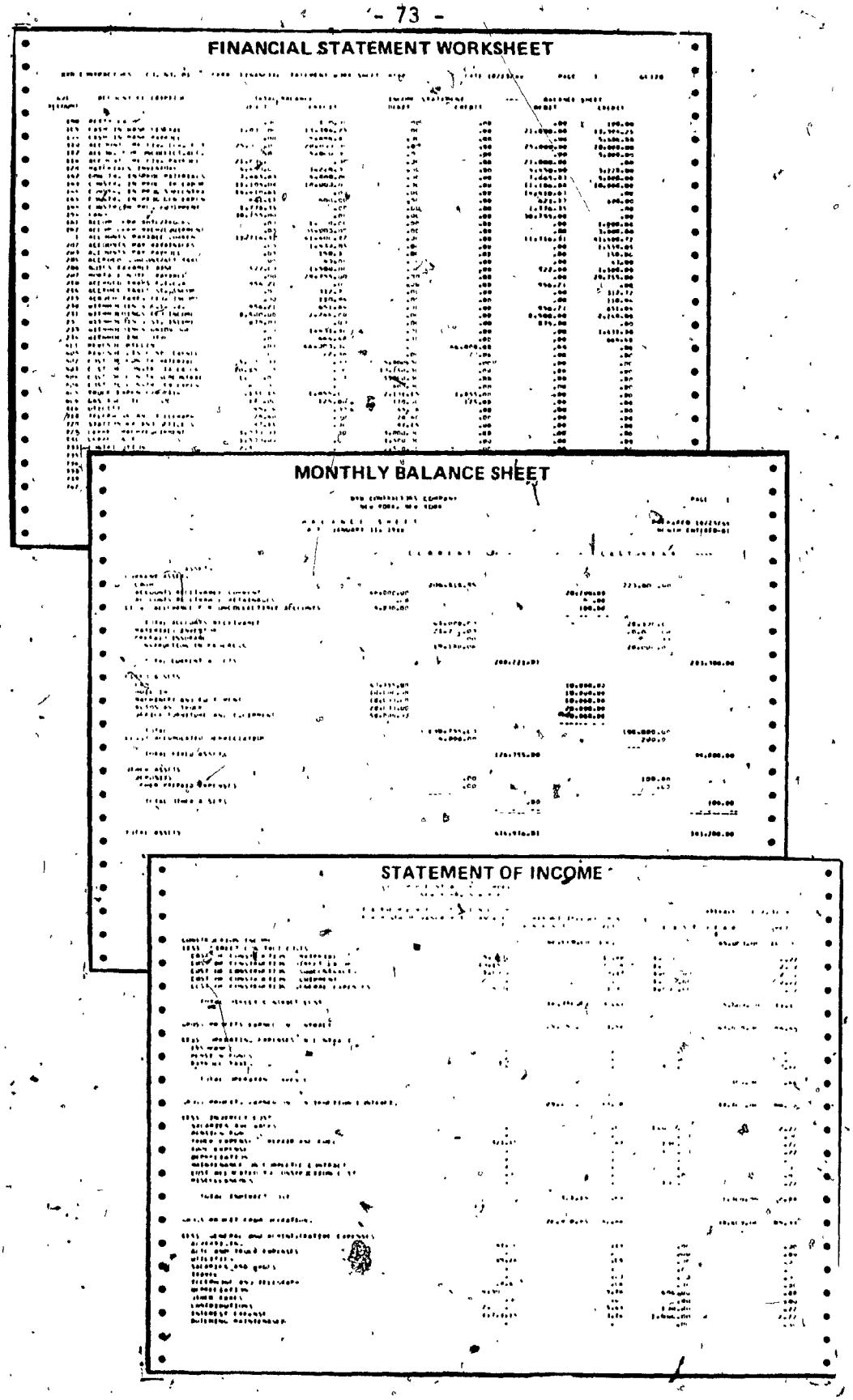
EXAMPLE REPORTS - JOB COST MODULE

FIG. 2.9.



IBM - CMAS
GENERAL LEDGER MODULE SYSTEM FLOW

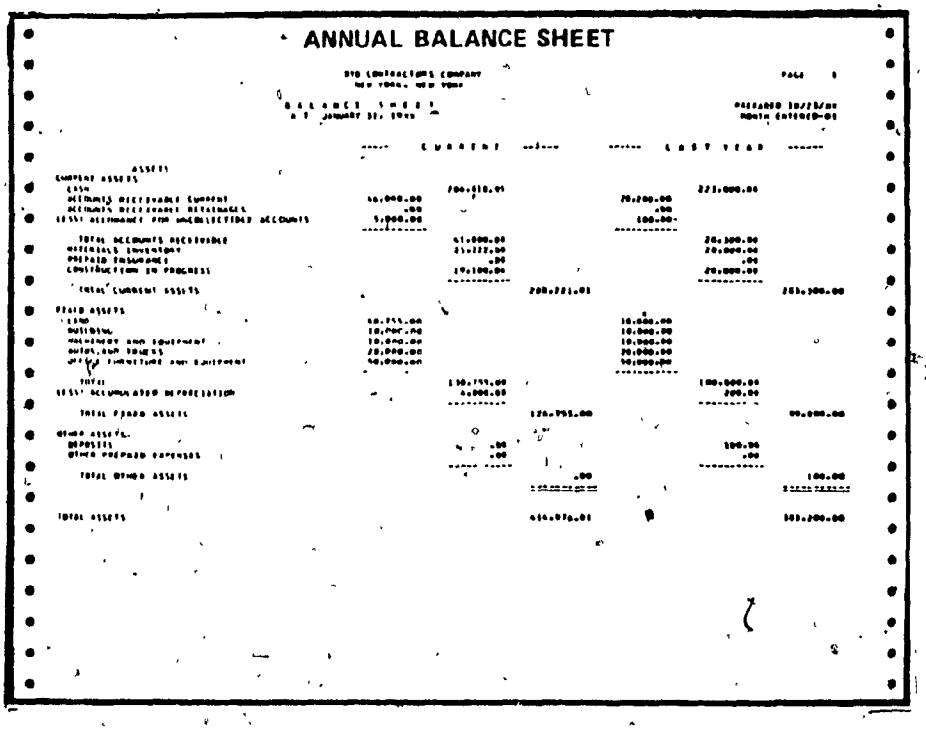
FIG. 2.10



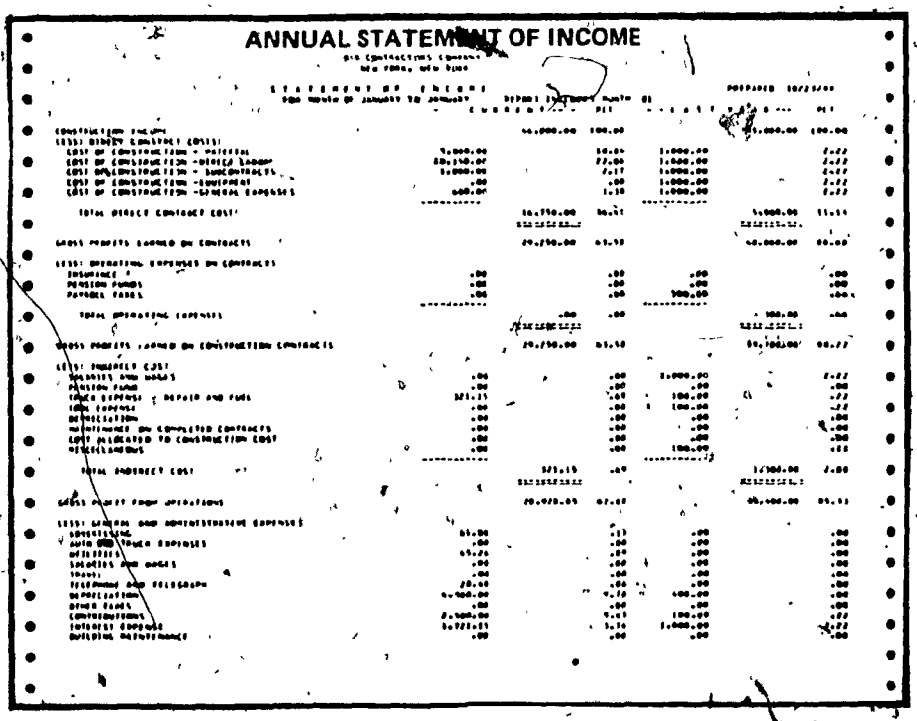
EXAMPLE REPORTS G/L MODULE

FIG. 2.11

ANNUAL BALANCE SHEET

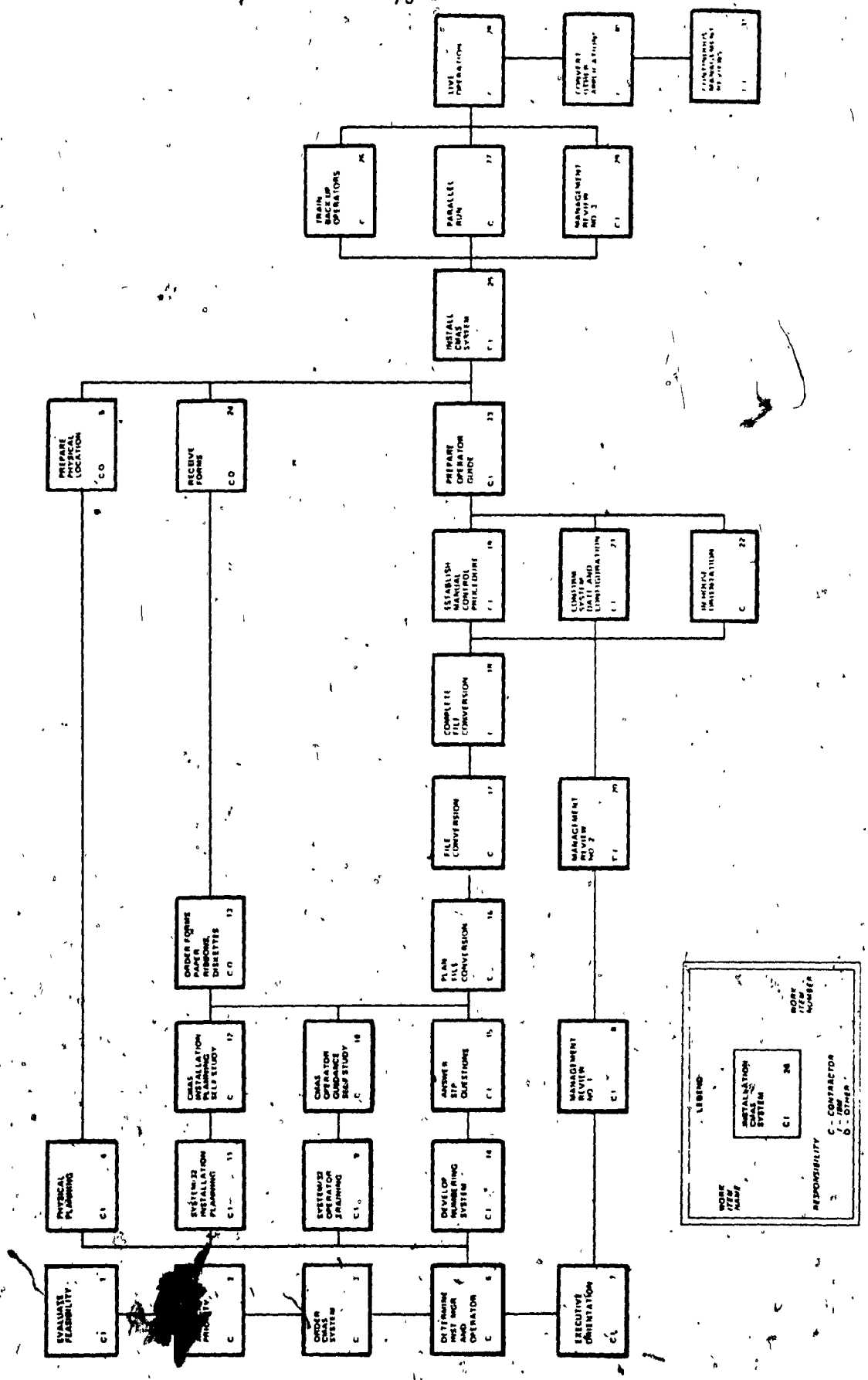


ANNUAL STATEMENT OF INCOME



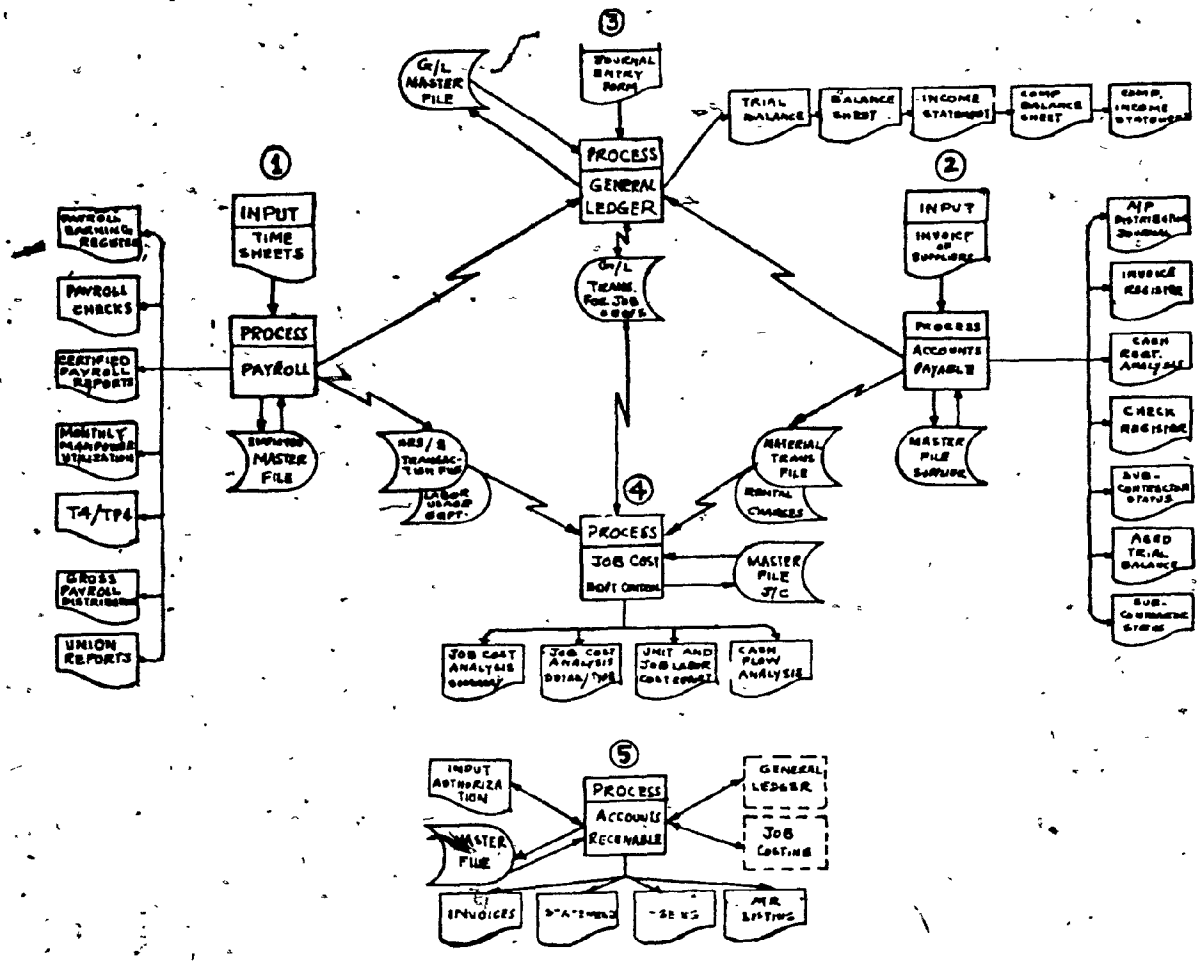
EXAMPLE REPORTS G/L MODULE

FIG. 2.12



IBM - SYSTEM/32 IMPLEMENTATION PLAN

FIG. 2.13



NCR - Construction Management System flow Chart (CMS)

FIG. 2.14

GROSS PAYROLL DISTRIBUTION — 11-23-7- — PAGE 001

EMP NO	DAY	JOB	CODE	REG HRS	OT HRS	DT HRS	TT HRS	REG PAY	OT PAY	DT PAY	TT PAY	PREM	FRINGES	TRAVEL	OTH EARN	OTH HRS
101	1	1000	2240	8.00	.00	.00	.00	82.04	.00	.00	.00	.00	18.00	.00	.00	.00
101	2	1000	2240	8.00	.00	.00	.00	82.04	.00	.00	.00	.00	18.00	.00	.00	.00
101	4	1000	2270	4.00	.00	.00	.00	41.02	.00	.00	.00	.00	9.00	.00	.00	.00
101	5	1000	2270	2.00	.00	.00	.00	20.51	.00	.00	.00	.00	4.50	.00	.00	.00
101	5	1000	3040	2.00	.00	1.00	.00	20.51	.00	20.51	.00	10.25	6.75	.00	.00	.00
101	3	1200	1000	8.00	2.00	.00	.00	82.04	30.76	.00	.00	10.25	22.50	.00	.00	.00
101	4	1200	1000	4.00	.00	.00	.00	41.02	.00	.00	.00	.00	9.00	.00	.00	.00
101	5	1200	1000	4.00	.00	.00	.00	41.02	.00	.00	.00	.00	9.00	.00	.00	.00
101	EMP TOT			40.00	2.00	1.00	.00	410.20	30.76	20.51	.00	20.50	96.75	.00	.00	.00
102	1	1000	2240	8.00	.00	.00	.00	97.10	.00	.00	.00	.00	23.68	10.00	.00	.00
102	5	1000	2240	8.00	.00	.00	.00	97.10	.00	.00	.00	.00	23.68	.00	.00	.00
102	2	1000	3040	6.00	.00	.00	1.00	72.82	.00	.00	36.41	24.27	20.72	.00	.00	.00
102	3	1000	2270	8.00	.00	1.00	.00	97.10	.00	24.27	.00	12.13	26.64	.00	.00	.00
102	2	1000	2270	2.00	.00	.00	.00	24.27	.00	.00	.00	.00	5.92	.00	.00	.00
102	4	1000	3040	8.00	.00	.00	.00	97.10	.00	.00	.00	.00	23.68	.00	.00	.00
102	EMP TOT			40.00	.00	1.00	1.00	485.49	.00	24.27	36.41	36.40	124.32	10.00	.00	.00
103	1	1000	5600	8.00	.00	.00	.00	63.60	.00	.00	.00	.00	10.80	.00	00	.00
103	2	1000	3040	8.00	.00	.00	.00	63.60	.00	.00	.00	.00	10.80	.00	.00	.00
103	3	1000	2270	8.00	.00	.00	.00	63.60	.00	.00	.00	.00	10.80	.00	.00	.00
103	4	1000	2240	8.00	.00	.00	.00	63.60	.00	.00	.00	.00	10.80	.00	.00	.00
103	5	1000	3040	8.00	.00	.00	.00	63.60	.00	.00	.00	.00	10.80	.00	.00	00
103	EMP TOT			40.00	.00	.00	.00	318.00	.00	.00	.00	.00	54.00	.00	.00	.00
104	1	1000	3060	8.00	.00	2.00	.00	47.04	.00	23.52	.00	11.76	14.20	.00	.00	.00
104	2	1000	3040	8.00	.00	1.00	.00	74.80	.00	18.70	.00	9.35	12.78	10.00	.00	.00
104	3	1000	2270	8.00	.00	.00	.00	47.04	.00	.00	.00	.00	11.36	.00	.00	.00
104	4	1000	2260	8.00	.00	.00	.00	47.04	.00	.00	.00	.00	11.36	.00	.00	.00
104	5	1000	5600	8.00	.00	.00	.00	75.20	.00	.00	.00	.00	11.36	.00	.00	.00
104	3	1000	2270	8.00	.00	.00	.00	47.04	.00	.00	.00	.00	11.36	.00	.00	.00
104	3	1000	2270	8.00	.00	.00	.00	77.20	.00	.00	.00	.00	11.36	.00	.00	.00
104	EMP TOT			40.00	.00	3.00	.00	321.28	.00	42.22	.00	21.11	61.06	10.00	.00	.00

DISTRIBUTION JOURNAL — PAGE NR. 1

CODE	VEND NR	NAME	JOB NR.	DATE	INVOICE INV NR	AMOUNT	DUE DATE 1	DISC	GEN LEDGER ACCT NR	GEN LEDGER AMOUNT	JOB JOB NR	JOB CODE	JOB AMOUNT	PHASE	PROOF
1	1,800	EMERSON	1000	7-20-7-	1,876	145.00	8-20-7- .1000	14.50			1000	2	145.00	2260	
															0.00
1	2,900	WATER WORK	1000	7-01-7-	7,465	93.46	7-25-7- .1000	9.35	633	93.46					
															0.00
1	2,900	WATER WORK	1000	7-11-7-	7,563	105.73	7-31-7- .1000	10.57	680	105.73					
															0.00
1	3,612	EQ PARTS	1000	7-04-7-	3,215	2,436.46	7-20-7- .1500	365.47			1000	2	2,436.46	2270	
															0.00
1	3,612	EQ PARTS	1000	6-30-7-	3,168	867.42	7-20-7- .1500	130.11			1000	2	867.42	3040	
															0.00
1	4,431	A-Z RENTAL	1000	7-10-7-	4,332	1,648.20	7-20-7- .1000	164.82			1000	4	1,648.20	5600	
															0.00
1	8,843	BLDR LBR	1150	7-10-7-	1,574	136.25	7-20-7- .1000	13.63			1150	3	136.25	1000	
															0.00
1	8,843	BLDR LBR	1200	7-10-7-	6,632	2,895.00	7-20-7- .1000	289.50			1200	2	2,895.00	1000	
															0.00
4	8,843	BLDR LBR	1200	7-10-7-	827	1,500.00	7-10-7-	150.00			1200	3	1,500.00	1127	
															0.00
1	9,111	ROADWAY	1000	7-01-7-	1,262	10,000.00	7-20-7- .1000	1,000.00			1000	3	10,000.00	9060	
															0.00
1	9,112	HANSON	1200	7-06-7-	1,842	12,000.00	7-20-7- .1000	1,200.00			1200	3	12,000.00	1000	
															0.00
1	9,115	ALLMAN CON	1000	7-10-7-	6,385	1,000.00	7-20-7- .1000	100.00			1000	3	1,000.00	9330	
															0.00
	9,999														

07/15/7- — SUB CONTRACTORS STATUS — PAGE 01

JOB #	ACCT#	NAME	CONTRACT	BILLED	RETAINED	PAID	CONTRACT BALANCE
1000	9110	WILLIAMS PLUMBING	20,000.00	2,500.00	250.00	0.00	17,500.00
1000	9111	ROADWAY CONSTRUCTION CO	126,455.00	20,000.00	2,000.00	18,000.00	106,455.00
		JOB TOTAL	146,455.00	22,500.00	2,250.00	18,000.00	123,955.00
1300	9112	HANSON MASONARY CONT	244,000.00	38,000.00	3,800.00	34,200.00	206,000.00
		JOB TOTAL	244,000.00	38,000.00	3,800.00	34,200.00	206,000.00
1150	9113	WISCONSIN ELECTRIC CO.	100,000.00	100,000.00	10,000.00	90,000.00	0.00
1150	9114	COMCO CORP.	50,000.00	5,756.00	575.60	5,180.40	44,244.00
		JOB TOTAL	150,000.00	105,756.00	10,575.60	95,180.40	44,244.00
1000	9115	ALLMAN CONSTRUCTION CO	128,000.00	86,000.00	8,600.00	77,400.00	42,000.00
		JOB TOTAL	128,000.00	86,000.00	8,600.00	77,400.00	42,000.00
		GRAND TOTAL	668,455.00	252,256.00	25,225.60	224,780.40	416,199.00

END OF JOB

EXAMPLE REPORTS PAYROLL AND ACCOUNTS PAYABLE - NCR - CMS

FIG. 2.15

JOB COST ANALYSIS

DATE 01/01/7-

PAGE 1

JOB # / JOB TITLE / COST CODE DESCRIPTION	COST CODE	TYPE CODE	BUDGET COST	COST CURRENT	COST JOB TO DATE	COST EST % COMP	COST EST COST TO DATE	BUDGET OVER/UNDER TO DATE	BUDGET OVER/UNDER PROJECTED
1000 SUNSHINE TOWERS APTS									
SUPERTENDENT		L	2,000	300	1,200	60	1,200	0	0
		M	0	0	0	60	0	0	0
		S	0	0	0	60	0	0	0
		E	0	0	0	60	0	0	0
		M	50	0	14	60	30	16	20
		O	0	0	0	60	0	0	0
TOTAL SUB-PHASE	1010		2,050	300	1,214	60	1,230	16	20
ENGINEERING & LAYOUT		L	207	0	158	100	207	49	49
		M	0	0	0	100	0	0	0
		S	0	0	0	100	0	0	0
		E	0	0	0	100	0	0	0
		M	0	0	0	100	0	0	0
		O	0	0	0	100	0	0	0

JOB COST ANALYSIS

DATE 01/01/7-

PAGE 2

JOB # / JOB TITLE / COST CODE DESCRIPTION	COST CODE	TYPE CODE	BUDGET COST	COST CURRENT	COST JOB TO DATE	COST EST % COMP	COST EST COST TO DATE	BUDGET OVER/UNDER TO DATE	BUDGET OVER/UNDER PROJECTED
1000 SUNSHINE TOWERS APT			164,035	19,204	81,941	50	82,017	76	153
1150 CIVIC CENTER			560,758	82,367	366,790	65	364,491	2,299	3,537
1200 KENMORE VILLAGE			275,570	16,589	171,269	50	137,785	33,511	67,022
1250 TOM'S AUTO SUPPLY			84,588	0	30,955	45	38,063	-7,108	-15,794
1275 KENMORE APTS			1,508,755	87,564	808,663	60	905,251	-96,588	-160,979
1300 MILLERSVILLE LOAN			27,691	1,267	16,558	70	19,383	-2,825	-4,035
TOTAL JOBS			2,621,397	206,991	1,476,203		1,547,378	-70,635	-110,096

JOB NBR 1000
PERIOD ENDING 01/01/7-

UNIT AND JOB LABOR COST REPORT
SUNSHINE TOWERS APTS

PAGE 1

CONTRACT NO: 00111975

COST CODE	UNIT	CURRENT PERIOD QTY UNITS	CURRENT PERIOD LABOR COST	CURRENT PERIOD LAB COST PER UNIT	BUDGET QTY UNITS	BUDGET LABOR COST	BUDGET LAB COST PER UNIT	JOB TO DATE QTY UNITS	JOB TO DATE LABOR COST	JOB TO DATE LAB COST PER UNIT	% COMP	PROJECTED GAIN - LOSS
SUPERTENDENT												
1010	20	300	15.00	133	2,000	15.04	80	1,200	15.00	0	0	0
ENGINEERING & LAYOUT												
1030	0	0	0.00	16	207	12.94	16	158	9.88	0	0	48
HAULING												
1050	0	23	0.00	114	612	5.37	63	348	5.52	0	0	0
BOND & JOBBING												
1060 EA	0	0	0.00	1	0	0.00	1	0	0.00	1	0	0
TOTAL COST CODE		323			2,819			1,706			0	48
WRECKING & DEMO												
2020 EA	0	0	0.00	1	575	575.00	0	633	0.00	1	0	575
CLEANING												
2040 CA	0	0	0.00	1	350	350.00	1	0	0.00	1	0	350
MASS EXCAVATION												
2060 CY	0	0	0.00	125	278	2.22	125	239	1.91	1	0	0
HAND EXCAVATION												
2080 CY	0	0	0.00	10	38	3.80	10	43	4.30	1	0	0
TOTAL COST CODE		0			1,241			915			0	925
DRILL TIE BACK RODS												
2260 SC	0	644	0.00	160	12,500	78.13	125	4,994	39.95	0	0	6,060

CASH FLOW ANALYSIS

DATE 01/01/7-

PAGE 1

JOB# JOB TITLE	% COMP	COST BUDGET	COST JOB TO DATE	COST REMAINING	BILLINGS CONTRACT	BILLINGS JOB TO DATE	BILLINGS REMAINING	PROJECTED OVER/UNDER
1000 SUNSHINE TOWERS APTS	50	164,035	81,941	82,094	164,035	102,000	62,035	153
1150 CIVIC CENTER	65	560,758	366,790	193,968	560,758	425,500	135,258	3,537
1200 KENMORE VILLAGE	50	275,570	171,296	104,274	275,570	179,000	96,570	67,022
1250 TOM'S AUTO SUPPLY	45	84,588	30,955	53,633	84,588	35,800	48,788	-15,794
1275 KENMORE APTS	60	1,508,755	808,663	700,122	1,508,755	975,250	533,505	-160,979
1300 MILLERSVILLE LOAN	70	27,691	16,588	11,103	27,691	23,150	4,541	-4,035
TOTAL JOBS		2,621,397	1,476,203	1,145,194	2,621,397	1,740,700	880,697	-110,096

EXAMPLE REPORTS JOB COST MODULE - NCR - CMS

FIG. 2.16

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COMPARATIVE INCOME STATEMENT

PAGE 1

	-- CURRENT PERIOD -- THIS YEAR AMOUNT	%	LAST YEAR AMOUNT	%	-- YEAR TO DATE -- THIS YEAR AMOUNT	%	LAST YEAR AMOUNT	%
BILLINGS								
SALES-JOBS	240,188.40	100.00	233,438.30	100.00	1,824,753.61	100.00	1,753,753.22	100.00
TOTAL BILLINGS	240,188.40	100.00	233,438.30	100.00	1,824,753.61	100.00	1,753,753.22	100.00
CONSTRUCTION COSTS								
DIRECT JOB COSTS								
DIRECT LABOR	53,317.07	22.20	48,833.48	20.92	427,268.29	23.42	396,533.89	22.61
MATERIAL	76,758.23	31.95	71,552.76	30.65	615,000.95	33.70	602,211.05	34.34
EQUIPMENT	21,563.13	8.98	15,547.42	6.66	86,252.54	4.73	79,189.71	4.52
SUBCONTRACT	250.58	.10	255.41	.11	187,002.35	10.25	182,021.64	10.38
OTHER DIRECT JOB COSTS	0.00	.00	0.00	.00	0.00	.00	0.00	.00
OVERHEAD	1,779.39	.74	1,511.92	.65	7,117.57	.39	6,047.71	.34
TOTAL DIRECT COST	153,660.40	63.97	137,700.99	58.99	1,322,641.70	72.48	1,266,004.00	72.19
OTHER DIRECT JOB COSTS								
INDIRECT LABOR-ON SITE	4,156.60	1.73	6,884.85	2.95	16,627.21	.91	27,539.42	1.57
INDIRECT LABOR-OFF SITE	156.34	.07	656.59	.28	625.36	.03	2,626.39	.15
FICA	3,432.49	1.43	2,377.63	1.02	37,729.97	2.07	36,310.54	2.08
UNEMPLOYMENT INSURANCE	239.36	.10	163.96	.07	957.47	.05	655.86	.04
WORKMAN'S COMPENSATION	33.91	.01	19.02	.01	135.67	.01	76.09	.00
HEALTH & WELFARE	1,608.61	.67	1,524.07	.65	6,434.46	.35	6,096.31	.35
PENSION	20.00	.01	15.63	.01	80.00	.00	62.55	.00
APPRENTICE FUND	0.00	.00	0.00	.00	0.00	.00	0.00	.00
INDUSTRY FUND	0.00	.00	0.00	.00	0.00	.00	0.00	.00
CREDIT UNION	0.00	.00	0.00	.00	0.00	.00	0.00	.00
VACATION PAY	0.00	.00	0.00	.00	0.00	.00	0.00	.00
TRAVEL EXPENSE	0.00	.00	0.00	.00	0.00	.00	0.00	.00
JOB INSURANCE	0.00	.00	0.00	.00	0.00	.00	0.00	.00
SMALL TOOLS EXPENSE	0.00	.00	0.00	.00	0.00	.00	0.00	.00
EQUIPMENT RENTAL	1,022.87	.43	473.00	.20	4,091.48	.22	1,892.02	.11
JOB SUPPLIES	912.03	.38	2,080.53	.89	3,648.13	.20	8,322.12	.47
TELEPHONE & TELEGRAPH	1,009.49	.42	1,227.71	.53	4,037.98	.22	4,910.84	.28
TRUCK & EQUIP EXPENSE	0.00	.00	0.00	.00	0.00	.00	0.00	.00
SALES TAX	0.00	.00	0.00	.00	0.00	.00	0.00	.00
USE TAX	0.00	.00	0.00	.00	0.00	.00	0.00	.00
OTHER TAX	0.00	.00	0.00	.00	0.00	.00	0.00	.00
CONSTRUCTION BONDS	0.00	.00	0.00	.00	0.00	.00	0.00	.00
PERMITS	0.00	.00	0.00	.00	0.00	.00	0.00	.00
TEMPORARY SERVICES	0.00	.00	0.00	.00	0.00	.00	0.00	.00
CLEANUP	0.00	.00	0.00	.00	0.00	.00	0.00	.00
DRAYAGE	0.00	.00	0.00	.00	0.00	.00	0.00	.00
WARRANTY & GUARANTEE	0.00	.00	0.00	.00	0.00	.00	0.00	.00
DELAY PENALTIES	0.00	.00	0.00	.00	0.00	.00	0.00	.00
ALLOCATED G&A EXPENSES	0.00	.00	0.00	.00	0.00	.00	0.00	.00
MISCELLANEOUS COSTS	6.25	.00	5.93	.00	25.00	.00	23.75	.00
OTHER DIRECT COSTS	4.95	.00	19.87	.01	19.80	.00	79.50	.00
TOTAL OTHER DIRECT COSTS	12,603.10	5.25	15,448.79	6.62	74,412.53	4.08	88,795.39	5.06

COMPARATIVE BALANCE SHEET
NOV 30 7-

PAGE 1

	THIS YEAR	LAST YEAR
	ASSETS	
CURRENT ASSETS		
CASH		
CASH-REGULAR ACCOUNT	146,018.87	133,268.29
CASH-SAVINGS ACCOUNT	15,568.56	6,434.46
CASH-PAYROLL ACCOUNT	8,322.12	22,274.77
CASH-SPECIAL ACCOUNT	0.00	0.00
CASH-PETTY CASH FUND	16.93	114.97
TOTAL CASH	169,926.48	162,092.49
INVESTMENTS		
US GOVERNMENT SECURITIES	0.00	0.00
STATE & MUNICIPAL BONDS	0.00	0.00
CORPORATE BONDS	0.00	0.00
COMMON STOCKS	242,603.64	431,000.00
OTHER INVESTMENTS	2,250.00	100.00
ACCRUED INTEREST	0.00	0.00
DIVIDENDS RECEIVABLE	0.00	0.00
TOTAL INVESTMENTS	244,853.64	431,100.00
NOTES & ACCTS RECEIVABLE		
NOTES RECEIVABLE	62,211.05	90,337.23
ACCTS REC-CURRENT	474,131.67	452,961.44
ACCTS REC-RETENTION	62,189.71	51,075.19
OTHER RECEIVABLES	8,975.12	9,192.64
EXCESS ON UNCOMPLETED	12,048.13	16,627.21
ALLOW. FOR UNCOLLECTIBLE	5,091.67P	5,799.68P
TOTAL RECEIVABLES	614,464.01	614,394.03
UNCOMPLETED CONTRACT COST		
DIRECT LABOR	0.00	0.00
MATERIAL	0.00	0.00
EQUIPMENT	0.00	0.00
SUBCONTRACT	0.00	0.00
OTHER DIRECT JOB COSTS	0.00	0.00
TOTAL COST	0.00	0.00
INVENTORY OF MATERIALS		
WAREHOUSE	2,111.08	3,648.13
SERVICE DEPARTMENT	3,538.78	3,307.97
FABRICATION DEPARTMENT	27,539.42	45,203.39
TOTAL INVENTORY	33,189.28	52,159.49
EXPENDABLE TOOLS		
WAREHOUSE	111.00	135.67
SERVICE DEPARTMENT	655.86	800.00
FABRICATION DEPARTMENT	0.00	0.00

EXAMPLE REPORTS GENERAL LEDGER MODULE - NCR - CMS

FIG. 2.17

BALANCE SHEET
NOV 30 7-

ASSETS

CURRENT ASSETS	
CASH	
CASH-REGULAR ACCOUNT	144,018.87
CASH-SAVINGS ACCOUNT	15,368.56
CASH-PAYROLL ACCOUNT	8,722.12
CASH-SPECIAL ACCOUNT	0.00
CASH-PETTY CASH FUND	16.93
TOTAL CASH	169,926.48
INVESTMENTS	
US GOVERNMENT SECURITIES	0.00
STATE & MUNICIPAL BONDS	0.00
CORPORATE BONDS	0.00
COMMON STOCKS	242,603.64
OTHER INVESTMENTS	2,250.00
ACCRUED INTEREST	0.00
DIVIDENDS/RECEIVABLE	0.00
TOTAL INVESTMENTS	244,853.64
NOTES & ACCTS RECEIVABLE	
NOTES RECEIVABLE	62,211.05
ACCTS REC-CURRENT	474,131.67
ACCTS REC-RETENTION	62,189.71
OTHER RECEIVABLES	8,975.12
EXCESS ON UNCOMPLETED	12,048.13
ALLOW. FOR UNCOLLECTIBLE	5,091.67-
TOTAL RECEIVABLES	614,464.01
UNCOMPLETED CONTRACT COST	
DIRECT LABOR	0.00
MATERIAL	0.00
EQUIPMENT	0.00
SUBCONTRACT	0.00
OTHER DIRECT JOB COSTS	0.00
TOTAL COST	0.00
INVENTORY OF MATERIALS	
WAREHOUSE	2,111.08
SERVICE DEPARTMENT	3,538.78
FABRICATION DEPARTMENT	27,539.42
TOTAL INVENTORY	33,189.28
EXPENDABLE TOOLS	
WAREHOUSE	111.00
SERVICE DEPARTMENT	655.84
FABRICATION DEPARTMENT	0.00

BALANCE SHEET
NOV 30 7-

TOTAL EXPENDABLE TOOLS	766.84
PREPAID EXPENSE	
PREPAID INSURANCE	2,626.39
PREPAID TAXES & LICENSES	9,510.54
TRAVEL ADVANCES	79.50
OTHER PREPAID EXPENSES	0.00
TOTAL PREPAID EXPENSE	12,216.43
TOTAL CURRENT ASSETS	1,075,416.70
FIXED ASSETS	
COST	
LAND	431,353.69
BUILDINGS	0.00
LEASEHOLD IMPROVEMENTS	87,184.23
CONSTRUCTION EQUIPMENT	431,000.00
SERVICE DEPT EQUIPMENT	51,075.19
FABRICATION DEPT EQUIP	26,387.21
OFFICE FURNITURE & EQUIP	16,568.56
AUTO. & TRANSP. EQUIPMENT	90,337.23
OTHER PROPERTY	6,096.31
TOTAL COST	1,140,002.42
RESERVE FOR DEPRECIATION	
BUILDINGS	0.00
LEASEHOLD IMPROVEMENTS	47,000.00-
CONSTRUCTION EQUIPMENT	179,529.56-
SERVICE DEPT EQUIPMENT	27,863.80-
FABRICATION DEPT EQUIP	5,799.68-
OFFICE FURNITURE & EQUIP	6,185.42-
AUTO. & TRANSP. EQUIPMENT	37,811.98-
OTHER PROPERTY	1,983.50-
TOTAL DEPRECIATION	306,173.92-
TOTAL FIXED ASSETS	833,828.50
OTHER ASSETS	
RET. CONTAINER DEPOSITS	1,021.64
DEPOSITS FOR BIDS	2,129.83
UTILITY DEPOSITS	0.00
OTHER DEPOSITS	1,892.02
DEFERRED CHARGES	0.00
INVESTMENTS--NON-CURRENT	0.00
CASH VALUE-LIFE INSURANCE	0.00
TOTAL OTHER ASSETS	5,043.49
TOTAL ASSETS	1,914,288.69

BALANCE SHEET
NOV 30 7-

LIABILITIES & NET WORTH

CURRENT LIABILITIES	
NOTES PAYABLE	
NOTES PAYABLE-BANKS	160,000.00
NOTES PAYABLE-OTHERS	65,231.47
TOTAL NOTES PAYABLE	225,231.47
ACCOUNTS PAYABLE	
ACCOUNTS PAYABLE-TRADE	342,154.89
ACCTS PAY-SUBCONTRACTORS	25,527.39
ACCTS PAY-RETENTION	0.00
LOANS PAYABLE	40,223.20
BILLINGS ON UNCOMPLETED	0.00
UNEARNED BILLINGS	0.00
TOTAL ACCOUNTS PAYABLE	407,907.48
PAYROLL WITHHOLDINGS	
FEDERAL INCOME TAX W/H	2,370.30
FICA TAX W/H-EMPLOYEE	787.13
STATE INCOME TAX W/H	692.12
STATE DISABILITY TAX W/H	0.00
CITY OR COUNTY TAX W/H	0.00
HOSPITALIZATION W/H	0.00
GROUP INSURANCE W/H	124.29
UNION DUES W/H	548.74
TOTAL P/R WITHHOLDINGS	4,522.58
ACCRUED EXPENSES	
ACCRUED FICA-EMPLOYER	0.00
ACCRUED STATE UNEMP INSUR	0.00
ACCRUED FED UNEMP INSUR	0.00
ACCRUED WAGES	0.00
ACCRUED INTEREST	0.00
ACCRUED INSURANCE	0.00
ACCRUED FRINGES	0.00
OTHER ACCRUED EXPENSES	0.00
TOTAL ACCRUED EXPENSE	0.00
OTHER CURRENT LIABILITIES	
PROPERTY TAXES PAYABLE	0.00
CITY & COUNTY TAX PAYABLE	0.00
SALES & USE TAX PAYABLE	0.00
FED INCOME TAX PAYABLE	0.00
STATE INCOME TAX PAYABLE	0.00
OTHER CURRENT LIABILITIES	0.00
TOTAL OTHER CURR LIAB.	0.00
TOTAL CURRENT LIABILITIES	637,661.53

BALANCE SHEET
NOV 30 7-

LONG TERM LIABILITIES	
NOTES PAYABLE-BANKS	461,997.53
NOTES PAYABLE-OTHERS	85,000.00
MORTGAGES PAYABLE	0.00
OTHER LONG TERM LIAB.	0.00
TOTAL LONG TERM LIAB.	546,997.53
OTHER LIABILITIES	
DUE TO PRINCIPALS	0.00
DEFERRED CREDITS	0.00
RESERVE FOR WARRANTY	0.00
OTHER LIABILITIES	0.00
TOTAL OTHER LIABILITIES	0.00
OWNERS' EQUITY	
OWNER OR PARTNERS CAPITAL	120,728.93
PERSONAL DRAWINGS	108,007.21-
TOTAL OWNERS' EQUITY	12,721.72
STOCKHOLDERS EQUITY	
PREFERRED STOCK	199,875.80
COMMON STOCK	171,005.85
PAID-IN SURPLUS	0.00
RETAINED EARNINGS	265,990.00
TREASURY STOCK	0.00
TOTAL STOCKHOLDERS EQUITY	636,871.65
TOTAL LIAB. & NET WORTH	1,834,252.43

EXAMPLE REPORTS

GENERAL LEDGER MODULE - NCR - CMS

FIG. 2.17

INCOME STATEMENT
NOV 30 7-

	-- CURRENT PERIOD -- AMOUNT	%	-- YEAR TO DATE -- AMOUNT	%
BILLINGS				
SALES-JOBS	240,188.40	100.00	1,824,753.61	100.00
TOTAL BILLINGS	240,188.40	100.00	1,824,753.61	100.00
CONSTRUCTION COSTS				
DIRECT JOB COSTS				
DIRECT LABOR	53,317.07	22.20	427,268.29	23.42
MATERIAL	74,750.23	31.95	615,000.95	33.70
EQUIPMENT	21,563.13	8.98	86,252.54	4.73
SUBCONTRACT	250.58	.10	187,002.35	10.25
OTHER DIRECT JOB COSTS	0.00	.00	0.00	.00
OVERHEAD	1,779.39	.74	7,117.57	.39
TOTAL DIRECT COST	153,660.40	63.97	1,322,641.70	72.48
OTHER DIRECT JOB COSTS				
INDIRECT LABOR-ON SITE	4,154.80	1.73	16,627.21	.91
INDIRECT LABOR-OFF SITE	156.34	.07	625.36	.03
FICA	3,432.49	1.43	37,729.97	2.07
UNEMPLOYMENT INSURANCE	239.36	.10	957.47	.05
WORKMAN'S COMPENSATION	33.91	.01	135.67	.01
HEALTH & WELFARE	1,608.61	.67	6,434.46	.35
PENSION	20.00	.01	80.00	.00
APPRENTICE FUND	0.00	.00	0.00	.00
INDUSTRY FUND	0.00	.00	0.00	.00
CREDIT UNION	0.00	.00	0.00	.00
VACATION PAY	0.00	.00	0.00	.00
TRAVEL EXPENSE	0.00	.00	0.00	.00
JOB INSURANCE	0.00	.00	0.00	.00
SMALL TOOLS EXPENSE	0.00	.00	0.00	.00
EQUIPMENT RENTAL	1,022.87	.43	4,091.48	.22
JOB SUPPLIES	912.03	.38	3,648.13	.20
TELEPHONE & TELEGRAPH	1,009.49	.42	4,037.98	.22
TRUCK & EQUIP EXPENSE	0.00	.00	0.00	.00
SALES TAX	0.00	.00	0.00	.00
USE TAX	0.00	.00	0.00	.00
OTHER TAX	0.00	.00	0.00	.00
CONSTRUCTION BONDS	0.00	.00	0.00	.00
PERMITS	0.00	.00	0.00	.00
TEMPORARY SERVICES	0.00	.00	0.00	.00
CLEANUP	0.00	.00	0.00	.00
DRAYAGE	0.00	.00	0.00	.00
WARRANTY & GUARANTEE	0.00	.00	0.00	.00
DELAY PENALTIES	0.00	.00	0.00	.00
ALLOCATED G&A EXPENSES	0.00	.00	0.00	.00
MISCELLANEOUS COSTS	4.25	.00	25.00	.00
OTHER DIRECT COSTS	4.95	.00	19.80	.00
TOTAL OTHER DIRECT COSTS	12,603.10	5.25	74,412.53	4.08

INCOME STATEMENT
NOV 30 7-

	-- CURRENT PERIOD -- AMOUNT	%	-- YEAR TO DATE -- AMOUNT	%
TOTAL CONSTRUCTION COST	166,263.50	69.22	1,397,054.23	76.56
GENERAL & ADMINISTRATIVE				
WAGES				
OFFICERS	5,568.69	2.32	58,274.77	3.19
OWNERS	0.00	.00	0.00	.00
ADMINISTRATIVE	15,483.38	6.45	137,933.55	7.56
EQUIPMENT MAINTENANCE	202.85	.08	811.41	.04
ESTIMATING & ENGINEERING	3,027.98	1.26	12,111.93	.66
PURCHASING	993.54	.41	3,974.18	.22
PROJECT ADMINISTRATION	7,570.04	3.15	30,280.24	1.66
WAREHOUSE	0.00	.00	0.00	.00
SALESMAN SALARY & COMM	6,612.75	2.75	26,451.01	1.45
BONUSES	0.00	.00	0.00	.00
TOTAL WAGES	39,459.25	16.43	269,837.09	14.79
PAYROLL WITHHOLDINGS				
FICA	2,298.16	.96	9,192.64	.50
UNEMPLOYMENT INSURANCE	131.96	.05	2,527.85	.14
WORKMAN'S COMPENSATION	0.00	.00	0.00	.00
LIFE INSURANCE	679.00	.28	8,716.00	.48
HOSPITALIZATION	28.74	.01	114.97	.01
PENSION TRUST	0.00	.00	0.00	.00
PROFIT SHARING TRUST	0.00	.00	0.00	.00
STOCK PURCHASE PLAN	0.00	.00	0.00	.00
TRAVEL EXPENSE	68.46	.03	273.86	.02
INSURANCE	22.42	.01	100.00	.01
TOTAL WITHHOLDINGS	3,228.74	1.34	20,925.32	1.15
OFFICE EXPENSES				
EQUIPMENT RENTAL	0.00	.00	0.00	.00
OFFICE SUPPLIES	1,511.92	.63	6,047.71	.33
ENGINEERING SUPPLIES	50.65	.02	202.61	.01
TELEPHONE & TELEGRAPH	735.72	.31	2,942.89	.16
TOTAL OFFICE EXPENSE	2,298.29	.96	9,193.21	.50
AUTO & TRUCK				
AUTO & TRUCK-REPAIRS	429.24	.18	1,716.99	.09
AUTO & TRUCK-GAS & OIL	576.01	.24	2,304.07	.13
AUTO & TRUCK-RENTAL	0.00	.00	0.00	.00
AUTO & TRUCK-INSUR & LIC	218.80	.09	875.21	.05
TOTAL AUTO & TRUCK	1,224.05	.51	4,896.27	.27
TAXES				

INCOME STATEMENT
NOV 30 7-

	-- CURRENT PERIOD -- AMOUNT	%	-- YEAR TO DATE -- AMOUNT	%
SALES TAX	5.93	.00	23.75	.00
USE TAX	0.00	.00	0.00	.00
PERSONAL PROPERTY TAX	0.00	.00	0.00	.00
REAL ESTATE TAX	0.00	.00	0.00	.00
BUSINESS LICENSE TAX	0.00	.00	0.00	.00
STATE FRANCHISE TAX	0.00	.00	0.00	.00
OTHER TAX	0.00	.00	0.00	.00
TOTAL TAXES	5.93	.00	23.75	.00
UTILITIES & RENT				
LIGHT,HEAT,POWER,WATER	84.41	.04	337.66	.02
RENT OF PREMISES	4,158.09	1.73	16,632.36	.91
TOTAL UTILITIES & RENT	4,242.50	1.77	16,970.02	.93
PROMOTIONAL				
ADVERTISING	68.00	.03	272.00	.01
SALES AIDS	447.47	.19	1,789.88	.10
ENTERTAINMENT	156.43	.07	625.71	.03
TOTAL PROMOTIONAL	671.90	.28	2,687.59	.15
OTHER EXPENSES				
MAINT & REPAIRS-BUILDING	1,360.95	.57	5,443.83	.30
JANITORIAL SERVICES	1,227.71	.51	4,910.84	.27
EMPLOYEE RELATIONS	468.98	.20	1,875.92	.10
EMPLOYEE TRAINING	826.99	.34	3,307.97	.18
COLLECTION EXPENSE	4.95	.00	19.80	.00
BAD DEBTS	19.02	.01	76.09	.00
TOTAL OTHER EXPENSE	3,908.60	1.63	15,634.45	.84
DEPRECIATION				
BUILDING	0.00	.00	0.00	.00
LEASEHOLD IMPROVEMENTS	0.00	.00	0.00	.00
CONSTRUCTION EQUIPMENT	0.00	.00	0.00	.00
OFFICE FURNITURE & EQUIP	0.00	.00	0.00	.00
AUTO. & TRANSP. EQUIPMENT	0.00	.00	0.00	.00
OTHER PROPERTY	0.00	.00	0.00	.00
TOTAL DEPRECIATION	0.00	.00	0.00	.00
MISCELLANEOUS EXPENSE				
LEGAL & PROFESSIONAL	326.75	.14	1,307.00	.07
WARRANTY & GUARANTEE	3.00	.00	12.00	.00
DUES & SUBSCRIPTIONS	1,372.50	.57	5,490.03	.30
DONATIONS	0.00	.00	0.00	.00
MISCELLANEOUS EXPENSE	286.15	.12	1,144.60	.06
G&A EXP CHARGED TO JOBS	0.00	.00	0.00	.00

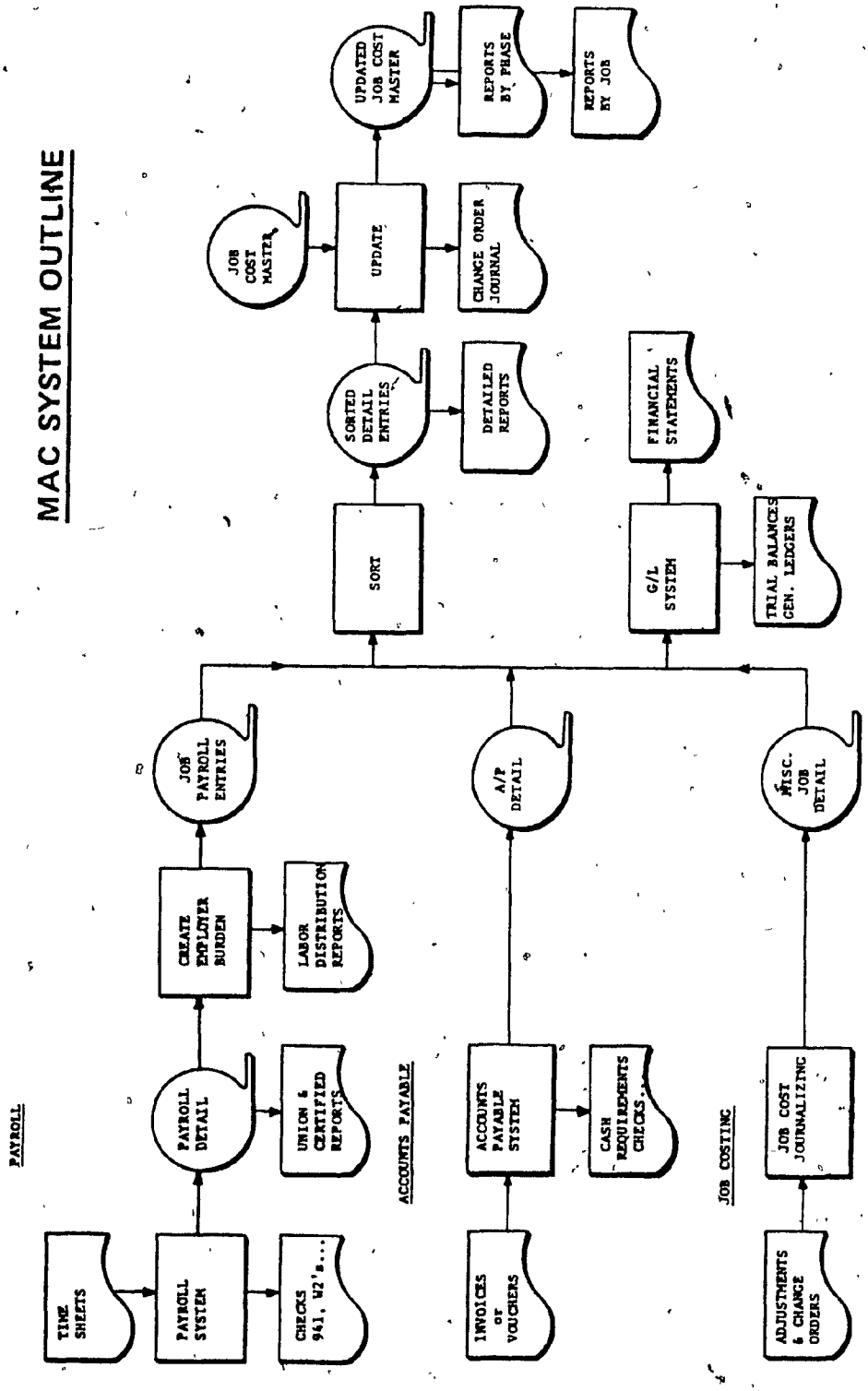
INCOME STATEMENT
NOV 30 7-

	-- CURRENT PERIOD -- AMOUNT	%	-- YEAR TO DATE -- AMOUNT	%
TOTAL MISC EXPENSE	1,988.40	.83	7,953.63	.44
TOTAL GENERAL & ADMIN	223,291.16	92.97	1,743,175.36	95.54
OTHER INCOME				
GAIN ON SALE OF ASSETS	0.00	.00	0.00	.00
PURCHASE DISCOUNT	176.11	.07	724.46	.04
RENTAL INCOME-EQUIPMENT	158.41	.07	633.64	.03
INTEREST INCOME	292.82	.12	1,171.28	.06
TOTAL OTHER INCOME	627.34	.26	2,529.38	.14
OTHER EXPENSES				
LOSS ON SALE OF ASSETS	88.00	.04	352.00	.02
INTEREST EXPENSE	429.79	.18	1,719.17	.09
TOTAL OTHER EXPENSE	517.79	.22	2,071.17	.11
TAXES ON INCOME				
FEDERAL INCOME TAXES	0.00	.00	0.00	.00
STATE INCOME TAXES	0.00	.00	0.00	.00
TOTAL TAXES	0.00	.00	0.00	.00
NET PROFIT OR LOSS	17,006.79	7.08	80,036.26	4.39

EXAMPLE REPORTS

GENERAL LEDGER MODULE - NCR - CMS

FIG. 2.17



BURROUGHS MANAGEMENT ACCOUNTING FOR CONTRACTORS (MAC) SYSTEM FLOW

FIG. 2.18

REAL INDUSTRIES, INC. -- PAYROLL JOURNAL 04-15-76 04-15-76 PAGE 1

L SI DP DIST	R-HRS	O-HRS	RATE	R-PAY	O-PAY	CODE	UNITS	RATE	AMOUNT	GROSS	FWH	FICA	SWH	SAIF	DED CO	DED CO	NET	CK #
1001 ANDREW A. ANDERSON																		
1 11 01 1234 87				600.00														
2 11 01 5498 8	8		6.90	55.20	8.280					738.00	116.03	43.17	18.51	7.38	4.30 04	33.21 10	515.40	1234
1010 BARBARA B. BAXTER																		
1 01 01 54621 87				660.00														
2 01 04 87215	4		7.59		45.54	3	21.200	.12	25.44	730.98	120.06	42.76	20.22	7.31	35.00 25X	10.00 03		
															39.60 11	5.00 01	451.03	1235
1040 CHARLES C. CALAHAN																		
1 01 20 8715 18.5		2.5	2.60	48.10	9.75	10			32.50									
1 01 20 1258 16			2.60	41.60		9	15.00	1.25	18.75									
2 04 17 6418 8			2.755	22.04														
3 04 20 8794		D 8	2.60		41.60					214.34	33.71	12.53	2.19	2.14	3.80 05	20.00 12		
															32.50 30	18.75 29	88.72	1236
1155 DARLENE D. DAVIS																		
1 01 20 31584 87				150.00						150.00	17.00	8.78		1.50	25.00 27X	7.50 03		
															3.20 04	15.00 01		
															18.75 02		53.27	1237
1180 EVERETTE E. EDWARDS																		
1 04 20 6412 8.00			1.60	1,280.00		3	156.00	.135	21.06									
2 05 14 1235 15.25			1.60	24.40		9	13.00	1.25	16.25									
3 04 17 9157 24			1.75	42.00		10			22.50									
4 01 08 3279 8		1.5	1.60	12.80	3.60	1			25.00									
1 04 20 6412 8.00-			1.60	1,280.00-														
1 04 20 6412 8			1.60	12.80						180.41	16.92	10.56	1.18	1.80	10.00 23	22.50 30		
															16.25 29		101.20	1238

EXAMPLE REPORTS PAYROLL - MAC.

FIG. 2.19

LABOR DISTRIBUTION REPORT

REAL INDUSTRIES CONSTR. JULY 1, 1976

JOB NUMBER	TOTAL PAY	TOTAL HOURS	UNION BURDEN	SI BURDEN
9000	431.25	55.00	41.25	215.63
50000	34.10	2.00	1.50	11.94
700000	176.00	35.00	26.25	61.60
TOTALS	641.35	92.00	69.00	289.17

LABOR DISTRIBUTION REPORT

REAL INDUSTRIES CONSTR. JULY 1, 1976

JOB NUMBER	REGULAR PAY	O-T PAY	QUARTER BONUS	TOTAL PAY
9000	276.00	155.25	.00	431.25
50000	.00	11.60	22.50	34.10
700000	176.00	.00	.00	176.00
TOTALS	452.00	166.85	22.50	641.35

EXAMPLE REPORTS ACCOUNTS PAYABLE MODULE - MAC

FIG. 2.20

REAL INDUSTRIES, INC. -- ACCOUNTS PAYABLE ANALYSIS 04-30-76 PAGE 1

I.D.#: R001 CASH REQUIREMENTS PROJECTION

VENDOR # / POST-DT	SEQ#	NAME / INV-DTE	INV#	FLOAT PMT-DATE	BALANCE	TELEPHONE DEDUCT	CD	CASH REQD	BY
100 8		BETTER BUSINESS BANK		1		503 644-8570			
04-16-76	1	04-16-76	87654	05-01-76	360.00			360.00	1
04-30-76*	1	04-30-76	87654	05-10-76	100.00			100.00	2
				TOTALS	460.00			460.00	
200 6		MODIFIED MANUFACTURING		4		206 287-1134			
04-16-76	1	04-12-76	74891	05-10-76	84.57			84.57	2
04-16-76	2	04-15-76	75037	05-10-76	74.36	1.48	0	72.88	2
04-30-76	1	04-09-76	76142	05-10-76	125.27	2.50	0	122.77	2
04-30-76	2	04-13-76	76873	05-10-76	78.92	1.79	0	77.13	2
04-30-76	3	04-27-76	77048	05-10-76	256.23	12.81	1	243.42	2
04-30-76	4	04-27-76	77049	06-10-76	100.00			100.00	3
				TOTALS	719.35	18.58		700.77	
250 1		PANE PEDDLERS		0					
04-30-76	1	04-21-76	3218	05-10-76	25.00			25.00	1

REAL INDUSTRIES, INC. -- PURCHASE JOURNAL I.D.#: R001 SOURCE: 12 04-30-76 PAGE 1

VENDOR #	VENDOR NAME	DAILY SEQ #	-- INVOICE -- DATE	NUMBER	DESCRIPTION	GROSS	DEDUCT	C D	PROPOSED PMT DATE	ACCT #	AMOUNT
100 8	BETTER BUSINESS BANK	1	04-30-76	87654	ADD PMT ON NOTE	100.00			05-10-76	220	100.00
200 6	MODIFIED MANUFACTURING	1	04-09-76	76142	MOTOR PARTS	125.27	2.50	1	05-10-76	600	125.27
		2	04-13-76	76873	100" MOLDINGS	78.92					
					VOID SEQ # 2						
		2	04-13-76	76873	100" MOLDINGS	78.92	1.79	1	05-10-76	500	78.92
		3	04-27-76	77048	144 MANIPULATORS	256.23	12.81	2	05-10-76	600	256.23
		4	04-27-76	77049	100 MANIPULATORS	100.00			06-10-76	600	100.00
250 1*	PANE PEDDLERS 4321 SW X ST DOWNTOWN, UPSTATE ZZIPP										
		1	04-21-76	3218	3X4 PLATEGLASS	25.00			05-10-76	999	25.00
300 4	REALISTIC RENT CORP.	1	04-21-76	3218	WINDOW REPLACEMENT	25.00-			05-10-76	999	25.00-
500 9	TYPICAL TELEPHONE CO.	1	04-25-76		PER STATEMENT	142.78			05-10-76	600	14.78
										750	42.39
										700	85.61
600 7	WIDGET WHOLESALERS	1	04-26-76-	5873	100 WIDGETS	500.00			05-10-76		
		2	04-26-76	5873	100 WIDGETS	500.00			06-10-76		
		3	04-26-76	5873	100 WIDGETS	378.75			07-10-76	120	1,378.75
	GROSS	2,181.95									

JOB INFORMATION

Field

1. Job Number
2. Phase
3. Description
4. G/L Account Number
5. Starting Date
6. Estimated Completion Date
7. Contract Price
8. Change Orders
9. Billings
10. Income Received
11. Other Amount 1
12. Other Amount 2
13. Treat Labor Units equal to Labor Hours
14. Job Units Estimate
15. Job Hours Estimate
16. Month-to-date Job Units
17. Month-to-date Job Hours
18. To-date Job Units
19. To-date Job Hours
20. Job Units Description
21. ID Code 1
22. ID Code 2
23. ID Code 3

1. Job Number - the job master file must be in job number order which can be up to six digits.
2. Phase - for job record always zero.
3. Description - the job description (23 characters).
4. G/L Account Number - the 9-digit G/L number that applies to this job (for documentation only).
5. Starting Date - date contract begins (6 digits).
6. Estimated Completion Date - (6 digits).

7-12. Dollar Fields - can really be used for any dollar amounts: overhead, purchase orders, holdbacks, draws, down payments, etc.

13. Labor Units = Labor Hours - OCX1, for no; OCX2, for Yes. If Yes, labor units and labor hours will be updated together.

14-20. Non-building Contractor Info - used when job units or number of hours on job are needed. Excellent for road builders requiring cost per mile.

21-23. ID Codes - These are two-digit fields the user can assign according to their needs. They are helpful in marking types of jobs and producing selected reports.

PHASE INFORMATION

Field

1. Job Number
2. Phase
3. Phase Description
4. Activity Code
5. Ledger Update
6. Unit Description-1
7. Unit Description-2
8. Estimated Units Tran-1
9. Estimated Cost per Unit Tran-1
10. Estimated Units Tran-2
11. Estimated Cost per Unit Tran-2
12. Estimated Units Tran-3
13. Estimated Costs Tran-3
14. Estimated Units Tran-4
15. Estimated Cost per Unit Tran-4
16. Month-to-date Units Tran-1
17. Month-to-date Costs Tran-1
18. Month-to-date Units Tran-2
19. Month-to-date Costs Tran-2
20. Month-to-date Units Tran-3
21. Month-to-date Costs Tran-3
22. Month-to-date Units Tran-4
23. Month-to-date Costs Tran-4
24. Month-to-date Labor Hours
25. To-date Units Tran-1
26. To-date Costs Tran-1
27. To-date Units Tran-2
28. To-date Costs Tran-2
29. To-date Units Tran-3
30. To-date Costs Tran-3
31. To-date Units Tran-4
32. To-date Costs Tran-4
33. To-date Labor Hours

1. Job Number - automatically carried over from job record.
2. Phase - job master must be in phase order with each job (4 digits).
3. Phase Description - 23 characters.
4. Activity Code - possible values. zero: phase is unstarted (during update this is changed to 1), one: phase is started; two: phase is completed; nine: marks group phase (description is now group description), used in JC040.
5. Ledger Update - If yes, during update, the program will stop and allow inserting of ledger for updating.
6-7. Unit Descriptions - 3 characters.

8-33. Values are kept for units and dollars by estimate, current period, and job to date. The trans are breakdowns within the phase: labor, materials, subs, equipment, rentals, misc. etc. Which breakdowns to use is determined by the contractor. Normally, four are provided but four additional ones are available.

EXAMPLE REPORT JOB COST MODULE - MAC

FIG. 2.21

REAL INDUSTRIES CONSTR. JULY 1, 1976 PAGE 1

JOB COST REPORT BY GROUP

700000 INFORMATION CENTER

PHASE	ESTIMATE UNITS	ESTIMATE COST	ESTIMATE $\UNIT	MONTH UNITS	MONTH COST	MONTH $\UNIT	TO DATE UNITS	TO DATE COST	TO DATE $\UNIT	%	VARIANCE	EST $ TO COMPLETE
SITE PREPARATION												
110 EQUIPMENT SETUP*												
LABOR HRS	1500	15000	1000				1400	14500	1036	93	500-	
MATERIALS	200	15000	7500				200	15000	7500	100		
MISC.	1200	24000	2000				1100	22000	2000	92		
120 BRUSH REMOVAL*												
LABOR HRS	1000	7500	750				1200	9000	750	120	1500-	
MISC.	1800	18000	1000				2000	20000	1000	111	2000-	
130 GRADING*												
LABOR HRS	500	6000	1200				600	7000	1167	120	1000-	
MISC.	500	7500	1500				500	7500	1500	100		
SUBTOT	6700	93000					7000	95000			5000-	
CONSTRUCTION												
210 FOUNDATION*												
LABOR HRS	4000	32000	800				3700	30000	811	93	400-	
MATERIALS	7000	35000	500				6000	28000	467	86	2000	
SUB CONTR	100	50000					100	50000		100		
MISC.	200	22500	11250				200	24500	12250	100	2000-	
220 FRAME CONSTRUCTION*												
LABOR HRS	10000	100000	1000	800	7800	975	9700	95000	979	97	2000	
MATERIALS	25000	150000	600	1500	9000	600	21000	130000	618	86	4000-	

Choice of any three percents

Choice of any four variances

"*" indicates phase is complete

Choice of four projections

REAL INDUSTRIES CONSTR. JULY 1, 1976 PAGE 1

JOB SUMMARY REPORT

JOB NUMBER	JOB DESCRIP	PRICE	EST COST	TO DATE COST	% COMPL	BILLING	EARNED INCOME	$ TO BE BILLED	FINISH DATE
5600	RETAINING WALL	400.00	290.00	.00	.00	.00	.00	.00	08-15-75
9000	WHITWORTH BUILDING	102,000.00	82,775.00	29,010.00	35.05	26,000.00	35,751.00	9,751.00	12-30-75
35000	BUILDING REMOVAL	6,000.00	6,500.00	6,500.00	100.00	6,000.00	6,000.00	.00	05-30-75
50000	LAY GAS LINE	65,000.00	57,500.00	.00	.00	.00	.00	.00	05-20-76
700000	INFORMATION CENTER	8,500.00	7,612.50	5,702.50	74.91	3,200.00	6,367.35	3,167.35	09-30-75
		181,900.00*	154,677.50*	41,212.50*	26.64*	35,200.00*	48,118.35*	12,918.35*	

$\frac{\text{Est Cost}}{\text{To Date Cost}}$ = % Compl

Price x % Compl = Earned Income

EXAMPLE REPORT JOB COST MODULE - MAC

FIG. 2.22

ADS-CAS, INC
SOUTH BEND, WASH

STATEMENT OF INCOME AND EXPENSE - FOR PERIOD ENDED JULY 31, 1975

	CURRENT BALANCE	CURRENT PERCENT	TO-DATE BALANCE	TO-DATE PERCENT
INCOME				
WHOLESALE SALES	$ 18,453.37		$102,269.19	
RETAIL SALES	126.00		794.00	
TOTAL SALES	$ 18,579.37	100.00 %	$103,063.19	100.00 %
COST OF GOODS SOLD				
BEGINNING INVENTORY	14,534.65		12,222.00	
ADD PURCHASES	10,136.46		58,144.54	
LESS ENDING INVENTORY	(14,594.78)		(14,594.78)	
TOTAL COST OF GOODS	$ 10,076.33	54.23 %	$ 55,771.76	54.11 %
GROSS PROFIT	$ 8,503.04	45.77 %	$ 47,291.43	45.89 %
DIRECT COSTS				
WAGES	5,733.02	30.86	22,417.10	21.75
DISCOUNTS	300.04	1.61	1,733.89	1.68
PIECE WORK	170.10	.92	1,746.60	1.69
PAYROLL TAXES	691.17	3.72	2,891.60	2.81
TOOLS	885.69	4.77	1,546.97	1.50
TRUCK EXPENSE	436.13	2.35	4,850.96	4.71
TOTAL DIRECT COSTS	$ 8,216.15	44.22 %	$ 35,187.12	34.14 %
GENERAL EXPENSES				
ADVERTISING	-0-		55.00	
LEGAL & ACCOUNTING	80.00		695.00	
FREIGHT	-0-		-0-	
FUEL	-0-		31.52	
INSURANCE	627.02		627.02	
LICENSES & TONNAGE	-0-		40.50	
PENSION PLAN	4,812.78		4,812.78	
PHONE & UTILITIES	68.83		236.62	
REPAIRS	52.17		528.82	
SUPPLIES	15.96		646.81	
TAXES - BUSINESS	53.20		808.76	
TRAVEL	50.00		253.00	
SHOP & OFFICE	-0-		76.80	
DEPRECIATION	631.00		2,466.00	
MISCELLANEOUS	-0-		19.50	
TOTAL GENERAL EXPENSES	$ 6,390.96	34.40 %	$ 11,298.13	10.96 %
PROFIT	$ (6,104.07)	(32.85)%	$ 806.18	.78 %
MISCELLANEOUS INCOME	-0-		795.87	
NET PROFIT	$ (6,104.07)		$ 1,602.05	

EXAMPLE REPORTS - GENERAL LEDGER MODULE - MAC

FIG. 2.22

ADS-CAS, INC
SOUTH BEND, WASH

BALANCE SHEET AS OF JULY 31, 1975

ASSETS

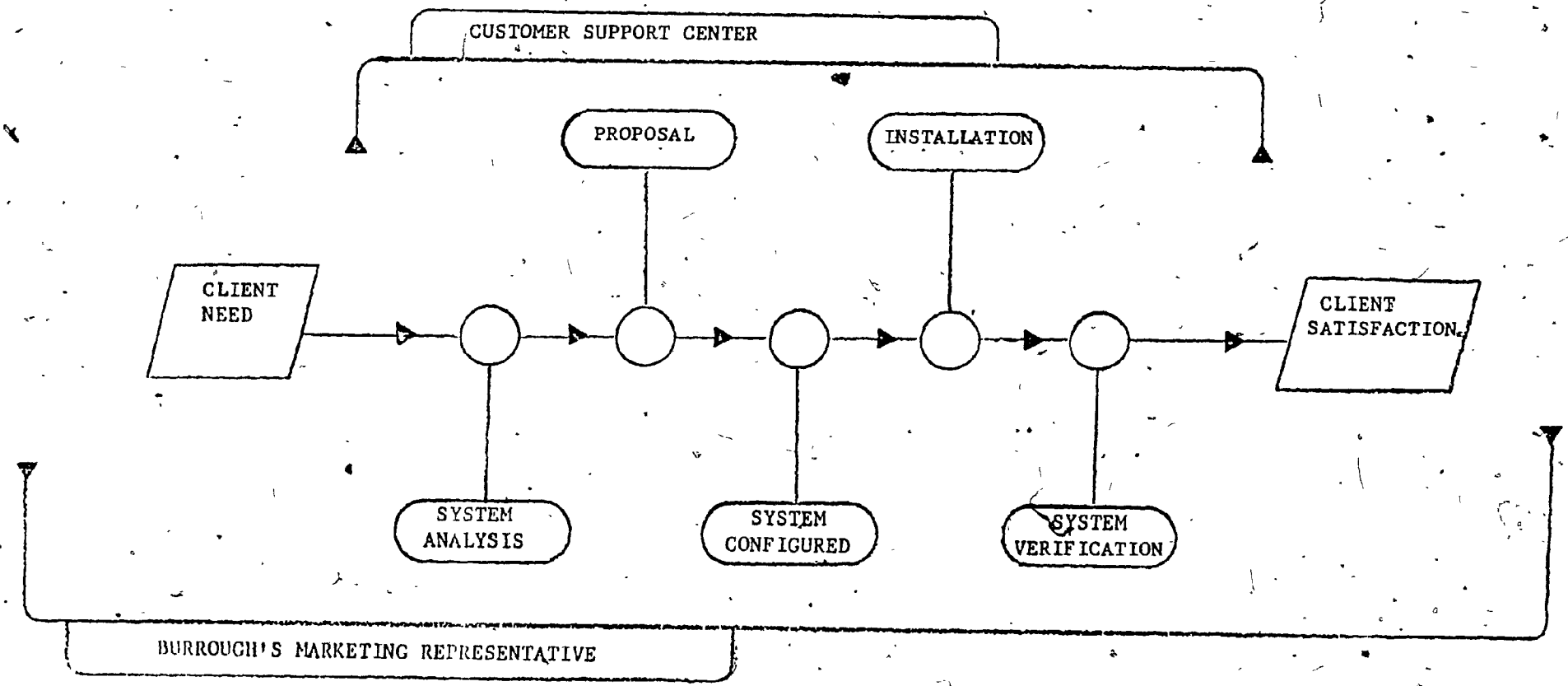
CURRENT ASSETS		
CASH IN BANK - SEATTLE 1ST NATIONAL	$ 15,096.51	
ACCOUNTS RECEIVABLE	20,927.86	
INVENTORY	14,594.78	
TOTAL CURRENT ASSETS		$ 50,619.15
FIXED ASSETS		
BUILDING & IMPROVEMENTS	21,651.48	
EQUIPMENT	46,747.71	
LESS RESERVE FOR DEPRECIATION	(25,256.52)	
TOTAL FIXED ASSETS		43,142.67
OTHER ASSETS		
INCOME TAX REFUND	252.97	
DEPOSIT DEPT OF L & I	231.75	
TOTAL OTHER ASSETS		484.72
TOTAL ASSETS		$ 94,246.54

LIABILITIES & CAPITAL

CURRENT LIABILITIES		
ACCRUED TAXES PAYABLE	$ 2,879.34	
ACCOUNTS PAYABLE	8,283.08	
WAGES PAYABLE	2,042.08	
TOTAL CURRENT LIABILITIES		$ 13,204.50
CAPITAL		
COMMON STOCK ISSUED & OUTSTANDING	16,950.28	
RETAINED EARNINGS	64,091.76	
TOTAL CAPITAL		81,042.04
TOTAL LIABILITIES & CAPITAL		$ 94,246.54

EXAMPLE REPORTS GENERAL LEDGER MODULE - MAC

FIG. 2.24



BURROUGHS SYSTEM DEVELOPMENT

FIG. 2.25

CHAPTER 3

3.1 INTRODUCTION

The reply to the question "Should we use a computer?" is not an easy one for any construction firm. It requires a careful study of the possible implications for the firm in terms of formalization of its information flow, reporting procedures, and organizational structure, on one side and a framework for evaluation of alternative computer systems to meet the firm's requirements on the other side. The goal of this chapter is to initiate discussion on these two topics and to suggest key elements that should be considered.

3.2 IMPLICATIONS OF COMPUTER USAGE

The possible implications of computer usage for a construction firm are studied under four major headings. Each individual heading corresponds to one of the major aspects of a firm's normal operations. These are:

1. Human factors
2. Organization
3. Functions
4. Technical aspects

3.2.1 Human Factors

Treated under the topic of human factors are such terms as educational background, skills, attitudes, modes of working, communication

skills and psychological factors such as confidence and level of security. These factors are first considered herein with respect to senior management personnel, project managers and related office support personnel and field management personnel. They are then analyzed with respect to their interaction with the decision to use computer based management information systems such as described in Chapter 2.

With respect to senior management, relevant human factors include the following:

1. Building construction firms are in many cases family owned. Thus key positions in senior management are held within the family. Such ownership can inhibit delegation of responsibility to non family members. Consequently, senior management spends considerable time on day to day operational issues, and thus requires information at a high level of detail.

2. Educational levels can vary significantly all the way from grade school education to professional degrees in engineering or architecture. In general, however, education levels tend to be low. Much more emphasis is placed on experience and on the job training. Upgrading of management's skills by way of short formal courses is seldom pursued.

3. Because of the nature of their training, management tends to be supportive of the status quo. They are skeptical of

the worth of techniques such as CPM, PERT, computerized estimating etc. and thus tend not to support their use.

4. In some firms, senior management expresses little confidence in the ability of field staff to provide accurate quantitative data pertaining to project progress. Thus they do not make use of formal reports and are at best neutral with respect to their use by others.

5. The favored mode of communication and reporting is informal and oral. They believe in people to people contact rather than contact through a written report interface.

6. Because of the highly competitive nature of construction, they are not receptive to changes in their procedures which will increase their overhead. They tend to be skeptical of the benefits claimed for use of more formal reporting and computerized data processing, and do not believe that these benefits will outweigh the costs. They give far greater weight to the failures than the successes that have occurred with respect to computer use by other contractors.

With respect to project management and related support personnel (e.g. estimators), relevant human factors include the following:

1. Their educational training is normally at the level of technical school, technologist or engineer. Thus they have a reasonable level of quantitative skills.

2. Heavy emphasis, however, is given to experience and on the job training and they tend to support the status quo. They do not see themselves as vehicles for initiating changes in the firm with respect to reporting and data processing procedures, even though their own effectiveness could be improved by such change.

3. Despite the fact that project managers in many cases keep detailed quantitative records for their own use, they tend to report to other company personnel, especially senior management, orally through informal meetings.

4. Duties and responsibilities of project management personnel tend to be a function of the capabilities they demonstrate to senior management. Significant variations in style and degree of freedom occur between project managers within the same company.

With respect to field management personnel, relevant human factors include the following:

1. In general, educational levels of field management personnel are low. Heavy emphasis is given to experience and on the job training. A typical path to the role of project superintendent includes stints as apprentice carpenter, carpenter—foreman, assistant superintendent, superintendent.

2. The main strength of field personnel is their knowledge

of construction. They possess little, if any, formal management training.

3. They are action oriented and are loathe to maintaining written records. They tend to procrastinate in completing written reports, resulting in the need to recall from memory data pertaining to job costing and project progress.

4. They are more comfortable with qualitative than quantitative reporting and prefer oral rather than written means. They are more capable of using simple data gathering and project control formats (e.g. bar chart versus CPM diagram) than complicated ones.

5. They tend to be optimistic and thus their reports must be carefully assessed. This is especially the case when they feel that their reports on progress are used as a means of evaluating their performance.

6. They are satisfied with the status quo. They do not feel compelled to challenge the status quo, especially in light of the fact that job security in the construction industry is low.

The implications of the foregoing factors for implementing a computer system in a construction firm are summarized in Table 3.1. Implications both in terms of the computer system and the firm itself are treated.

3.2.2 ORGANIZATION - THEORIES AND CHARACTERISTICS

Three different theories pertaining to organization structures have been identified in the brief history of management [19]. These are:

1. Classical theory
2. Human relation school
3. System approach

Figure 3.1 illustrates these theories, the sources from which they drew, and the techniques they have produced. A brief description of the main characteristics of organization as treated by each of the above theories is given below.

1. CLASSICAL THEORY

The features of the classical theory of the organization may be described in terms of three key variables, viz, structure, process, and values.

STRUCTURE

Under the classical theory, the key to precision and effectiveness within the organization is seen to lie in defining a centralized pyramidal authority structure, with the numbers of hierarchial levels, spans of control and line-staff relations carefully defined. Thus, the tasks involved in setting up an organization are taken as the formulation of an organization chart with line

(vertical) and staff (lateral) relations clearly laid out and as the preparation of elaborate job specifications setting out the incumbents' authority, responsibilities, functions, rank, and duties.

PROCESS

The tasks of management are viewed as being comprised of four elements: planning, organizing, leading (command and co-ordination) and control.

Planning — is how an organization makes a strategic decision; diagnosing the problem, finding alternatives, projecting the results of each, and selecting a specific alternative.

Organizing — is the design of the organizational chart and writing of role specifications.

Leading — refers to the actual process of commanding and co-ordinating and in the classical approach is essentially a matter of delegation, good staff work, and careful decision making.

Control — involves measuring progress towards the objectives. If operations are not progressing well, one goes back to the plan to take the necessary corrective action to get back on course.

Values — In this essentially bureaucratic approach the value system presumes that classical man will always act in the best interest of the firm and behave rationally.

2. HUMAN RELATIONS SCHOOL

The human relations school views the organization as a social system with twin objectives: one, producing the product and the other, generating and distributing satisfaction among employees, thereby achieving both economic effectiveness and job satisfaction.

The human relations school, believing that economic and technological aspects of business are adequately developed, concerns itself with developing better human relations within the firm.

The basic premise for structuring an organization based on this approach is that if an employee is experiencing satisfaction at his work, he will be more productive. In terms of critical dimension, the structure of the organization may be formal or informal. The decision as to which one is a function of the tasks to be performed and the resources available to achieve them (technical, human and economic); not a function of personality. The process is based on consultation and participation and the value system is employee-centered. People matter and recognition is given to sentiments.

3. SYSTEMS APPROACH

System theory is essentially concerned with the notion that an organization consists of a set of interrelated parts and functions like a living creature. The direct development of the system theory is the system shown in fig. 3.2. In this system and its subsystems attention is focused on information flow rather than authority relationships.

Thus the organization is defined as an information processing system analogous to a computer process, with the process modules as shown in figure 3.3.

The organization functions by collecting information, processing it, storing some of it and taking action and formulating plans based on it so that the cycle can be started again. Some characteristics of the systems approach to the organization are:

1. The traditional division of line and staff is treated as irrelevant. The theory minimizes the importance of personality and assumes that roles can be objectified; thus efficiency is maximized and conflict minimized.

2. In the systems oriented organizations, there are the presumptions (1) of bonded rationality (2) that information is expensive and (3) that organizations work by programmed decisions. Thus models must exist for each of the decision processes within the firm.

These organization theories lead to the following important parameters with which a firm can be described and analyzed:

1. Hierarchical structure - The organization chart sets out relations of people in terms of line, function and staff, line of communication and span of control.

2. Definition of roles, authority, responsibilities, functions and duties.

3. Procedures (policy) - a formal set of rules governing information

flow, processing and use of information.

4. Decision networks - identification of the manner in which decisions should be made, the interrelationship between individuals involved in the decision process and the flow of information between these individuals.

Viewed in terms of the above parameters, the organizational forms used by contractors are seen to possess many of the characteristics of classical organizations and some of those organizations founded on the human relations approach. There is an inherent element of informality involved in a contractors organization with respect to the definition of roles, authority, responsibilities, functions and mode of communication. Job roles are seldom clearly defined and are a function of the individual's capabilities and personality. Communication is completely informal most of the time which is a characteristic of the human relations approach. Decision networks are informal. There is often no set process for handling routine and non routine decision situations. Procedures governing information flow, processing and use, while known to individuals are not documented or formalized in an integrated manner.

This state of affairs can be described as a lack of maturity on the part of the firm. The issue of organizational maturity has been dealt with by Ein-Dor and Segov [6] as follows: "We define mature organizations as those in which systems are formalized, quantified and produce data appropriate to their decision and control processes.

Given this definition, old established organizations which are run informally and intuitively may be very immature, whereas, a new rationally structured and well planned organization may be very mature, in spite of its youth".

Further on they state: "The construction of formal information systems requires not only that processes be well understood, but they also be presented in a form suitable for processing and can be quantified only if data are both available and accessible. First, some of the data required for decision analysis may not have been collected in the past, or may be available only in a form unsuitable for use without considerable massaging. Second the desired data may exist somewhere in the organization, but are of little use because of the difficulty entailed in actually putting them together."

These issues are of particular importance to the construction firm especially with respect to job cost and time control. Many firms do not have formal processes, collect insufficient data for effective control and informed decision making, and have no established means for coordinating the information that is generated by various individuals within the firm. Extensive treatment of the problem of appropriate records and procedures may be found in the report by Revay [21].

Implications for the organization and any computer system adopted or developed are suggested in Table 3.2. Additional research should be conducted in order to make a comprehensive compilation of implications. It should be noted that use of a computer system will require

construction firms to move closer to a systems approach of management.

3.2.3 Functions

The functions of a construction firm which are most amenable to computerization are:

- Estimating
- Planning
- Scheduling
- Progress Control
- Cost Control
- Management Accounting for
  - Payroll
  - Accounts payable
  - Accounts receivable
  - Job Costing
  - Financial Reporting
- Inventory Control
- Equipment Usage

In order to computerize any particular function, it is first necessary to develop a model of it. In developing this model, attention must be directed at the following issues:

- What input data is required for this function and what is its source (external, internal - from other functions).
- What operations are involved in putting this data in a form

suitable for computer manipulations.

What algorithms are required for this manipulation.

What mode of interacting with the computer is required - on line, batch, graphics.

What information does this function generate and how is it interfaced with other functions.

What individuals are involved in this function, what are their capabilities?

What response time must this function have?

How routine or non routine is this function and what degree of variability can occur in its execution from one project to the next.

To date, most attention has been directed at those functions which are routine in nature, which require batch processing for cycles of one week or more and for which input data is internally generated (e.g. payroll, accounts payable, accounts receivable - see Chapter 2).

More work directed at answering the foregoing questions for other functions as they relate to the building contractor is required before they can be effectively computerized.

3.2.4 Technical Factors

Prior to making a decision whether to computerize one or more data processing functions of the firm, several technical factors, both at

the overall level of the firm and at the function level must be assessed. Some of these factors were noted in Chapter 2 with respect to the evaluation procedures employed by various computer firms.

At the level of the firm these factors include:

1. Rate of growth of the firm.
2. Diversity of project types.
3. Percentage of work subcontracted.
4. Development of a coding procedure which can integrate the estimating, planning and scheduling and control phases of a project. This topic is an exceedingly important one. An effective coding system is essential for the development of an integrated management information system which supports a range of functions. Further, it is crucial to the production of reports which are tailored to the specific needs of individual users.

At the level of the function these factors include:

1. Volume of data to be processed.
2. Volume of data to be retained for long term use.
3. Frequency of processing and reporting.
4. Mode of work - on line, batch
5. Type of man machine interface required - graphic, written
6. Variability in the function and flexibility required for input data and output information.

3.2.5 Summary

To date, almost no literature exists which is aimed at helping the contractor to assess the implications with repsect to the form of computerizing various functions.

In this section of the report, an attempt has been made to discuss those implications under four major headings - viz: human factors, organizations, major functions and technical aspects of the firm. Much more work must be done. An important heading which has not been treated is that of the benefits - both tangible and intangible - to be derived form use of a computer. A prerequisite to such a treatment is a detailed study of firms which have adopted a computer system. It is recommended that usch a study be undertaken in the future.

3.3 ASSESSMENT OF COMPUTER SYSTEMS

The decision process for deciding on whether to computerize one or more of the firm's data processing functions and what computer to use, assuming that a minicomputer system will be selected, amy be viewed as involving three phases. The first phase involves an assessment of the implications for computer use, including initial cost assessment. Out of this phase will come a yes or no decision that the firm is prepared to adopt changes in its structure and procedures as required, to use the computer. Certain aspects of the analysis conducted in this phase were treated in the previous section. In the second phase, attention is focused on the costs and benefits to be derived from computerization. Functions to be computerized are identified and ordered in terms of importance and a conceptual model of what the firm requires from a system is developed. Based on this model, an analysis of the possible costs and benefits is made [18].

The output of this second phase is an extimate fo the financial resources the firm is willing to commit to the acquisition of a computer system. The function of the last phase is to develop a set of criteria or performance brief which potential suppliers must use in preparing their submission to the firm. These assessment criteria are briefly examined below. Their description is taken from Reference [7]. Methods of measurement for these criteria are not considered.

Service Level: The ability of the system to do work quickly and reliably.

Flexibility: Growth potential of the system within the same computer family.

Quality of Supplier Management:

1. Experience and past performance of the support personnel.
2. Experience of conversion team leader (if a conversion is required).
3. User satisfaction with similar systems and support services.

System Features:

1. Ability to meet the mandatory and optional requirements.
2. Ability to communicate with a variety of terminals and other computer systems.
3. Available programming languages.
4. Range of available software and application programs that may benefit the users.

Reliability & Backup:

1. Ability to improve reliability by adding equipment.
2. Range of possible backup alternatives near the computer site.
3. Range and quality of security features included in the hardware and software.

System Support:

1. Quality and amount of support that will be available.
2. Quality of maintenance and emergency services and proximity of replacement parts.

Ease of Use:

1. Ability to use software from independant suppliers.
2. Ease of operation of hardware and software.
3. Ease of understanding the job control language, the software documentation and the programming procedures.

Cost:

- operating cost of proposed system.
- cost of adding main storage, processing power, and peripheral equipment.
- cost of programming conversion.
- cost of education and support services.
- installation cost.

Miscellaneous:

- Delivery time from the order date.
- Age of equipment (date of the first delivery).
- Physical space requirements (including electrical power and cooling, if required).
- Compatibility with the equipment the user is currently using.

This list of criteria is not complete. A further study is recommended which should include a means of measuring these criteria.

TABLE 3.1

IMPLICATIONS ON ORGANIZATION

	INPUT	INTERFACE	PROCESSING	INTERFACE	OUTPUT
Computer system	Input data required must be - collectable - able to be correctly measured and quantified - related to the information needs of management. Its collection and recording must not require skills not compatible with those of site personnel.	Require someone able to understand use of system, but who also can assess accuracy of input data.	Algortihm incorporated in the software must be understood by the user.	User should be able to select output format most appropriate for his needs.	Output formats must not overload user with extraneous information.
Organization	- must develop standard proceedures and formats for data collection. - must convince personnel of importance of accuracy in data collection. Also, should consult them regarding what level of detail can be monitored. - may require aditional site personnel to collect and document data.	For input to be meaningful and relatively error free, machine operator must be able to cope with input problems, but also should know about construction.	Must have on staff someone capable of manually executing the computer algorithm in order to check computer output as required. The person should possess quantitative skills and must know about the data being input and the purposes the related output is being used for.	Person should be able to tailor the output reports to the need of the user.	Must know who needs what information, how often, what level of detail and for what purpose. Hence process of decision making for various functions and also roles of individuals with respect to these functions must be identified.

TABLE 3.2

IMPLICATIONS ON HUMAN FACTORS

	INPUT	INPUT INTERFACE	PROCESSING	OUTPUT INTERFACE	OUTPUT
Computer System	Data required for input should be measurable. Only data essential for producing desired reports should be called for. Date entry forms should correspond to full reporting formats.	Interface between user and machine should be simple. Detailed documentation should be available along with error diagnostics.	Processing algorithms should be kept as simple as possible consistent with the output objectives.	The user should be able to query the computer for information he requires.	Output formats should be designed to permit ease of use for a varied audience.
Human Factors	Must teach people the importance of collecting data accurately. Must consult field staff regarding understandable formats for collecting data. Must indicate management support for collecting information by showing how it will be used, by providing appropriate clerical help, as required, and providing detailed procedures on collection.	Should use field reports as input data formats to avoid errors in transcribing.	Personnel should be trained as to the uses of various data and how they can be meaningfully manipulated to produce progress reports, productivity data, trends, etc. Some upgrading of computational skills is required.	Personnel should be trained to work directly with a computer.	Personnel should be trained to work with both graphical and tabular output.

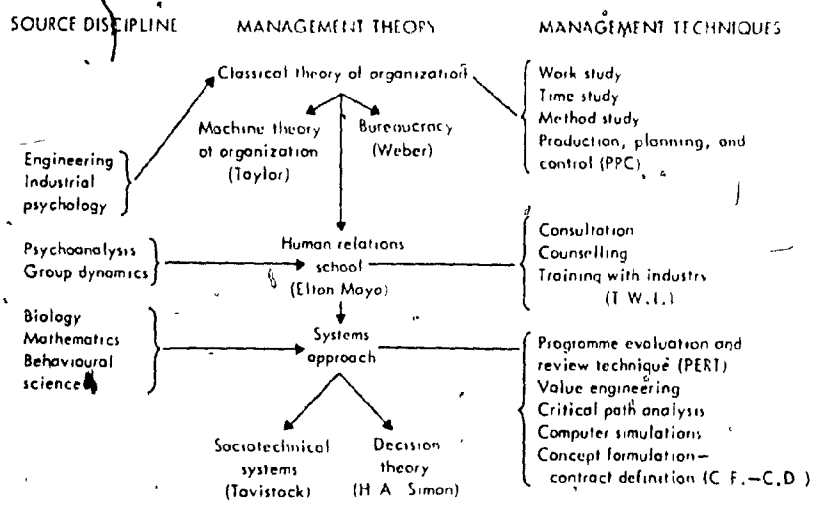


FIGURE 3.1

The relationship between management theory, source discipline and management technique. [19]

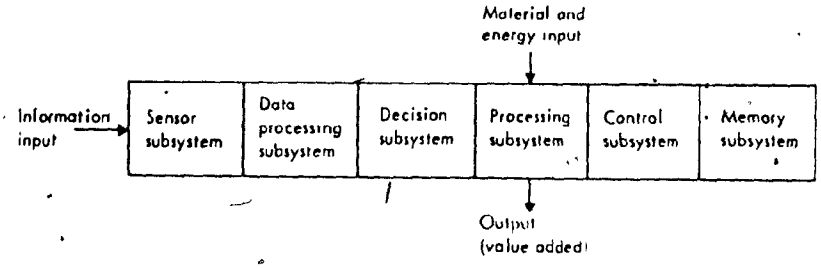


FIGURE 3.2

System Approach - A System and its Subsystems [19]

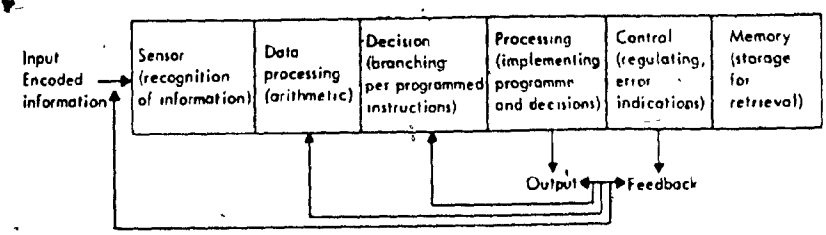


FIGURE 3.3

Basic Computer Process Modules [19]

CHAPTER 4

4.1 SUMMARY OF FINDINGS

The findings of the report are summarised with respect to the objectives stated in Chapter 1.

Objectives 1 and 2

Contractors who adopted computer systems did so because of the need for accurate and timely reports. Some of the recognized benefits included reduction in staff, reduction in errors, control and better understanding of operations, reduction of time in processing data, tighter control over pricing and savings achieved through improved inventory control.

Objective 3

Computer systems are available to address several of the major functions of the contractor's firm. Three such systems were examined (Chapter 2) and were observed to be quite comprehensive in the area of the management accounting function for the contractor. A comparative study of the merits and demerits of these systems was not carried out. Nevertheless, it was found that the systems examined were all designed using a modular approach so that a contractor could adopt one or more of the modules to carry out a particular function. All systems could be tailored to a limited extent to meet specific needs of the contractor. Adoption of one of these systems requires a complete systemization of the contractor's data collection, processing and management reporting, and more precise definition of personnel functions and roles.

Objectives 4 and 5

Four major headings were identified under which the sutdy of possible implications for the firm were carried out. These are human factors, organization, functions and technical factors. It was indicated that these factors can be significant and bear close examination. Further studies in this regard are recommended because of the incomplete understanding of these implications.

4.2 SUMMARY OF RECOMMENDATIONS

In attempting to address the objectives set forth in this report, several areas requiring further study were noted. They are:

1. There is a lack of easily understood information regarding computers and their usage directed at the contractor. A report directed at their specific interest and needs would be of significant benefit to them. This report could provide a basis for the preparation of such a report.
2. Work should be directed at determining the problems and needs of contractors in each of the major functions (estimating, planning, scheduling, etc.) and to determine those specific functions where the computer could make a significant contribution to solve the problem.
3. An in-depth analysis of all the possible implications of computer utilization for the firm with respect to human organizational, functional and technical factors needs to be undertaken. Such an analysis would require considerable interaction with the construction firms.
4. A more detailed analysis of the criteria used to assess system alternatives should be carried out (which should help a contractor to evaluate a computer system before adapting computerized information system).
5. A study should be undertaken to design a framework by which a potential user of a computer system should be able to assess and compare the costs and benefits resulting from the use of a computer system. Such a study should reflect the continuous decrease in computer costs and increase in their capabilities.

APPENDIX I

QUESTIONNAIRE FOR INTERVIEWING CONTRACTORS

Centre des études sur le bâtiment

Centre for Building Studies

Université Concordia, 1455 ouest, boul. de Maisonneuve Montréal, Québec, Canada H3G 1M8 téléphone 879-8551

Concordia University, 1455 de Maisonneuve Blvd W Montreal Que., Canada H3G 1M8 telephone 879 8551

QUESTIONNAIRE ON USE OF COMPUTER SYSTEMS BY CONTRACTORS

A SIZE AND CHARACTER OF THE FIRM AND ITS OBJECTIVES

1. Please indicate which roles your firm typically assumes:

	%
General Contractor	_____
Trade Contractor	_____
Engineering Contractor	_____
Design Build	_____
Construction Management	_____
Other (please specify)	_____
_____	_____

2. What is the approximate breakdown of the range of projects undertaken?

	%
Residential	_____
Commercial	_____
Light Industrial	_____
Heavy Industrial	_____
Other (please specify)	
_____	_____

3. The average annual volume of the firm at present, in current dollars is:

less than $1 million	_____
$1 million to $5 million	_____
$5 million to $10 million	_____
$10 million to $20 million	_____
$20 million to $40 million	_____
over $40 million	_____

and the average annual rate of growth over the last 3 years has been _____%.

4. At any one time the firm is involved in:

2-5 projects	_____
6-10 projects	_____
11-15 projects	_____
16-20 projects	_____
21-30 projects	_____
over 30 projects	_____

5. The firm's projects range in value from $_____ to $_____ and in duration from _____ months to _____ months.

6. From _____ percent to _____ percent of the work on a typical project is subcontracted out.

7. The work performed by the firm on a typical project consists of _____

8. The geographic distribution of projects is roughly as follows:

	%
Montreal	_____
Quebec	_____
Quebec and Ontario	_____
Eastern Canada	_____
Western Canada	_____
International	_____

9. The mix of contract types the firm is normally engaged in is roughly as follows:

	%
Fixed price	_____
Cost plus fixed fee	_____
Cost plus percentage	_____
Construction Management	_____
Turnkey (Design Build)	_____

10. Head office staff consists of _____ people, of which _____ are clerical staff. Site personnel maintained full time by the compnay include _____ superintendents and _____ foremen.

11. Please sketch the organizational chart for your firm in the space provided below. Please show key personnel and lines of authority.

12. Please sketch the site staffing arrangement used by your firm for medium to large-sized projects (please include interface with head office).

13. Listed below are several possible objectives for a construction firm. Please identify, in order of importance, those objectives pursued by your firm.

		Priority
a)	Percentage return on volume not less than some predetermined number.	_____
b)	Development of a reputation for timely completion of projects within budget.	_____
c)	Maximization of return on equity.	_____
d)	Attainment of a specified rate of annual growth in dollar volume.	_____
e)	Diversification into other forms of construction.	_____
f)	To become a national construction company.	_____
g)	To become an international construction company.	_____
h)	To become a development company.	_____
i)	Other (please specify)	_____

_____

_____

B. IDENTIFICATION OF NEED FOR CHANGE

1. What business factors led your firm to consider the use of computers?
2. What problems with the previous means of processing information led management to consider using computer systems?
3. Which functions (e.g. payroll, accounting, scheduling, etc.) were identified as being most in need of improvement and/or computer assisted information processing?
4. How were the information processing and management reporting requirements defined for the functions outlined in #3?

C. SEEKING WAYS TO CHANGE

1. Please describe the alternatives considered for solving the problems posed by questions 1 and 2 in the previous section e.g.
   a. Expand staff;
   b. Use computer service bureaus;
   c. Use of a time-share system;
   d. Purchase or lease of in-house mini-computer system;
2. Who conducted the assessment of alternatives identified above? What criteria were used?
3. What assessment was made with respect to how use of a computer system could change the manner in which the firm is organized and how it collects and uses information?

D. USE OF COMPUTERS

1. How long have you been using your computer system?
2. What problems were encountered with its implementation?
3. Has the adoption of a computer system met your expectations?
4. What training and education programmes did you implement to inform staff of the use and implications of the system?
5. What changes, if any, have taken place in the firms organization because of use of the computer?
6. What changes in the frequency and level of detail of reporting have occurred since adoption of the computer?
7. Have additional functions been computerized?
8. Please summarize the benefits you feel your firm has gained from the use of the computer?
9. In your view, have these benefits exceeded the cost of the computer?

E. DESCRIPTION OF HARDWARE AND SOFTWARE

1. Please describe the hardware configuration you have.
2. Please describe the software system you are using. Was this system tailored to suit your specific needs? If yes, please describe briefly these needs.

APPENDIX II

LIST OF SOFTWARE PROGRAMMES

SOURCE: 1. A study of project planning and progress control practices in the Canadian construction industry by Revay and Associates - Jan. 1974.

2. Cost engineering related computer software, by Thomas J. Call. Computer Application Committee, American Association of Cost Engineers. 1978.

ANALYSIS OF CAPITAL INVESTMENT

Computation of tables of depreciation, salvage values, earnings and interest payments of a project, to determine rates of return.

SWR.

BEARING - DISTANCE INTERSECT

Solves intersection of two lines, given bearing of the first, length of the second and starting and ending coordinates. Unknown bearing and distance are calculated.

BUDGET STATUS SYSTEM

Comparisons of budgets vs costs for projects.

SWR.

BUILDING INDUSTRY PROGRAM (UNIBAU 91)

This program is used for calculations in the General Building Industry. It may also be used for superstructure, deep workings, road construction and dike construction. Besides computations of lengths, areas, and volumes.

UNIVAC.

BUILDING SUPPLIED CALCULATION

This package has been designed specifically for the construction industry to calculate the areas and volumes of materials used both in the excavation and the erection of structures of all types. The program uses formulas found in civil engineering handbooks to calculate areas such as rectangles, trapezoids, triangles pentagons, circle segments, spirals, etc., and volumes such as cylinders, taurus, cones, etc.

UNIVAC.

CBEES II (CANADIAN BUILDING ECONOMIC EVALUATION STUDY)

This program helps provide in-depth cashflow analysis and summary measures to help evaluate the economic viability of proposed building projects. CBEES II can be used on any type of building

project and is designed to base its calculations on the new federal tax structure. Portland Cement Association.

CONSTRUCTION COST ESTIMATING

Technical Programs, Inc.

CONSTRUCTION PROJECT CONTROL SYSTEM (CPC)

CPC provides a basic, flexible tool for bidding and managing construction projects, gaining the best possible utilization of labour and equipment resources under constantly changing conditions. The CPC System is made up of 28 programs that fall into four function categories schedule generation, calendar generation, monitoring, and reporting.

Honeywell.

CONSTRUCTION SITE CUT AND FILL

Technical Programs, Inc.

CPM

CPM offers a systematic procedure which records, analyzes and controls each sequential step necessary for the completion of a particular work project.

CDC and Dataline.

CRITICAL PATH EVALUATION

This program will compute CPATH and print a summary of earliest and latest event times and actual and maximum activity times, and indicate which are on the critical path.

Hewlett Packard.

CRITICAL PATH SCHEDULING

DEC.

CUT AND FILL

Computes Cut and Fill Volumes

Wang.

CUT AND FILL CALCULATIONS

I.P. Sharp

DATA PRESENTATION SYSTEM

The 1130 Data Presentation System provides graphic programming support at three distinct levels of versatility and usefulness. The first level provides the programming necessary for control of the plotter. Level 2 sub-routines utilize those of level 1 to perform more extensive tasks such as times, plotting, scale annotation and curve fitting. The highest level, the Graphic Report Generator, provides the ability to make many different graphic presentations of data files without any programming effort by the user. It is controlled by input statements, which may be prepared by a person with no programming experience, that describe the plot to be generated and the data files to be processed.

IBM and SNC.

EARTHWORK

Processes basic engineering design data and is not simply a "cut and fill" quantities calculator. Handles complete right of way design problems. Includes vertical curve and profile grade design, template design, off-shoulder design, including drainage channels, back-slope design, and multiple-layer terrain models. Provides special project capabilities: equations, lump sums, grade stations and end sections.

Honeywell.

EARTHWORK

EARTHWORK, a package modified from CUTFILL, provides massive calculations dealing with road building and its earthwork variables. The program calculates a profile, slope stakes, both ditches, medians, grades, rates for left and right offs, elevations, offs width elevations, rate of the offs elevations, areas, cubic yard quantities, summation quantities in cubic yards, cuts, and fills.

FINANCIAL SIMULATION MODEL

Analysis of probable return on investment for high-rise building using monte carlo simulation.

SWR.

INDUSTRIAL PAYROLL SERVICE (IPS)

IPS provides an easy to use method of performing payroll functions.

Multiple Access Ltd.

MATERIAL INVENTORY AND SCHEDULING SYSTEM

Varian Data Machines.

MINIPERT FOR PROJECT CONTROL

I.P. Sharp.

PERT

PERT/COST

PERT is used to plan, monitor, and evaluate projects and programs; PERT/COST provides effective project control from the standpoint of cost. PERT/COST System utilizes a cost-oriented work breakdown structure to define the end items and functional sub-elements that are combined to produce the end items.

CDC.

PERT/TIME

PERT is used to plan, monitor and evaluate projects and programs; PERT/TIME provides effective project control from the standpoint of time. The PERT/TIME System utilizes a time-oriented network structure which represents the flow of work activities and events that mark their completion.

CDC.

PLOTTER

By connecting an incremental plotter to a computer the user has at his command a drafting machine of sufficient sophistication to produce any kind of graphic output whilst the computer assumes the order of detailed control.

Dataline

PROJECT CONTROL SYSTEM

Scheduling and progress reporting on a project described by a critical path network.

SWR.

PROJECT COSTING/BILLING SYSTEM

Project invoices, billings and billing status. Sub-system of budget status system.

SWR.

PROJECT COSTING SYSTEM (PROCOST)

Multiple Access General Computer Corporation's Project Costing System (PROCOST) is a set of fully supported computer programs to aid engineers, contractors, and architects to control the progress and cost of projects. This system may also be applied to other types of projects in which the allocation and control of employee time and cost is essential.

Multiple Access Ltd.

PROJECT MANAGEMENT AND CONTROL SYSTEM (PMCS)

PMCS is a modern Critical Path system. This powerful, but simple, technique is used for planning, scheduling and controlling large complex projects. It identifies both current and potential problem areas of the project so that corrective action may be applied immediately.

Multiple Access Ltd.

PROJECT MANAGEMENT SYSTEM (PMS)

PMS/360 is a system of computer programs to aid in the project management functions of critical path analysis, resource allocation, project costs and progress control and report generations.

SDL and Computed

PROJECT PLANNING SYSTEM

PPSIV is the fourth improved revision of computer program which aids in planning and managing complex projects such as construction jobs and maintenance of refineries, chemical plants and airplanes. It is a fast critical-path method/resource allocation program designed to find the shortest feasible project length while observing restrictions on manpower and equipment. PPSIV produces work schedules that enable the user to shorten project length, whether it is plant turnaround or a long-term construction project, and also help the user utilize each resource fully, men and equipment.

CDC.

SYMPL

SYMPL was designed to assist in preparing projections of the future, i.e. forecasting, planning, budgeting, etc. Provision is made for the user to create a data bank of time dependent data, to manipulate the data, and to generate reports using specific parts of the data.

SDL.

THE PROJECT COST MODEL (PCM)

Forecasts final total and to-date costs and revenue. Prepares schedules yielding least cost. Tabulates and/or forecasts resource usage. Prepares period by period forecasts of cost incurred, revenue earned, outgoings, cash received and cash balance. Assesses the effect of any actual or contemplated change to work content, costs, resources utilization, sequence of work, and future schedule/completion date of the project by symulation technique.

(Project Software Limited - UK)

Additionally there a number of programmes in private use and/or various variations of commercial programmes altered to

TITLE	SCOPE	COST	COMPUTER	SOURCE
AUTO-COST (8 Programs)	Manufacturing - Maintains, updates Cost & work-in-process inventory information. Output - work-in-process, closed jobs, cancelled jobs, cost history, direct labor by Cost Center. Information includes job number, part number, description, quantity opened, date opened, date required, standard cost, date closed, date cancelled, material amount, labor hours, direct labor, labor overhead, outside process, tooling, partial quantity closed, partial amount closed, total amount, loss quantity, loss amount, trouble amount, unit cost, unit hours, varience from standard cost.	$6,000 terms negotiable	IBM 360/370	Mr Allan Caplan Sysco, Inc. 50 Van Buren Ave. Westwood, NJ 07675 Tel (201) 666-4052
COMPUTERIZED ACCOUNTING & INFORMATION SYSTEM (CAIS)	Construction & Manufacturing - Integrated modules. Produces current job cost & billing analysis, management reports by exception, current & projected profit & loss statements, payroll, accounts payable/receivable, general ledger. Available as system or components	Based on usage, Number of transactions processed	UNIVAC	Mr Jack Safran Digital Solutions, Inc. 100 Menlo Park Edison, NJ 08817
CONSTRUCTION ACCOUNTING SYSTEM	Six independent integrated modules - Payroll, Accounts Payable, Accounts Receivable, Cost Accounting, Equipment costing and General Ledger. Cost Accounting module - 10,000 available Cost Categories.	$8,000	IBM 360/370 LOCKHEED SYSTEM III	Mr S.K. Woodhouse Telesystems Corp. 350 S. 4th East Suite 114 Salt Lake City UT 84115 Tel (801) 532-3567
CONSTRUCTION COMPUTER SYSTEM V	Payroll with checkwriting at terminal, union, tax reports, workmans compensation and certified payroll; tied in weekly and monthly cumulative job analysis with cost compared to extimates by phase branch & detail, unit cost and varience calculations, projections, earnings to date. Complete accounting on either completed job or percent completion basis.	Negotiable	BURROUGHS B5500	Mr Bill Konig Construction Computer Control Corp. 615 Michigan St. Milwaukee, WI 53202

TITLE	SCOPE	COST	COMPUTER	SOURCE
CONSTRUCTION INFORMATION SYSTEMS	Integrated package - 1. Project Cost and Productivity Control 2. Generalized Data Editing 3. General ledger & financial reports 4. Equipment Cost & Inventory Management 5. Cost Estimating 6. Construction Bid Analysis 7. Precedence Network Schedule 8. Resource allocation scheduling 9. Resource leveling 10. Project Cost & Income Analysis 11. Material Store Inventory 12. Payroll 13. Accounts Payable	Price on Request	IBM 360/370	Mr. Peter J. Hogg Construction Information Systems Box 484 Mill Valley, CA 94941 Tel (415) 332-5073
CONTRACTOR/SUBCONTRACTOR BATCHED INPUT FOR PAYROLL ACCOUNTS, GENERAL LEDGER JOB COSTING, ESTIMATING ACCOUNTS RECEIVABLE	Loads a file from previously prepared input cards to be used by named Contractor/Separate loader for each program Payroll (APK) Accounts Payable (APM) General Ledger (APN) Job Costing (APP) Accounts Receivable (APW)	APK 21/mo APM 10/mo APN 10/mo APP 21/mo APW 10/mo all for 12 mo.	IBM Sys 3/10	Local IBM General Systems Systems Office
CONTRACTOR/SUBCONTRACTOR COSTING SYSTEM	Provides for incremental addition of cost control in areas of equipment; materials, and total job costing. Compatible with other Contract or Subcontractor series. System is broken down into three major areas - Material Costing System; Equipment Costing System; and Total Job Cost System (FOP) (5798 - AJC)	$93/MO 12 MO	IBM SYS 3/6 SYS 3/10	Local IBM General Systems Office

TITLE	SCOPE	COST	COMPUTER	SOURCE
CONTRACTOR/SUBCONTRACTOR EQUIPMENT ACCOUTING	Designed to offer the contractor a method of monitoring equipment cost and utilization. Can be integrated with the subcontractor Job Costing (5798-AVC) system to provide the ability to charge equipment costs automatically to each job. Can also be integrated with Contractor/Subcontractor General Ledger System (5798AJD) (FOP) 5798-ASW.	59/MO $59/MO	IBM SYS 3/10	Local IBM General Systems Office
JOB COST (11 Programs)	Manufacturing - Tailored for needs of small to medium size manufacturing companies. Assumes each job can be uniquely identified: Level of detail is optional and cost can be obtained as low as a part and operation within a department. Will supply input transactions for payroll calculation.	$7,500	IBM 370/158 OS/VS	Mr. Edward P Cardille Director of Marketing Burlington Management Services Co. P.O. Box 21207 Greensboro NC 27420
KEY COST/TRACKER CONSTRUCTION SYSTEM	Set of 5 Systems - Construction Payroll, Equipment Management, Job Costs, Accounts Payable, General Ledger Systems. Designed to use as a complete package	Price on Request	IBM SYS 3/10	Mr. Stephen L. Roe Key Management Inc. 3501 Kenwood Ave. S. Minneapolis, MN 55416
KEY COST/TRACKER	Inputs information by bid or Control Item with estimated quantities, costs, and bid price. System combines the information with payables, payroll and general ledger data, completed work quantities and adjusted cost information to produce the Adjusted Cost Statement and Unit Cost Report.	Price on Request	IBM SYS 3/10	See above

TITLE	SCOPE	COST	COMPUTER	SOURCE
KEY COST/TRACKER EQUIPMENT MANAGEMENT SYSTEMS	Complete equipment management Controls for companies of all sizes. Designed on a modular basis and users can select the modules required for their company's operation. Provides scheduling of all lubrication, preventive maintenance, OSHA safety and component replacements. Provides operating cost reports in detail and summary. Cumulative and monthly.	$15, 000 Installed	IBM SYS 3/10 Burroughs B-1700	See Above
LIGHTING SYSTEM COST ANALYSIS	Gives cost comparison between different types of lighting systems for a given installation. The comparison considers original equipment cost, installation cost, maintenance cost, and power costs on a yearly breakdown per fixture. Will accept 5 systems using the first as the base.	$350.00	IBM360	Mr. Bill Frazure Dow Engineering Co. 3636 Richmond Ave. Houston, TX 77027
Mc^2 ACCOUNTS - CONSTRUCTION PAYROLL AND COST ACCOUNTING	Complete payroll and job accounting system for the contractor. Includes chart of accounts, detailed procedures proven forms. Emphasis is on operation control and use of experience as basis for future estimates.	Negotiable Lease	IBM 360	Mr. W. Cole Early Management Computer Controls, Inc. Suite 302, Tanner Bldg. 2714 Union Ave., Extd. Memphis, TN 38112

TITLE	SCOPE	COST	COMPUTER	SOURCE
PROGRAM EVALUATION AND REVIEW TECHNIQUE (PEPT) PACKAGE	Inputs involve job breakdown of the project and time estimates on individual jobs. Costs may also be supplied. Outputs include analysis of time and costs. Through use of updating features estimates can be corrected to reflect in-process experience.	$300/yr	CDC 1700	Mr. Fred C. Tarbox, Jr. Hydra Computer Corp. P.O. Box 17883 North Hills Office Mall Raleigh NC 27609
PE 10130: CRITICAL PATH METHOD (CPM)	Generates a schedule giving longest duration of a project. Handles 3000 activities and 3000 events. Output includes Bar Chart.	On Request	FORTRAN IV	Louis B. Kahn Ph.D. President Technical Economics Inc. 573 The Alemeda Berkeley, CA 94707 Tel (415) 525-7774
MINI-PERT	Mini-computer based project control system with capability for up to 999 activities.	Negotiable	NOVA 8K	Mr. John M. Cavley Digital Systems Corp. Suite 311 Monroeville Mall Monroeville, PA 15146
MILORD - PLANNING A PROJECT WITH RESOURCE	Uses MPM (Methods des potentiels METRA) to schedule stages of a project. It solves the problem in time and optimizes resource allocation, Scope-Scheduling for shops, Civil Engineering projects consulting engineers. Handles 2000 assignments, 15 firms, 700 kinds of equipment,	$15,000	CDC 3600 CDC 6600	SIA International 35 blvd Brune Paris 14 e France

TITLE	SCOPE	COST	COMPUTER	SOURCE
CONCORD - CONCEPTION AND COORDINATION OF WORK PLAN	Computes starting & ending dates for each task: computer margins, critical path and near critical paths: print and sort results in several ways. Uses M.P.M. (methods des potentials METRA). Limitations 8000 tasks, 30,000 rules, 15 industries, 65 kinds of equipment..	$9,000	CDC 3600 CDC 6600	SIA International 35 blvd Brune – Paris 14e France
OSCAR	Resource allocation system. Enables user to simultaneously schedule multiple projects in a user-provided resource environment.	Time-sharing or Lease	IBM DEC	Mr. Peter E. Matsoulas, Bill Associates, Inc. 55 Holton St. Peabody, MA 01960 Tel (617) 927-6640
ACS PROJECT MANAGEMENT SYSTEM	Schedule and control; software development, systems installation engineering, architectual design and building construction. Utilizes the Activity-on-node method of network analysis with a dual-time activity overlap feature. Limitation 1000 activities but easily expandable with added core. Outputs include Project Schedule, Project Budget Report, Gantt charts.	Price on Request	IBM 360/370	Mr. James C. Edenfield American Software & Computer Co. 550 Pharr Rd. N.E. Atlanta, GA 30305 Tel (404) 261-4381
TOPS/SCHEDULE	TOPS implements Integrated Project Control (IPC). IPC assigns values to meeting various cost, schedule and performance objective. TOPS/SCHEDULE generates the optimum schedule for optimizing profit of a complex project. Developed for a 20,000 activity project, but is practical for any project or company large enough for PERT or similar controls. Core requirements depend on network size.	$35,000 + $ 995/mo	IBM 360/370 7090/94 XDS SIGMA 7	Software Marketing Mgr Hollander Associates P.O. Box 2276 Fullerton, CA 92633 Tel (714) 879-9000

TITLE	SCOPE	COST	COMPUTER	SOURCE
PAC-FACS (programmed Appropriation Commitments Fixed Asset Control System)	(16 Programs) Used for control of capital budgeting, appropriation and construction-in-progress-information. Provides timely and accurate reporting of all costs, capital and expense, and time commitments-from authorization of an expenditure to the beginning of fixed asset depreciation. May be interfaced with purchase order and accounts payable systems.	Price on Request	360/370	Mr. Davis R. Blaine Vice President American Valuation Consultants Inc. One Broadway North Des Plains, IL 60016 Tel (312) 217-6100
PAC II	Offers a total management tool including: planning, scheduling, control, accounting, cost allocation, simulation and historical profiling. The planning module supports a simulation capability with critical path, resource loading, inter-project networking and full resource accountability. The Control Module offers easy-to-use turnaround documents for input. Supports capability of tracking management for personnel as well as an unlimited number of other resources. Training & installation are included in the base price.	$16,500	IBM, Honeywell, Burroughs, UNIVAC NCR	Mr. Edward Hipp International Systems Inc. 150 Allendale Rd. King of Prussia, PA 19406 Tel (215) 265-1550
MANAGEMENT CONTROL SYSTEM (MCS)	(80 Programs) Integrated systems relate schedule & cost. Mark I handles up to 10,000 activities for scheduling and 104,000 activities in multiproject resource leveling. Mark II provides for 30,000 activities and includes user formatted schedule reports and graphs, respectively provide 32 or 69 characters of user assigned code for extracting, sorting etc. Both provide cash flow forecasting relating to current schedule. Available as modules or as total system.	$200 400/mo lease $5,000 purchase	IBM 360/370 Honeywell	Mr. Dwight A. Zink Construction Management Systems P.O. Box 90 Haddonfield, NJ 08033 Tel (609) 429-4030

TITLE	SCOPE	COST	COMPUTER	SOURCE
PRONET - PROJECT NETWORK	(6 programs) - Provides for CPM and PERT Network processing: Free format plans such as listing of independent activities; Processing time and cost calculations for any planning technique: generate graphic display - Bar Charts, Histograms, separate Budget analysis report. Can be integrated with other PMS systems.	$550/mo $4,900 purchase	Any with Fortran IV and Cobol Compiler	Mr. Dan Shiller Sysnet 322 W 52nd St. Suite 311 Radio City Station New York NY 10019
PROJECT CONTROL/70 AUDITING	Enables planning, monitoring and Accounting for progress on any project Requires minimum input utilizing simple turnaround documents. Can utilize any type resource. Also a total time accounting system handling all direct and indirect time and cost entries. Provides total cost (man & maching) information. Features include priority facilities, comments capability and multiple resource scheduling alogrithms.	$15,000	IBM, Burroughs COC Honeywell Univac Spectra 70	Mr. Richard W. Thatcher Jr. Atlantic Software Inc. Lafayett Bldg. 5th & Chestnut St. Philadelphia, PA 19106 Tel (215) 922-7500
EASYTROL	Encompasses test features of PERT, CPM, Short Interval scheduling and percentage of completion methods. Allows a phase and task approach to project planning and control. Allows option of overall broad planning at the beginning of a project and detail planning of each phase. Provides project status reports, individual and project level personnel information, staffing plan, forecast.	$8,500 purchase	IBM 360/ 370	Marsh Roberts K&A Software Products 11500 N Stemmons Freeway Dallas, TX 75229 Tel (214) 620-1860

TITLE	SCOPE	COST	COMPUTER	SOURCE
BID ANALYSIS SYSTEM	Organizes, summarizes and presents, on a bid item basis, engineering estimates for contracts to be awarded and cost proposals received from respondent bidders. Input: Engineering estimates by item for contracts to be awarded. This will include alternate bid items as appropriate; Bidder proposals by item. Output: Engineers Estimate Report: Tabulation of Bids Reports: Contract Bid Analysis Report: Transaction cards for input of bidders cost proposals: Data validation diagnostics.	$5,000	IBM 360/370	Mr. Richard R. Shively Vice President MDC Systems Corp 26 Springdale Rd. Cherry Hill, NJ 08034 Tel (609) 424-3800
BILL OF MATERIAL	(6 Programs) For use in manufacturing or engineering applications. Loads and maintains item and structure information. Retrieves single level indented and summarized parts listed at single level. Can be used alone or used with a requirements planning program.	Price upon Request	IBM 360/370	Mr. W.R. Vechory McDonnel Douglas Automation Company P.O. Box 516 St. Louis, MO 63166 Tel (314) 232-8021
(BIS) BUILDERS INFORMATION SYSTEM - ACCOUNTS PAYABLE, ACCOUNTS RECEIVABLE, PAYROLL, CRITICAL PATH & INVENTORY FEE & TIME KEEPERS SYSTEM FOR LAW FIRMS (100 PROGRAMS)	A complete accounting service for all types of builders, contractors and manufacturers	Monthly charge and contract terms vary with the size of the firm and data volume	IBM 370/135	Mr. Clifford E. Forlines Exec. Vice President Forlines and Assoc. Inc. 7315 Wisconsin Ave. Suite 200W Bethesda, MD 20014 Tel (301) 656-5600

TITLE	SCOPE	COST	COMPUTER	SOURCE
CASH FLOW ANALYSIS	Provides cash flow analysis in three formats in manufacturing. - Long format - year by year values of all costs, income and cash flow components are printed - Medium Format - Only values for one selected year are printed - Brief Format - only the return on investment and discounted cash flow rate of return is printed. Input extensive. System does not relieve management of decisions. It simply does the math and presentation.	AACE Members Small Handling Fee.	Source Listing	Mr. Ivan V. Klumpar Ledgemont Laboratory 128 Spring Street Lexington, MS 02173 Tel (617) 862-8268
CHANGE ORDER CONTROL SYSTEM	Permits sophisticated and thorough control of contracts and change orders. Provides: A complete transaction ledger; ability to estimate cost of unnegotiated change orders and derive an estimate to complete: the monitoring of emmulative effects of changes: the relating of total projects costs to authorized amount: standardized reporting procedures: monitor on functional level of responsibility the status of change orders.	$10,000	IBM 360/370	Mr. Richard A. Spivey Vice President MDC Systems Corp. 26 Springdale Rd. Cherry Hill, NJ 08034 Tel (609) 424-3800
COMPUTERIZED ACCOUNTING AND INFORMATION SYSTEM (CAIS)	(5 Programs) Fully integrated accounting and management information system. designed for the construction and manufacturing industries. Produces current job cost and billing analysis reports, management reports by exception and current and projected profit and loss statements as well as complete payroll, accounts payable, accounts receivable and general ledger.	Priced on Usage Basis by Number	UNIVAC 1108	Mr. Jack Sufran Digital Solutions, Inc. 100 Menlo Park Edison, NJ 08817 Tel (201) 549-1700

TITLE	SCOPE	COST	COMPUTER	SOURCE
CONTRACT STATUS SYSTEM	Comprehensive system for maintaining complete control and records for unit price construction contracts. For typical construction contracts the CSS provides for official contract bid item breakdown showing bid items, quantities, rates and amounts. Once contract is activiated engineer certifications are provided for verification of material in place. Can interface with other MSC Systems.	$8,000	IBM360/370	Mr. Richard B. Shively Vice President MDC Systems Corp 26 Springdale Rd. Cherry Hill, NJ 08034 Tel (609) 424-1800
CONSTRUCTION ACCOUNTING SYSTEM	(150 Programs) Complete information processing system composed of six independent integrated modules - Payroll, Accounts Payable, Accounts Receivable, Cost Accounting, Equipment Costing and General Ledger. Full range of reports is provided by each module.	$8,000	IBM360/370	Mr. Stephen K. Woodhouse Telesystems Corp 350 South 4th St East Suite 114 Salt Lake City, UT 84115 Tel (801) 532-3567
CONSTRUCTION COMPUTER SYSTEM ✓	Remote Batch based Accounting and Payroll system with ability to produce cumulative cost compared to estimates by phase, branch and detail, unit cost and variance calculated and projected earnings to date. Complete accounting journals through ledgers to financial statements.	Negotiable	BURROUGHS B-5500	Mr. Bill Konig Construction Computer Control Corporation 615 E. Michigan St. Milwaukee, WI 53202 Tel (414) 794-2631
CDM PROJECT MANAGEMENT SYSTEM	(7 Programs) System brings CPM job scheduling to the small computer user. Based on I-J and remaining time principal. Value of work in place is computed. Provision for forcing a particular date on an I or J number. Program, available on 9c hole card or diskette.	$1,000	Any Mini, small Business disk, RPG	Comer Daughtry P.O. Box 2124 Dothan, AL 36301 Tel (205) 794-2631

TITLE	SCOPE	COST	COMPUTER	SOURCE
ELECTRICAL CONSTRUCTION COST ESTIMATING	Makes a definitive electrical construction cost estimate for a typical chemical process plant or rectifier area based on major equipment oriented input. Provision for input of known variables such as labor, cost, overnead & profit, distribution methods and size of classified areas. All distribution in program allocated on basis of galvanized cable tray, rigid iron conduits or plastic-coated iron conduits.	$1,000	IBM 360	Mr Bill Frazure Dow Engineering Co 3636 Richmond Ave. Houston, TX 77027 Tel (713) 623-3011
MC^2/ESTIMATING CONSTRUCTION QUANTITY SURVEYING AND COST ESTIMATING	Produces detailed construction surveys and cost estimates at any time during the design cycle. included are over 80 work package parameters to take off parts of building works. Costing is based on money equivalents standards based upon dynamic experience.	Negotiable Lease	IBM 360	Mr W. Cole Early Management Computer Controls, Inc. Suite 302, Tanner Bldg. 2714 Union Ave. Extd Memphis, TN 38122 Tel (901) 323-2651
PAC II - CONSTRUCTION	A resource and machine scheduling simulation and control tool. Uses CPM scheduling and facilitates resource tracking and replanning. Permits progress and cost gathering at various levels of detail, minimizing manual effort required. Not limited as to number of activities, resources dependencies, scheduling alogrithms and costing. Can be used in simulation mode permitting "what if" planning.		IBM, Honeywell, Burroughs, UNIVAC, NCR, CDC	Mr Edward Ripp International Systems, Inc. 150 Allendale Road King of Prussia, PA 19406 Tel (215) 265-1550

APPENDIX III

BURROUGH'S SURVEY QUESTIONNAIRE FOR ASSESSMENT OF CONTRACTOR'S NEEDS

PURCHASING

Volumes

How many purchase orders are written? _____

How many lines per order? _____

How many vendors in file? _____

How many vendors are active? _____

What is the frequency of new vendors? _____

What is the frequency of changes to file? _____

How many purchase locations are there? _____

Purchases for 1 job or multiple jobs? _____

Purchase to inventory or to specific jobs? _____

Outstanding purchases recorded by project? _____

PAYABLES

Volumes

Average number of suppliers invoices: Per day _____
Per week _____
Per month _____

Growth factor? _____

Seasonal changes? _____

Number of distributions per invoice? Minimum _____
Maximum _____
Average _____

How are distributions coded? _____

Number of General Ledger expense accounts? _____

Number of high-volume General Ledger expense accounts? _____

PAYABLES - Volumes (cont'd.)

Average number of cheques required? Per day _____
Per week _____
Per month _____

How many invoices paid per cheque? _____

Are remittance advices used? _____

Are they made up when cheque is written? _____

Are remittance advices used? _____

Are they made up when cheque is written? (Direct pay) _____

Is the voucher system used? _____

Do you use vendor cards? _____

What method of discounting do you use? Gross _____
Net _____

Do you capture most discounts? _____

Do you record purchases year-to-date? _____

Aging by vendor? _____

PAYROLL

Number of employees? Hourly: _____
Weekly: _____
Bi-weekly: _____
Monthly: _____

How many pay cheques are required? Weekly: _____
Bi-weekly: _____
Monthly: _____

Number of T4's per year? _____

Any special reports required apart from T4?

1. _____ Frequency: _____
2. _____ Frequency: _____
3. _____ Frequency: _____

PAYROLL (cont'd.)

Is shift premium paid to any employees? _____

Is piecework/bonus in effect? _____

Are Quebec taxes only in effect? _____

How many provinces? _____

How many accounts is labour distributed to? _____

What year-to-date totals are required? _____

How many unions involved? _____

GENERAL LEDGER AND FINANCIAL STATEMENTS

Number of General Ledger accounts? _____

How many General Ledger postings are made? Per day: _____

Per month: _____

How many financial statement reports are required? _____

Which reports? Profit and Loss: _____

Balance Sheet: _____

Others: _____

_____

_____

How is General Ledger coded? _____

Explain account number. _____

ACCOUNTS RECEIVABLE

Volumes

What is the number of customers? Active: _____

Non-active: _____

Number of invoices posted per month: _____

Number of distributions made: _____

Number of distribution centres: _____

How coded: _____

Progressive billing done? _____

What is the number of cash receipts? Monthly: _____

Weekly: _____

Daily: _____

Number of credit memos: _____

Credits have own series numbers? _____

Are statements required? Yes: _____

No: _____

Selectively: _____

Open item: _____

Balance forward: _____

Changes

Frequency of new customers: _____

Frequency of changes: _____

Control

Are there credit limits? _____

ACCOUNTS PAYABLE (cont'd.)

Other controls used: _____

Are you involved with holdbacks? _____

Age analysis required: On all accounts: _____
On active accounts: _____
On statements: _____

Do you use service charges? _____

Automatic service charges: _____

Are payments primarily by invoice or by statement? _____

Sample of present statement attached? _____

Other pertinent information: _____

INVENTORY

Volumes	Raw	Finished
What is the number of products?		
Active?		
What is the number of product groups?		
Active?		
What is the number of storage locations?		

Changes		
What is the frequency of price changes?		
What is the frequency of new items?		
Is there a seasonal product change?		

Control		
Is there a minimum order limit in effect?		
Is there a minimum stock quantity in effect?		
Is there a maximum stock quantity in effect?		
Is control on stock re-order required?		

Number of inquiries per day?

Reports

INVENTORY STATUS REPORTING FREQUENCY

1. _____ _____ _____
2. _____ _____ _____
3. _____ _____ _____

HISTORICAL REPORTING FREQUENCY

1. _____ _____ _____
2. _____ _____ _____
3. _____ _____ _____

USAGE REPORTING

1. _____ _____ _____
2. _____ _____ _____

Sample forms attached? (with sample figures) Yes ____ No ____

COSTING

(Accounts Payable)

Number of jobs? _____

How are they broken down? _____

How many cost centres? _____

Active? _____

History? _____

Length of jobs? _____

Job number (what does it indicate?) _____

Who uses costing? _____

For what purpose? _____

How many people in costing? _____

If up-to-date information available on costing, what other information would be wanted?

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